Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

7876434750

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

DC (CJ/FC) 212434/2
© UCLES 2021

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

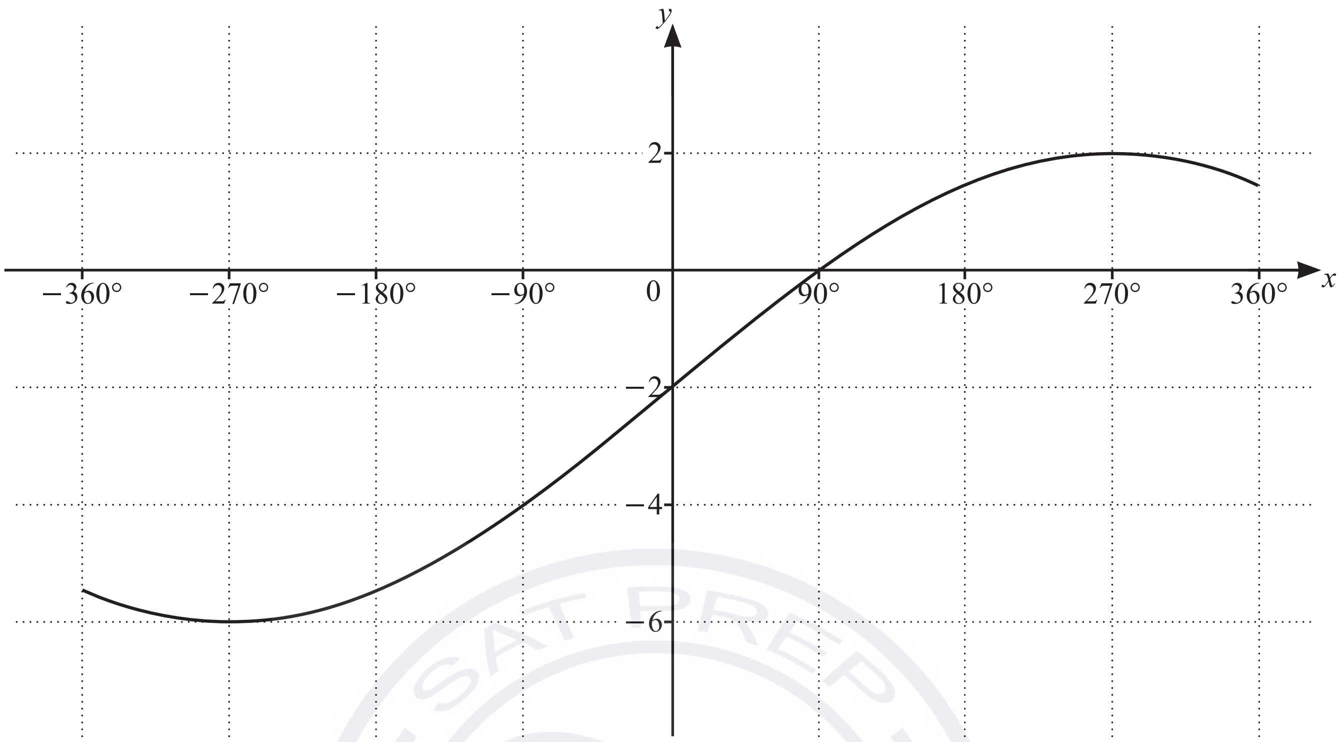
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2021

1



The diagram shows the graph of $y = a\sin\dfrac{x}{b} + c$ for $-360° \leqslant x \leqslant 360°$, where a, b and c are integers.

(a) Write down the period of $a\sin\dfrac{x}{b} + c$. [1]

(b) Find the value of a, of b and of c. [3]

2 Points A and C have coordinates $(-4, 6)$ and $(2, 18)$ respectively. The point B lies on the line AC such that $\overrightarrow{AB} = \frac{2}{3}\overrightarrow{AC}$.

(a) Find the coordinates of B. [2]

(b) Find the equation of the line l, which is perpendicular to AC and passes through B. [2]

(c) Find the area enclosed by the line l and the coordinate axes. [2]

SAT PREP
SP
www.satprep.co.in

3 **(a)** Find the vector which has magnitude 39 and is in the same direction as $\begin{pmatrix} 12 \\ -5 \end{pmatrix}$. [2]

(b) Given that $\mathbf{a} = \begin{pmatrix} 2 \\ -1 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} -4 \\ 5 \end{pmatrix}$, find the constants λ and μ such that $5\mathbf{a} + \lambda\begin{pmatrix} 4 \\ 6 \end{pmatrix} = \mu\mathbf{b}$. [4]

SAT PREP SP www.satprep.co.in

4 **(a)** Given that $\dfrac{q^{-2}\sqrt{pr}}{\sqrt[3]{r}(pq)^{-3}} = p^a q^b r^c$, find the value of each of the constants a, b and c. [3]

(b) Solve the equation $3x^{\frac{4}{5}} - 8x^{\frac{2}{5}} + 5 = 0$. [4]

SAT PREP SP www.satprep.co.in

5 The polynomial $p(x) = ax^3 + bx^2 + 6x + 4$, where a and b are integers, is divisible by $x - 2$. When $p'(x)$ is divided by $x + 1$ the remainder is -7.

(a) Find the value of a and of b. [5]

(b) Using your answers to **part (a)**, find the remainder when $p''(x)$ is divided by x. [2]

SAT PREP SP www.satprep.co.in

6 A curve with equation $y = \mathrm{f}(x)$ is such that $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2} = 6\mathrm{e}^{3x} + 4x$. The curve has a gradient of 5 at the point $\left(0, \dfrac{5}{3}\right)$. Find $\mathrm{f}(x)$. [7]

7 The first three terms, in ascending powers of x, in the expansion of $(2+ax)^n$ can be written as $64+bx+cx^2$, where n, a, b and c are constants.

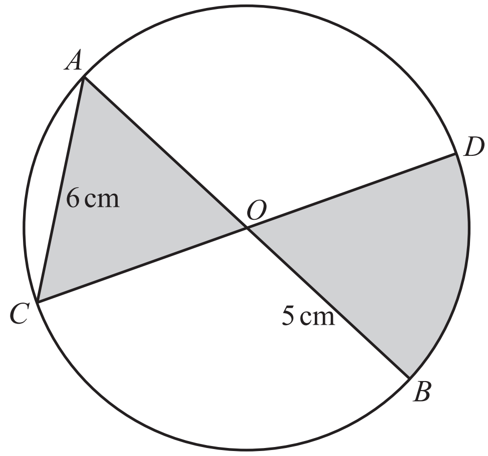
(a) Find the value of n. [1]

(b) Show that $5b^2 = 768c$. [4]

(c) Given that $b = 12$, find the exact value of a and of c. [2]

SAT PREP SP www.satprep.co.in

8



The diagram shows a circle, centre O, radius 5 cm. The lines AOB and COD are diameters of this circle. The line AC has length 6 cm.

(a) Show that angle $AOC = 1.287$ radians, correct to 3 decimal places. [2]

(b) Find the perimeter of the shaded region. [2]

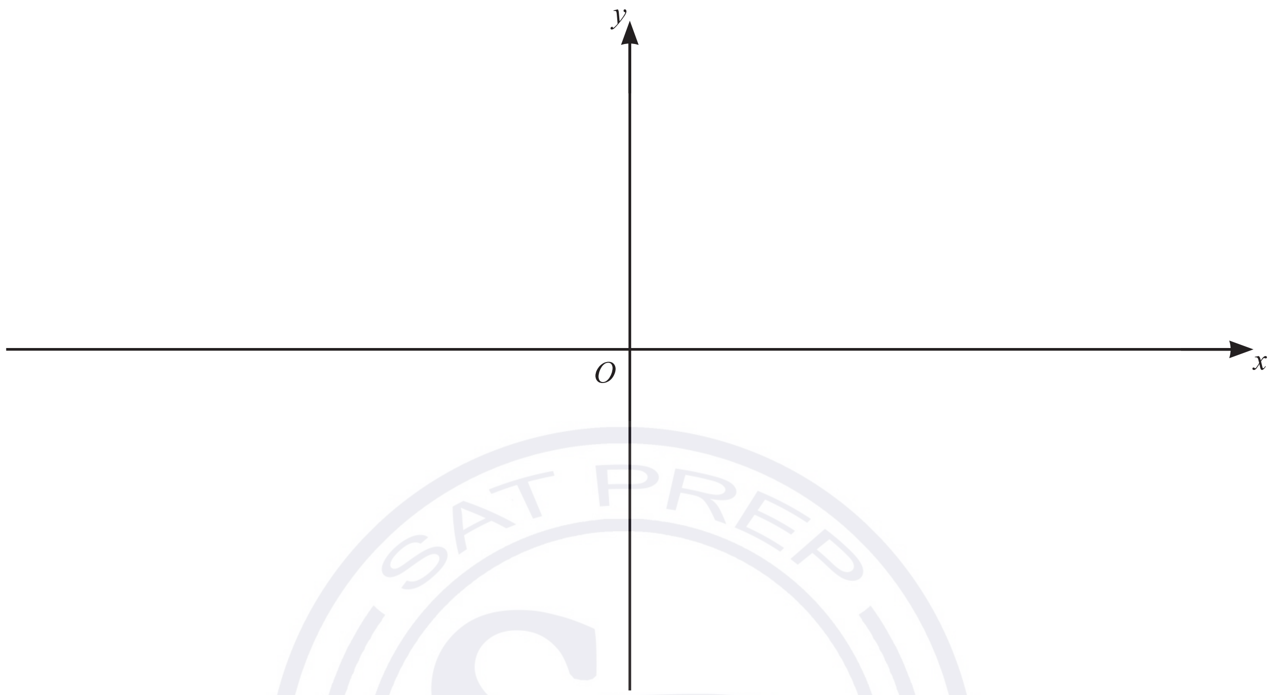
(c) Find the area of the shaded region. [3]

SAT PREP
SP
www.satprep.co.in

9 **(a)** Find the coordinates of the stationary points on the curve $y=(2x+1)(x-3)^2$. Give your answers in exact form. [4]

www.satprep.co.in

(b) On the axes below, sketch the graph of $y = \left|(2x+1)(x-3)^2\right|$, stating the coordinates of the points where the curve meets the axes. [4]



(c) Hence write down the value of the constant k such that $\left|(2x+1)(x-3)^2\right| = k$ has exactly 3 distinct solutions. [1]

SAT PREP
www.satprep.co.uk

10 **(a)** Jess runs on 5 days each week to prepare for a race.
In week 1, every run is 2 km.
In week 2, every run is 2.5 km.
In week 3, every run is 3 km.
Jess increases the distance of the run by 0.5 km every week.

(i) Find the week in which Jess runs 16 km on each of the 5 days. [2]

(ii) Find the total distance Jess will have run by the end of week 8. [3]

(b) Kyle also runs on 5 days each week to prepare for a race.
In week 1, every run is 2 km.
In week 2, every run is 2.5 km.
In week 3, every run is 3.125 km.
The distances he runs each week form a geometric progression.

(i) Find the common ratio of the geometric progression. [1]

(ii) Find the first week in which Kyle will run more than 16 km on each of the 5 days. [3]

(iii) Find the total distance Kyle will have run by the end of week 8. [3]

Question 11 is printed on the next page.

11 **(a)** Solve the equation $3\operatorname{cosec}^2\theta - 5 = 5\cot\theta$ for $0° \leqslant \theta \leqslant 180°$. [4]

(b) Solve the equation $\sin\left(\phi + \frac{\pi}{3}\right) = -\frac{1}{2}$, where ϕ is in radians and $-\pi \leqslant \phi \leqslant \pi$. Give your answers in terms of π. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5982126712

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (CE/CB) 212422/4
© UCLES 2021

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

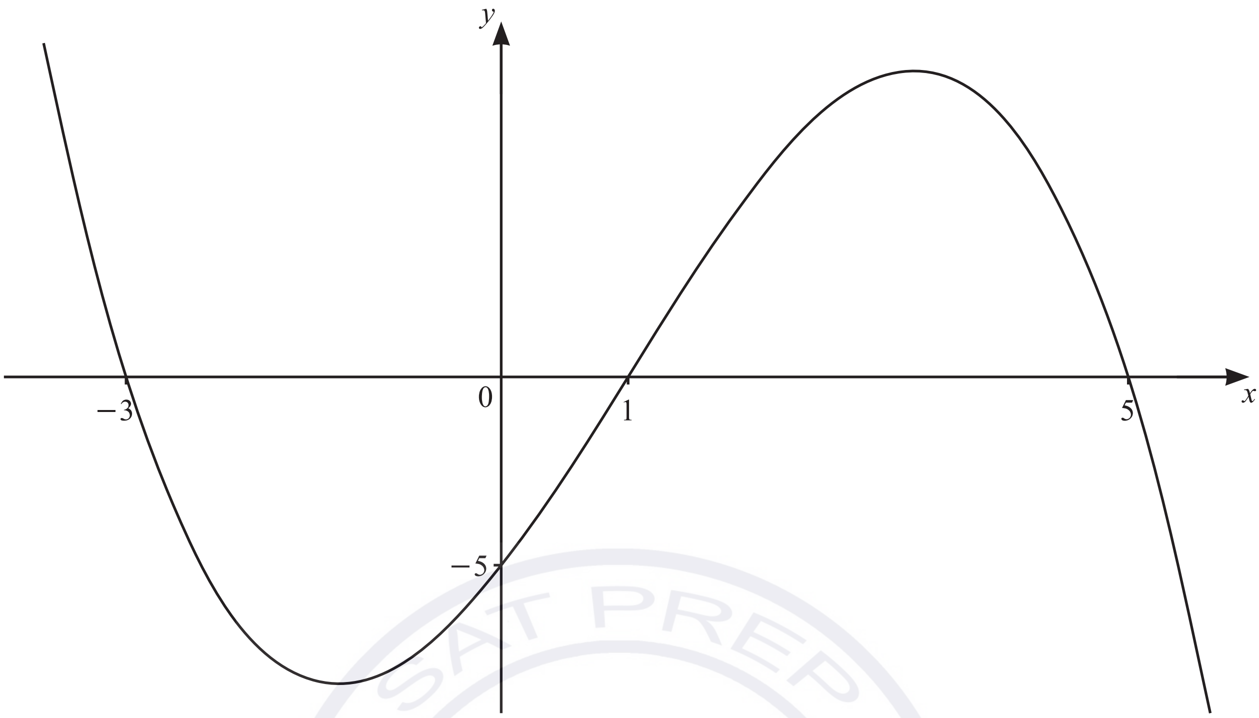
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2021

1



The diagram shows the graph of the cubic function $y = \mathrm{f}(x)$. The intercepts of the curve with the axes are all integers.

(a) Find the set of values of x for which $\mathrm{f}(x) < 0$. [1]

(b) Find an expression for $\mathrm{f}(x)$. [3]

© UCLES 2021

2 **(a)** Given that $\dfrac{\sqrt[3]{xy}\,(zy)^2}{(xz)^{-3}\sqrt{z}} = x^a y^b z^c$, find the exact values of the constants a, b and c. [3]

(b) Solve the equation $5(2^{2p+1}) - 17(2^p) + 3 = 0$. [4]

www.satprep.co.in

3 **(a)** Write $3 + 2\lg a - 4\lg b$ as a single logarithm to base 10. [4]

(b) Solve the equation $3\log_a 4 + 2\log_4 a = 7$. [5]

SAT PREP www.satprep.co.in

4 Solve the equation $\cot\left(2x+\frac{\pi}{3}\right)-\sqrt{3}=0$, where $-\pi < x < \pi$ radians. Give your answers in terms of π. [4]

5 Find the possible values of the constant c for which the line $y=c$ is a tangent to the curve $y=5\sin\frac{x}{3}+4$. [3]

SAT PREP SP www.satprep.co.in

6 DO NOT USE A CALCULATOR IN THIS QUESTION.

The polynomial $p(x) = 10x^3 + ax^2 - 10x + b$, where a and b are integers, is divisible by $2x + 1$. When $p(x)$ is divided by $x + 1$, the remainder is -24.

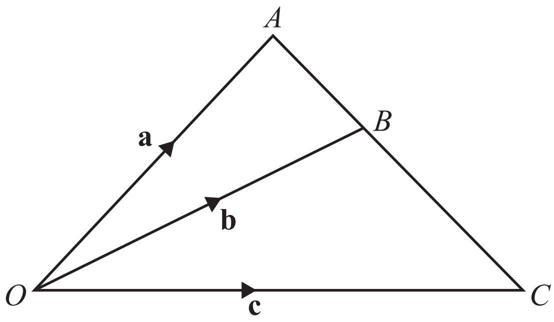
(a) Find the value of a and of b. [4]

(b) Find an expression for $p(x)$ as the product of three linear factors. [4]

(c) Write down the remainder when $p(x)$ is divided by x. [1]

SAT PREP SP www.satprep.co.in

7 (a)



The diagram shows triangle OAC, where $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$. The point B lies on the line AC such that $AB:BC = m:n$, where m and n are constants.

(i) Write down $\overrightarrow{AB}$ in terms of **a** and **b**. [1]

(ii) Write down $\overrightarrow{BC}$ in terms of **b** and **c**. [1]

(iii) Hence show that $n\mathbf{a} + m\mathbf{c} = (m+n)\mathbf{b}$. [2]

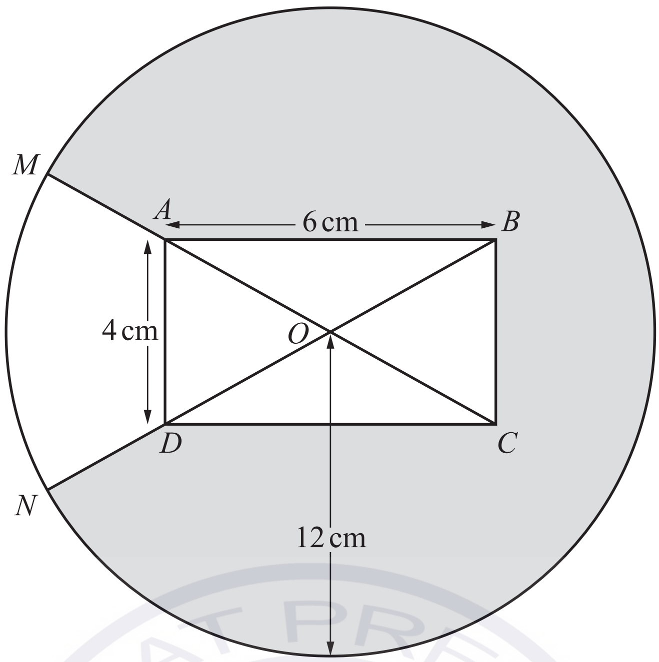
(b) Given that $\lambda\begin{pmatrix}2\\1\end{pmatrix} + (\mu - 1)\begin{pmatrix}-4\\7\end{pmatrix} = (\lambda + 1)\begin{pmatrix}4\\-2\end{pmatrix}$, find the value of each of the constants λ and μ. [4]

8 **(a)** A 5-digit number is made using the digits 0, 1, 4, 5, 6, 7 and 9. No digit may be used more than once in any 5-digit number. Find how many such 5-digit numbers are even and greater than 50 000. [3]

(b) The number of combinations of n objects taken 4 at a time is equal to 6 times the number of combinations of n objects taken 2 at a time. Calculate the value of n. [5]

www.satprep.co.in

9



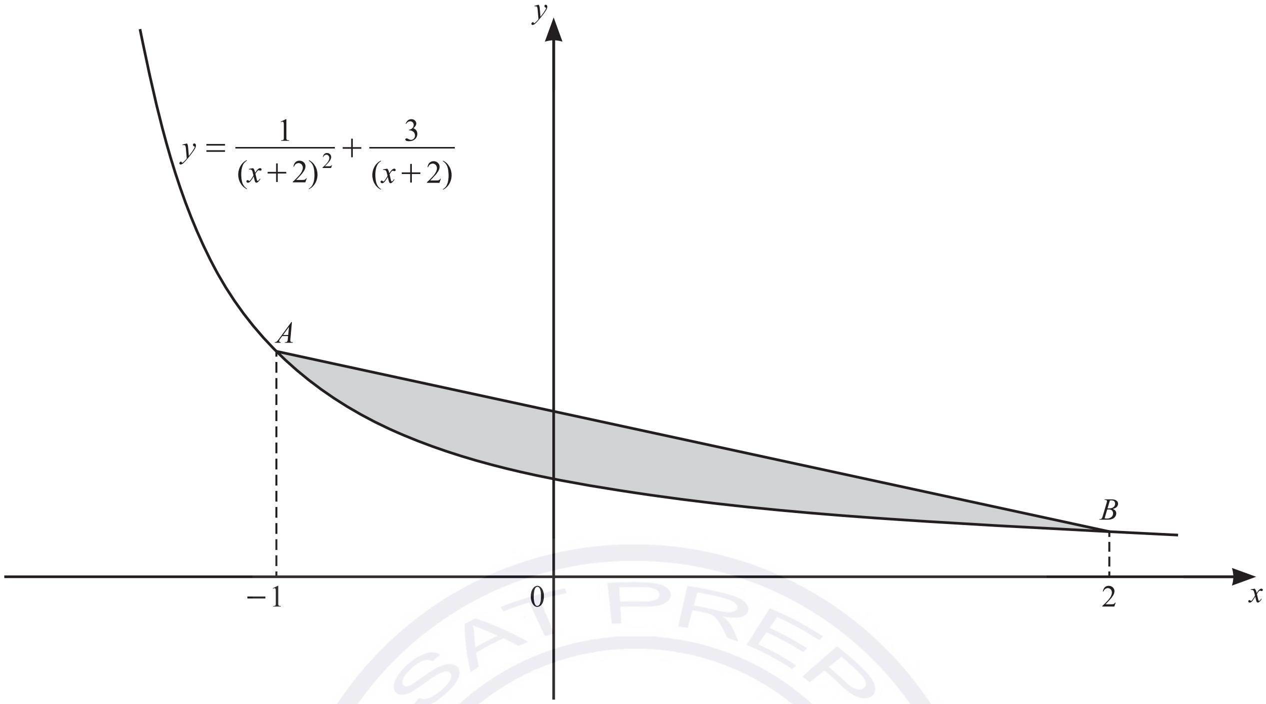
The diagram shows a circle, centre O, radius 12 cm, and a rectangle $ABCD$. The diagonals AC and BD intersect at O. The sides AB and AD of the rectangle have lengths 6 cm and 4 cm respectively. The points M and N lie on the circumference of the circle such that MAC and NDB are straight lines.

(a) Show that angle AOD is 1.176 radians correct to 3 decimal places. [2]

(b) Find the perimeter of the shaded region. [4]

(c) Find the area of the shaded region. [3]

10



The diagram shows the graph of the curve $y = \frac{1}{(x+2)^2} + \frac{3}{(x+2)}$ for $x > -2$. The points A and B lie on the curve such that the x-coordinates of A and of B are -1 and 2 respectively.

(a) Find the exact y-coordinates of A and of B. [2]

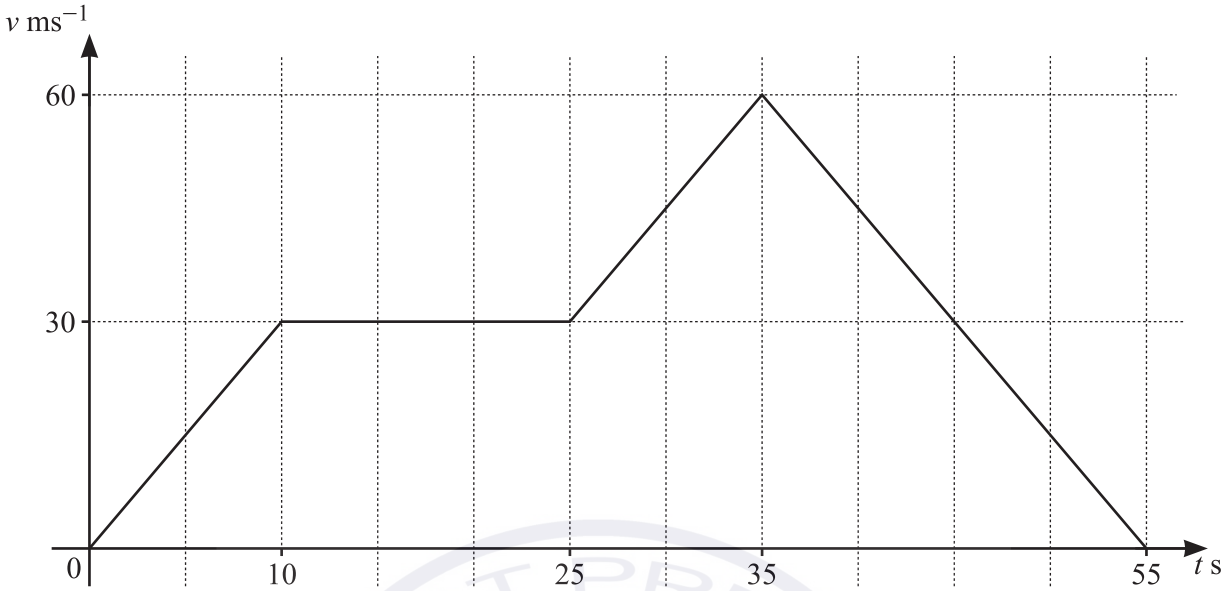
(b) Find the area of the shaded region enclosed by the line AB and the curve, giving your answer in the form $\frac{p}{q} - \ln r$, where p, q and r are integers. [6]

© UCLES 2021

Additional working space for Question 10(b).

SAT PREP
SP
www.satprep.co.in

11 **(a)**



The diagram shows the velocity–time graph for a particle P, travelling in a straight line with velocity $v\,\text{ms}^{-1}$ at a time t seconds. P accelerates at a constant rate for the first 10 s of its motion, and then travels at constant velocity, $30\,\text{ms}^{-1}$, for another 15 s. P then accelerates at a constant rate for a further 10 s and reaches a velocity of $60\,\text{ms}^{-1}$. P then decelerates at a constant rate and comes to rest when $t = 55$.

(i) Find the acceleration when $t = 12$. [1]

(ii) Find the acceleration when $t = 50$. [1]

(iii) Find the total distance travelled by the particle P. [2]

(b) A particle Q travels in a straight line such that its velocity, $v\,\text{ms}^{-1}$, at time t s after passing through a fixed point O is given by $v = 4\cos 3t - 4$.

(i) Find the speed of Q when $t = \frac{5\pi}{9}$. [2]

(ii) Find the smallest positive value of t for which the acceleration of Q is zero. [3]

(iii) Find an expression for the displacement of Q from O at time t. [2]

SAT PREP SP www.satprep.co.in

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

© UCLES 2021

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2709190526

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (PQ/SG) 212423/2
© UCLES 2021

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

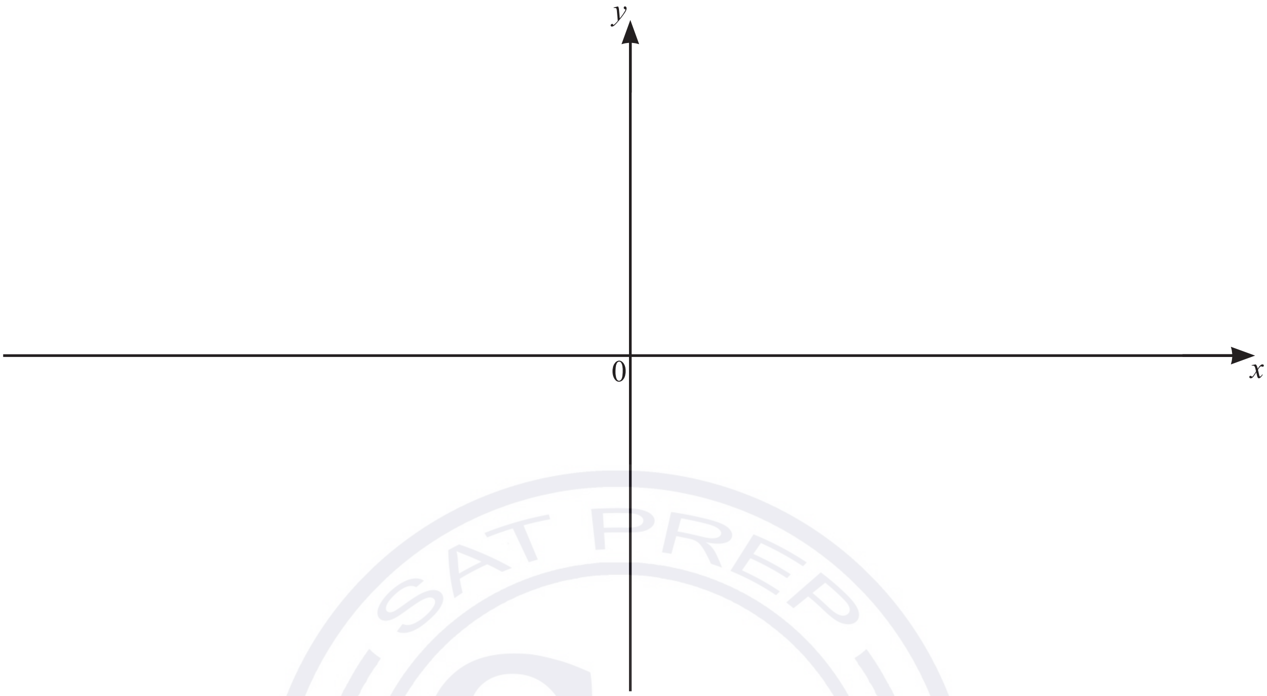
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2021

1 On the axes below, sketch the graph of $y = -\frac{1}{4}(2x+1)(x-3)(x+4)$ stating the intercepts with the coordinate axes. [3]



2 A particle moves in a straight line such that its velocity, $v\,\text{ms}^{-1}$, at time t seconds after passing through a fixed point O, is given by $v = e^{3t} - 25$. Find the speed of the particle when $t = 1$. [2]

SAT PREP SP www.satprep.co.in

3 Solve the equation $\cot^2\left(2x - \frac{\pi}{3}\right) = \frac{1}{3}$, where x is in radians and $0 \leqslant x < \pi$. [5]

SAT PREP SP www.satprep.co.in

4 **(a)** Find the first three terms, in ascending powers of x^2, in the expansion of $\left(\frac{1}{2}-\frac{2}{3}x^2\right)^8$. Write your coefficients as rational numbers. [3]

(b) Find the coefficient of x^2 in the expansion of $\left(\frac{1}{2}-\frac{2}{3}x^2\right)^8\left(2x+\frac{1}{x}\right)^2$. [3]

SAT PREP SP www.satprep.co.in

5 A geometric progression is such that its sum to 4 terms is 17 times its sum to 2 terms. It is given that the common ratio of this geometric progression is positive and not equal to 1.

(a) Find the common ratio of this geometric progression. [3]

(b) Given that the 6th term of the geometric progression is 64, find the first term. [2]

(c) Explain why this geometric progression does not have a sum to infinity. [1]

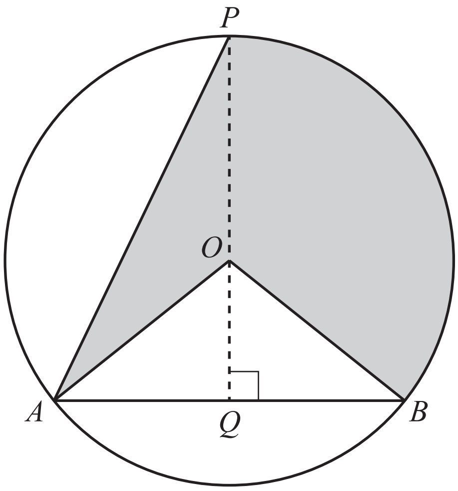
© UCLES 2021

6 **(a)** A 5-digit number is made using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9. No digit may be used more than once in any 5-digit number. Find how many such 5-digit numbers are odd and greater than 70 000. [3]

(b) The number of combinations of n objects taken 3 at a time is 2 times the number of combinations of n objects taken 2 at a time. Find the value of n. [4]

SAT PREP SP www.satprep.co.in

7



The diagram shows a circle, centre O, radius 10 cm. The points A, B and P lie on the circumference of the circle. The chord AB is of length 14 cm. The point Q lies on AB and the line POQ is perpendicular to AB.

(a) Show that angle POA is 2.366 radians, correct to 3 decimal places. [2]

SAT PREP SP www.satprep.co.in

(b) Find the area of the shaded region. [3]

(c) Find the perimeter of the shaded region. [5]

SAT PREP
SP
www.satprep.co.in

8 The curves $y = x^2 + x - 1$ and $2y = x^2 + 6x - 2$ intersect at the points A and B.

(a) Show that the mid-point of the line AB is (2, 9). [5]

The line l is the perpendicular bisector of AB.

(b) Show that the point C (12, 7) lies on the line l. [3]

© UCLES 2021

(c) The point D also lies on l, such that the distance of D from AB is two times the distance of C from AB. Find the coordinates of the two possible positions of D. [4]

www.satprep.co.in

9 When e^{2y} is plotted against x^2, a straight line graph passing through the points (4, 7.96) and (2, 3.76) is obtained.

(a) Find y in terms of x. [5]

(b) Find y when $x = 1$. [2]

(c) Using your equation from **part (a)**, find the positive values of x for which the straight line exists. [3]

www.satprep.co.in

10 A curve with equation $y = \mathrm{f}(x)$ is such that $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2} = (2x+3)^{-\frac{1}{2}} + 5$ for $x > 0$. The curve has gradient 10 at the point $\left(3, \dfrac{19}{2}\right)$.

(a) Show that, when $x = 11$, $\dfrac{\mathrm{d}y}{\mathrm{d}x} = 52$. [5]

(b) Find $\mathrm{f}(x)$. [4]

© UCLES 2021

11 A curve has equation $y = \dfrac{\left(x^2 - 5\right)^{\frac{1}{3}}}{x+1}$ for $x > -1$.

(a) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{Ax^2 + Bx + C}{3\left(x+1\right)^2\left(x^2 - 5\right)^{\frac{2}{3}}}$ where A, B and C are integers. [6]

www.satprep.co.in

(b) Find the x-coordinate of the stationary point on the curve. [2]

(c) Explain how you could determine the nature of this stationary point. [2]
[You are not required to find the nature of this stationary point.]

© UCLES 2021

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2172618678

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (LK/FC) 202078/4
© UCLES 2021

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

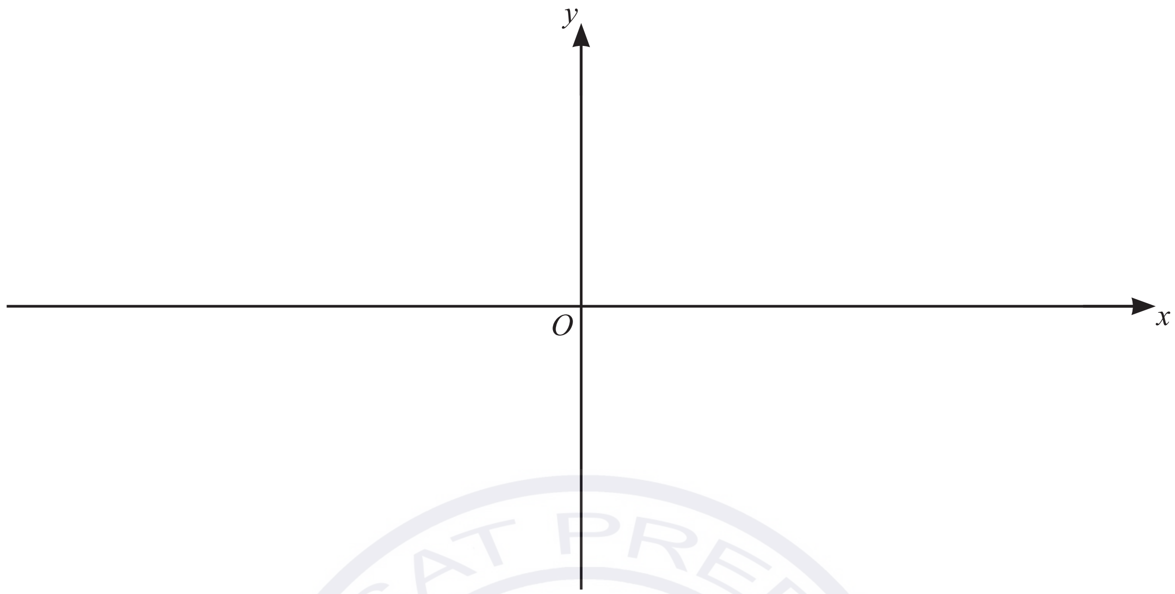
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 **(a)** On the axes, sketch the graph of $y = 5(x+1)(3x-2)(x-2)$, stating the intercepts with the coordinate axes. [3]



(b) Hence find the values of x for which $5(x+1)(3x-2)(x-2) > 0$. [2]

SAT PREP
SP
www.satprep.co.in

2 Find $\int_3^5 \left(\frac{1}{x-1} - \frac{1}{(x-1)^2}\right) \mathrm{d}x$, giving your answer in the form $a + \ln b$, where a and b are rational numbers. [5]

3 The polynomial $p(x) = ax^3 - 9x^2 + bx - 6$, where a and b are constants, has a factor of $x - 2$. The polynomial has a remainder of 66 when divided by $x - 3$.

(a) Find the value of a and of b. [4]

(b) Using your values of a and b, show that $p(x) = (x - 2)q(x)$, where $q(x)$ is a quadratic factor to be found. [2]

(c) Hence show that the equation $p(x) = 0$ has only one real solution. [2]

www.satprep.co.in

4 The first 3 terms in the expansion of $(a+x)^3\left(1-\frac{x}{3}\right)^5$, in ascending powers of x, can be written in the form $27+bx+cx^2$, where a, b and c are integers. Find the values of a, b and c. [8]

www.satprep.co.in

5 The functions f and g are defined as follows.

$$f(x) = x^2 + 4x \quad \text{for} \quad x \in \mathbb{R}$$

$$g(x) = 1 + e^{2x} \quad \text{for} \quad x \in \mathbb{R}$$

(a) Find the range of f. [2]

(b) Write down the range of g. [1]

(c) Find the exact solution of the equation $fg(x) = 21$, giving your answer as a single logarithm. [4]

SAT PREP
SP
www.satprep.co.in

6 **(a)** **(i)** Find how many different 5-digit numbers can be formed using the digits 1, 3, 5, 6, 8 and 9. No digit may be used more than once in any 5-digit number. [1]

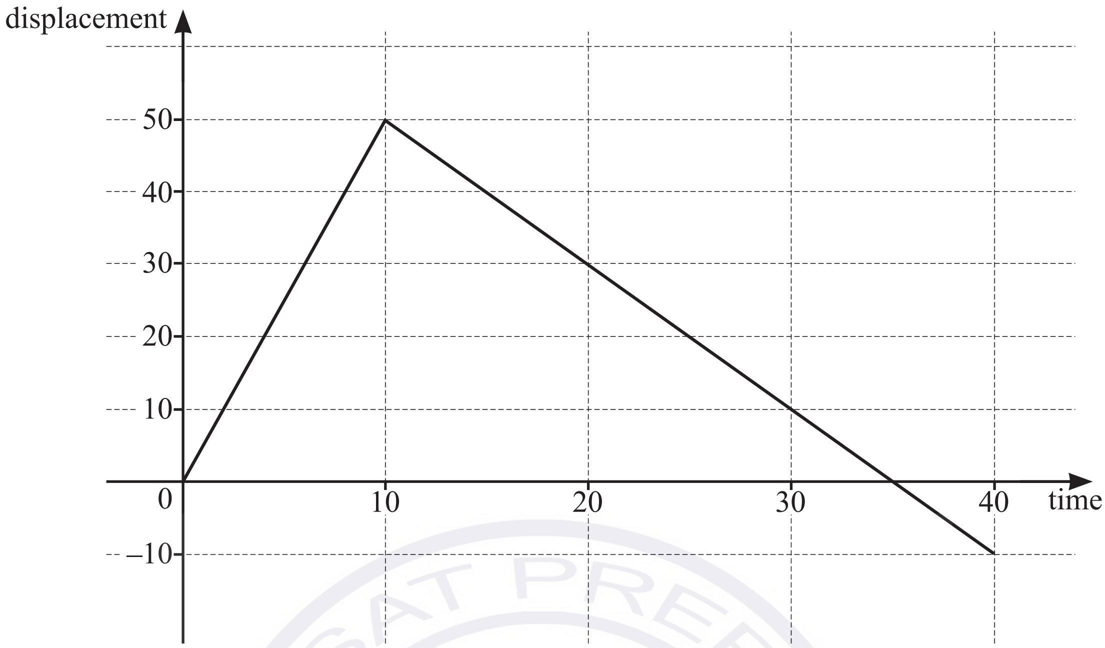
(ii) How many of these 5-digit numbers are odd? [1]

(iii) How many of these 5-digit numbers are odd and greater than 60 000? [3]

(b) Given that $45 \times {}^{n}\mathrm{C}_4 = (n+1) \times {}^{n+1}\mathrm{C}_5$, find the value of n. [4]

SAT PREP SP www.satprep.co.in

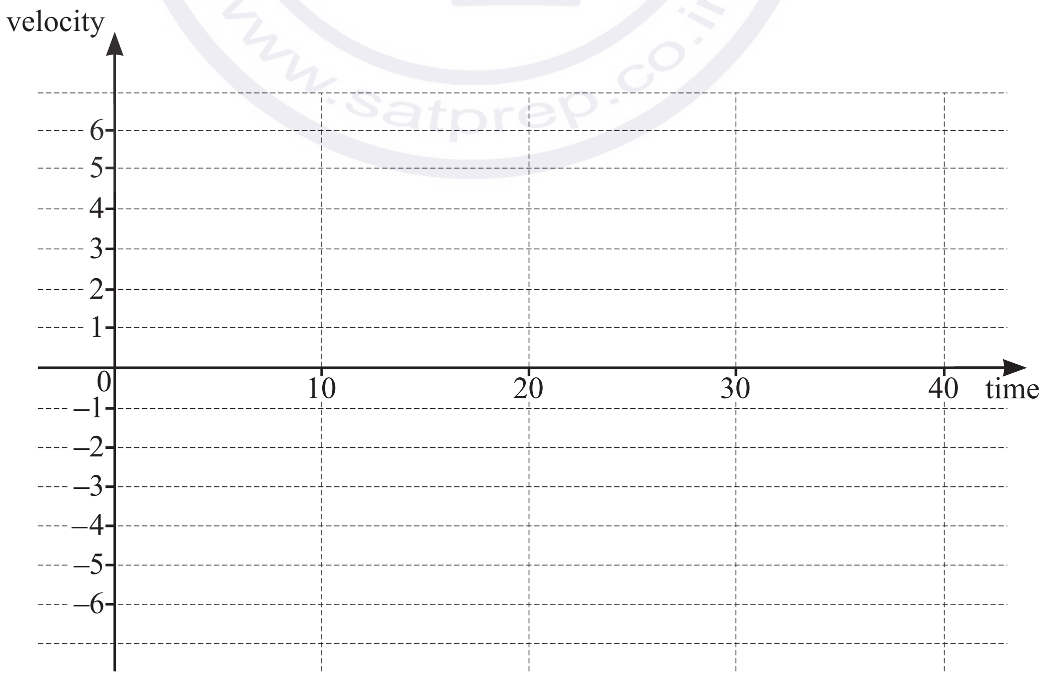
7 **(a)** In this question, all lengths are in metres and time, t, is in seconds.



The diagram shows the displacement–time graph for a runner, for $0 \leqslant t \leqslant 40$.

(i) Find the distance the runner has travelled when $t = 40$. [1]

(ii) On the axes, draw the corresponding velocity–time graph for the runner, for $0 \leqslant t \leqslant 40$. [2]



(b) A particle, P, moves in a straight line such that its displacement from a fixed point at time t is s.

The acceleration of P is given by $(2t+4)^{-\frac{1}{2}}$, for $t > 0$.

(i) Given that P has a velocity of 9 when $t = 6$, find the velocity of P at time t. [3]

(ii) Given that $s = \frac{1}{3}$ when $t = 6$, find the displacement of P at time t. [3]

SAT PREP SP www.satprep.co.in

8 DO NOT USE A CALCULATOR IN THIS QUESTION.

A curve has equation $y = \left(2 - \sqrt{3}\right)x^2 + x - 1$. The x-coordinate of a point A on the curve is $\dfrac{\sqrt{3}+1}{2-\sqrt{3}}$.

(a) Show that the coordinates of A can be written in the form $\left(p + q\sqrt{3}, r + s\sqrt{3}\right)$, where p, q, r and s are integers. [5]

SAT PREP SP www.satprep.co.in

(b) Find the x-coordinate of the stationary point on the curve, giving your answer in the form $a + b\sqrt{3}$, where a and b are rational numbers. [3]

© UCLES 2021

9 **(a)** **(i)** Write $6xy+3y+4x+2$ in the form $(ax+b)(cy+d)$, where a, b, c and d are positive integers. [1]

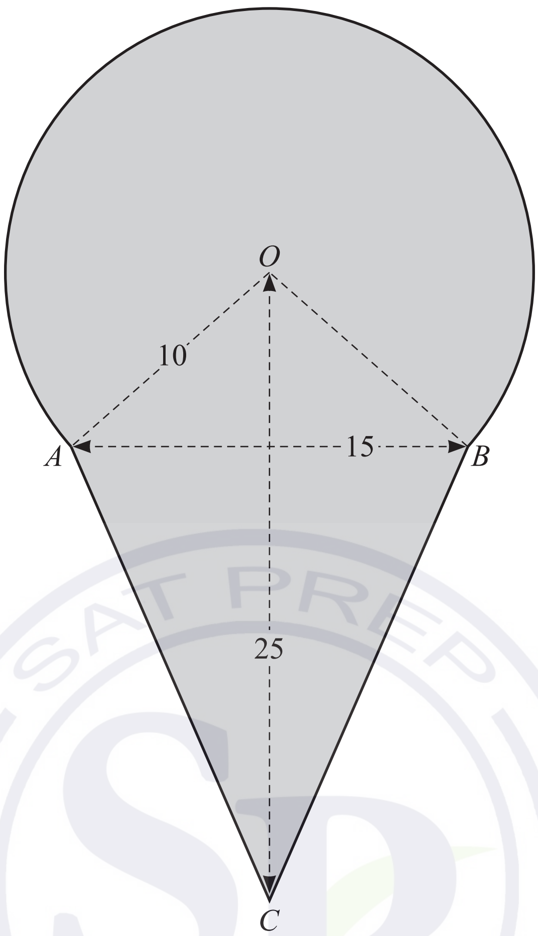
(ii) Hence solve the equation $6\sin\theta\cos\theta+3\cos\theta+4\sin\theta+2=0$ for $0° < \theta < 360°$. [4]

SAT PREP SP www.satprep.co.in

(b) Solve the equation $\frac{1}{2}\sec\left(2\phi + \frac{\pi}{4}\right) = \frac{1}{\sqrt{3}}$ for $-\pi < \phi < \pi$, where ϕ is in radians. Give your answers in terms of π. [5]

SAT PREP SP www.satprep.co.in

10 In this question all lengths are in centimetres.



The diagram shows a shaded shape. The arc AB is the major arc of a circle, centre O, radius 10. The line AB is of length 15, the line OC is of length 25 and the lengths of AC and BC are equal.

(a) Show that the angle AOB is 1.70 radians correct to 2 decimal places. [2]

(b) Find the perimeter of the shaded shape. [4]

(c) Find the area of the shaded shape. [5]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3617765859

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

© UCLES 2021

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

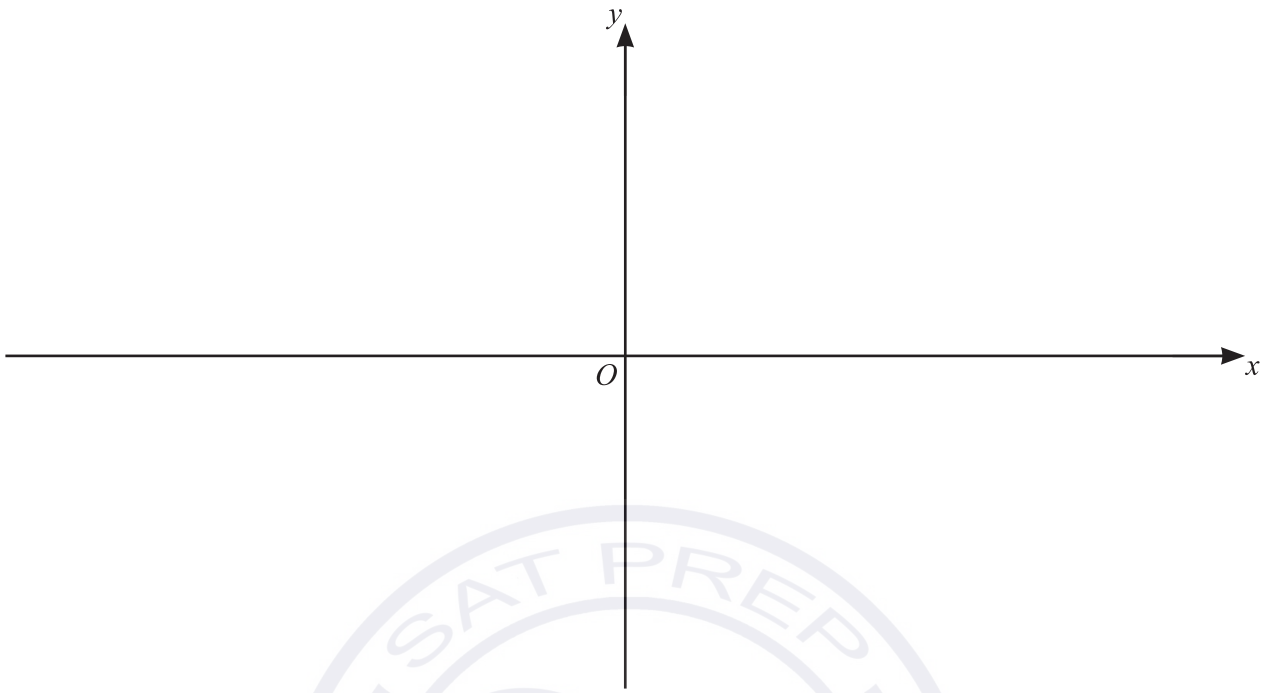
$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2021

1 Write $\dfrac{(pqr)^{-2}r^{\frac{1}{3}}}{\left(p^2r\right)^{-1}q^3}$ in the form $p^aq^br^c$, where a, b and c are constants. [3]

SAT PREP www.satprep.co.in

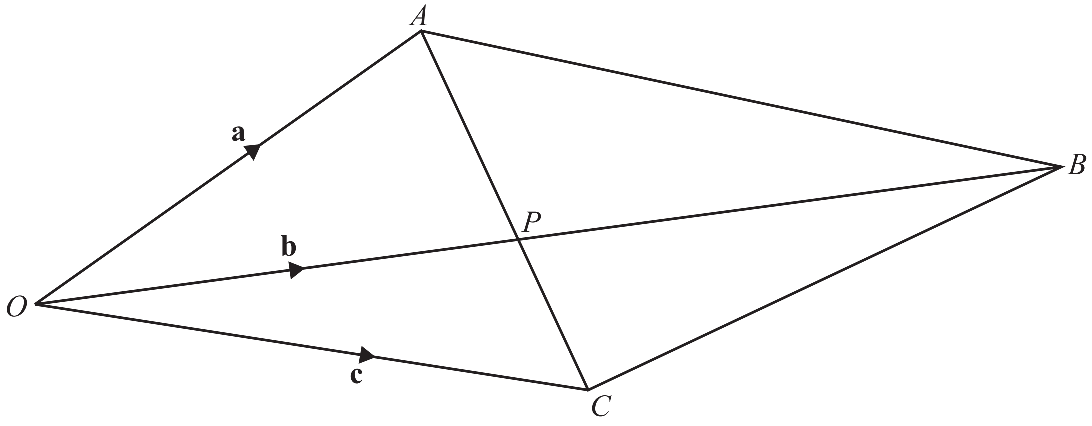
2 **(a)** On the axes, sketch the graph of $y = |4 - 3x|$, stating the intercepts with the coordinate axes. [2]



(b) Solve the inequality $|4 - 3x| \geqslant 7$. [3]

SAT PREP
SP
www.satprep.co.in

3



The diagram shows the quadrilateral *OABC* such that $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$. The lines *OB* and *AC* intersect at the point *P*, such that $AP : PC = 3 : 2$.

(a) Find $\overrightarrow{OP}$ in terms of **a** and **c**. [3]

SAT PREP SP www.satprep.co.in

(b) Given also that $OP : PB = 2 : 3$, show that $2\mathbf{b} = 3\mathbf{c} + 2\mathbf{a}$. [2]

4 A curve is such that $\frac{d^2y}{dx^2} = (3x+2)^{-\frac{1}{3}}$. The curve has gradient 4 at the point $(2, 6.2)$. Find the equation of the curve. [6]

SAT PREP SP www.satprep.co.in

5 **(a)** Given that $\log_a p + \log_a 5 - \log_a 4 = \log_a 20$, find the value of p. [2]

(b) Solve the equation $3^{2x+1} + 8(3^x) - 3 = 0$. [3]

(c) Solve the equation $4\log_y 2 + \log_2 y = 4$. [3]

www.satprep.co.in

6 DO NOT USE A CALCULATOR IN THIS QUESTION.

A curve has equation $y = (3 + \sqrt{5})x^2 - 8\sqrt{5}x + 60$.

(a) Find the x-coordinate of the stationary point on the curve, giving your answer in the form $a + b\sqrt{5}$, where a and b are integers. [4]

www.satprep.co.in SAT PREP SP

(b) Hence find the y-coordinate of this stationary point, giving your answer in the form $c\sqrt{5}$, where c is an integer. [3]

www.satprep.co.in

7 **(a)** A six-character password is to be made from the following eight characters.

Digits	1	3	5	8	9
Symbols	*	$	#		

No character may be used more than once in a password.

Find the number of different passwords that can be chosen if

(i) there are no restrictions, [1]

(ii) the password starts with a digit and finishes with a digit, [2]

(iii) the password starts with three symbols. [2]

(b) The number of combinations of 5 objects selected from n objects is six times the number of combinations of 4 objects selected from $n-1$ objects. Find the value of n. [3]

SAT PREP SP www.satprep.co.in

8 Variables x and y are such that $y = Ax^b$, where A and b are constants. When $\lg y$ is plotted against $\lg x$, a straight line graph passing through the points (0.61, 0.57) and (5.36, 4.37) is obtained.

(a) Find the value of A and of b. [5]

Using your values of A and b, find

(b) the value of y when $x = 3$, [2]

(c) the value of x when $y = 3$. [2]

SAT PREP SP www.satprep.co.in

9 **(a)** The first three terms of an arithmetic progression are $-4, 8, 20$. Find the smallest number of terms for which the sum of this arithmetic progression is greater than 2000. [4]

© UCLES 2021

(b) The 7th and 9th terms of a geometric progression are 27 and 243 respectively. Given that the geometric progression has a positive common ratio, find

(i) this common ratio, [2]

(ii) the 30th term, giving your answer as a power of 3. [2]

(c) Explain why the geometric progression $1, \sin\theta, \sin^2\theta, \ldots$ for $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$, where θ is in radians, has a sum to infinity. [2]

10 **(a)** Solve the equation $\sin\alpha\,\mathrm{cosec}^2\alpha + \cos\alpha\,\sec^2\alpha = 0$ for $-\pi < \alpha < \pi$, where α is in radians. [4]

SAT PREP
SP
www.satprep.co.in

(b) **(i)** Show that $\dfrac{\cos\theta}{1-\sin\theta}+\dfrac{1-\sin\theta}{\cos\theta}=2\sec\theta$. [4]

(ii) Hence solve the equation $\dfrac{\cos 3\phi}{1-\sin 3\phi}+\dfrac{1-\sin 3\phi}{\cos 3\phi}=4$ for $0° \leqslant \phi \leqslant 180°$. [4]

Question 11 is printed on the next page.

11 The normal to the curve $y = \dfrac{\ln\left(x^2+2\right)}{2x-3}$ at the point where $x = 2$ meets the y-axis at the point P.

Find the coordinates of P. [7]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2445269796

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Any blank pages are indicated.

DC (LK/FC) 202076/2
© UCLES 2021

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 Find the possible values of the constant k such that the equation $kx^2 + 4kx + 3k + 1 = 0$ has two different real roots. [4]

www.satprep.co.in

2 **(a)** Find $\frac{d}{dx}\left(x^2 e^{3x}\right)$. [3]

(b) **(i)** Find $\frac{d}{dx}\left(3x^2+4\right)^{\frac{1}{3}}$. [2]

(ii) Hence find $\int_0^2 x\left(3x^2+4\right)^{-\frac{2}{3}} dx$. [3]

3 Solve the equation $\operatorname{cosec}^2\theta + 2\cot^2\theta = 2\cot\theta + 9$, where θ is in radians and $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$. [5]

SAT PREP SP www.satprep.co.in

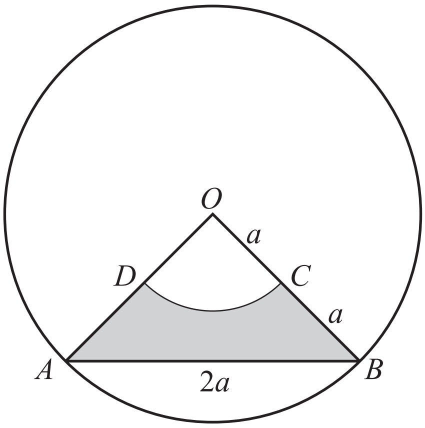
4 **(a)** Find the first three non-zero terms in the expansion of $\left(2-\frac{x^2}{4}\right)^6$ in ascending powers of x. Simplify each term. [3]

(b) Hence find the term independent of x in the expansion of $\left(2-\frac{x^2}{4}\right)^6\left(3-\frac{1}{x^2}\right)^2$. [3]

5 When e^y is plotted against x^2 a straight line graph passing through the points $(2.24, 5)$ and $(4.74, 10)$ is obtained. Find y in terms of x. [5]

SAT PREP
SP
www.satprep.co.in

6



The diagram shows a circle, centre O, radius $2a$. The points A and B lie on the circumference of the circle. The points C and D are the mid-points of the lines OB and OA respectively. The arc DC is part of a circle centre O. The chord AB is of length $2a$.

(a) Find angle AOB, giving your answer in radians in terms of π. [1]

(b) Find, in terms of a and π, the perimeter of the shaded region $ABCD$. [2]

(c) Find, in terms of a and π, the area of the shaded region $ABCD$. [3]

© UCLES 2021

7 **(a)** A committee of 8 people is to be formed from 5 teachers, 4 doctors and 3 police officers. Find the number of different committees that could be chosen if

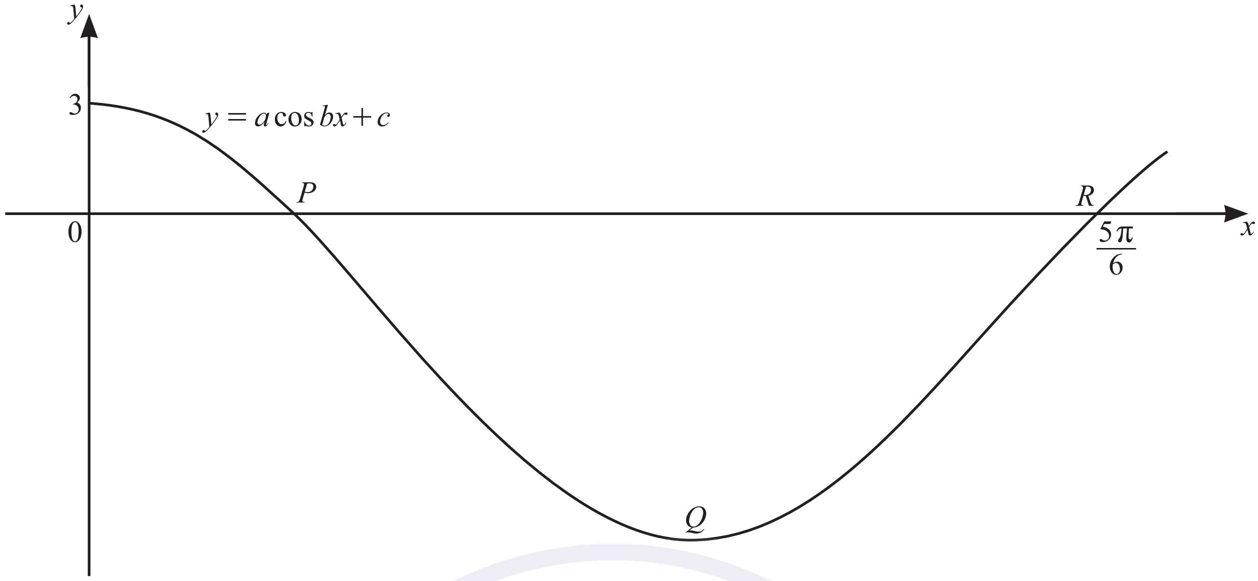
(i) all 4 doctors are on the committee, [2]

(ii) there are at least 2 teachers on the committee. [3]

(b) Given that ${}^{n}\mathrm{P}_5 = 6 \times {}^{n-1}\mathrm{P}_4$, find the value of n. [3]

SAT PREP www.satprep.co.in

8



The graph shows the curve $y = a\cos bx + c$, for $0 \leqslant x \leqslant 2.8$, where a, b and c are constants and x is in radians. The curve meets the y-axis at (0, 3) and the x-axis at the point P and point $R\left(\frac{5\pi}{6}, 0\right)$.

The curve has a minimum at point Q. The period of $a\cos bx + c$ is π radians.

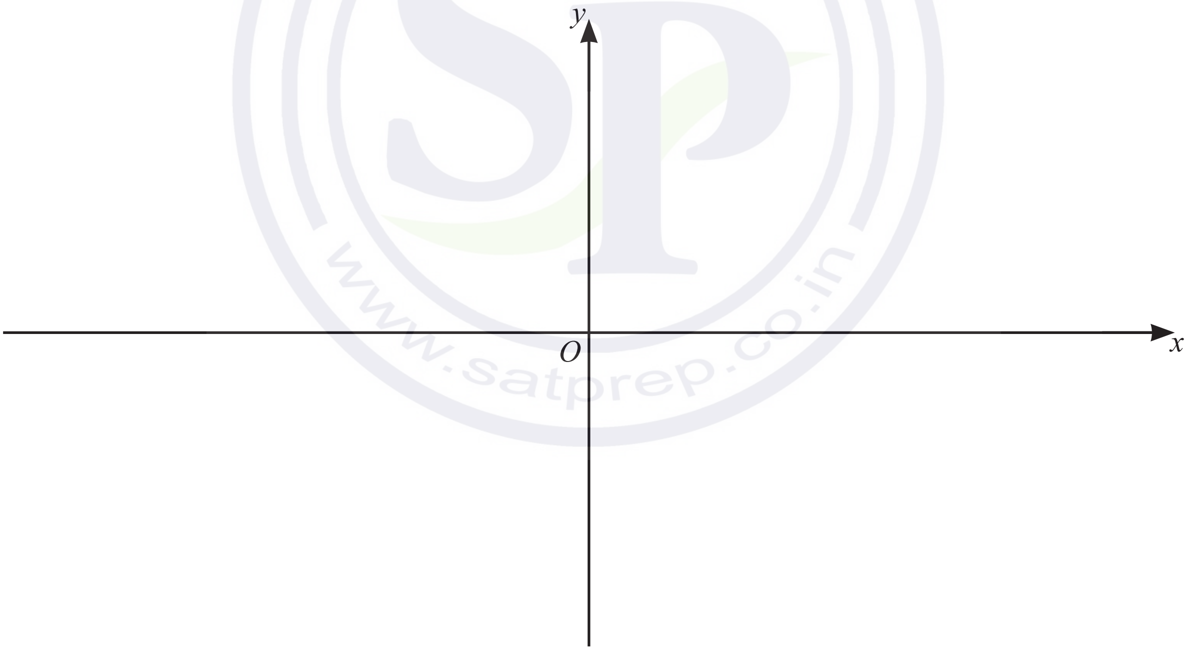
(a) Find the value of each of a, b and c. [4]

(b) Find the coordinates of P. [1]

(c) Find the coordinates of Q. [2]

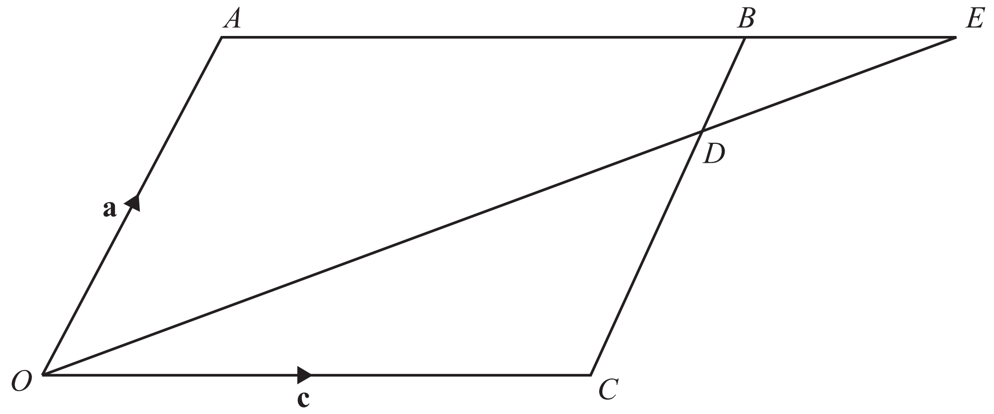
9 **(a)** Show that the equation of the curve $y = (x^2 - 4)(x - 2)$ can be written as $y = x^3 + ax^2 + bx + 8$, where a and b are integers. Hence find the exact coordinates of the stationary points on the curve. [4]

(b) On the axes, sketch the graph of $y = \left|(x^2 - 4)(x - 2)\right|$, stating the intercepts with the coordinate axes. [4]



(c) Find the possible values of the constant k for which $\left|(x^2 - 4)(x - 2)\right| = k$ has exactly 4 different solutions. [2]

10



The diagram shows the parallelogram $OABC$, such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$. The point D lies on CB such that $CD : DB = 3 : 1$. When extended, the lines AB and OD meet at the point E. It is given that $\overrightarrow{OE} = h\overrightarrow{OD}$ and $\overrightarrow{BE} = k\overrightarrow{AB}$, where h and k are constants.

(a) Find $\overrightarrow{DE}$ in terms of $\mathbf{a}$, $\mathbf{c}$ and h. [4]

© UCLES 2021

(b) Find $\overrightarrow{DE}$ in terms of **a**, **c** and k. [1]

(c) Hence find the value of h and of k. [4]

SAT PREP
SP
www.satprep.co.in

11 The line $x+2y=10$ intersects the two lines satisfying the equation $|x+y|=2$ at the points A and B.

(a) Show that the point $C(-5, 20)$ lies on the perpendicular bisector of the line AB. [8]

SAT PREP
SP
www.satprep.co.in

(b) The point D also lies on this perpendicular bisector. M is the mid-point of AB. The distance CD is three times the distance of CM. Find the possible coordinates of D. [4]

www.satprep.co.in SAT PREP SP

BLANK PAGE

www.satprep.co.in SAT PREP

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3251633375

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2021**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages.

DC (CE/SW) 202024/2
© UCLES 2021

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

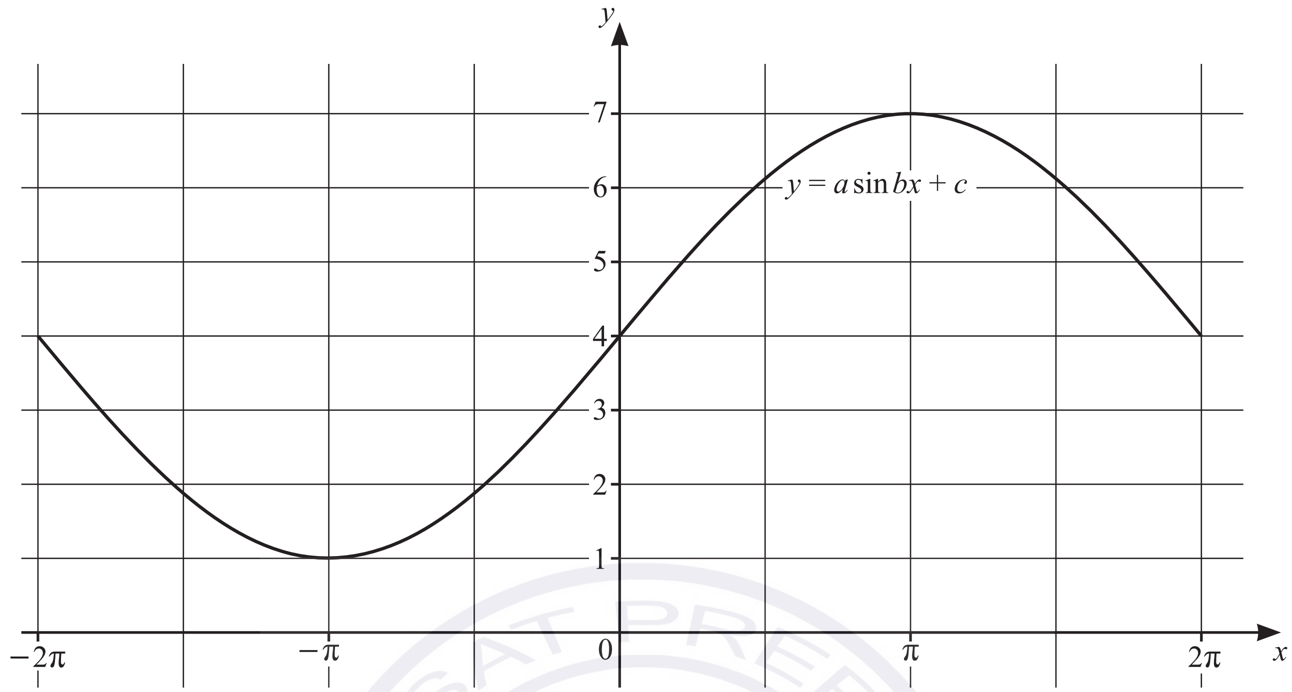
$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 Find the exact solutions of the equation $3(\ln 5x)^2 + 2\ln 5x - 1 = 0$. [4]

SAT PREP
www.satprep.co.in

2



The diagram shows the graph of $y = a\sin bx + c$ where x is in radians and $-2\pi \leqslant x \leqslant 2\pi$, where a, b and c are positive constants. Find the value of each of a, b and c. [3]

3 The line AB is such that the points A and B have coordinates $(-4, 6)$ and $(2, 14)$ respectively.

(a) The point C, with coordinates $(7, a)$ lies on the perpendicular bisector of AB. Find the value of a. [4]

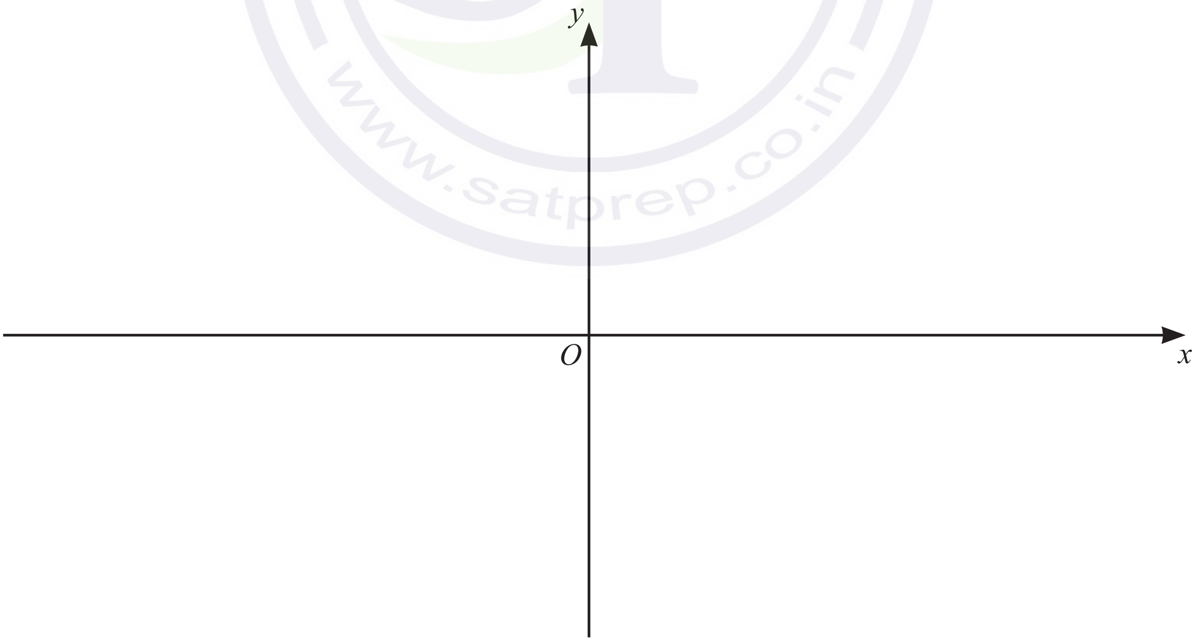
SAT PREP SP www.satprep.co.in

(b) Given that the point D also lies on the perpendicular bisector of AB, find the coordinates of D such that the line AB bisects the line CD. [2]

4 **(a)** Show that $2x^2+5x-3$ can be written in the form $a(x+b)^2+c$, where a, b and c are constants. [3]

(b) Hence write down the coordinates of the stationary point on the curve with equation $y=2x^2+5x-3$. [2]

(c) On the axes below, sketch the graph of $y=\left|2x^2+5x-3\right|$, stating the coordinates of the intercepts with the axes. [3]



(d) Write down the value of k for which the equation $\left|2x^2+5x-3\right|=k$ has exactly 3 distinct solutions. [1]

SAT PREP www.satprep.co.in

5 In this question all lengths are in kilometres and time is in hours.

Boat A sails, with constant velocity, from a point O with position vector $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$. After 3 hours A is at the point with position vector $\begin{pmatrix} -12 \\ 9 \end{pmatrix}$.

(a) Find the position vector, $\overrightarrow{OP}$, of A at time t. [1]

At the same time as A sails from O, boat B sails from a point with position vector $\begin{pmatrix} 12 \\ 6 \end{pmatrix}$, with constant velocity $\begin{pmatrix} -5 \\ 8 \end{pmatrix}$.

(b) Find the position vector, $\overrightarrow{OQ}$, of B at time t. [1]

(c) Show that at time t $\left|\overrightarrow{PQ}\right|^2 = 26t^2 + 36t + 180$. [3]

(d) Hence show that A and B do not collide. [2]

6 **(a)** A geometric progression has first term 10 and sum to infinity 6.

(i) Find the common ratio of this progression. [2]

(ii) Hence find the sum of the first 7 terms, giving your answer correct to 2 decimal places. [2]

SAT PREP SP www.satprep.co.in

(b) The first three terms of an arithmetic progression are $\log_x 3,\ \log_x(3^2),\ \log_x(3^3)$.

(i) Find the common difference of this progression. [1]

(ii) Find, in terms of n and $\log_x 3$, the sum to n terms of this progression. Simplify your answer. [2]

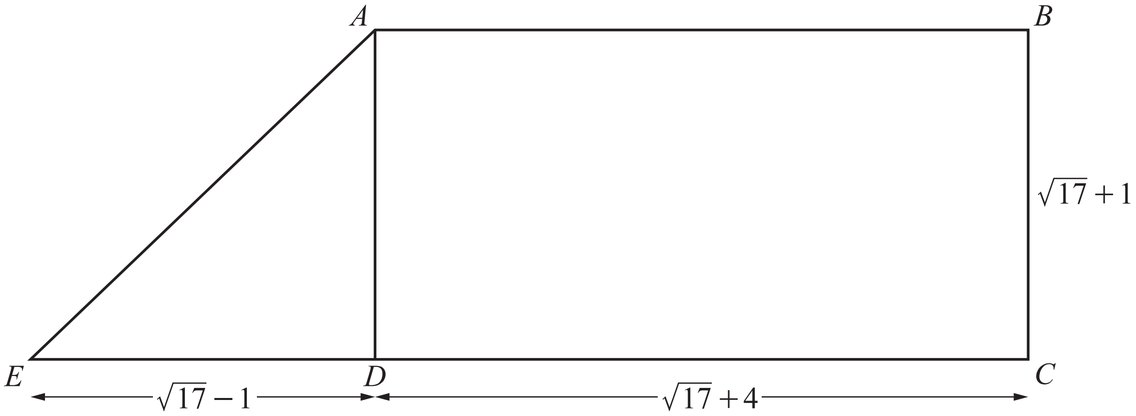
(iii) Given that the sum to n terms is $3081\log_x 3$, find the value of n. [2]

(iv) Hence, given that the sum to n terms is also equal to 1027, find the value of x. [2]

SAT PREP SP www.satprep.co.in

7 DO NOT USE A CALCULATOR IN THIS QUESTION

In this question all lengths are in centimetres.



The diagram shows a trapezium *ABCDE* such that *AB* is parallel to *EC* and *ABCD* is a rectangle. It is given that $BC = \sqrt{17}+1$, $ED = \sqrt{17}-1$ and $DC = \sqrt{17}+4$.

(a) Find the perimeter of the trapezium, giving your answer in the form $a+b\sqrt{17}$, where a and b are integers. [3]

(b) Find the area of the trapezium, giving your answer in the form $c+d\sqrt{17}$, where c and d are integers. [2]

(c) Find $\tan AED$, giving your answer in the form $\frac{e+f\sqrt{17}}{8}$, where e and f are integers. [2]

(d) Hence show that $\sec^2 AED = \frac{81+9\sqrt{17}}{32}$. [2]

SAT PREP SP www.satprep.co.in

8 **(a)** **(i)** Show that $\sin x \tan x + \cos x = \sec x$. [3]

(ii) Hence solve the equation $\sin\frac{\theta}{2}\tan\frac{\theta}{2} + \cos\frac{\theta}{2} = 4$ for $0 \leqslant \theta \leqslant 4\pi$, where θ is in radians. [4]

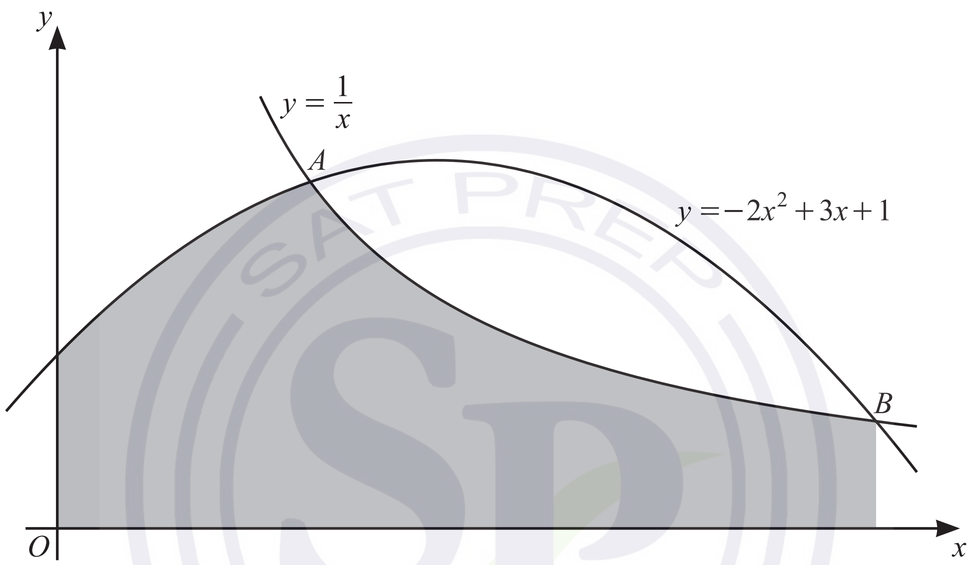
SAT PREP SP www.satprep.co.in

(b) Solve the equation $\cot(y+38^\circ) = \sqrt{3}$ for $0^\circ \leqslant y \leqslant 360^\circ$. [3]

SAT PREP
SP
www.satprep.co.in

9 The polynomial $p(x) = 2x^3 - 3x^2 - x + 1$ has a factor $2x - 1$.

(a) Find $p(x)$ in the form $(2x-1)q(x)$, where $q(x)$ is a quadratic factor. [2]



The diagram shows the graph of $y = \frac{1}{x}$ for $x > 0$, and the graph of $y = -2x^2 + 3x + 1$. The curves intersect at the points A and B.

(b) Using your answer to **part (a)**, find the exact x-coordinate of A and of B. [4]

www.satprep.co.in

(c) Find the exact area of the shaded region. [6]

SAT PREP
SP
www.satprep.co.in

Question 10 is printed on the next page.

10 A curve has equation $y = \dfrac{\left(2x^2+10\right)^{\frac{3}{2}}}{x-1}$ for $x > 1$.

(a) Show that $\dfrac{dy}{dx}$ can be written in the form $\dfrac{\left(2x^2+10\right)^{\frac{1}{2}}}{\left(x-1\right)^2}(Ax^2+Bx+C)$, where A, B and C are integers. [5]

(b) Show that, for $x > 1$, the curve has exactly one stationary point. Find the value of x at this stationary point. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3081135600

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS
- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION
- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

SAT PREP SP www.satprep.co.in

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\text{cosec}^2 A = 1 + \cot^2 A$$

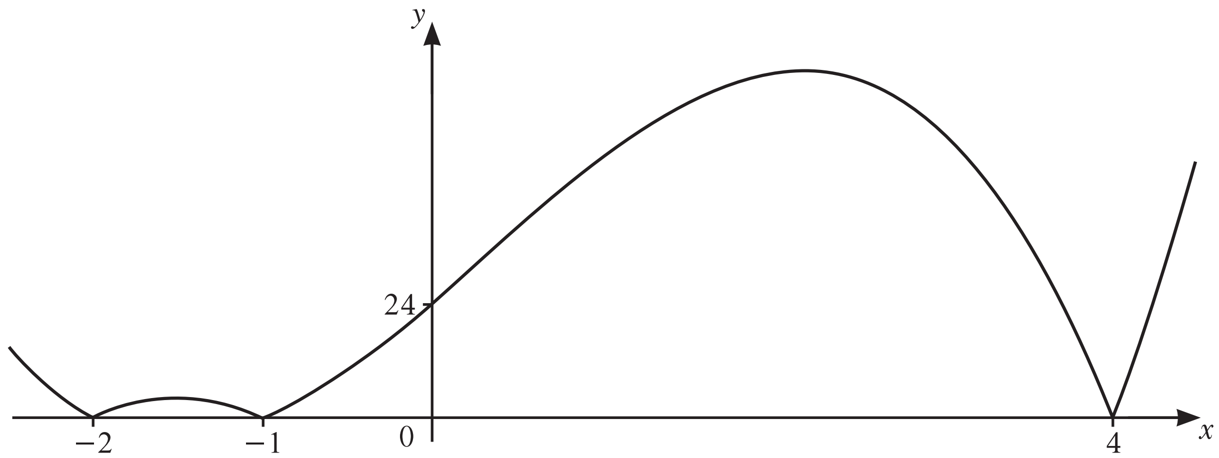
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1

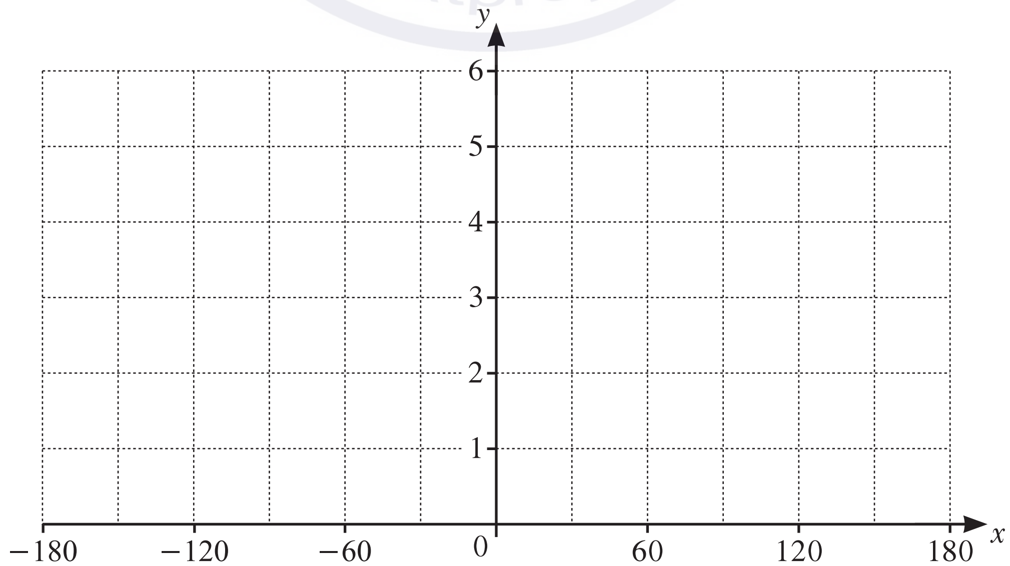


The diagram shows the graph of $y = |p(x)|$, where $p(x)$ is a cubic function. Find the two possible expressions for $p(x)$. [3]

2 **(a)** Write down the amplitude of $1 + 4\cos\left(\frac{x}{3}\right)$. [1]

(b) Write down the period of $1 + 4\cos\left(\frac{x}{3}\right)$. [1]

(c) On the axes below, sketch the graph of $y = 1 + 4\cos\left(\frac{x}{3}\right)$ for $-180° \leqslant x° \leqslant 180°$.



[3]

SAT PREP
SP
www.satprep.co.in

3 **(a)** Write $\dfrac{\sqrt{p}\left(qr^2\right)^{\frac{1}{3}}}{\left(q^3p\right)^{-1}r^3}$ in the form $p^a q^b r^c$, where a, b and c are constants. [3]

(b) Solve $6x^{\frac{2}{3}} - 5x^{\frac{1}{3}} + 1 = 0$. [3]

© UCLES 2020

4 It is given that $y = \dfrac{\tan 3x}{\sin x}$.

(a) Find the exact value of $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ when $x = \dfrac{\pi}{3}$. [4]

(b) Hence find the approximate change in y as x increases from $\dfrac{\pi}{3}$ to $\dfrac{\pi}{3} + h$, where h is small. [1]

(c) Given that x is increasing at the rate of 3 units per second, find the corresponding rate of change in y when $x = \dfrac{\pi}{3}$, giving your answer in its simplest surd form. [2]

SAT PREP SP www.satprep.co.in

5 **(a)** **(i)** Find how many different 4-digit numbers can be formed using the digits 1, 3, 4, 6, 7 and 9. Each digit may be used once only in any 4-digit number. [1]

(ii) How many of these 4-digit numbers are even and greater than 6000? [3]

SAT PREP
SP
www.satprep.co.in

(b) A committee of 5 people is to be formed from 6 doctors, 4 dentists and 3 nurses. Find the number of different committees that could be formed if

(i) there are no restrictions, [1]

(ii) the committee contains at least one doctor, [2]

(iii) the committee contains all the nurses. [1]

www.satprep.co.in

6 A particle P is initially at the point with position vector $\begin{pmatrix}30\\10\end{pmatrix}$ and moves with a constant speed of $10\,\text{ms}^{-1}$ in the same direction as $\begin{pmatrix}-4\\3\end{pmatrix}$.

(a) Find the position vector of P after t s. [3]

As P starts moving, a particle Q starts to move such that its position vector after t s is given by $\begin{pmatrix}-80\\90\end{pmatrix}+t\begin{pmatrix}5\\12\end{pmatrix}$.

(b) Write down the speed of Q. [1]

(c) Find the exact distance between P and Q when $t = 10$, giving your answer in its simplest surd form. [3]

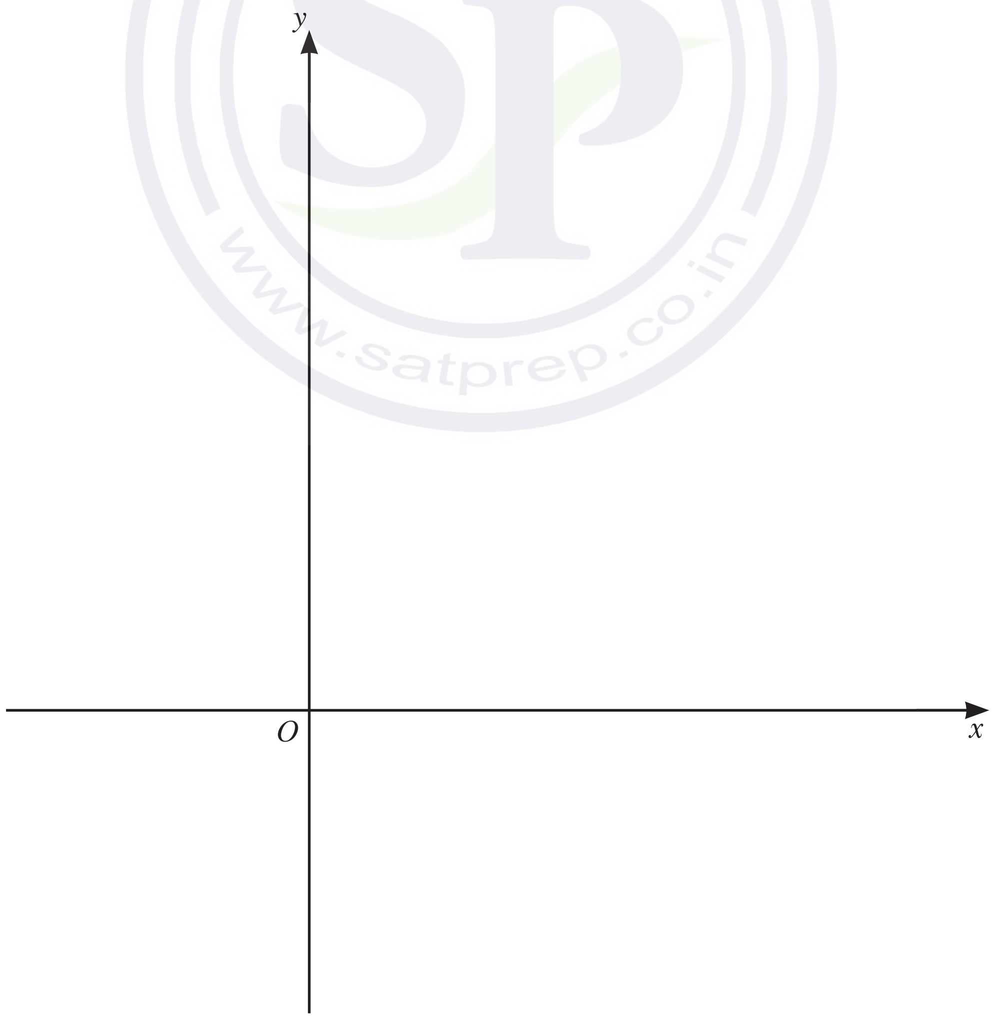
www.satprep.co.in SAT PREP SP

7 It is given that $f(x) = 5\ln(2x+3)$ for $x > -\frac{3}{2}$.

(a) Write down the range of f. [1]

(b) Find f^{-1} and state its domain. [3]

(c) On the axes below, sketch the graph of $y = f(x)$ and the graph of $y = f^{-1}(x)$. Label each curve and state the intercepts on the coordinate axes.



[5]

8 **(a)** **(i)** Show that $\dfrac{1}{(1+\operatorname{cosec}\theta)(\sin\theta-\sin^2\theta)} = \sec^2\theta$. [4]

(ii) Hence solve $(1+\operatorname{cosec}\theta)(\sin\theta-\sin^2\theta) = \dfrac{3}{4}$ for $-180° \leqslant \theta \leqslant 180°$. [4]

SAT PREP SP www.satprep.co.in

(b) Solve $\sin\left(3\phi + \frac{2\pi}{3}\right) = \cos\left(3\phi + \frac{2\pi}{3}\right)$ for $0 \leqslant \phi \leqslant \frac{2\pi}{3}$ radians, giving your answers in terms of π. [4]

www.satprep.co.in

9 **(a)** Given that $\int_1^a \left(\frac{1}{x} - \frac{1}{2x+3}\right) dx = \ln 3$, where $a > 0$, find the exact value of a, giving your answer in simplest surd form. [6]

(b) Find the exact value of $\int_0^{\frac{\pi}{3}}\left(\sin\left(2x+\frac{\pi}{3}\right)-1+\cos 2x\right)\mathrm{d}x$. [5]

SAT PREP SP www.satprep.co.in

10 **(a)** An arithmetic progression has a second term of 8 and a fourth term of 18. Find the least number of terms for which the sum of this progression is greater than 1560. [6]

SAT PREP
SP
www.satprep.co.in

(b) A geometric progression has a sum to infinity of 72. The sum of the first 3 terms of this progression is $\frac{333}{8}$.

(i) Find the value of the common ratio. [5]

SAT PREP SP www.satprep.co.in

(ii) Hence find the value of the first term. [1]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME										
CENTRE NUMBER						CANDIDATE NUMBER				

7394703437

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

DC (PQ/FC) 187996/3
© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!\,r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

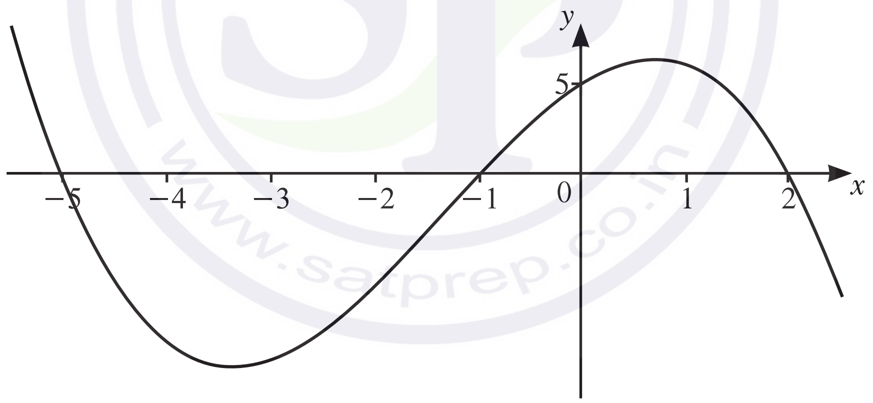
$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2020

1 The curve $y = 2x^2 + k + 4$ intersects the straight line $y = (k+4)x$ at two distinct points. Find the possible values of k. [4]

2



The diagram shows the graph of $y = \mathrm{f}(x)$, where $\mathrm{f}(x)$ is a cubic polynomial.

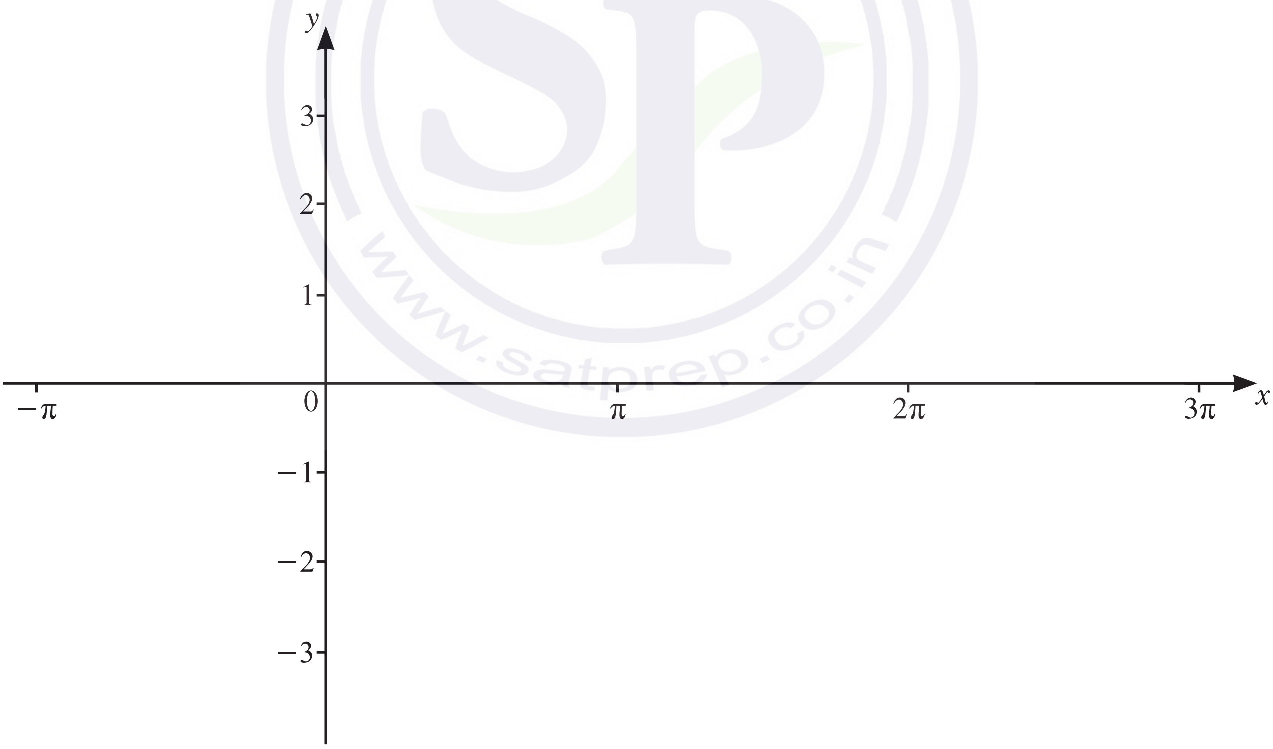
(a) Find $\mathrm{f}(x)$. [3]

(b) Write down the values of x such that $\mathrm{f}(x) < 0$. [2]

3 **(a)** Write down the amplitude of $2\cos\frac{x}{3} - 1$. [1]

(b) Write down the period of $2\cos\frac{x}{3} - 1$. [1]

(c) On the axes below, sketch the graph of $y = 2\cos\frac{x}{3} - 1$ for $-\pi \leqslant x \leqslant 3\pi$ radians.



[3]

SAT PREP
SP
www.satprep.co.in

© UCLES 2020

4 The 7th and 10th terms of an arithmetic progression are 158 and 149 respectively.

(a) Find the common difference and the first term of the progression. [3]

(b) Find the least number of terms of the progression for their sum to be negative. [3]

© UCLES 2020

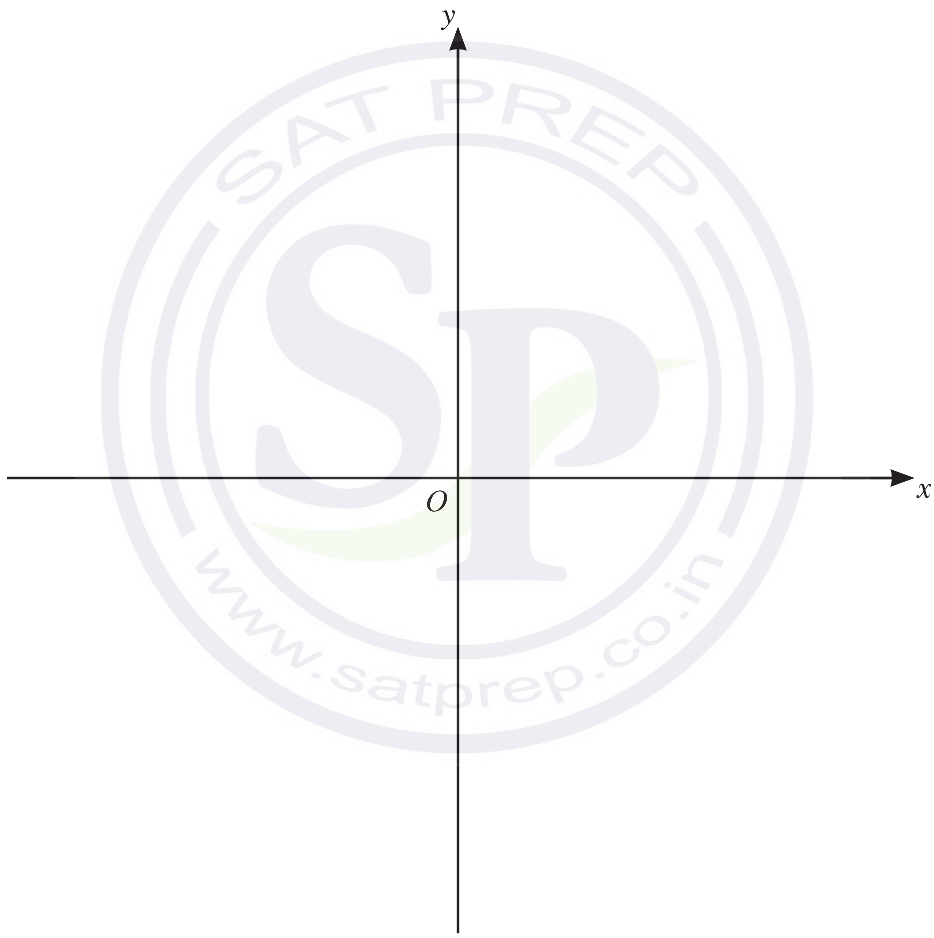
5 Find the coefficient of x^2 in the expansion of $\left(x-\frac{3}{x}\right)\left(x+\frac{2}{x}\right)^5$. [5]

SAT PREP SP www.satprep.co.in

6 $$\mathrm{f}(x) = x^2 + 2x - 3 \quad \text{for } x \geqslant -1$$

(a) Given that the minimum value of $x^2 + 2x - 3$ occurs when $x = -1$, explain why $\mathrm{f}(x)$ has an inverse. [1]

(b) On the axes below, sketch the graph of $y = \mathrm{f}(x)$ and the graph of $y = \mathrm{f}^{-1}(x)$. Label each graph and state the intercepts on the coordinate axes.



[4]

7 A curve has equation $y = \dfrac{\ln(3x^2 - 5)}{2x + 1}$ for $3x^2 > 5$.

(a) Find the equation of the normal to the curve at the point where $x = \sqrt{2}$. [6]

(b) Find the approximate change in y as x increases from $\sqrt{2}$ to $\sqrt{2} + h$, where h is small. [1]

8 **(a)** Find the number of ways in which 12 people can be put into 3 groups containing 3, 4 and 5 people respectively. [3]

(b) 4-digit numbers are to be formed using four of the digits 2, 3, 7, 8 and 9. Each digit may be used once only in any 4-digit number. Find how many 4-digit numbers can be formed if

(i) there are no restrictions, [1]

(ii) the number is even, [1]

(iii) the number is greater than 7000 and odd. [3]

SAT PREP SP www.satprep.co.in

9 A curve has equation $y = (2x-1)\sqrt{4x+3}$.

(a) Show that $\frac{dy}{dx} = \frac{4(Ax+B)}{\sqrt{4x+3}}$, where A and B are constants. [5]

(b) Hence write down the x-coordinate of the stationary point of the curve. [1]

(c) Determine the nature of this stationary point. [2]

SAT PREP SP www.satprep.co.in

10 The polynomial $p(x) = 6x^3 + ax^2 + bx + 2$, where a and b are integers, has a factor of $x - 2$.

(a) Given that $p(1) = -2p(0)$, find the value of a and of b. [4]

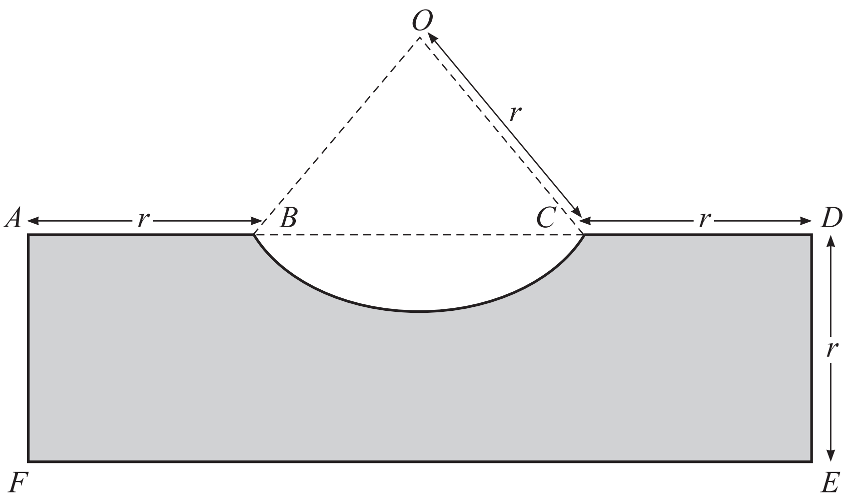
SAT PREP SP www.satprep.co.in

(b) Using your values of a and b,

(i) find the remainder when $p(x)$ is divided by $2x - 1$, [2]

(ii) factorise $p(x)$. [2]

11 In this question all lengths are in centimetres and all angles are in radians.



The diagram shows the rectangle *ADEF*, where $AF = DE = r$. The points *B* and *C* lie on *AD* such that $AB = CD = r$. The curve *BC* is an arc of the circle, centre *O*, radius *r* and has a length of $1.5r$.

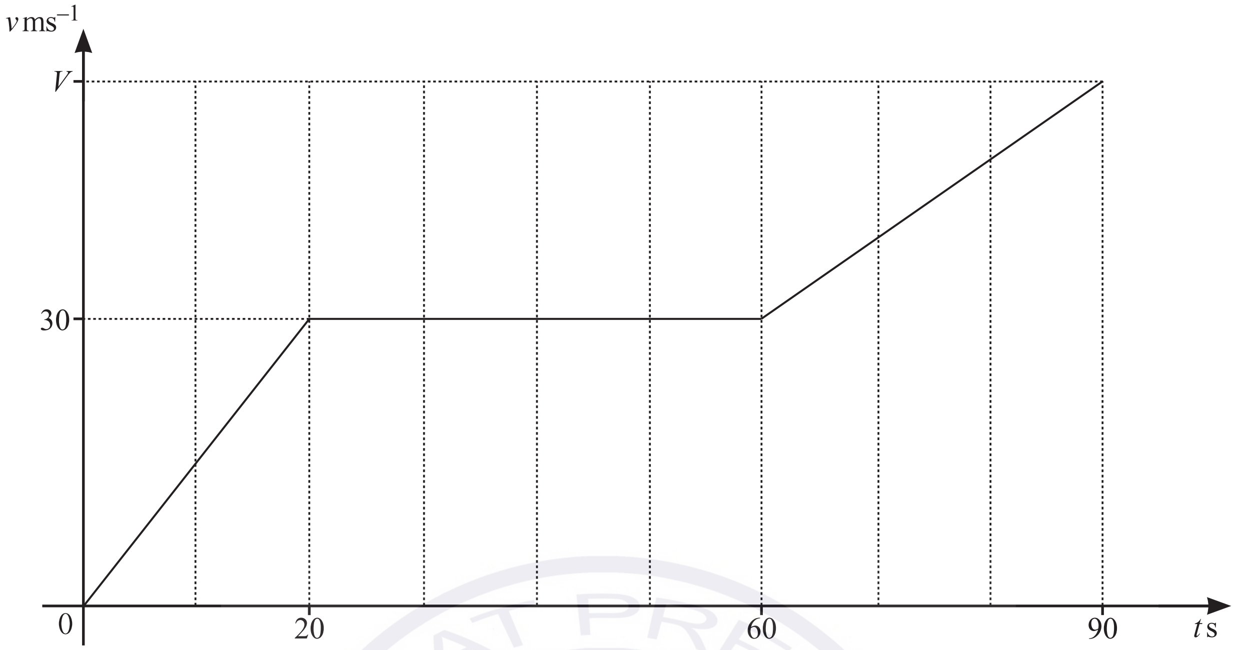
(a) Show that the perimeter of the shaded region is $(7.5 + 2\sin 0.75)r$. [5]

www.satprep.co.in

(b) Find the area of the shaded region, giving your answer in the form kr^2, where k is a constant correct to 2 decimal places. [4]

SAT PREP
SP
www.satprep.co.in

12 **(a)**



The diagram shows the velocity–time graph of a particle P that travels 2775 m in 90 s, reaching a final velocity of V ms^{-1}.

(i) Find the value of V. [3]

(ii) Write down the acceleration of P when $t = 40$. [1]

(b) The acceleration, a ms^{-2}, of a particle Q travelling in a straight line, is given by $a = 6\cos 2t$ at time t s. When $t = 0$ the particle is at point O and is travelling with a velocity of $10\,\text{ms}^{-1}$.

(i) Find the velocity of Q at time t. [3]

(ii) Find the displacement of Q from O at time t. [3]

SAT PREP SP www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

2950468632

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a + l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1 - r^n)}{1 - r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1 - r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

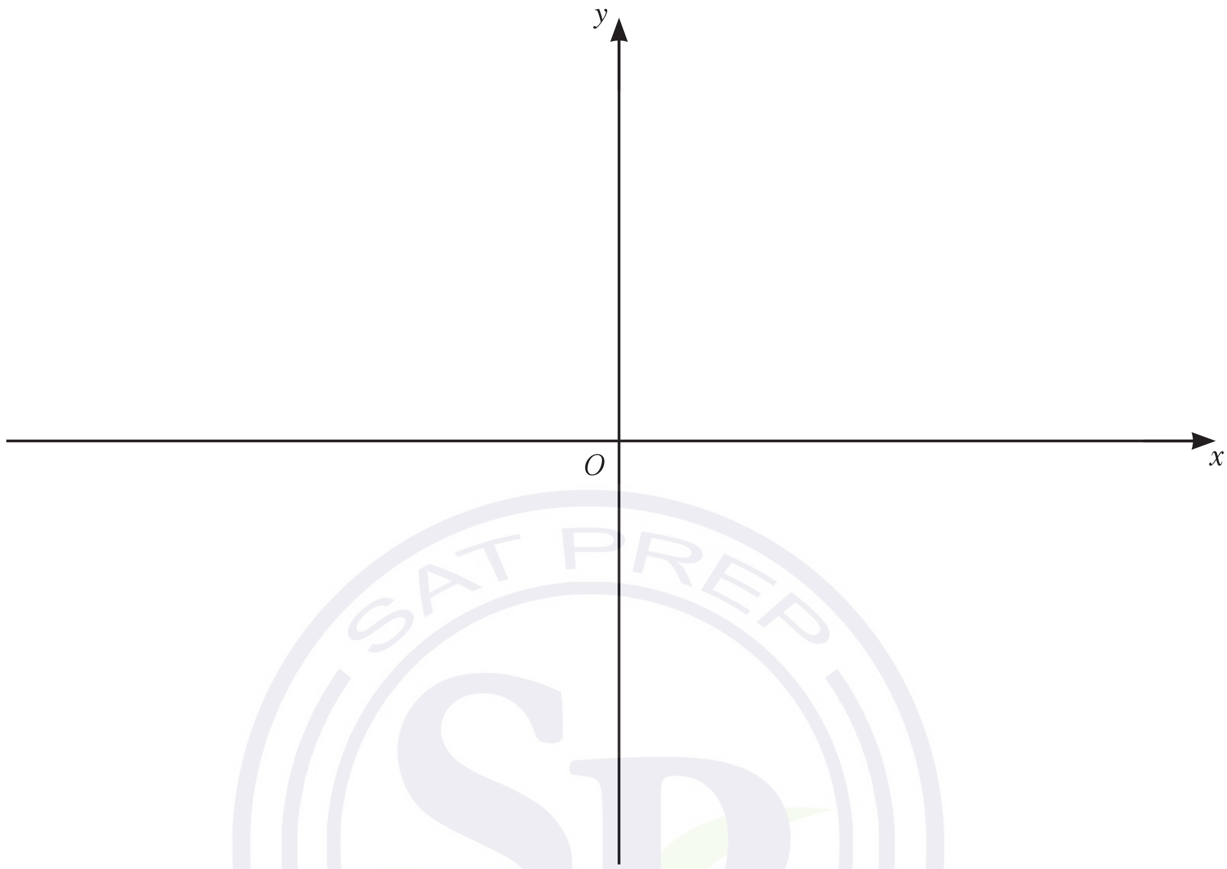
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 **(a)** On the axes below, sketch the graph of $y=(x-2)(x+1)(3-x)$, stating the intercepts on the coordinate axes.



[3]

(b) Hence write down the values of x such that $(x-2)(x+1)(3-x) > 0$. [2]

SAT PREP SP www.satprep.co.in

2 **(a)** Given that $y = \dfrac{e^{2x-3}}{x^2+1}$, find $\dfrac{dy}{dx}$. [3]

(b) Hence, given that y is increasing at the rate of 2 units per second, find the exact rate of change of x when $x = 2$. [3]

SAT PREP
SP
www.satprep.co.in

3 **(a)** $\mathrm{f}(x) = 4\ln(2x-1)$

(i) Write down the largest possible domain for the function f. [1]

(ii) Find $\mathrm{f}^{-1}(x)$ and its domain. [3]

(b)

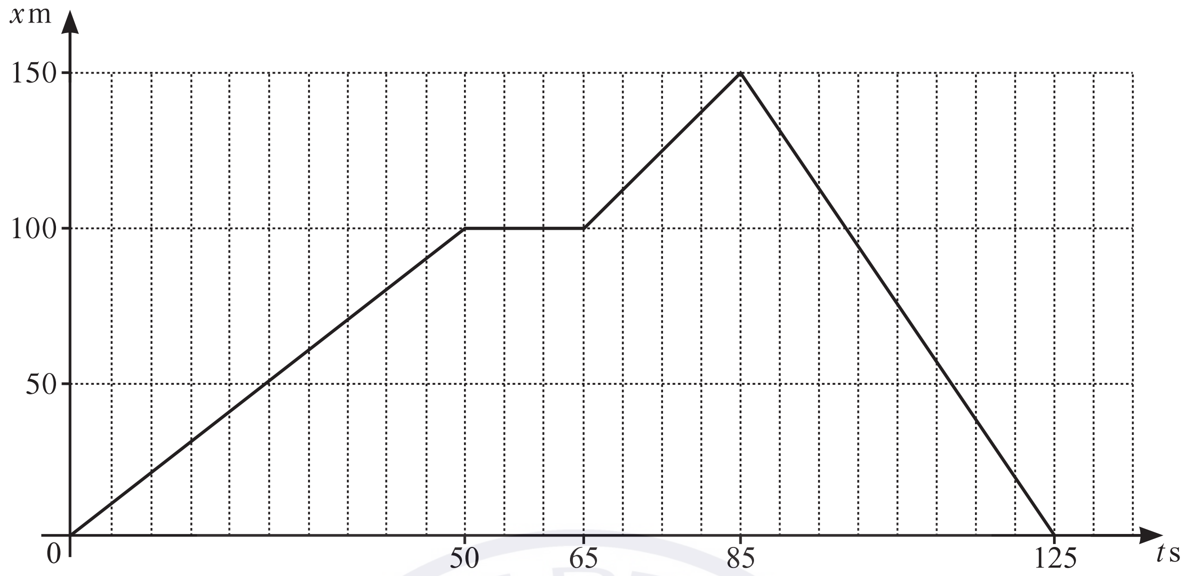
$\mathrm{g}(x) = x+5 \quad \text{for } x \in \mathbb{R}$

$\mathrm{h}(x) = \sqrt{2x-3} \quad \text{for } x \geqslant \frac{3}{2}$

Solve $\mathrm{gh}(x) = 7$. [3]

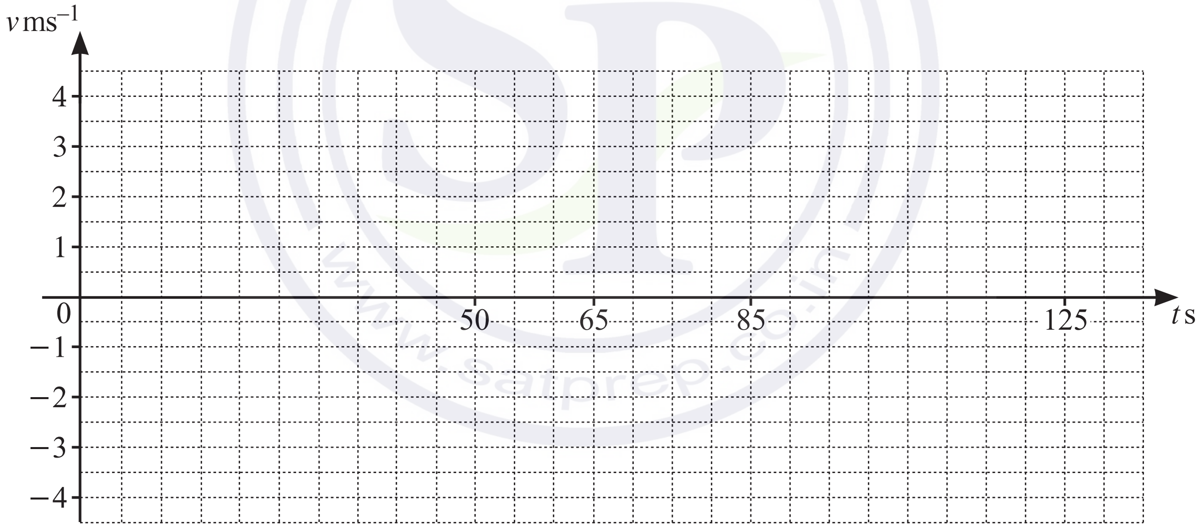
© UCLES 2020

4 **(a)**



The diagram shows the x–t graph for a runner, where displacement, x, is measured in metres and time, t, is measured in seconds.

(i) On the axes below, draw the v–t graph for the runner. [3]



(ii) Find the total distance covered by the runner in 125 s. [1]

(b) The displacement, x m, of a particle from a fixed point at time t s is given by $x = 6\cos\left(3t + \frac{\pi}{3}\right)$. Find the acceleration of the particle when $t = \frac{2\pi}{3}$. [3]

5 Given that the coefficient of x^2 in the expansion of $(1+x)\left(1-\frac{x}{2}\right)^n$ is $\frac{25}{4}$, find the value of the positive integer n. [5]

www.satprep.co.in

6 It is known that $y = A \times 10^{bx^2}$, where A and b are constants. When $\lg y$ is plotted against x^2, a straight line passing through the points (3.63, 5.25) and (4.83, 6.88) is obtained.

(a) Find the value of A and of b. [4]

Using your values of A and b, find

(b) the value of y when $x = 2$, [2]

(c) the positive value of x when $y = 4$. [2]

© UCLES 2020

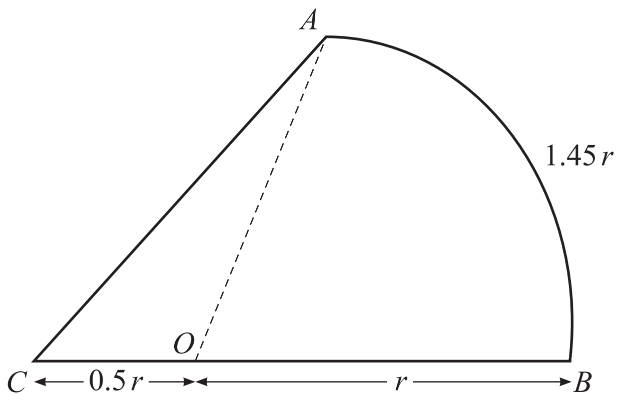
7 The polynomial $p(x) = ax^3 + bx^2 - 19x + 4$, where a and b are constants, has a factor $x + 4$ and is such that $2p(1) = 5p(0)$.

(a) Show that $p(x) = (x+4)(Ax^2 + Bx + C)$, where A, B and C are integers to be found. [6]

(b) Hence factorise $p(x)$. [1]

(c) Find the remainder when $p'(x)$ is divided by x. [1]

8 In this question all lengths are in centimetres.



The diagram shows the figure ABC. The arc AB is part of a circle, centre O, radius r, and is of length $1.45r$. The point O lies on the straight line CB such that $CO = 0.5r$.

(a) Find, in radians, the angle AOB. [1]

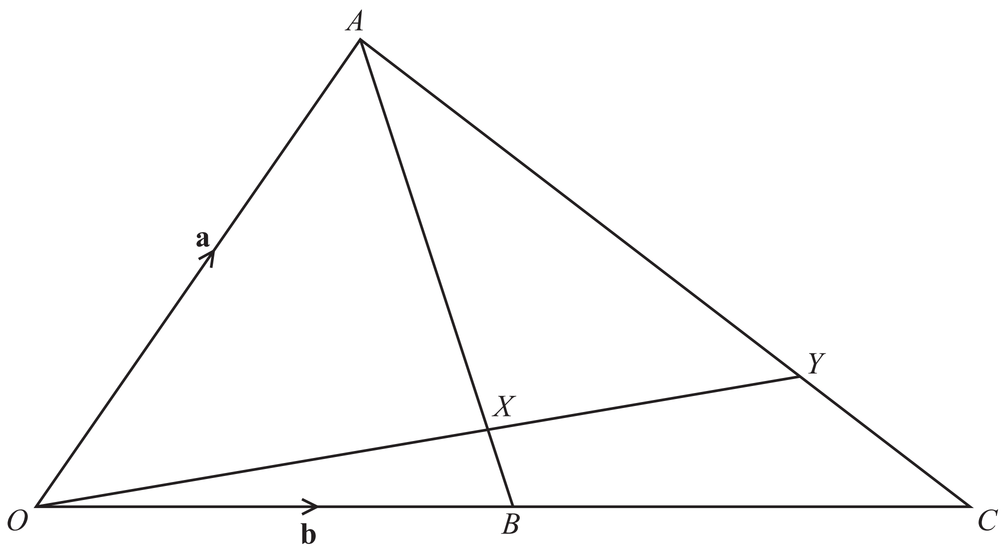
(b) Find the area of ABC, giving your answer in the form kr^2, where k is a constant. [3]

www.satprep.co.in

(c) Given that the perimeter of ABC is 12 cm, find the value of r. [4]

SAT PREP
SP
www.satprep.co.in

9



The diagram shows the triangle OAC. The point B is the midpoint of OC. The point Y lies on AC such that OY intersects AB at the point X where $AX : XB = 3:1$. It is given that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

(a) Find $\overrightarrow{OX}$ in terms of $\mathbf{a}$ and $\mathbf{b}$, giving your answer in its simplest form. [3]

(b) Find $\overrightarrow{AC}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. [1]

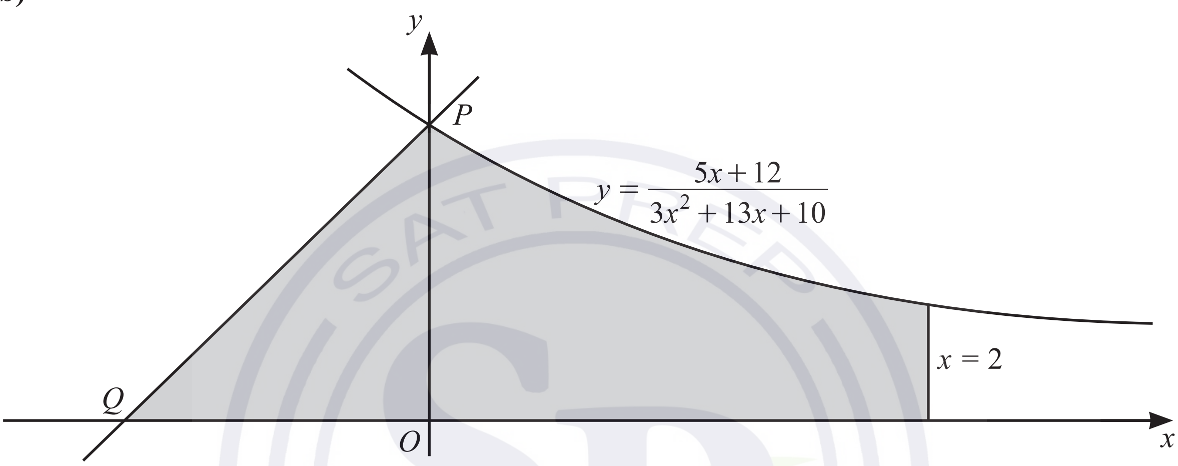
(c) Given that $\overrightarrow{OY} = h\overrightarrow{OX}$, find $\overrightarrow{AY}$ in terms of **a**, **b** and h. [1]

(d) Given that $\overrightarrow{AY} = m\overrightarrow{AC}$, find the value of h and of m. [4]

SAT PREP
SP
www.satprep.co.in

10 (a) Show that $\dfrac{1}{x+1}+\dfrac{2}{3x+10}$ can be written as $\dfrac{5x+12}{3x^2+13x+10}$. [1]

(b)



The diagram shows part of the curve $y=\dfrac{5x+12}{3x^2+13x+10}$, the line $x = 2$ and a straight line of gradient 1. The curve intersects the y-axis at the point P. The line of gradient 1 passes through P and intersects the x-axis at the point Q. Find the area of the shaded region, giving your answer in the form $a+\frac{2}{3}\ln\left(b\sqrt{3}\right)$, where a and b are constants. [9]

© UCLES 2020

Additional working space for question 10

SAT PREP
SP
www.satprep.co.in

Question 11 is printed on the next page.

11 **(a)** Given that $2\cos x = 3\tan x$, show that $2\sin^2 x + 3\sin x - 2 = 0$. [3]

(b) Hence solve $2\cos\left(2\alpha + \frac{\pi}{4}\right) = 3\tan\left(2\alpha + \frac{\pi}{4}\right)$ for $0 < \alpha < \pi$ radians, giving your answers in terms of π. [4]

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

© UCLES 2020

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4440026581

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

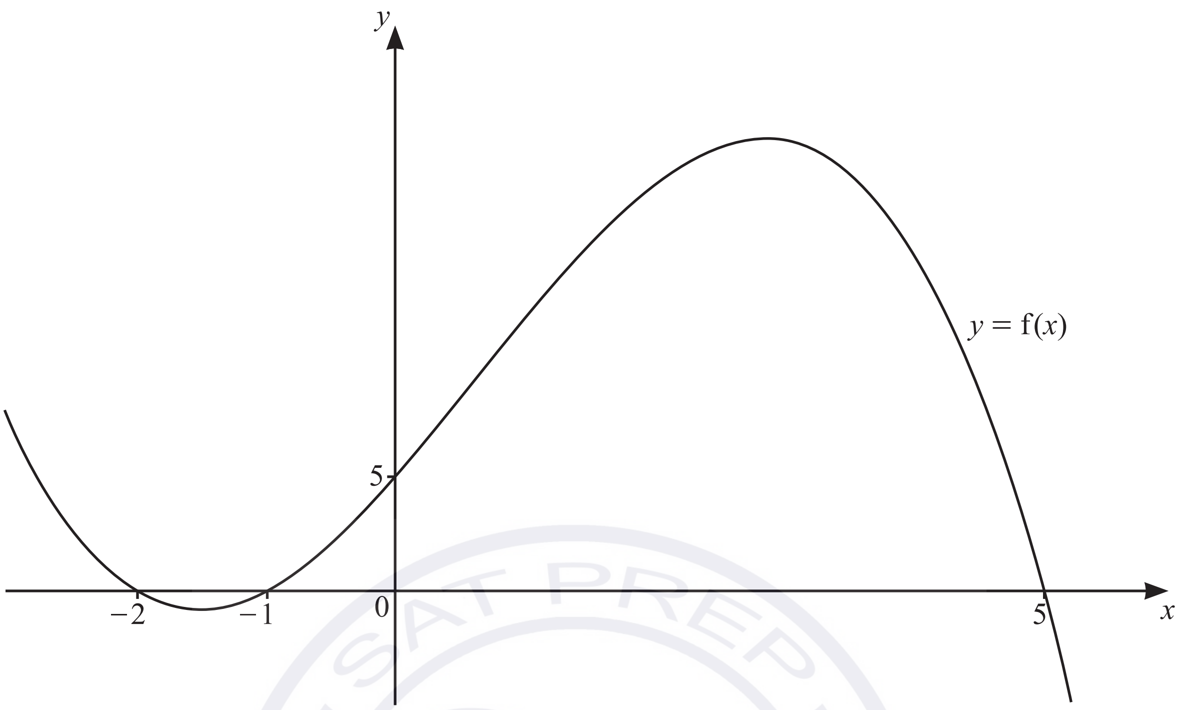
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2020

1 The diagram shows the graph of a cubic curve $y = f(x)$.



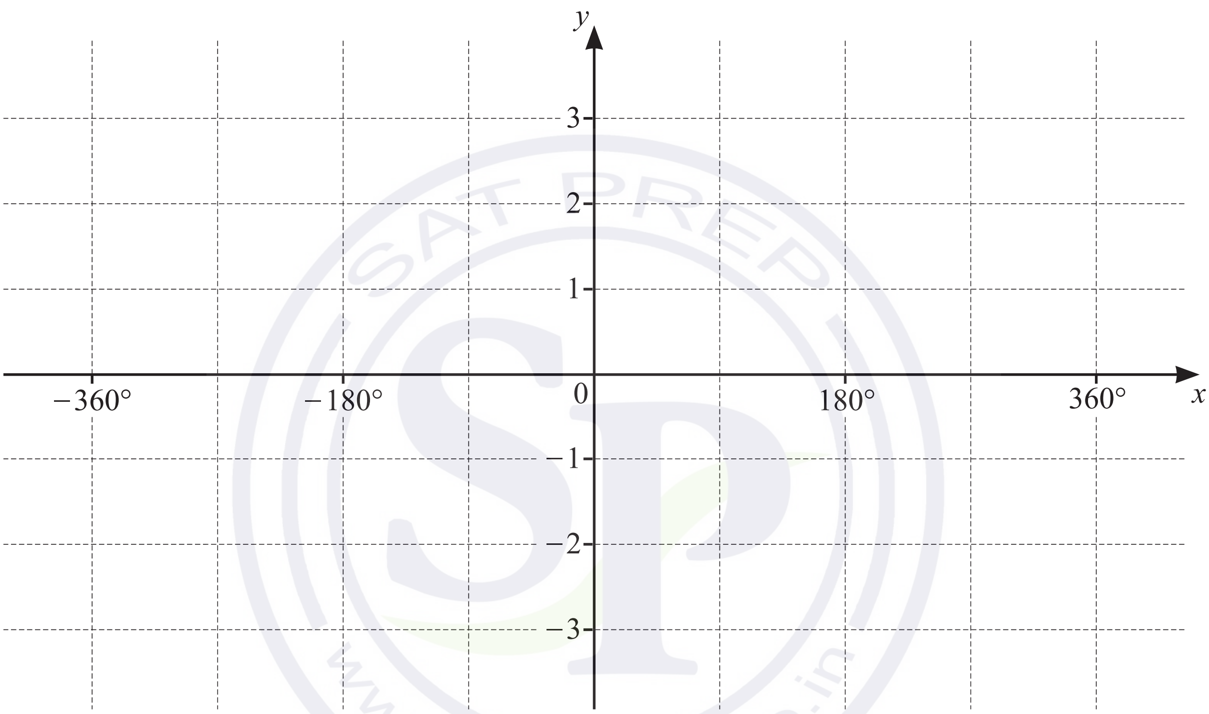
(a) Find an expression for $f(x)$. [2]

(b) Solve $f(x) \leqslant 0$. [2]

www.satprep.co.in

2 **(a)** Write down the period of $2\cos\frac{x}{3}-1$. [1]

(b) On the axes below, sketch the graph of $y=2\cos\frac{x}{3}-1$ for $-360° \leqslant x \leqslant 360°$. [3]



© UCLES 2020

3 The radius, r cm, of a circle is increasing at the rate of $5\,\text{cms}^{-1}$. Find, in terms of π, the rate at which the area of the circle is increasing when $r = 3$. [4]

www.satprep.co.in

4 DO NOT USE A CALCULATOR IN THIS QUESTION.

Find the positive solution of the equation $\left(5+4\sqrt{7}\right)x^2+\left(4-2\sqrt{7}\right)x-1=0$, giving your answer in the form $a+b\sqrt{7}$, where a and b are fractions in their simplest form. [5]

SAT PREP SP www.satprep.co.in

5 Find the equation of the tangent to the curve $y = \dfrac{\ln\left(3x^2 - 1\right)}{x+2}$ at the point where $x = 1$. Give your answer in the form $y = mx + c$, where m and c are constants correct to 3 decimal places. [6]

SAT PREP SP www.satprep.co.in

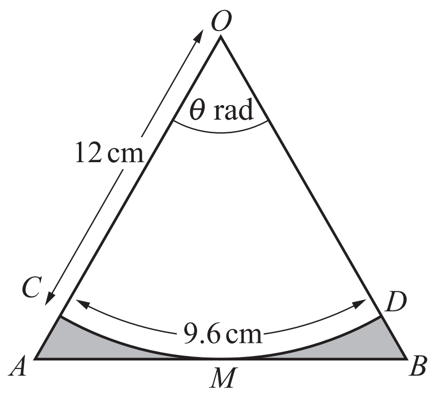
6 The line $y = 5x + 6$ meets the curve $xy = 8$ at the points A and B.

(a) Find the coordinates of A and of B. [3]

(b) Find the coordinates of the point where the perpendicular bisector of the line AB meets the line $y = x$. [5]

SAT PREP
SP
www.satprep.co.in

7



The diagram shows an isosceles triangle OAB such that $OA = OB$ and angle $AOB = \theta$ radians. The points C and D lie on OA and OB respectively. CD is an arc of length 9.6 cm of the circle, centre O, radius 12 cm. The arc CD touches the line AB at the point M.

(a) Find the value of θ. [1]

(b) Find the total area of the shaded regions. [4]

(c) Find the total perimeter of the shaded regions. [3]

© UCLES 2020

8 **(a)** Show that $\frac{3}{2x-3}+\frac{3}{2x+3}$ can be written as $\frac{12x}{4x^2-9}$. [2]

(b) Hence find $\int \frac{12x}{4x^2-9}\,\mathrm{d}x$, giving your answer as a single logarithm and an arbitrary constant. [3]

SAT PREP SP www.satprep.co.in

(c) Given that $\int_2^a \frac{12x}{4x^2-9}\,dx = \ln 5\sqrt{5}$, where $a > 2$, find the exact value of a. [4]

www.satprep.co.in

9 **(a)** An arithmetic progression has a second term of -14 and a sum to 21 terms of 84. Find the first term and the 21st term of this progression. [5]

SAT PREP
SP
www.satprep.co.in

(b) A geometric progression has a second term of $27p^2$ and a fifth term of p^5. The common ratio, r, is such that $0 < r < 1$.

(i) Find r in terms of p. [2]

(ii) Hence find, in terms of p, the sum to infinity of the progression. [3]

(iii) Given that the sum to infinity is 81, find the value of p. [2]

www.satprep.co.in

10 **(a)** **(i)** Show that $\dfrac{1}{\sec\theta - 1} - \dfrac{1}{\sec\theta + 1} = 2\cot^2\theta$. [3]

(ii) Hence solve $\dfrac{1}{\sec 2x - 1} - \dfrac{1}{\sec 2x + 1} = 6$ for $-90° < x < 90°$. [5]

SAT PREP SP www.satprep.co.in

(b) Solve $\operatorname{cosec}\left(y+\frac{\pi}{3}\right)=2$ for $0 \leqslant y \leqslant 2\pi$ radians, giving your answers in terms of π. [4]

SAT PREP SP www.satprep.co.in

Question 11 is printed on the next page.

11 A curve is such that $\dfrac{d^2y}{dx^2} = 5\cos 2x$. This curve has a gradient of $\dfrac{3}{4}$ at the point $\left(-\dfrac{\pi}{12}, \dfrac{5\pi}{4}\right)$. Find the equation of this curve. [8]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

5814812485

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

DC (NF/CB) 196732/3 **R**
© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

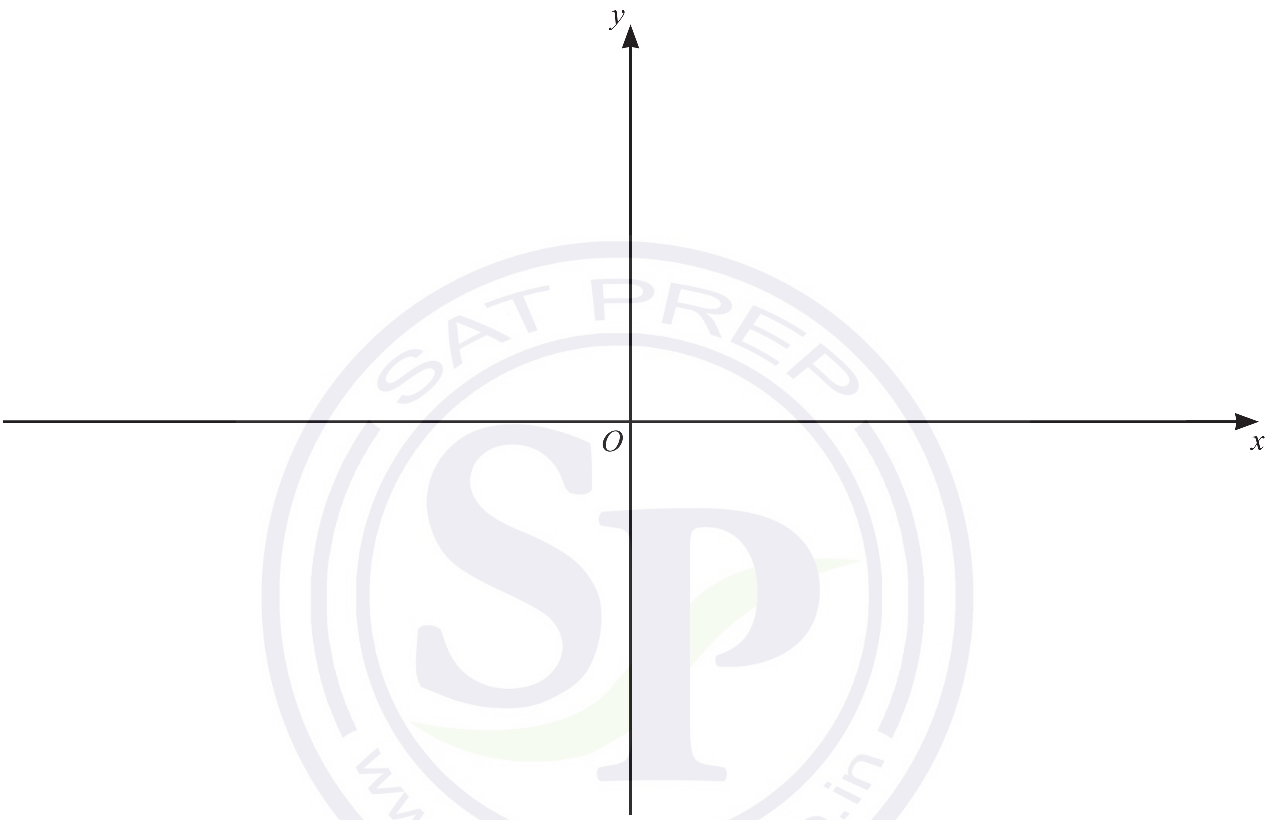
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 On the axes below, sketch the graph of $y = |(x-2)(x+1)(x+2)|$ showing the coordinates of the points where the curve meets the axes. [3]



SAT PREP
SP
www.satprep.co.in

2 The volume, V, of a sphere of radius r is given by $V = \frac{4}{3}\pi r^3$.

The radius, r cm, of a sphere is increasing at the rate of $0.5\,\text{cm s}^{-1}$. Find, in terms of π, the rate of change of the volume of the sphere when $r = 0.25$. [4]

3 **(a)** Find the first 3 terms in the expansion of $\left(4-\frac{x}{16}\right)^6$ in ascending powers of x. Give each term in its simplest form. [3]

(b) Hence find the term independent of x in the expansion of $\left(4-\frac{x}{16}\right)^6\left(x-\frac{1}{x}\right)^2$. [3]

www.satprep.co.in

4 **(a)** **(i)** Find how many different 5-digit numbers can be formed using the digits 1, 2, 3, 5, 7 and 8, if each digit may be used only once in any number. [1]

(ii) How many of the numbers found in **part (i)** are not divisible by 5? [1]

(iii) How many of the numbers found in **part (i)** are even and greater than 30 000? [4]

(b) The number of combinations of n items taken 3 at a time is 6 times the number of combinations of n items taken 2 at a time. Find the value of the constant n. [4]

SAT PREP SP www.satprep.co.in

5 $$f : x \mapsto (2x+3)^2 \quad \text{for } x > 0$$

(a) Find the range of f. [1]

(b) Explain why f has an inverse. [1]

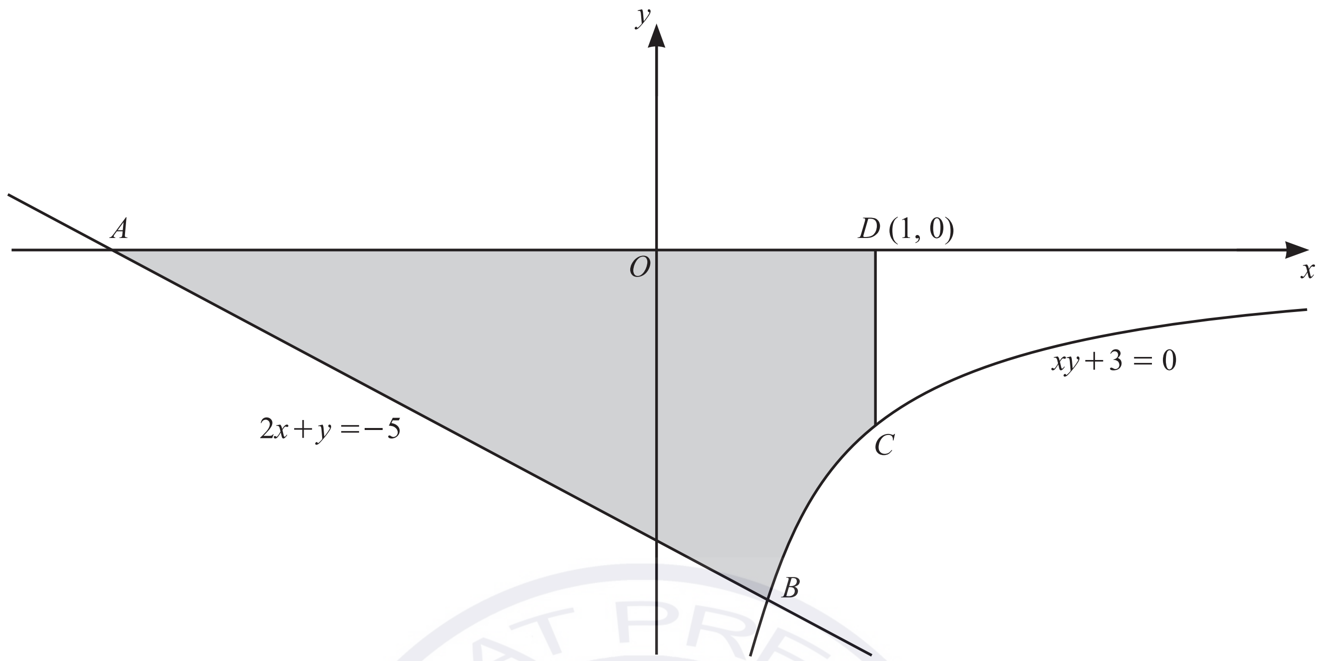
(c) Find f^{-1}. [3]

(d) State the domain of f^{-1}. [1]

(e) Given that $g : x \mapsto \ln(x+4)$ for $x > 0$, find the exact solution of $fg(x) = 49$. [3]

© UCLES 2020

6



The diagram shows the straight line $2x + y = -5$ and part of the curve $xy + 3 = 0$. The straight line intersects the x-axis at the point A and intersects the curve at the point B. The point C lies on the curve. The point D has coordinates $(1, 0)$. The line CD is parallel to the y-axis.

(a) Find the coordinates of each of the points A and B. [3]

(b) Find the area of the shaded region, giving your answer in the form $p + \ln q$, where p and q are positive integers. [6]

SAT PREP
SP
www.satprep.co.in

7 **(a)** Given that $y = (x^2 - 1)\sqrt{5x+2}$, show that $\frac{dy}{dx} = \frac{Ax^2 + Bx + C}{2\sqrt{5x+2}}$, where A, B and C are integers. [5]

www.satprep.co.in SAT PREP SP

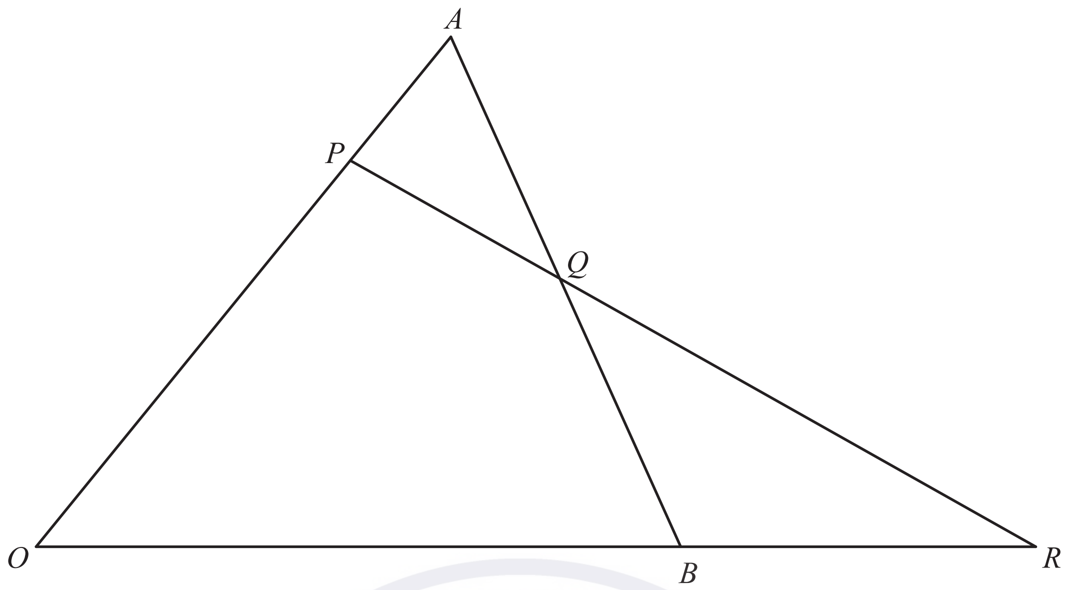
(b) Find the coordinates of the stationary point of the curve $y = (x^2 - 1)\sqrt{5x+2}$, for $x > 0$. Give each coordinate correct to 2 significant figures. [3]

SAT PREP
SP
www.satprep.co.in

(c) Determine the nature of this stationary point. [2]

© UCLES 2020

8



The diagram shows a triangle OAB such that $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. The point P lies on OA such that $OP = \frac{3}{4}OA$. The point Q is the mid-point of AB. The lines OB and PQ are extended to meet at the point R. Find, in terms of $\mathbf{a}$ and $\mathbf{b}$,

(a) $\overrightarrow{AB}$, [1]

(b) $\overrightarrow{PQ}$. Give your answer in its simplest form. [3]

It is given that $n\overrightarrow{PQ} = \overrightarrow{QR}$ and $\overrightarrow{BR} = k\mathbf{b}$, where n and k are positive constants.

(c) Find $\overrightarrow{QR}$ in terms of n, **a** and **b**. [1]

(d) Find $\overrightarrow{QR}$ in terms of k, **a** and **b**. [2]

(e) Hence find the value of n and of k. [3]

SAT PREP SP www.satprep.co.in

9 **(a)** A particle P moves in a straight line such that its displacement, x m, from a fixed point O at time t s is given by $x = 10\sin 2t - 5$.

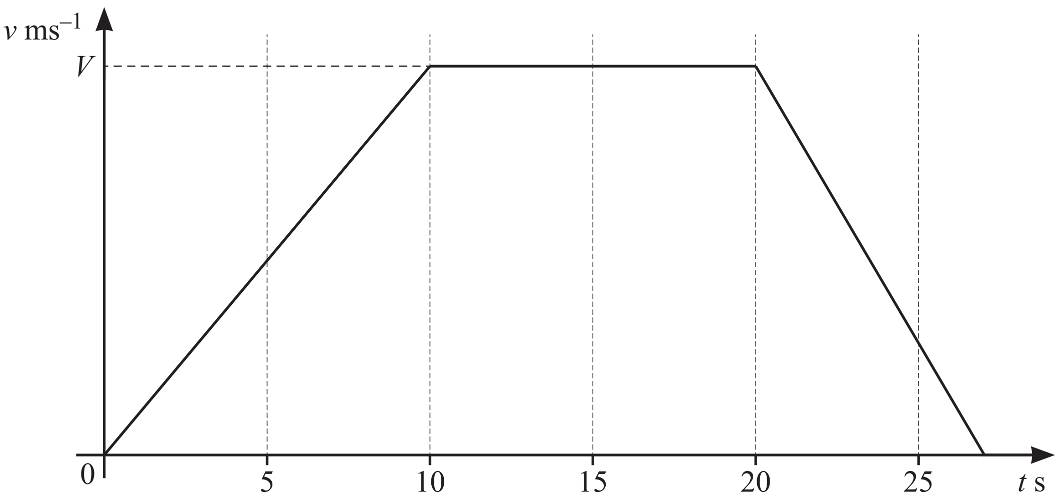
(i) Find the speed of P when $t = \pi$. [1]

(ii) Find the value of t for which P is first at rest. [2]

(iii) Find the acceleration of P when it is first at rest. [2]

SAT PREP SP www.satprep.co.in

(b)



The diagram shows the velocity–time graph for a particle Q travelling in a straight line with velocity $v\,\text{ms}^{-1}$ at time t s. The particle accelerates at $3.5\,\text{ms}^{-2}$ for the first 10 s of its motion and then travels at constant velocity, $V\,\text{ms}^{-1}$, for 10 s. The particle then decelerates at a constant rate and comes to rest. The distance travelled during the interval $20 \leqslant t \leqslant 25$ is 112.5 m.

(i) Find the value of V. [1]

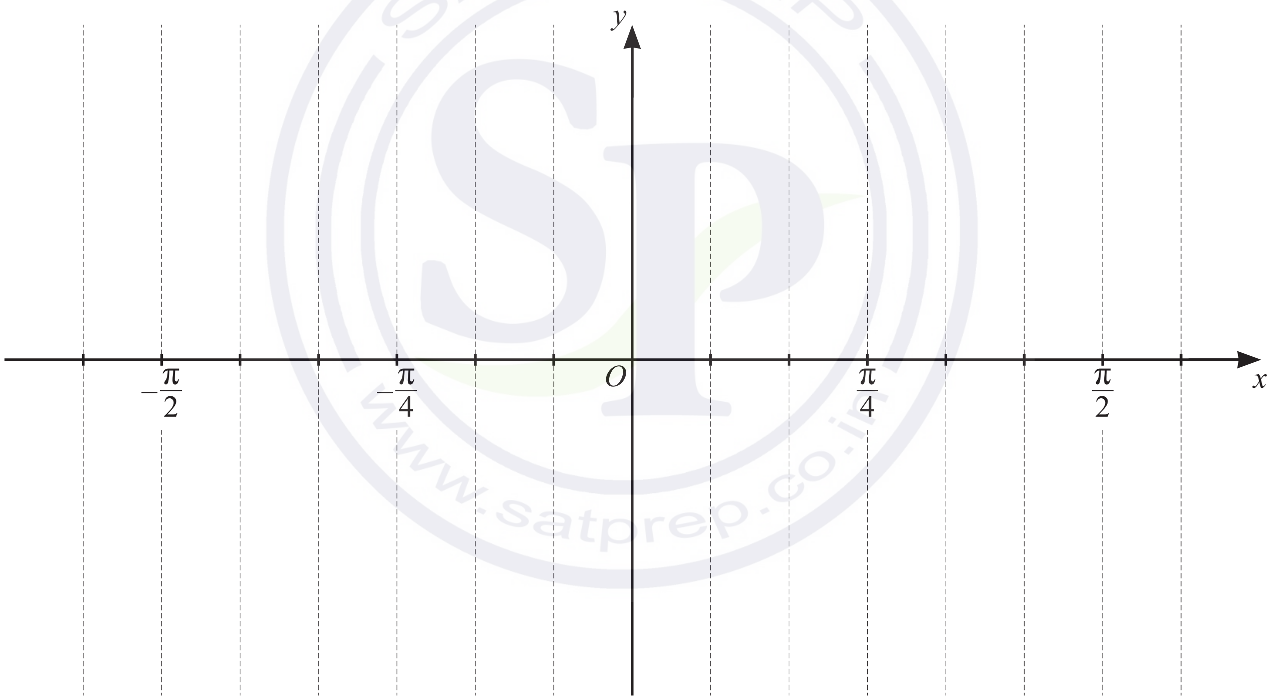
(ii) Find the velocity of Q when $t = 25$. [3]

(iii) Find the value of t when Q comes to rest. [3]

Question 10 is printed on the next page.

10 **(a)** Solve $\tan 3x = -1$ for $-\frac{\pi}{2} \leqslant x \leqslant \frac{\pi}{2}$ radians, giving your answers in terms of π. [4]

(b) Use your answers to **part (a)** to sketch the graph of $y = 4\tan 3x + 4$ for $-\frac{\pi}{2} \leqslant x \leqslant \frac{\pi}{2}$ radians on the axes below. Show the coordinates of the points where the curve meets the axes.



[3]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2037547431

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

DC (JC/CT) 196731/3 **R**
© UCLES 2020

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $\quad u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $\quad u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\mathrm{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2020

1

$$f(x) = 3 + e^x \quad \text{for } x \in \mathbb{R}$$

$$g(x) = 9x - 5 \quad \text{for } x \in \mathbb{R}$$

(a) Find the range of f and of g. [2]

(b) Find the exact solution of $f^{-1}(x) = g'(x)$. [3]

(c) Find the solution of $g^2(x) = 112$. [2]

© UCLES 2020

2 **(a)** Given that $\log_2 x + 2\log_4 y = 8$, find the value of xy. [3]

(b) Using the substitution $y = 2^x$, or otherwise, solve $2^{2x+1} - 2^{x+1} - 2^x + 1 = 0$. [4]

SAT PREP SP www.satprep.co.in

3 At time t s, a particle travelling in a straight line has acceleration $(2t+1)^{-\frac{1}{2}}\,\mathrm{ms}^{-2}$. When $t = 0$, the particle is 4 m from a fixed point O and is travelling with velocity $8\,\mathrm{ms}^{-1}$ away from O.

(a) Find the velocity of the particle at time t s. [3]

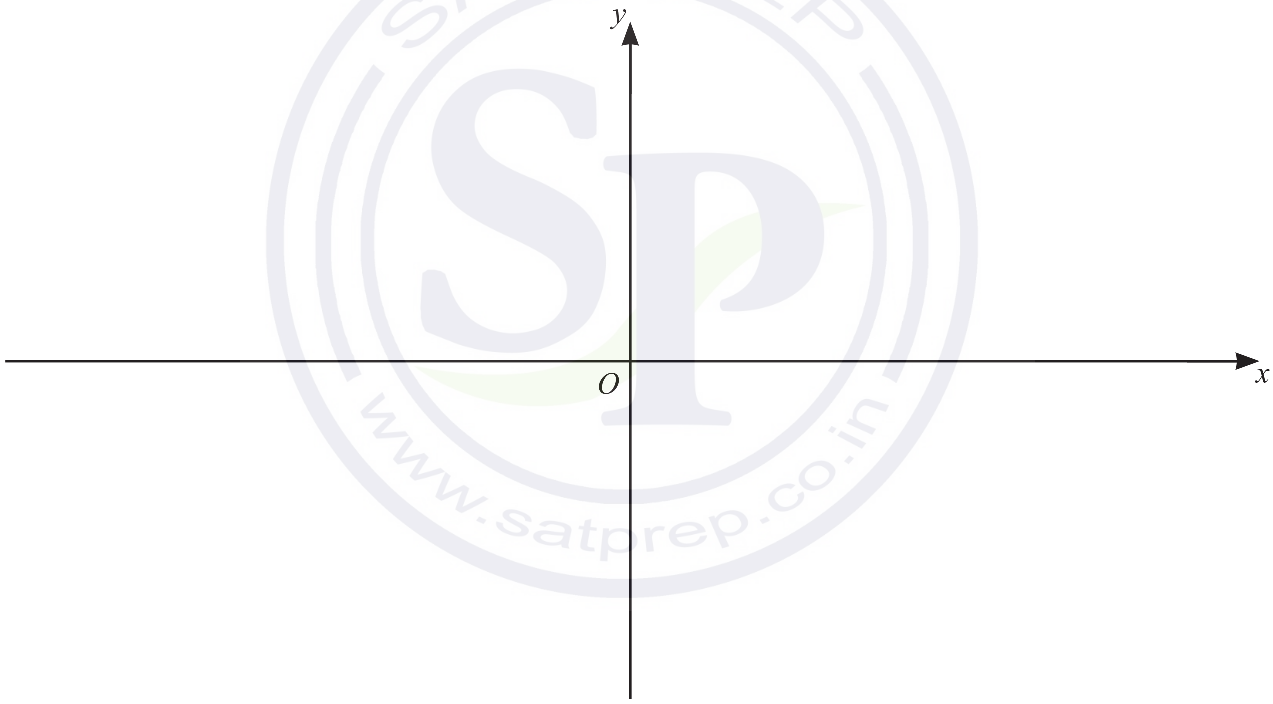
(b) Find the displacement of the particle from O at time t s. [4]

SAT PREP SP www.satprep.co.in

4 **(a)** Write $2x^2 + 3x - 4$ in the form $a(x+b)^2 + c$, where a, b and c are constants. [3]

(b) Hence write down the coordinates of the stationary point on the curve $y = 2x^2 + 3x - 4$. [2]

(c) On the axes below, sketch the graph of $y = |2x^2 + 3x - 4|$, showing the exact values of the intercepts of the curve with the coordinate axes. [3]



(d) Find the value of k for which $|2x^2 + 3x - 4| = k$ has exactly 3 values of x. [1]

© UCLES 2020

5 $\mathrm{p}(x) = 6x^3 + ax^2 + 12x + b$, where a and b are integers.

$\mathrm{p}(x)$ has a remainder of 11 when divided by $x - 3$ and a remainder of -21 when divided by $x + 1$.

(a) Given that $\mathrm{p}(x) = (x-2)Q(x)$, find $Q(x)$, a quadratic factor with numerical coefficients. [6]

(b) Hence solve $\mathrm{p}(x) = 0$. [2]

SAT PREP SP www.satprep.co.in

6 **(a)** Find the unit vector in the direction of $\begin{pmatrix} 5 \\ -12 \end{pmatrix}$. [1]

(b) Given that $\begin{pmatrix} 4 \\ 1 \end{pmatrix} + k\begin{pmatrix} -2 \\ 3 \end{pmatrix} = r\begin{pmatrix} -10 \\ 5 \end{pmatrix}$, find the value of each of the constants k and r. [3]

SAT PREP SP www.satprep.co.in

(c) Relative to an origin O, the points A, B and C have position vectors $\mathbf{p}$, $3\mathbf{q}-\mathbf{p}$ and $9\mathbf{q}-5\mathbf{p}$ respectively.

(i) Find $\overrightarrow{AB}$ in terms of $\mathbf{p}$ and $\mathbf{q}$. [1]

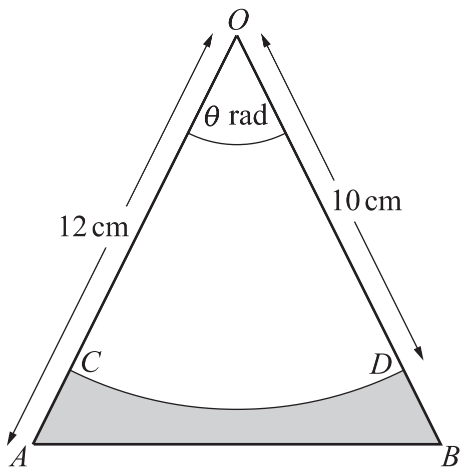
(ii) Find $\overrightarrow{AC}$ in terms of $\mathbf{p}$ and $\mathbf{q}$. [1]

(iii) Explain why A, B and C all lie in a straight line. [1]

SAT PREP
SP
www.satprep.co.in

(iv) Find the ratio $AB : BC$. [1]

7



The diagram shows an isosceles triangle OAB such that $OA = OB = 12\,\text{cm}$ and angle $AOB = \theta$ radians. Points C and D lie on OA and OB respectively such that CD is an arc of the circle, centre O, radius 10 cm. The area of the sector $OCD = 35\,\text{cm}^2$.

(a) Show that $\theta = 0.7$. [1]

(b) Find the perimeter of the shaded region. [4]

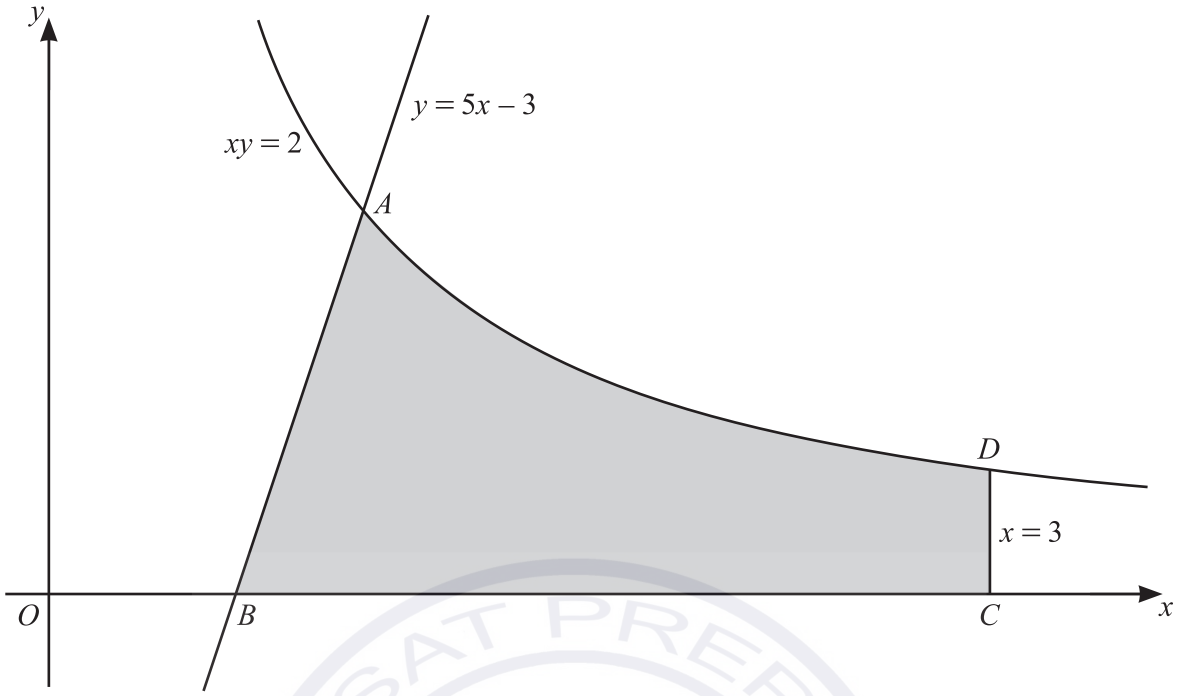
(c) Find the area of the shaded region. [3]

8 **(a)** An arithmetic progression has a first term of 7 and a common difference of 0.4. Find the least number of terms so that the sum of the progression is greater than 300. [4]

(b) The sum of the first two terms of a geometric progression is 9 and its sum to infinity is 36. Given that the terms of the progression are positive, find the common ratio. [4]

SAT PREP SP www.satprep.co.in

9



The diagram shows part of the curve $xy = 2$ intersecting the straight line $y = 5x - 3$ at the point A. The straight line meets the x-axis at the point B. The point C lies on the x-axis and the point D lies on the curve such that the line CD has equation $x = 3$. Find the exact area of the shaded region, giving your answer in the form $p + \ln q$, where p and q are constants. [8]

© UCLES 2020

Additional working space for question 9.

10 **(a)** Given that $y = x\sqrt{x+2}$, show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{Ax+B}{2\sqrt{x+2}}$, where A and B are constants. [5]

SAT PREP
SP
www.satprep.co.in

(b) Find the exact coordinates of the stationary point of the curve $y = x\sqrt{x+2}$. [3]

(c) Determine the nature of this stationary point. [2]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education

Cambridge IGCSE™

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

6562346474

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2020**

2 hours

You must answer on the question paper.

No additional materials are needed.

INSTRUCTIONS

- Answer **all** questions.
- Use a black or dark blue pen. You may use an HB pencil for any diagrams or graphs.
- Write your name, centre number and candidate number in the boxes at the top of the page.
- Write your answer to each question in the space provided.
- Do **not** use an erasable pen or correction fluid.
- Do **not** write on any bar codes.
- You should use a calculator where appropriate.
- You must show all necessary working clearly; no marks will be given for unsupported answers from a calculator.
- Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place for angles in degrees, unless a different level of accuracy is specified in the question.

INFORMATION

- The total mark for this paper is 80.
- The number of marks for each question or part question is shown in brackets [ ].

This document has **16** pages. Blank pages are indicated.

DC (NF/CB) 196735/3 **R**
© UCLES 2020

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

Arithmetic series $u_n = a + (n-1)d$

$$S_n = \frac{1}{2}n(a+l) = \frac{1}{2}n\{2a + (n-1)d\}$$

Geometric series $u_n = ar^{n-1}$

$$S_n = \frac{a(1-r^n)}{1-r} \quad (r \neq 1)$$

$$S_\infty = \frac{a}{1-r} \quad (|r| < 1)$$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

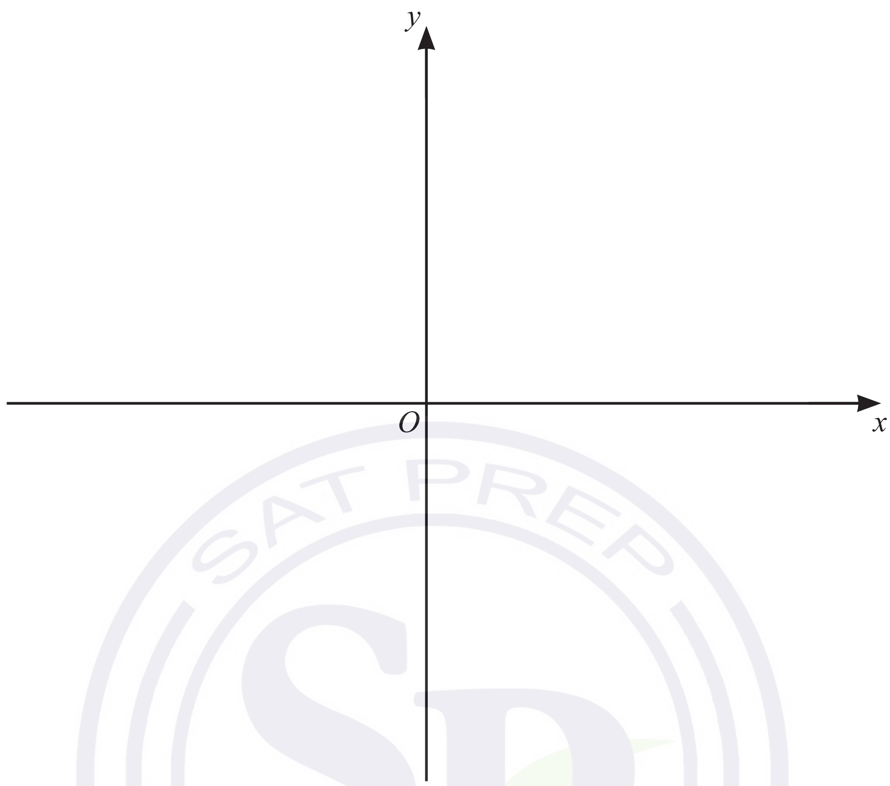
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2020

1 **(a)** On the axes below sketch the graph of $y = -3(x-2)(x-4)(x+1)$, showing the coordinates of the points where the curve intersects the coordinate axes. [3]



(b) Hence find the values of x for which $-3(x-2)(x-4)(x+1) > 0$. [2]

SAT PREP www.satprep.co.in

2 Find the values of k for which the line $y = kx + 3$ is a tangent to the curve $y = 2x^2 + 4x + k - 1$. [5]

SAT PREP SP www.satprep.co.in

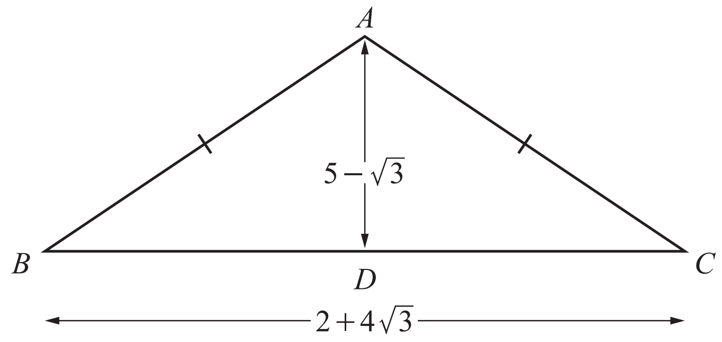
3 The first 3 terms in the expansion of $(3-ax)^5$, in ascending powers of x, can be written in the form $b-81x+cx^2$. Find the value of each of a, b and c. [5]

www.satprep.co.in

4 The tangent to the curve $y = \ln\left(3x^2 - 4\right) - \frac{x^3}{6}$, at the point where $x = 2$, meets the y-axis at the point P. Find the exact coordinates of P. [6]

SAT PREP SP www.satprep.co.in

5 DO NOT USE A CALCULATOR IN THIS QUESTION.
In this question all lengths are in centimetres.



The diagram shows the isosceles triangle ABC, where $AB = AC$ and $BC = 2+4\sqrt{3}$. The height, AD, of the triangle is $5-\sqrt{3}$.

(a) Find the area of the triangle ABC, giving your answer in the form $a+b\sqrt{3}$, where a and b are integers. [2]

(b) Find tan ABC, giving your answer in the form $c+d\sqrt{3}$, where c and d are integers. [3]

(c) Find $\sec^2 ABC$, giving your answer in the form $e+f\sqrt{3}$, where e and f are integers. [2]

6 **Solutions by accurate drawing will not be accepted.**

The points A and B have coordinates $(-2, 4)$ and $(6, 10)$ respectively.

(a) Find the equation of the perpendicular bisector of the line AB, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

The point C has coordinates $(5, p)$ and lies on the perpendicular bisector of AB.

(b) Find the value of p. [1]

It is given that the line AB bisects the line CD.

(c) Find the coordinates of D. [2]

© UCLES 2020

7 $p(x) = ax^3 + 3x^2 + bx - 12$ has a factor of $2x + 1$. When $p(x)$ is divided by $x - 3$ the remainder is 105.

(a) Find the value of a and of b. [5]

SAT PREP SP www.satprep.co.in

(b) Using your values of a and b, write $p(x)$ as a product of $2x + 1$ and a quadratic factor. [2]

(c) Hence solve $p(x) = 0$. [2]

8 In this question all distances are in km.

A ship P sails from a point A, which has position vector $\begin{pmatrix} 0 \\ 0 \end{pmatrix}$, with a speed of $52\,\text{km}\text{h}^{-1}$ in the direction of $\begin{pmatrix} -5 \\ 12 \end{pmatrix}$.

(a) Find the velocity vector of the ship. [1]

(b) Write down the position vector of P at a time t hours after leaving A. [1]

At the same time that ship P sails from A, a ship Q sails from a point B, which has position vector $\begin{pmatrix} 12 \\ 8 \end{pmatrix}$, with velocity vector $\begin{pmatrix} -25 \\ 45 \end{pmatrix}\text{km}\text{h}^{-1}$.

(c) Write down the position vector of Q at a time t hours after leaving B. [1]

(d) Using your answers to **parts (b)** and **(c)**, find the displacement vector $\overrightarrow{PQ}$ at time t hours. [1]

SAT PREP www.satprep.co.in

(e) Hence show that $PQ = \sqrt{34t^2 - 168t + 208}$. [2]

(f) Find the value of t when P and Q are first 2 km apart. [2]

SAT PREP SP www.satprep.co.in

9 **(a)** **(i)** Find how many different 4-digit numbers can be formed using the digits 2, 3, 5, 7, 8 and 9, if each digit may be used only once in any number. [1]

(ii) How many of the numbers found in **part (i)** are divisible by 5? [1]

(iii) How many of the numbers found in **part (i)** are odd and greater than 7000? [4]

SAT PREP www.satprep.co.in

(b) The number of combinations of n items taken 3 at a time is $92n$. Find the value of the constant n. [4]

SAT PREP SP www.satprep.co.in

10 **(a)** Solve $\tan(\alpha + 45°) = -\frac{1}{\sqrt{2}}$ for $0° \leqslant \alpha \leqslant 360°$. [3]

(b) **(i)** Show that $\frac{1}{\sin\theta - 1} - \frac{1}{\sin\theta + 1} = a\sec^2\theta$, where a is a constant to be found. [3]

SAT PREP SP www.satprep.co.in

(ii) Hence solve $\dfrac{1}{\sin 3\phi - 1} - \dfrac{1}{\sin 3\phi + 1} = -8$ for $-\dfrac{\pi}{3} \leqslant \phi \leqslant \dfrac{\pi}{3}$ radians. [5]

SAT PREP
SP
www.satprep.co.in

Question 11 is on the next page.

11 Given that $\int_1^a \left(\frac{2}{2x+3}+\frac{3}{3x-1}-\frac{1}{x}\right)dx = \ln 2.4$ and that $a > 1$, find the value of a. [7]

SAT PREP
www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3060253848

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (CE/SW) 172295/2
© UCLES 2019

Cambridge Assessment International Education

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

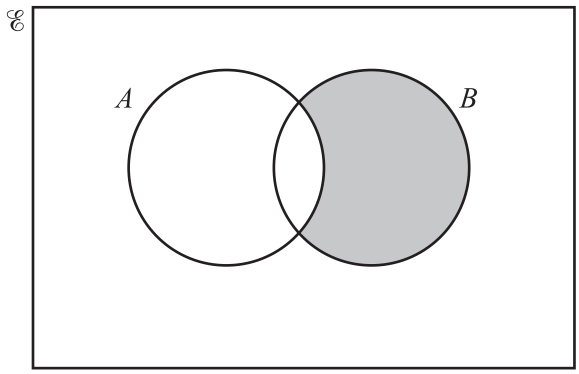
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

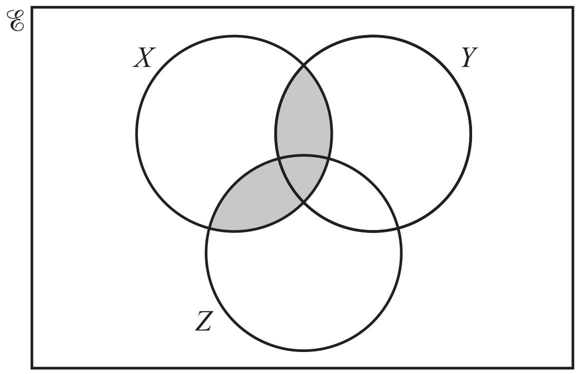
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2019

1 Using set notation, describe the regions shaded on the Venn diagrams below.





.... [2]

2 Find the values of k for which the line $y = kx - 3$ and the curve $y = 2x^2 + 3x + k$ do not intersect. [5]

3 Given that $7^x \times 49^y = 1$ and $5^{5x} \times 125^{\frac{2y}{3}} = \frac{1}{25}$, calculate the value of x and of y. [5]

SAT PREP SP www.satprep.co.in

4 It is given that $y = \dfrac{\ln(4x^2 + 1)}{2x - 3}$.

(i) Find $\dfrac{dy}{dx}$. [3]

(ii) Find the approximate change in y as x increases from 2 to $2 + h$, where h is small. [2]

SAT PREP SP www.satprep.co.in

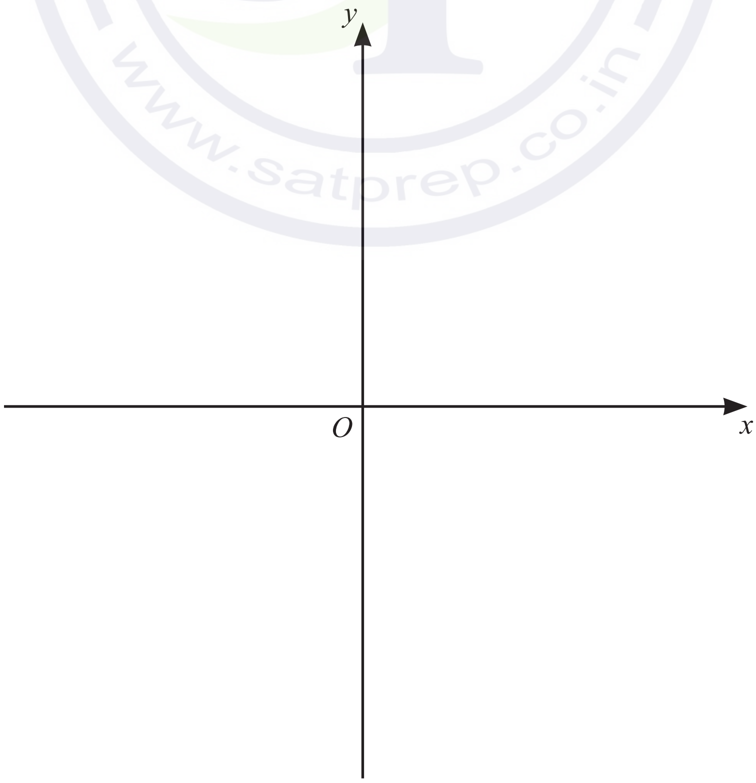
5 $\mathrm{f}(x) = 3\mathrm{e}^{2x} + 1 \quad \text{for } x \in \mathbb{R}$

$\mathrm{g}(x) = x + 1 \quad \text{for } x \in \mathbb{R}$

(i) Write down the range of f and of g. [2]

(ii) Evaluate $\mathrm{fg}^2(0)$. [2]

(iii) On the axes below, sketch the graphs of $y = \mathrm{f}(x)$ and $y = \mathrm{f}^{-1}(x)$, stating the coordinates of the points where the graphs meet the coordinate axes. [3]



SAT PREP www.satprep.co.in

6 Find the equation of the normal to the curve $y = \sqrt{8x+5}$ at the point where $x = \frac{1}{2}$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

SAT PREP SP www.satprep.co.in

7 When lg y is plotted against x, a straight line graph passing through the points (2.2, 3.6) and (3.4, 6) is obtained.

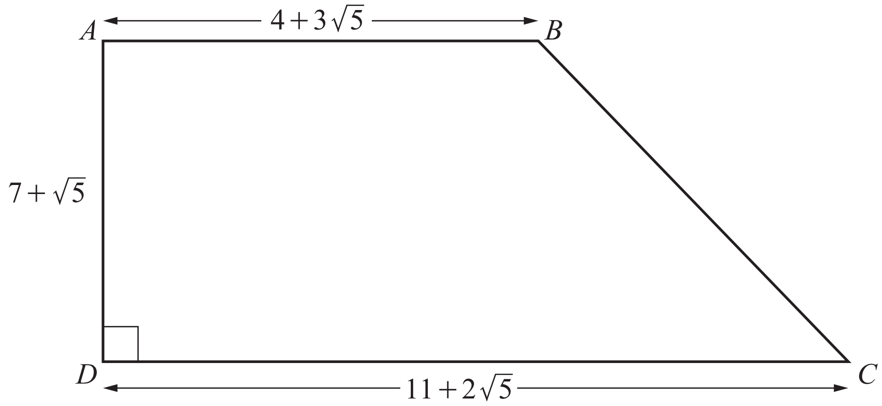
(i) Given that $y = Ab^x$, find the value of each of the constants A and b. [5]

SAT PREP
SP
www.satprep.co.in

(ii) Find x when $y = 900$. [2]

8 Do not use a calculator in this question.

In this question, all lengths are in centimetres.

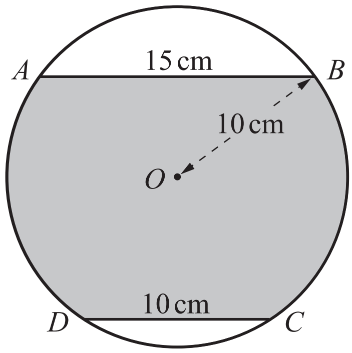


The diagram shows the trapezium *ABCD* in which angle *ADC* is 90° and *AB* is parallel to *DC*. It is given that $AB = 4+3\sqrt{5}$, $DC = 11+2\sqrt{5}$ and $AD = 7+\sqrt{5}$.

(i) Find the perimeter of the trapezium, giving your answer in simplest surd form. [3]

(ii) Find the area of the trapezium, giving your answer in simplest surd form. [3]

9



The diagram shows a circle with centre O and radius 10 cm. The points A, B, C and D lie on the circle such that the chord $AB = 15$ cm and the chord $CD = 10$ cm. The chord AB is parallel to the chord DC.

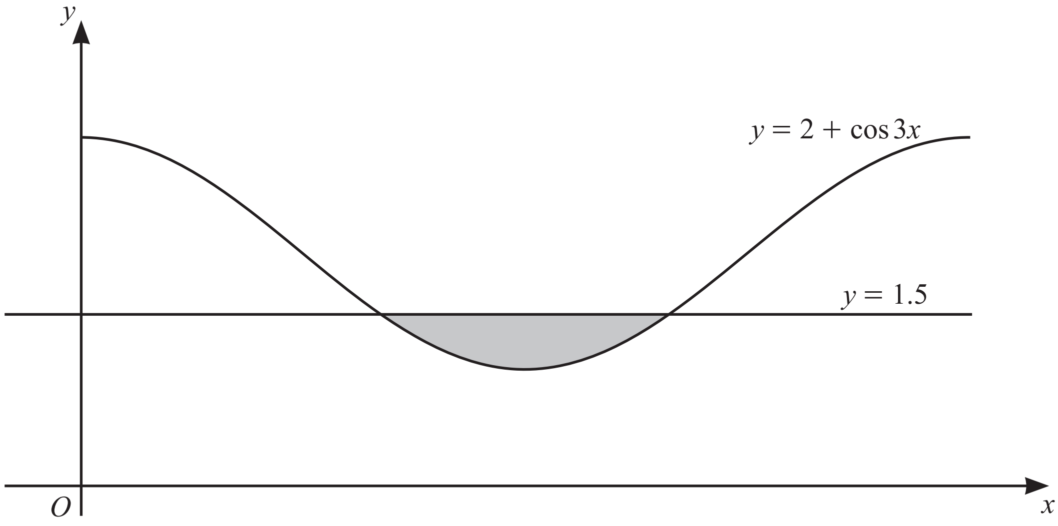
(i) Show that the angle AOB is 1.70 radians correct to 2 decimal places. [2]

(ii) Find the perimeter of the shaded region. [4]

SAT PREP SP www.satprep.co.in

(iii) Find the area of the shaded region. [4]

10



The diagram shows part of the graph of $y = 2 + \cos 3x$ and the straight line $y = 1.5$. Find the exact area of the shaded region bounded by the curve and the straight line. You must show all your working. [9]

Continuation of working space for Question 10

SAT PREP
SP
www.satprep.co.in

11 **(a)** Jess wants to arrange 9 different books on a shelf. There are 4 mathematics books, 3 physics books and 2 chemistry books. Find the number of different possible arrangements of the books if

(i) there are no restrictions, [1]

(ii) a chemistry book is at each end of the shelf, [2]

(iii) all the mathematics books are kept together and all the physics books are kept together. [3]

SAT PREP SP www.satprep.co.in

(b) A quiz team of 6 children is to be chosen from a class of 8 boys and 10 girls. Find the number of ways of choosing the team if

(i) there are no restrictions, [1]

(ii) there are more boys than girls in the team. [4]

SAT PREP SP www.satprep.co.in

Question 12 is printed on the next page.

12 A curve is such that $\dfrac{d^2y}{dx^2} = 2\sin\left(x + \dfrac{\pi}{3}\right)$. Given that the curve has a gradient of 5 at the point $\left(\dfrac{\pi}{3}, \dfrac{5\pi}{3}\right)$, find the equation of the curve. [8]

SAT PREP
www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (LK/TP) 172296/2
© UCLES 2019

Cambridge Assessment International Education

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\,.$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}\,b + \binom{n}{2}a^{n-2}\,b^2 + \ldots + \binom{n}{r}a^{n-r}\,b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

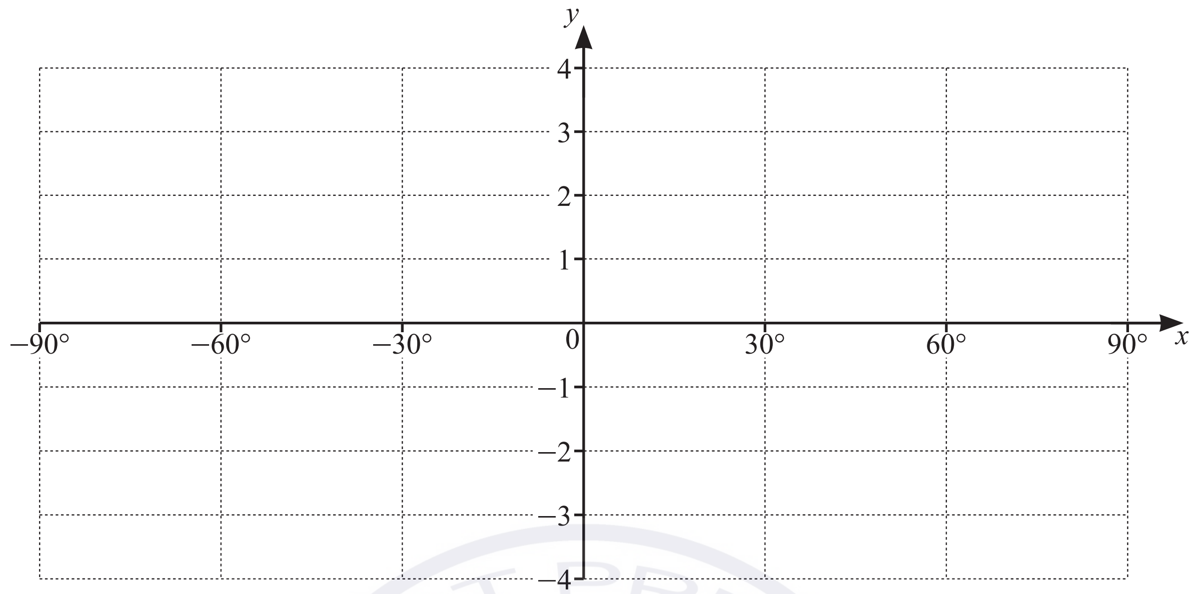
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}\,bc\sin A$$

© UCLES 2019

1 **(i)** On the axes below, sketch the graph of $y = 2\cos 3x - 1$ for $-90° \leqslant x \leqslant 90°$.



[3]

(ii) Write down the amplitude of $2\cos 3x - 1$. [1]

(iii) Write down the period of $2\cos 3x - 1$. [1]

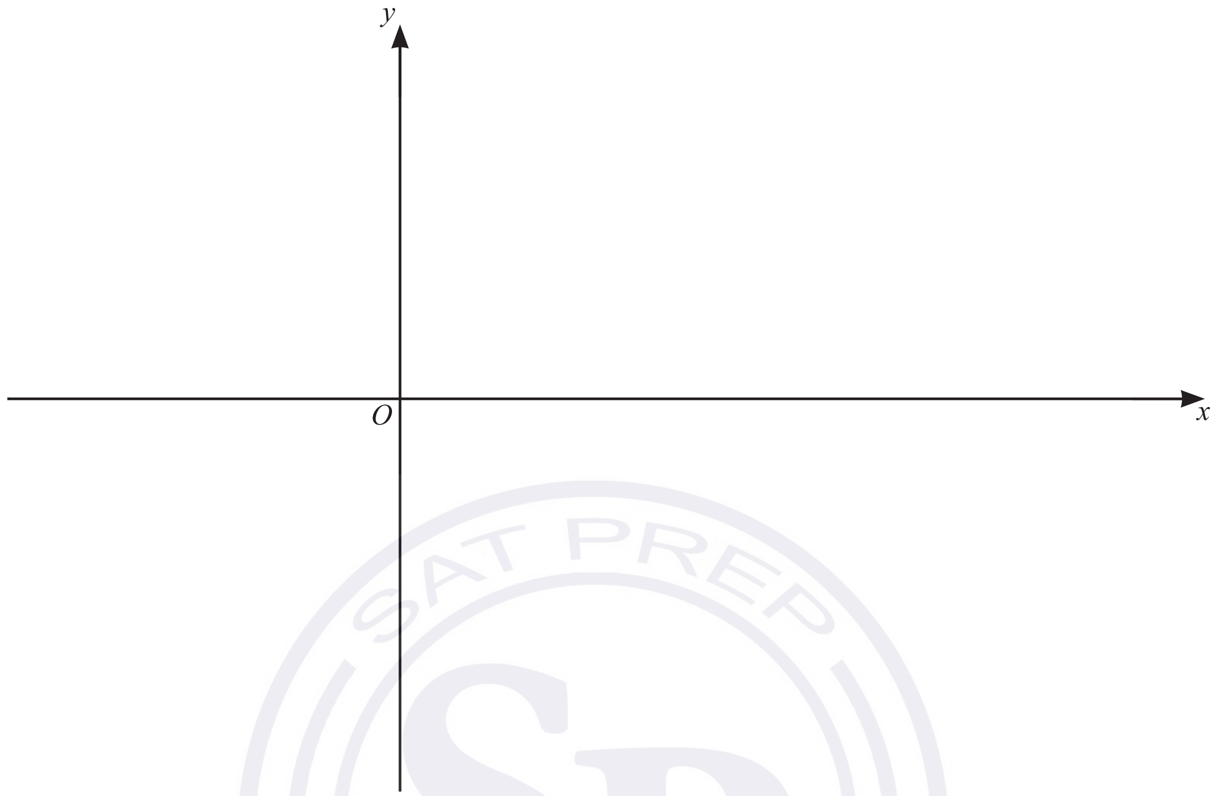
SAT PREP SP www.satprep.co.in

2 When $\lg y^2$ is plotted against x, a straight line is obtained passing through the points (5, 12) and (3, 20). Find y in terms of x, giving your answer in the form $y = 10^{ax+b}$, where a and b are integers. [5]

www.satprep.co.in

3 The first three terms in the expansion of $\left(1-\frac{x}{7}\right)^{14}(1-2x)^4$ can be written as $1+ax+bx^2$. Find the value of each of the constants a and b. [6]

4 **(i)** On the axes below, sketch the graph of $y = \left|2x^2 - 9x - 5\right|$ showing the coordinates of the points where the graph meets the axes. [4]



(ii) Find the values of k for which $\left|2x^2 - 9x - 5\right| = k$ has exactly 2 solutions. [3]

SAT PREP www.satprep.co.in

5 **(a)** It is given that

$$\text{f} : x \mapsto \sqrt{x} \quad \text{for} \quad x \geqslant 0,$$
$$\text{g} : x \mapsto x+5 \quad \text{for} \quad x \geqslant 0.$$

Identify each of the following functions with one of f^{-1}, g^{-1}, fg, gf, f^2, g^2.

(i) $\sqrt{x+5}$ [1]

(ii) $x-5$ [1]

(iii) x^2 [1]

(iv) $x+10$ [1]

(b) It is given that $\text{h}(x) = a + \dfrac{b}{x^2}$ where a and b are constants.

(i) Why is $-2 \leqslant x \leqslant 2$ not a suitable domain for $\text{h}(x)$? [1]

(ii) Given that $\text{h}(1) = 4$ and $\text{h}'(1) = 16$, find the value of a and of b. [2]

6 **(a)** Write $\dfrac{\sqrt{p}\left(\dfrac{qp}{r}\right)^2}{p^{-1}\sqrt[3]{qr}}$ in the form $p^a q^b r^c$, where a, b and c are constants. [3]

(b) Solve $\log_7 x + 2\log_x 7 = 3$. [4]

SAT PREP SP www.satprep.co.in

7 It is given that $y = \left(1 + e^{x^2}\right)(x + 5)$.

(i) Find $\frac{dy}{dx}$. [3]

(ii) Find the approximate change in y as x increases from 0.5 to $0.5 + p$, where p is small. [2]

(iii) Given that y is increasing at a rate of 2 units per second when $x = 0.5$, find the corresponding rate of change in x. [2]

www.satprep.co.in SAT PREP SP

8 **(a)** Five teams took part in a competition in which each team played each of the other 4 teams. The following table represents the results after all the matches had been played.

Team	Won	Drawn	Lost
A	2	1	1
B	1	3	0
C	1	1	2
D	0	1	3
E	3	0	1

Points in the competition were awarded to the teams as follows

4 for each match won, 2 for each match drawn, 0 for each match lost.

(i) Write down two matrices whose product under matrix multiplication will give the total number of points awarded to each team. [2]

(ii) Evaluate the matrix product from **part (i)** and hence state which team was awarded the most points. [2]

www.satprep.co.in

(b) It is given that $\mathbf{A} = \begin{pmatrix} 1 & -1 \\ 2 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 5 & 0 \\ 1 & -2 \end{pmatrix}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Hence find the matrix **C** such that **AC** = **B**. [3]

SAT PREP SP www.satprep.co.in

9 A solid circular cylinder has a base radius of r cm and a height of h cm. The cylinder has a volume of $1200\pi\text{ cm}^3$ and a total surface area of $S\text{ cm}^2$.

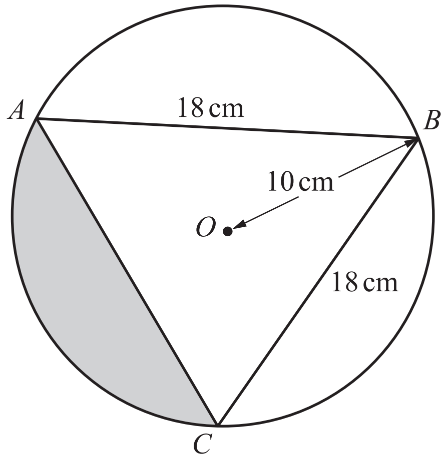
(i) Show that $S = 2\pi r^2 + \dfrac{2400\pi}{r}$. [3]

SAT PREP SP www.satprep.co.in

(ii) Given that h and r can vary, find the stationary value of S and determine its nature. [5]

SAT PREP
SP
www.satprep.co.in

10



The diagram shows a circle centre O, radius 10 cm. The points A, B and C lie on the circumference of the circle such that $AB = BC = 18$ cm.

(i) Show that angle $AOB = 2.24$ radians correct to 2 decimal places. [3]

(ii) Find the perimeter of the shaded region. [5]

Continuation of working space for Question 10(ii).

(iii) Find the area of the shaded region. [3]

SAT PREP
SP
www.satprep.co.in

Question 11 is printed on the next page.

11 A curve is such that $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = 2(3x-1)^{-\frac{2}{3}}$. Given that the curve has a gradient of 6 at the point (3, 11), find the equation of the curve. [8]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

9428013313

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (SC/FC) 172297/1
© UCLES 2019

Cambridge Assessment International Education

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\ .$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}\,b + \binom{n}{2}a^{n-2}\,b^2 + \ldots + \binom{n}{r}a^{n-r}\,b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!\,r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$
$$\sec^2 A = 1 + \tan^2 A$$
$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2}\,bc \sin A$$

© UCLES 2019

1 In a group of 145 students, the numbers studying mathematics, physics and chemistry are given below. All students study at least one of the three subjects.

x students study all 3 subjects

24 students study both mathematics and chemistry

23 students study both physics and chemistry

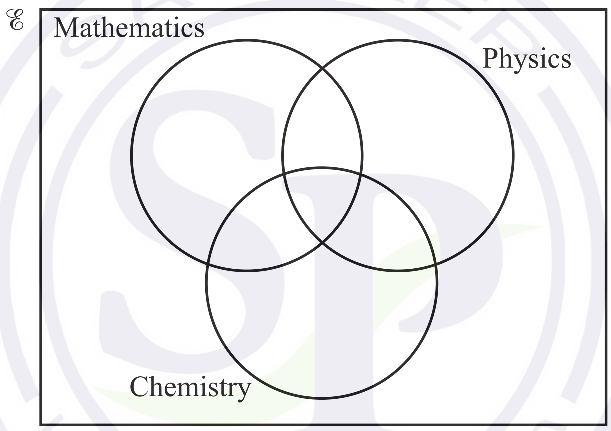
28 students study both mathematics and physics

50 students study chemistry

75 students study physics

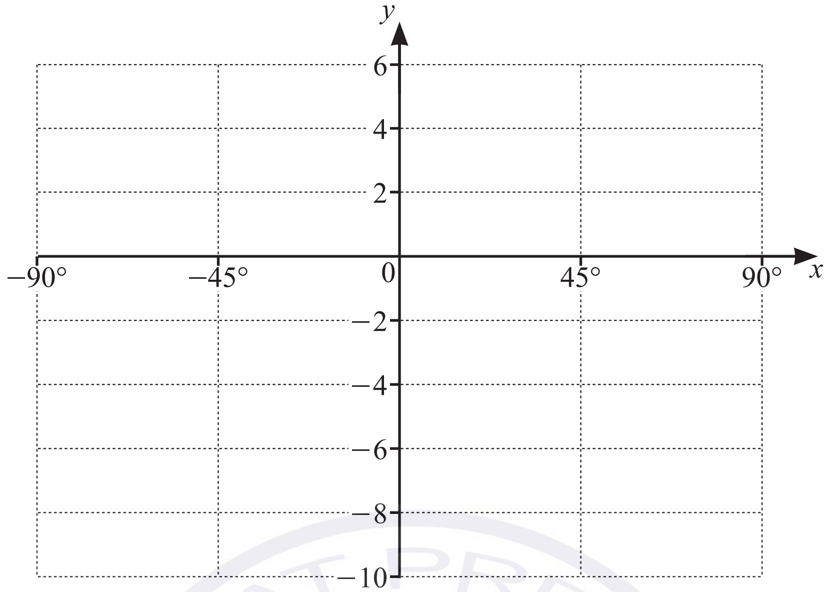
80 students study mathematics

(i) Using the Venn diagram, find the value of x. [4]



(ii) Find the number of students who study mathematics only. [1]

2 **(i)** On the axes below, sketch the graph of $y = 5\cos 4x - 3$ for $-90° \leqslant x \leqslant 90°$.



[4]

(ii) Write down the amplitude of y. [1]

(iii) Write down the period of y. [1]

SATPREP www.satprep.co.in

3 **(i)** Differentiate $y = (3x^2 - 1)^{-\frac{1}{3}}$ with respect to x. [2]

(ii) Find the approximate change in y as x increases from $\sqrt{3}$ to $\sqrt{3} + p$, where p is small. [1]

(iii) Find the equation of the normal to the curve $y = (3x^2 - 1)^{-\frac{1}{3}}$ at the point where $x = \sqrt{3}$. [3]

4 It is given that $\mathbf{A} = \begin{pmatrix} 5 & 2 \\ 4 & -1 \end{pmatrix}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Hence find, in radians, the acute angles x and y such that

$$5\tan x + 2\tan y = 12,$$
$$4\tan x - \tan y = 7.$$

[5]

SAT PREP SP www.satprep.co.in

5 **(i)** Differentiate $(x^2+3)\ln(x^2+3)$ with respect to x. [3]

(ii) Hence find $\int x\ln(x^2+3)\,dx$. [2]

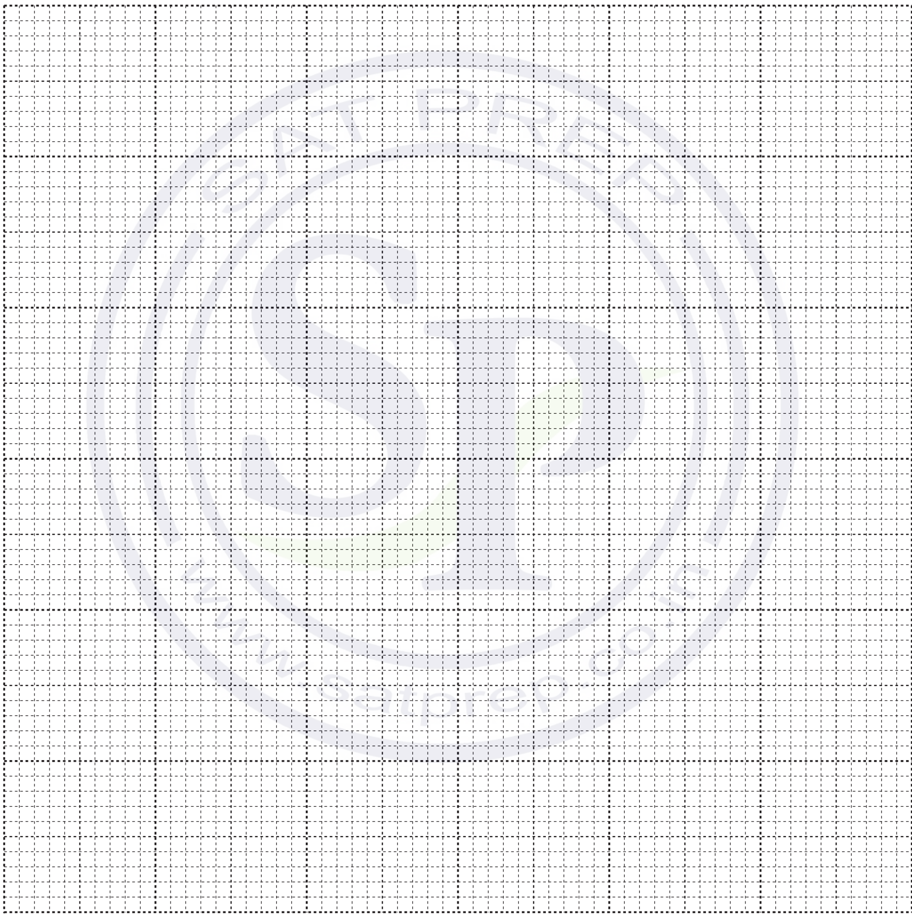
SAT PREP
SP
www.satprep.co.in

6

x	1	1.5	2	2.5	3
y	6	14.3	48	228	1536

The table shows values of the variables x and y such that $y = Ab^{x^2}$, where A and b are constants.

(i) Draw a straight line graph to show that $y = Ab^{x^2}$. [4]



(ii) Use your graph to find the value of A and of b. [4]

(iii) Estimate the value of x when $y = 100$. [2]

7 **(a)** A 5-digit code is to be chosen from the digits 1, 2, 3, 4, 5, 6, 7, 8 and 9. Each digit may be used once only in any 5-digit code. Find the number of different 5-digit codes that may be chosen if

(i) there are no restrictions, [1]

(ii) the code is divisible by 5, [1]

(iii) the code is even and greater than 70 000. [3]

(b) A team of 6 people is to be chosen from 8 men and 6 women. Find the number of different teams that may be chosen if

(i) there are no restrictions, [1]

(ii) there are no women in the team, [1]

(iii) there are a husband and wife who must not be separated. [3]

SAT PREP SP www.satprep.co.in

8 **(a)** Given that $\log_a x = p$ and $\log_a y = q$, find, in terms of p and q,

(i) $\log_a axy^2$, [2]

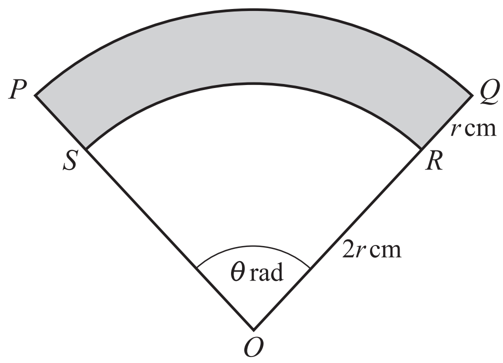
(ii) $\log_a \left(\dfrac{x^3}{ay}\right)$, [2]

(iii) $\log_x a + \log_y a$. [1]

(b) Using the substitution $m = 3^x$, or otherwise, solve $3^x - 3^{1+2x} + 4 = 0$. [3]

www.satprep.co.in SAT PREP

9



The diagram shows a sector OPQ of the circle centre O, radius $3r$ cm. The points S and R lie on OP and OQ respectively such that ORS is a sector of the circle centre O, radius $2r$ cm. The angle $POQ = \theta$ radians. The perimeter of the shaded region $PQRS$ is 100 cm.

(i) Find θ in terms of r. [2]

(ii) Hence show that the area, A cm^2, of the shaded region $PQRS$ is given by $A = 50r - r^2$. [2]

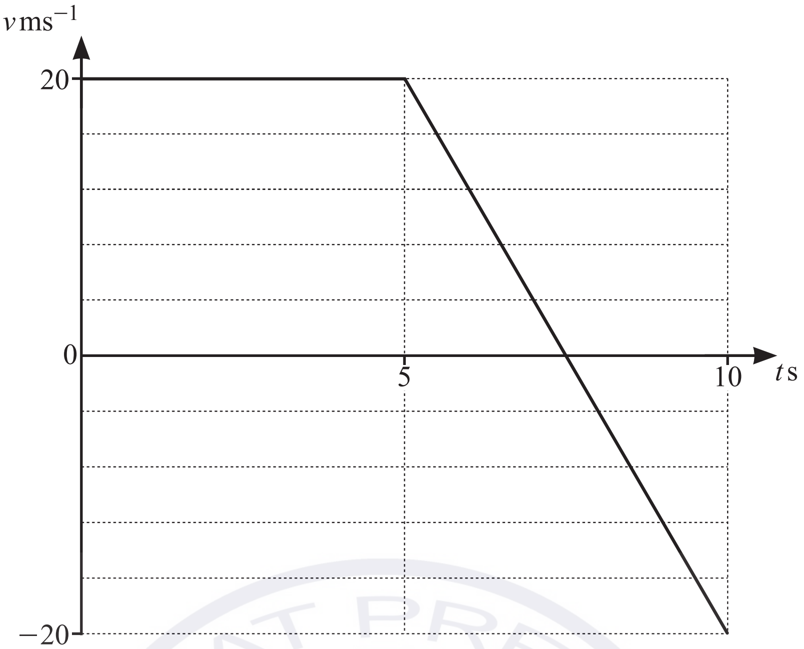
© UCLES 2019

(iii) Given that r can vary and that A has a maximum value, find this value of A. [2]

(iv) Given that A is increasing at the rate of $3\,\text{cm}^2\,\text{s}^{-1}$ when $r = 10$, find the corresponding rate of change of r. [3]

(v) Find the corresponding rate of change of θ when $r = 10$. [3]

10 **(a)**



The velocity-time graph for a particle P is shown by the two straight lines in the diagram.

(i) Find the deceleration of P for $5 \leqslant t \leqslant 10$. [2]

(ii) Write down the value of t when the speed of P is zero. [1]

(iii) Find the distance P has travelled for $0 \leqslant t \leqslant 10$. [2]

(b) A particle Q has a displacement of x m from a fixed point O, t s after leaving O. The velocity, $v\,\text{ms}^{-1}$, of Q at time t s is given by $v = 6e^{2t} + 1$.

(i) Find an expression for x in terms of t. [3]

(ii) Find the value of t when the acceleration of Q is $24\,\text{ms}^{-2}$. [3]

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

2049112309

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (CE/CB) 165273/2
© UCLES 2019

Cambridge Assessment International Education

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

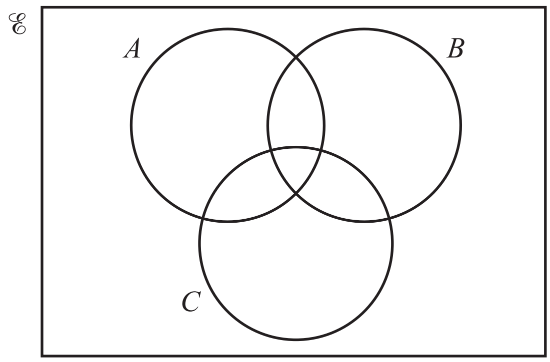
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

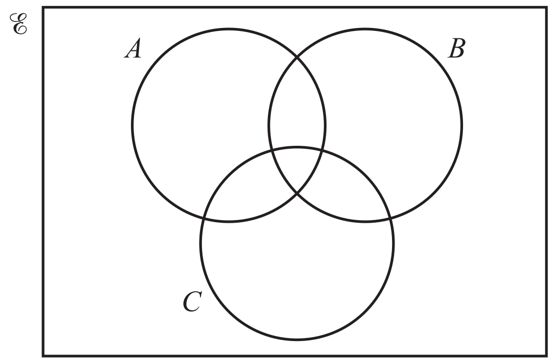
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 **(a)** On the Venn diagrams below, shade the region indicated.



$(A \cap B) \cup C$



$(A' \cup B) \cap C$

[2]

(b) On the Venn diagram below, draw sets P, Q and R such that

$$P \subset R, \quad Q \subset R \quad \text{and} \quad P \cap Q = \varnothing.$$

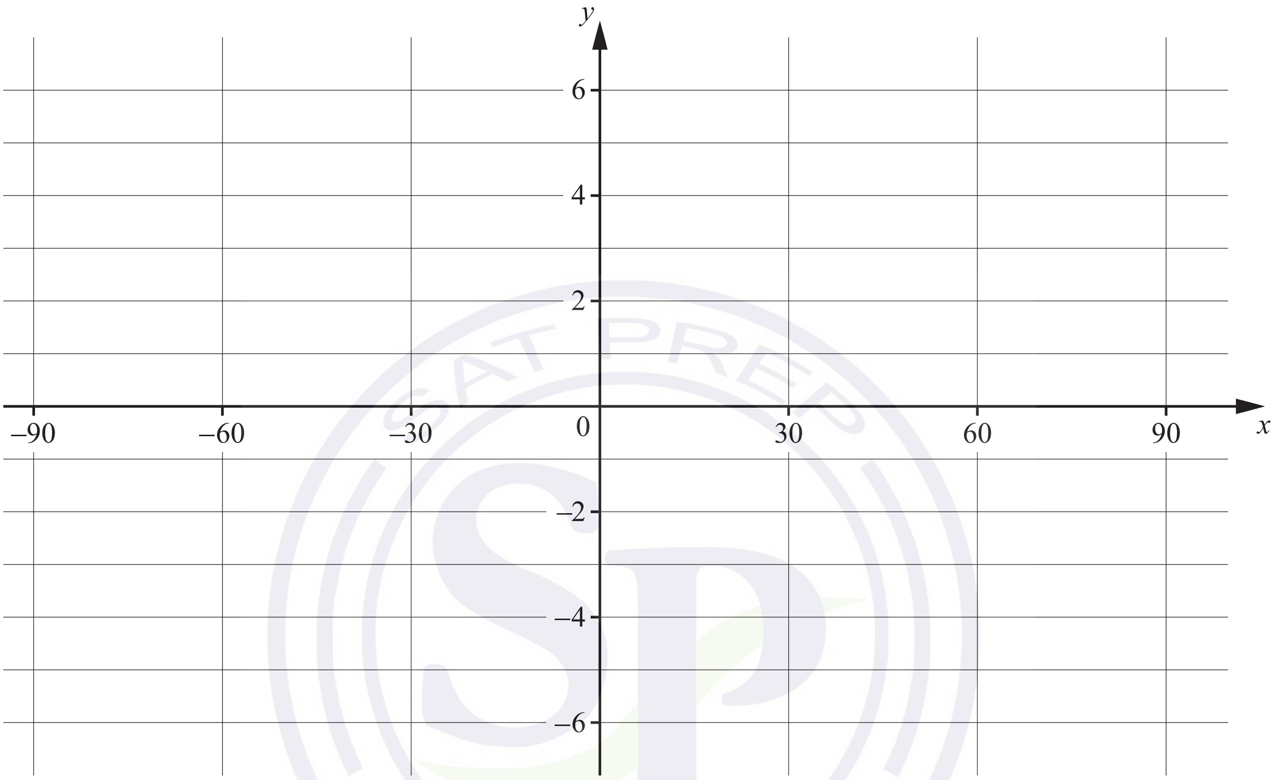
[2]

SATPREP
www.satprep.co.in

2 **(i)** Write down the amplitude of $4\sin 3x - 1$. [1]

(ii) Write down the period of $4\sin 3x - 1$. [1]

(iii) On the axes below, sketch the graph of $y = 4\sin 3x - 1$ for $-90° \leqslant x° \leqslant 90°$.



[3]

3 The polynomial $p(x) = (2x-1)(x+k) - 12$, where k is a constant.

(i) Write down the value of $p(-k)$. [1]

When $p(x)$ is divided by $x + 3$ the remainder is 23.

(ii) Find the value of k. [2]

(iii) Using your value of k, show that the equation $p(x) = -25$ has no real solutions. [3]

SAT PREP
SP
www.satprep.co.in

4 **(i)** The first 3 terms, in ascending powers of x, in the expansion of $(2+bx)^8$ can be written as $a + 256x + cx^2$. Find the value of each of the constants a, b and c. [4]

(ii) Using the values found in **part (i)**, find the term independent of x in the expansion of $(2+bx)^8\left(2x-\frac{3}{x}\right)^2$. [3]

SAT PREP SP www.satprep.co.in

5 A particle P is moving with a velocity of $20\,\text{ms}^{-1}$ in the same direction as $\begin{pmatrix}3\\4\end{pmatrix}$.

(i) Find the velocity vector of P. [2]

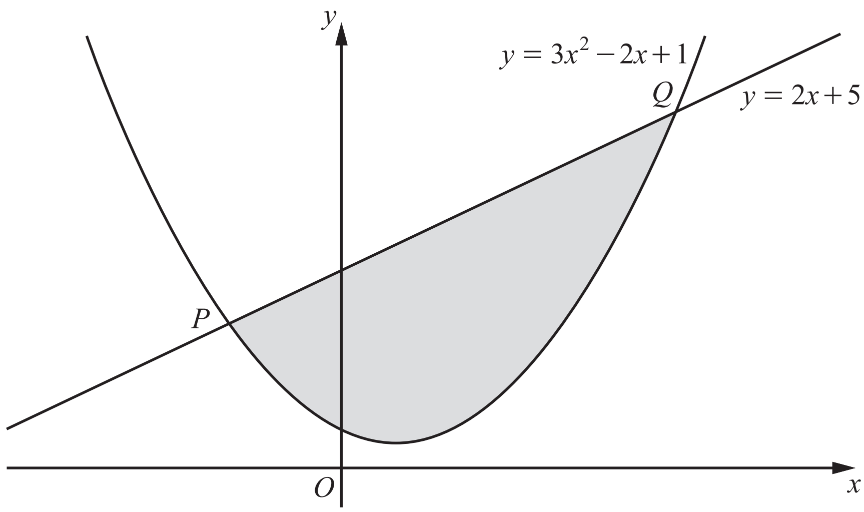
At time $t = 0\,\text{s}$, P has position vector $\begin{pmatrix}1\\2\end{pmatrix}$ relative to a fixed point O.

(ii) Write down the position vector of P after t s. [2]

A particle Q has position vector $\begin{pmatrix}17\\18\end{pmatrix}$ relative to O at time $t = 0\,\text{s}$ and has a velocity vector $\begin{pmatrix}8\\12\end{pmatrix}\,\text{ms}^{-1}$.

(iii) Given that P and Q collide, find the value of t when they collide and the position vector of the point of collision. [3]

6



The diagram shows the curve $y = 3x^2 - 2x + 1$ and the straight line $y = 2x + 5$ intersecting at the points P and Q. Showing all your working, find the area of the shaded region. [8]

SAT PREP
SP
www.satprep.co.in

7 **(a)** Solve $\log_3 x + \log_9 x = 12$. [3]

(b) Solve $\log_4(3y^2 - 10) = 2\log_4(y-1) + \frac{1}{2}$. [5]

8 It is given that $f(x) = 5e^x - 1$ for $x \in \mathbb{R}$.

(i) Write down the range of f. [1]

(ii) Find f^{-1} and state its domain. [3]

It is given also that $g(x) = x^2 + 4$ for $x \in \mathbb{R}$.

(iii) Find the value of fg(1). [2]

SAT PREP www.satprep.co.in

(iv) Find the exact solutions of $g^2(x) = 40$. [3]

SAT PREP SP www.satprep.co.in

9 In this question all lengths are in centimetres.

A closed cylinder has base radius r, height h and volume V. It is given that the total surface area of the cylinder is 600π and that V, r and h can vary.

(i) Show that $V = 300\pi r - \pi r^3$. [3]

(ii) Find the stationary value of V and determine its nature. [5]

SAT PREP SP www.satprep.co.in

10 When lg y is plotted against x^2 a straight line graph is obtained which passes through the points (2, 4) and (6, 16).

(i) Show that $y = 10^{A+Bx^2}$, where A and B are constants. [4]

(ii) Find y when $x = \frac{1}{\sqrt{3}}$. [2]

(iii) Find the positive value of x when $y = 2$. [3]

SAT PREP SP www.satprep.co.in

11 It is given that $y = (x^2 + 1)(2x - 3)^{\frac{1}{2}}$.

(i) Show that $\dfrac{dy}{dx} = \dfrac{Px^2 + Qx + 1}{(2x-3)^{\frac{1}{2}}}$, where P and Q are integers. [5]

www.satprep.co.in

(ii) Hence find the equation of the normal to the curve $y = (x^2+1)(2x-3)^{\frac{1}{2}}$ at the point where $x = 2$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

SAT PREP SP www.satprep.co.in

BLANK PAGE

SAT PREP
www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

Cambridge IGCSE

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

0773973091

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (JM/TP) 165274/2
© UCLES 2019

Cambridge Assessment International Education

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

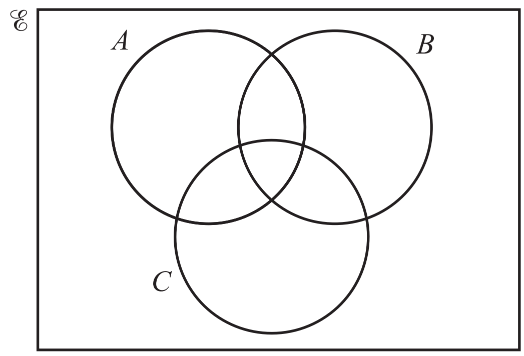
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

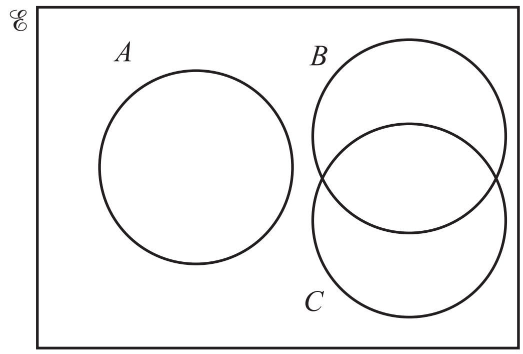
$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2019

1 **(a)** On the Venn diagrams below, shade the region indicated.



$A' \cap B' \cap C'$



$A \cup (B \cap C)$

[2]

(b)

$$\mathscr{E} = \{x : 0° \leqslant x \leqslant 360°\}$$
$$P = \{x : \cos 2x = 0.5\}$$
$$Q = \{x : \sin x = 0.5\}$$

Find $P \cap Q$. [3]

www.satprep.co.in

2 Do not use a calculator in this question.

Find the coordinates of the points of intersection of the curve $y = (2x+3)^2(x-1)$ and the line $y = 3(2x+3)$. [5]

SAT PREP SP www.satprep.co.in

3 The number, B, of a certain type of bacteria at time t days can be described by $B = 200e^{2t} + 800e^{-2t}$.

(i) Find the value of B when $t = 0$. [1]

(ii) At the instant when $\frac{dB}{dt} = 1200$, show that $e^{4t} - 3e^{2t} - 4 = 0$. [3]

(iii) Using the substitution $u = e^{2t}$, or otherwise, solve $e^{4t} - 3e^{2t} - 4 = 0$. [2]

4 **(a)** Given that $\dfrac{\left(pr^2\right)^{\frac{3}{2}}\sqrt{qr}}{q^2\left(pr^2\right)^{-1}}$ can be written in the form $p^a q^b r^c$, find the value of each of the constants a, b and c. [3]

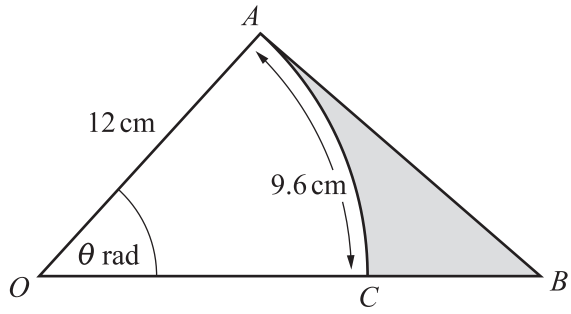
(b) Solve

$$3x^{\frac{1}{2}} - y^{-\frac{1}{2}} = 4,$$
$$4x^{\frac{1}{2}} + 3y^{-\frac{1}{2}} = 14.$$

[3]

SAT PREP SP www.satprep.co.in

5



The diagram shows the right-angled triangle *OAB*. The point *C* lies on the line *OB*. Angle $OAB = \frac{\pi}{2}$ radians and angle $AOB = \theta$ radians. *AC* is an arc of the circle, centre *O*, radius 12 cm and *AC* has length 9.6 cm.

(i) Find the value of θ. [2]

(ii) Find the area of the shaded region. [4]

www.satprep.co.in

6 **(a)** Eight books are to be arranged on a shelf. There are 4 mathematics books, 3 geography books and 1 French book.

(i) Find the number of different arrangements of the books if there are no restrictions. [1]

(ii) Find the number of different arrangements if the mathematics books have to be kept together. [3]

SAT PREP
SP
www.satprep.co.in

(iii) Find the number of different arrangements if the mathematics books have to be kept together and the geography books have to be kept together. [3]

(b) A team of 6 players is to be chosen from 8 men and 4 women. Find the number of different ways this can be done if

(i) there are no restrictions, [1]

(ii) there is at least one woman in the team. [2]

SAT PREP
SP
www.satprep.co.in

7 A pilot wishes to fly his plane from a point A to a point B on a bearing of 055°. There is a wind blowing at $120\,\text{km}\,\text{h}^{-1}$ from the west. The plane can fly at $650\,\text{km}\,\text{h}^{-1}$ in still air.

(i) Find the direction in which the pilot must fly his plane in order to reach B. [4]

(ii) Given that the distance between A and B is 1250 km, find the time it will take the pilot to fly from A to B. [4]

SAT PREP SP www.satprep.co.in

8 When e^y is plotted against $\frac{1}{x}$, a straight line graph passing through the points $(2, 20)$ and $(4, 8)$ is obtained.

(i) Find y in terms of x. [5]

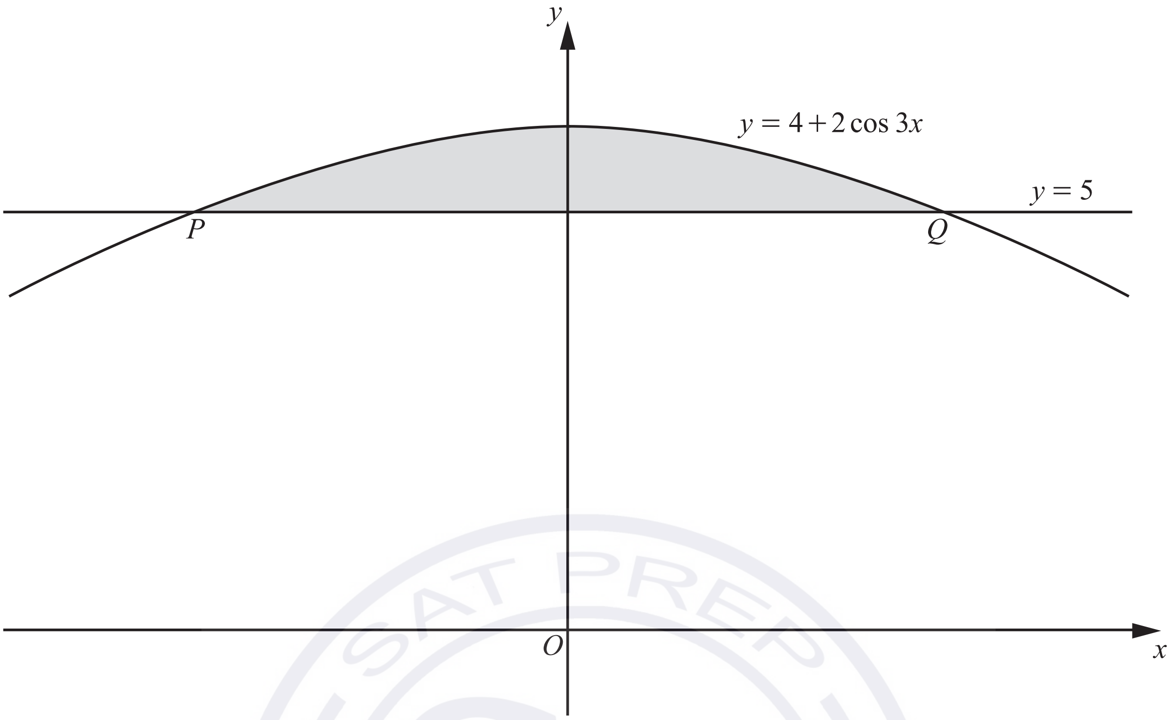
(ii) Hence find the positive values of x for which y is defined. [1]

(iii) Find the exact value of y when $x = 3$. [1]

(iv) Find the exact value of x when $y = 2$. [2]

www.satprep.co.in SAT PREP SP

9



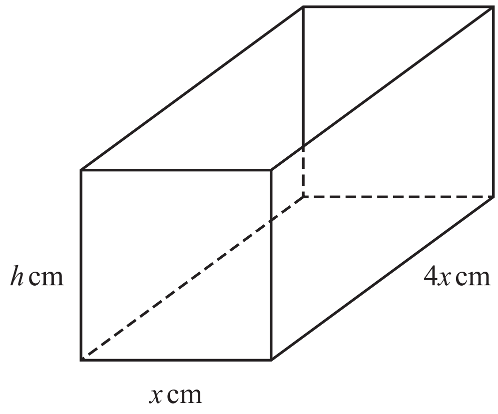
The diagram shows the curve $y = 4 + 2\cos 3x$ intersecting the line $y = 5$ at the points P and Q.

(i) Find, in terms of π, the x-coordinate of P and of Q. [3]

(ii) Find the exact area of the shaded region. You must show all your working. [6]

SAT PREP SP www.satprep.co.in

10



The diagram shows an open container in the shape of a cuboid of width x cm, length $4x$ cm and height h cm. The volume of the container is $800\,\text{cm}^3$.

(i) Show that the external surface area, $S\,\text{cm}^2$, of the open container is such that $S = 4x^2 + \dfrac{2000}{x}$. [4]

(ii) Given that x can vary, find the stationary value of S and determine its nature. [5]

SAT PREP SP www.satprep.co.in

Question 11 is printed on the next page.

11 The normal to the curve $y=(x-2)(3x+1)^{\frac{2}{3}}$ at the point where $x=\frac{7}{3}$, meets the y-axis at the point P. Find the exact coordinates of the point P. [7]

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

6938333361

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

DC (KN/TP) 165276/2
© UCLES 2019

Cambridge Assessment International Education

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}\,b + \binom{n}{2}a^{n-2}\,b^2 + \ldots + \binom{n}{r}a^{n-r}\,b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

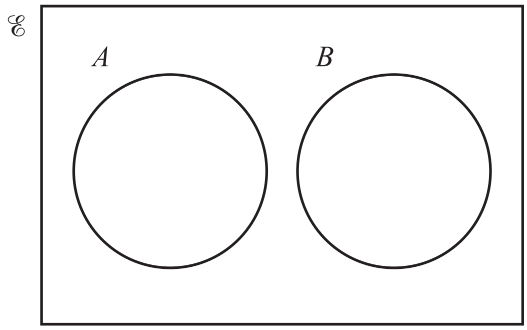
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

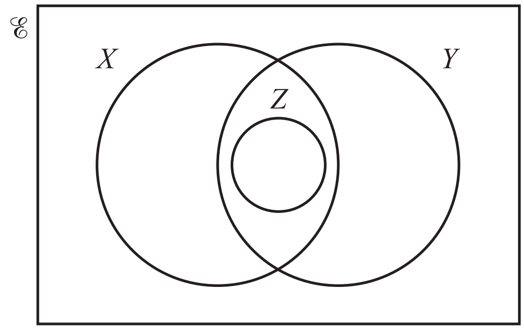
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2}\,bc \sin A$$

www.satprep.co.in

1 Describe, using set notation, the relationship between the sets shown in each of the Venn diagrams below.





....

[3]

2 Given that $\frac{\sqrt{p}(qr)^{-2}}{p^2q^{\frac{1}{3}}r} = \frac{1}{p^a q^b r^c}$, find the value of each of the constants a, b and c. [3]

SAT PREP www.satprep.co.in

3 Show that the line $y = mx + 4$ will touch or intersect the curve $y = x^2 + 3x + m$ for all values of m. [4]

© UCLES 2019

4 It is given that $y = \dfrac{\ln(2x^3+5)}{x-1}$ for $x > 1$.

(i) Find the value of $\dfrac{dy}{dx}$ when $x = 2$. You must show all your working. [4]

(ii) Find the approximate change in y as x increases from 2 to $2+p$, where p is small. [1]

www.satprep.co.in

5 **(i)** On the axes below, sketch the graph of $y = |3x^2 - 14x - 5|$, showing the coordinates of the points where the graph meets the coordinate axes.

[4]

(ii) Find the exact value of k such that $|3x^2 - 14x - 5| = k$ has 3 solutions only. [3]

© UCLES 2019

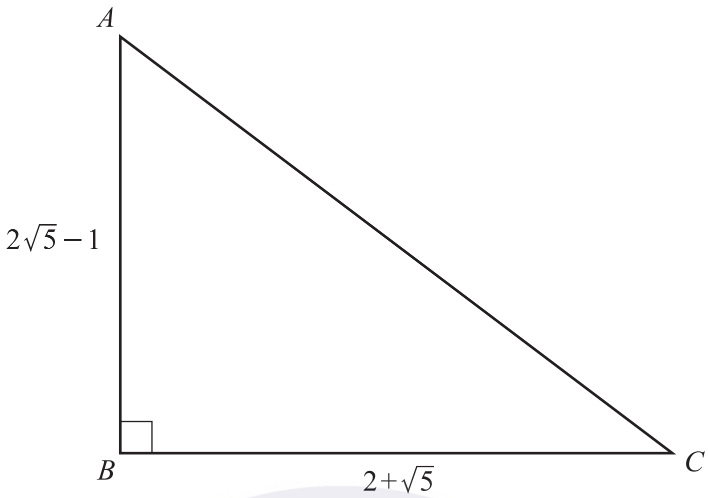
6 **(a)** **(i)** Show that $\sec\theta - \dfrac{\tan\theta}{\operatorname{cosec}\theta} = \cos\theta$. [3]

(ii) Solve $\sec 2\theta - \dfrac{\tan 2\theta}{\operatorname{cosec} 2\theta} = \dfrac{\sqrt{3}}{2}$ for $0° \leqslant \theta \leqslant 180°$. [3]

(b) Solve $2\sin^2\left(\phi + \dfrac{\pi}{3}\right) = 1$ for $0 < \phi < 2\pi$ radians. [4]

SAT PREP
SP
www.satprep.co.in

7 **Do not use a calculator in this question.**
In this question, all lengths are in centimetres.



The diagram shows the triangle *ABC* such that $AB = 2\sqrt{5} - 1$, $BC = 2 + \sqrt{5}$ and angle $ABC = 90°$.

(i) Find the exact length of *AC*. [3]

www.satprep.co.in

(ii) Find $\tan ACB$, giving your answer in the form $p+q\sqrt{r}$, where p, q and r are integers. [3]

(iii) Hence find $\sec^2 ACB$, giving your answer in the form $s+t\sqrt{u}$ where s, t and u are integers. [2]

SAT PREP
www.satprep.co.in

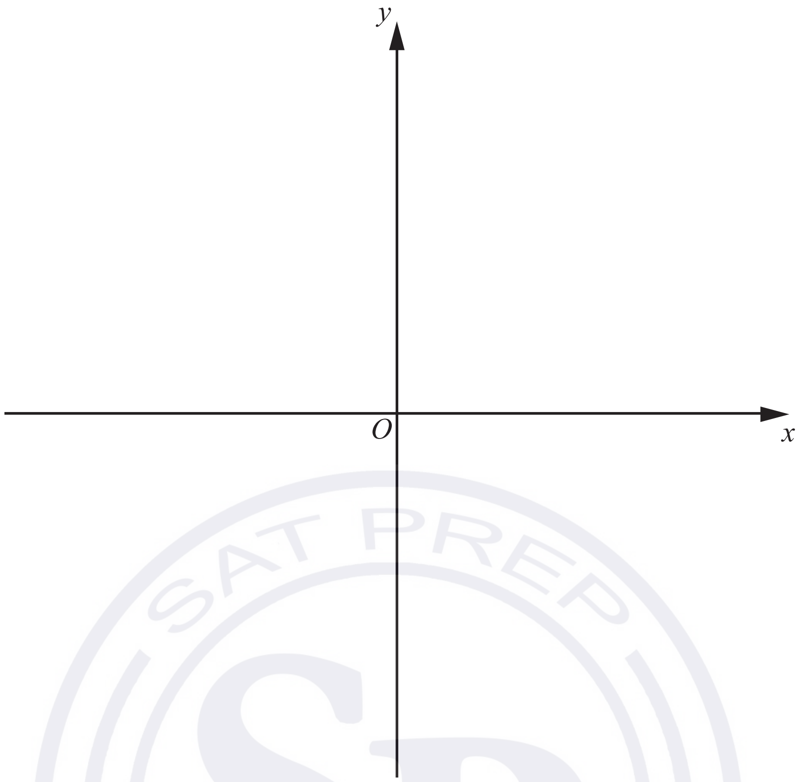
8 $\mathrm{f} : x \mapsto \mathrm{e}^{3x}$ for $x \in \mathbb{R}$
$\mathrm{g} : x \mapsto 2x^2 + 1$ for $x \geqslant 0$

(i) Write down the range of g. [1]

(ii) Show that $\mathrm{f}^{-1}\mathrm{g}(\sqrt{62}) = \ln 5$. [3]

(iii) Solve $\mathrm{f}'(x) = 6\mathrm{g}''(x)$, giving your answer in the form $\ln a$, where a is an integer. [3]

(iv) On the axes below, sketch the graph of $y = \mathrm{g}$ and the graph of $y = \mathrm{g}^{-1}$, showing the points where the graphs meet the coordinate axes.



[3]

SAT PREP
SP
www.satprep.co.in

9 **(a)** Jack has won 7 trophies for sport and wants to arrange them on a shelf. He has 2 trophies for cricket, 4 trophies for football and 1 trophy for swimming. Find the number of different arrangements if

(i) there are no restrictions, [1]

(ii) the football trophies are to be kept together, [3]

(iii) the football trophies are to be kept together and the cricket trophies are to be kept together. [3]

(b) A team of 8 players is to be chosen from 6 girls and 8 boys. Find the number of different ways the team may be chosen if

(i) there are no restrictions, [1]

(ii) all the girls are in the team, [1]

(iii) at least 1 girl is in the team. [2]

SAT PREP SP www.satprep.co.in

10 A curve is such that $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = (2x+3)^{-\frac{1}{2}}$. The curve has a gradient of 5 at the point where $x = 3$ and passes through the point $\left(\frac{1}{2}, -\frac{1}{3}\right)$.

(i) Find the equation of the curve. [7]

www.satprep.co.in

(ii) Find the equation of the normal to the curve at the point where $x = 3$, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. [4]

SAT PREP
SP
www.satprep.co.in

Question 11 is printed on the next page.

11 A pilot wishes to fly his plane from a point A to a point B. The bearing of B from A is 050°. A wind is blowing from the north at a speed of $120\,\text{km}\,\text{h}^{-1}$. The plane can fly at $600\,\text{km}\,\text{h}^{-1}$ in still air.

(i) Find the bearing on which the pilot must fly his plane in order to reach B. [4]

(ii) Given that the distance from A to B is 2500 km, find the time taken to fly from A to B. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6715046212

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2019**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

www.satprep.co.in

This document consists of **15** printed pages and **1** blank page.

DC (JM/CB) 165270/2
© UCLES 2019

Cambridge Assessment International Education

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2019

1 **(a)** Given that $\mathscr{E} = \{x : 1 < x < 20\}$,

$A = \{\text{multiples of } 3\}$,

$B = \{\text{multiples of } 4\}$,

find

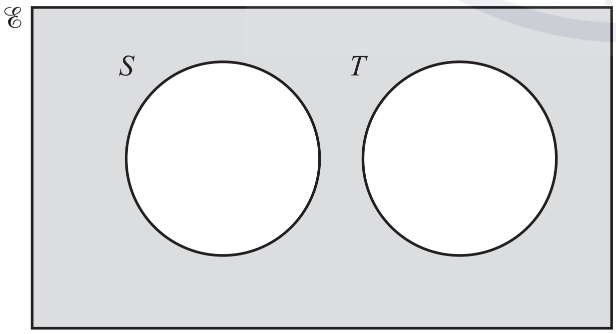
(i) $n(A)$, [1]

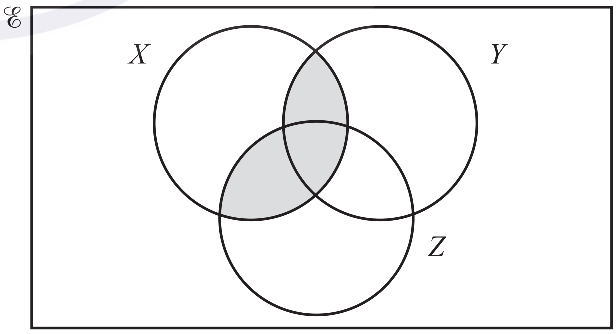
(ii) $n(A \cap B)$. [1]

(b) On the Venn diagram below, draw the sets P, Q and R such that $P \subset Q$ and $Q \cap R = \varnothing$.

[2]

(c) Using set notation, describe the shaded areas shown in the Venn diagrams below.

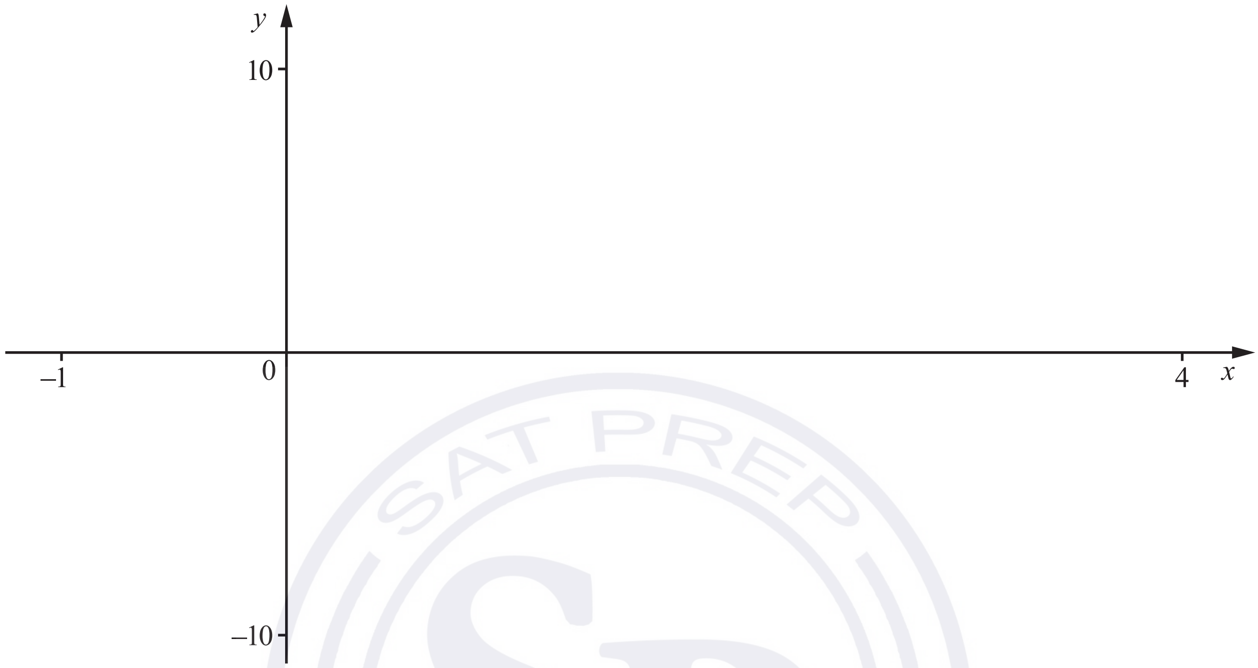




.... [2]

SAT PREP www.satprep.co.in

2 On the axes below, sketch the graph of the curve $y = |2x^2 - 5x - 3|$, stating the coordinates of any points where the curve meets the coordinate axes.



[4]

SAT PREP
SP
www.satprep.co.in

3 **(i)** Find the first 3 terms in the expansion, in ascending powers of x, of $\left(3-\frac{x}{9}\right)^6$. Give the terms in their simplest form. [3]

(ii) Hence find the term independent of x in the expansion of $\left(3-\frac{x}{9}\right)^6\left(x-\frac{2}{x}\right)^2$. [3]

www.satprep.co.in

4 The polynomial $p(x) = 2x^3 + ax^2 + bx - 49$, where a and b are constants. When $p'(x)$ is divided by $x+3$ there is a remainder of -24.

(i) Show that $6a - b = 78$. [2]

It is given that $2x-1$ is a factor of $p(x)$.

(ii) Find the value of a and of b. [4]

(iii) Write $p(x)$ in the form $(2x-1)Q(x)$, where $Q(x)$ is a quadratic factor. [2]

(iv) Hence factorise $p(x)$ completely. [1]

SAT PREP www.satprep.co.in

5 It is given that $\log_4 x = p$. Giving your answer in its simplest form, find, in terms of p,

(i) $\log_4(16x)$, [2]

(ii) $\log_4\left(\dfrac{x^7}{256}\right)$. [2]

Using your answers to **parts (i)** and **(ii)**,

(iii) solve $\log_4(16x) - \log_4\left(\dfrac{x^7}{256}\right) = 5$, giving your answer correct to 2 decimal places. [3]

SAT PREP SP www.satprep.co.in

6 **(a)** Given that $\mathbf{A}=\begin{pmatrix}1 & 2\\ 0 & -1\end{pmatrix}$, $\mathbf{B}=\begin{pmatrix}1 & -4\\ 2 & 5\\ 3 & 1\end{pmatrix}$ and $\mathbf{C}=\begin{pmatrix}3 & -2 & 0\end{pmatrix}$, write down the matrix products which are possible. You do not need to evaluate your products. [2]

(b) It is given that $\mathbf{X}=\begin{pmatrix}2 & -2\\ 5 & 3\end{pmatrix}$ and $\mathbf{Y}=\begin{pmatrix}4 & 1\\ 2 & 0\end{pmatrix}$.

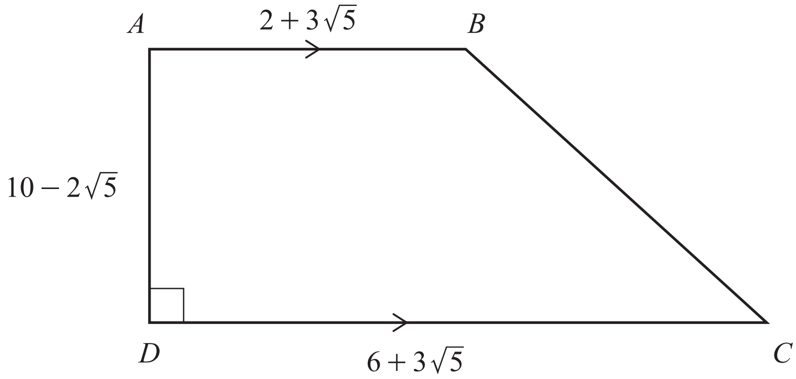
(i) Find $\mathbf{X}^{-1}$. [2]

(ii) Hence find the matrix $\mathbf{Z}$ such that $\mathbf{XZ}=\mathbf{Y}$. [3]

SAT PREP SP www.satprep.co.in

7 Do not use a calculator in this question.

All lengths in this question are in centimetres.

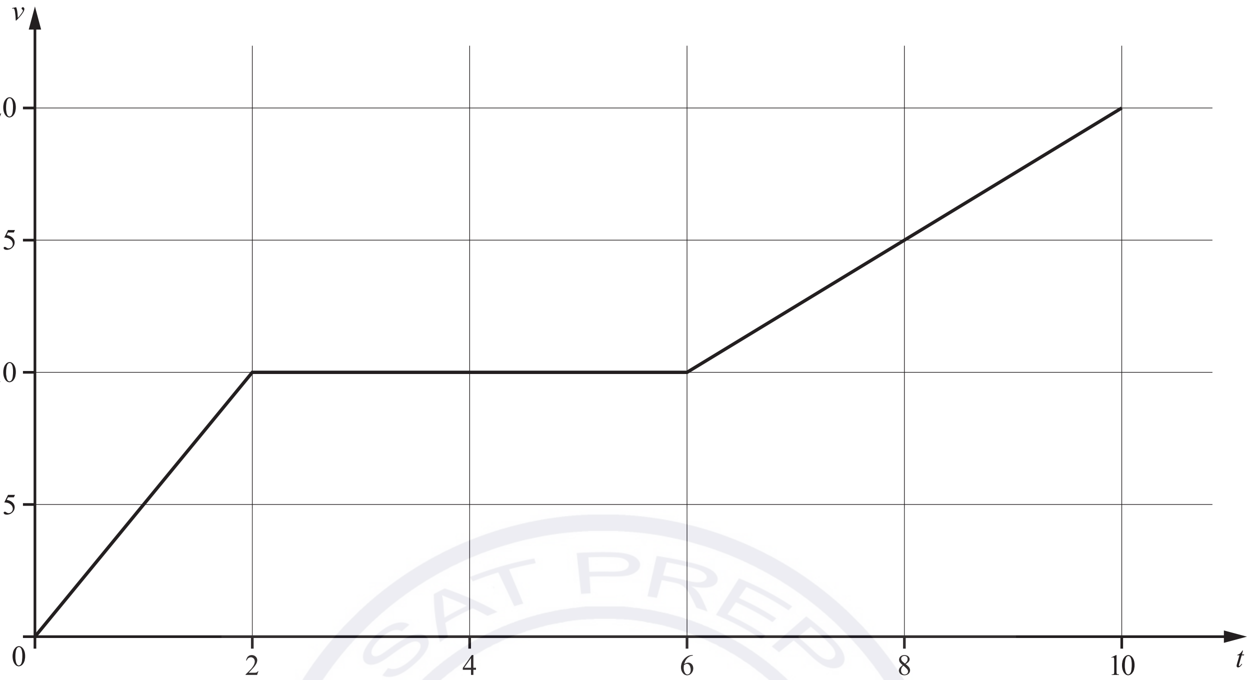


The diagram shows the trapezium *ABCD*, where $AB = 2+3\sqrt{5}$, $DC = 6+3\sqrt{5}$, $AD = 10-2\sqrt{5}$ and angle $ADC = 90°$.

(i) Find the area of *ABCD*, giving your answer in the form $a+b\sqrt{5}$, where a and b are integers. [3]

(ii) Find $\cot BCD$, giving your answer in the form $c+d\sqrt{5}$, where c and d are fractions in their simplest form. [3]

8 **(a)**



The diagram shows the velocity-time graph of a particle P moving in a straight line with velocity $v\,\text{ms}^{-1}$ at time t seconds after leaving a fixed point.

(i) Write down the value of the acceleration of P when $t = 5$. [1]

(ii) Find the distance travelled by the particle P between $t = 0$ and $t = 10$. [2]

(b) A particle Q moves such that its velocity, $v\,\text{ms}^{-1}$, t seconds after leaving a fixed point, is given by $v = 3\sin 2t - 1$.

(i) Find the speed of Q when $t = \frac{7\pi}{12}$. [2]

(ii) Find the least value of t for which the acceleration of Q is zero. [3]

SAT PREP SP www.satprep.co.in

9 The area of a sector of a circle of radius r cm is $36\,\text{cm}^2$.

(i) Show that the perimeter, P cm, of the sector is such that $P = 2r + \frac{72}{r}$. [3]

(ii) Hence, given that r can vary, find the stationary value of P and determine its nature. [4]

SAT PREP www.satprep.co.in

10 A curve is such that when $x = 0$, both $y = -5$ and $\frac{dy}{dx} = 10$. Given that $\frac{d^2y}{dx^2} = 4e^{2x} + 3$, find

(i) the equation of the curve, [7]

SAT PREP
SP
www.satprep.co.in

(ii) the equation of the normal to the curve at the point where $x = \frac{1}{4}$. [3]

11 **(a)** Solve $\sin x \cos x = \frac{1}{2}\tan x$ for $0° \leqslant x \leqslant 180°$. [3]

SAT PREP SP www.satprep.co.in

(b) **(i)** Show that $\sec\theta - \dfrac{\sin\theta}{\cot\theta} = \cos\theta$. [3]

(ii) Hence solve $\sec 3\theta - \dfrac{\sin 3\theta}{\cot 3\theta} = \dfrac{1}{2}$ for $-\dfrac{2\pi}{3} \leqslant \theta \leqslant \dfrac{2\pi}{3}$, where θ is in radians. [4]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cambridgeinternational.org after the live examination series.

Cambridge Assessment International Education is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which itself is a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0088942780

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (RW/SG) 153502/3
© UCLES 2018

CAMBRIDGE
International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} .$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\mathrm{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

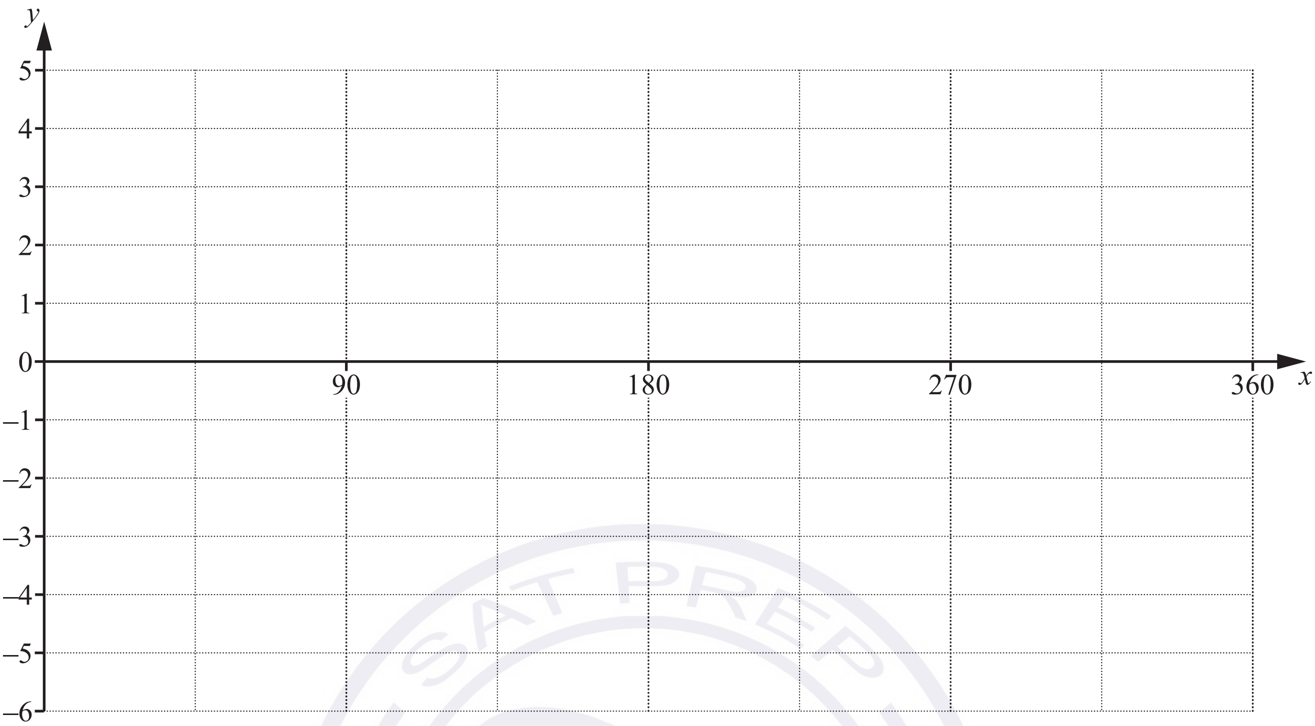
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2018

1 **(a)** On the axes below, sketch the graph of $y = 3\cos 2x - 1$, for $0° \leqslant x° \leqslant 360°$.



[3]

(b) Given that $y = 4\sin 6x$, write down

(i) the amplitude of y, [1]

(ii) the period of y. [1]

SAT PREP www.satprep.co.in

2 $$\mathrm{p}(x) = 2x^3 + 5x^2 + 4x + a$$

$$\mathrm{q}(x) = 4x^2 + 3ax + b$$

Given that p(x) has a remainder of 2 when divided by $2x + 1$ and that q(x) is divisible by $x + 2$,

(i) find the value of each of the constants a and b. [3]

Given that $\mathrm{r}(x) = \mathrm{p}(x) - \mathrm{q}(x)$ and using your values of a and b,

(ii) find the exact remainder when r(x) is divided by $3x - 2$. [3]

SAT PREP
SP
www.satprep.co.in

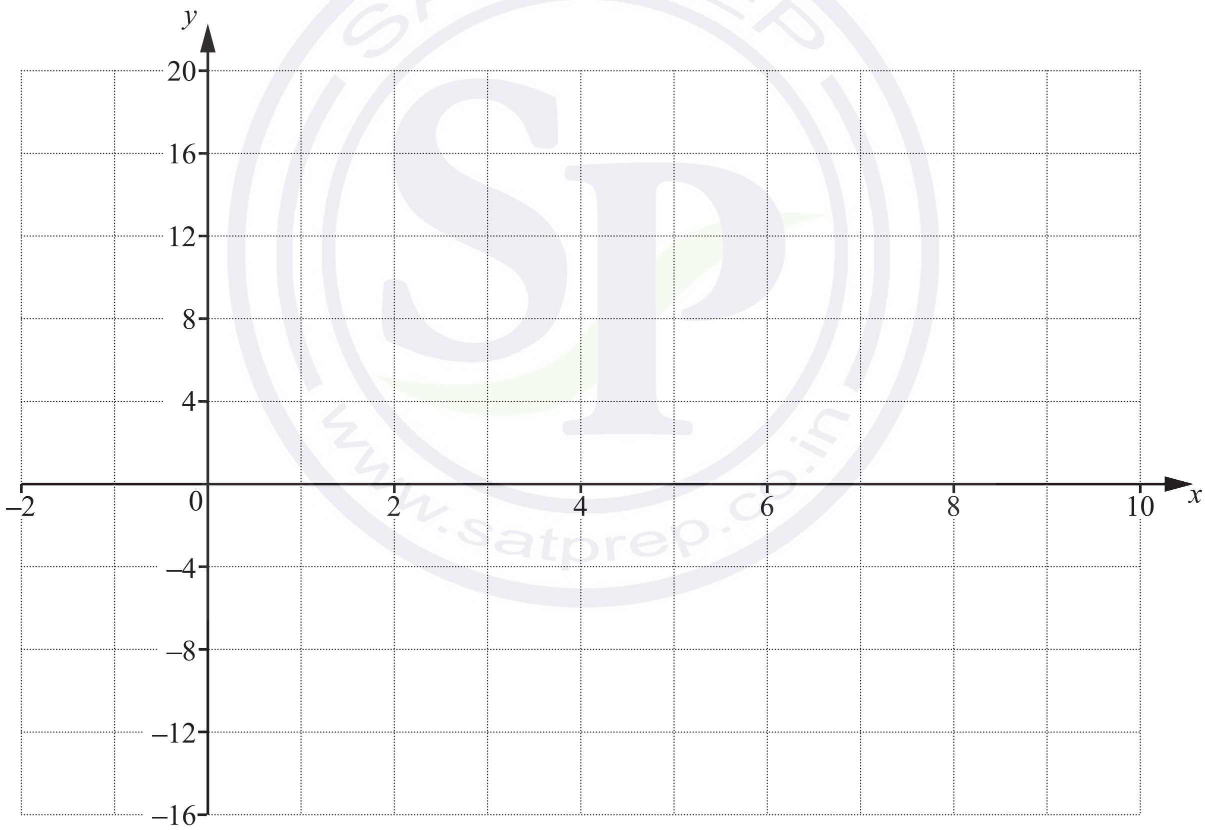
3 The coefficient of x^2 in the expansion of $(2-x)(3+kx)^6$ is equal to 972. Find the possible values of the constant k. [6]

© UCLES 2018

4 **(i)** Write $x^2 - 9x + 8$ in the form $(x - p)^2 - q$, where p and q are constants. [2]

(ii) Hence write down the coordinates of the minimum point on the curve $y = x^2 - 9x + 8$. [1]

(iii) On the axes below, sketch the graph of $y = |x^2 - 9x + 8|$, showing the coordinates of the points where the curve meets the coordinate axes.

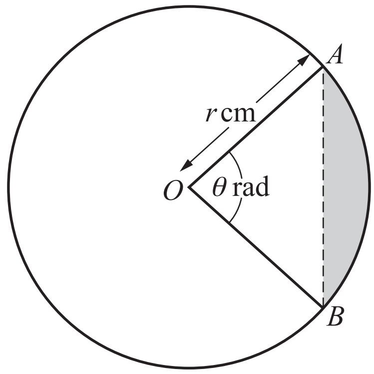


[3]

(iv) Write down the value of k for which $|x^2 - 9x + 8| = k$ has exactly 3 solutions. [1]

SAT PREP www.satprep.co.in

5



The diagram shows a circle with centre O and radius r cm. The minor arc AB is such that angle AOB is θ radians. The area of the minor sector AOB is $48\,\text{cm}^2$.

(i) Show that $\theta = \dfrac{96}{r^2}$. [2]

(ii) Given that the minor arc AB has length 12 cm, find the value of r and of θ. [3]

(iii) Using your values of r and θ, find the area of the shaded region. [2]

© UCLES 2018

6 A curve has equation $y = \dfrac{\ln(2x^2+3)}{5x+2}$.

(i) Show that $\dfrac{dy}{dx} = -\dfrac{5}{4}\ln 3$ when $x = 0$. [4]

(ii) Hence find the equation of the tangent to the curve at the point where $x = 0$. [2]

www.satprep.co.in SAT PREP SP

7 **(a)** Express $2+3\lg x-\lg y$ as a single logarithm to base 10. [3]

(b) **(i)** Solve $6x+7-\frac{3}{x}=0$. [2]

(ii) Hence, given that $6\log_a 3+7-3\log_3 a=0$, find the possible values of a. [4]

SAT PREP SP www.satprep.co.in

8 **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}(5x^2+4)^{\frac{3}{2}}$. [2]

(ii) Hence find $\int x(5x^2+4)^{\frac{1}{2}}\,\mathrm{d}x$. [2]

Given that $\int_0^a x(5x^2+4)^{\frac{1}{2}}\,\mathrm{d}x = \frac{19}{15}$,

(iii) find the value of the positive constant a. [4]

www.satprep.co.in SAT PREP

9 Variables s and t are such that $s = 4t + 3e^{-t}$.

(i) Find the value of s when $t = 0$. [1]

(ii) Find the exact value of t when $\frac{ds}{dt} = 2$. [4]

(iii) Find the approximate increase in s when t increases from $\ln 5$ to $\ln 5 + h$, where h is small. [3]

© UCLES 2018

10 Particle A is at the point with position vector $\begin{pmatrix} 2 \\ -5 \end{pmatrix}$ at time $t = 0$ and moves with a speed of $10\,\text{m s}^{-1}$ in the same direction as $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$.

(i) Given that A is at the point with position vector $\begin{pmatrix} 38 \\ a \end{pmatrix}$ when $t = 6\,\text{s}$, find the value of the constant a. [3]

SAT PREP SP www.satprep.co.in

Particle B is at the point with position vector $\begin{pmatrix} 16 \\ 37 \end{pmatrix}$ at time $t = 0$ and moves with velocity $\begin{pmatrix} 4 \\ 2 \end{pmatrix}\text{m s}^{-1}$.

(ii) Write down, in terms of t, the position vector of B at time $t\,\text{s}$. [1]

(iii) Verify that particles A and B collide. [4]

(iv) Write down the position vector of the point of collision. [1]

© UCLES 2018

11 **(a)** $f(x) = 3 - \cos 2x$ for $0 \leqslant x \leqslant \frac{\pi}{2}$.

(i) Write down the range of f. [2]

(ii) Find the exact value of $f^{-1}(2.5)$. [3]

SAT PREP
SP
www.satprep.co.in

(b) $g(x) = 3 - x^2$ for $x \in \mathbb{R}$.

Find the exact solutions of $g^2(x) = -6$. [4]

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

7206840868

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

SAT PREP www.satprep.co.in

This document consists of **16** printed pages.

DC (ST/JG) 153501/2
© UCLES 2018

CAMBRIDGE
International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} .$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2018

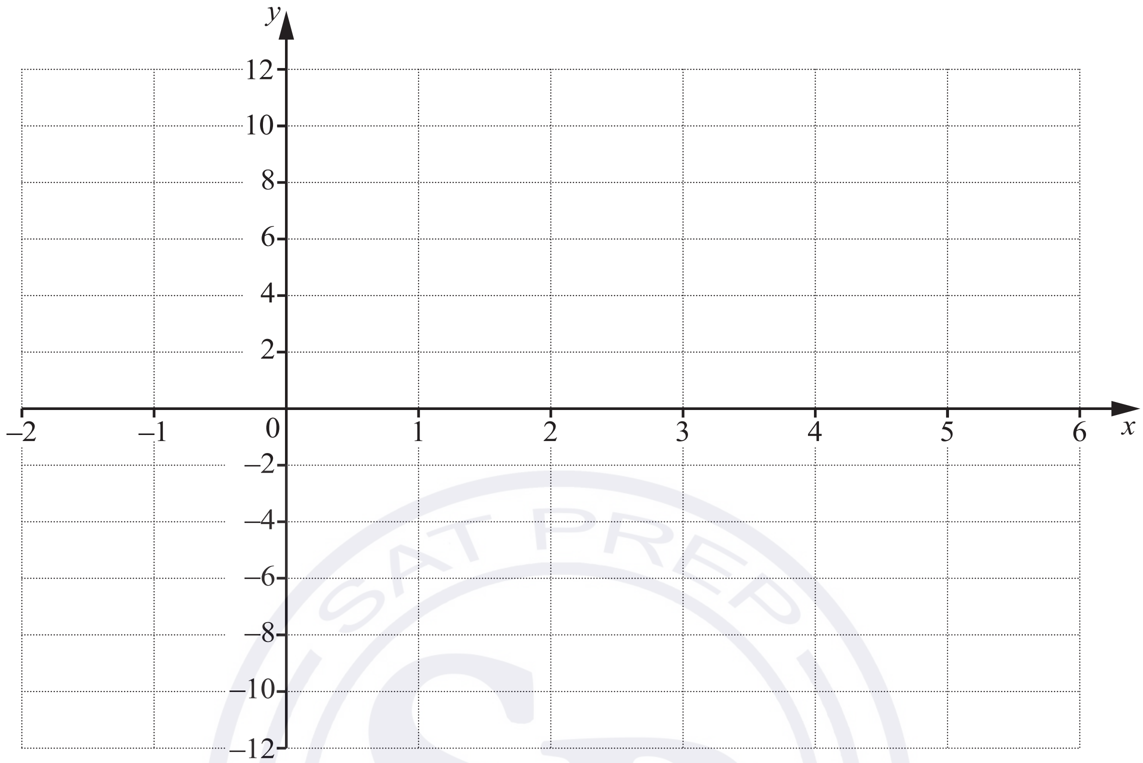
1 Solve $1+\sqrt{2}\sin(x+50°)=0$ for $-180° \leqslant x \leqslant 180°$. [4]

© UCLES 2018 **[Turn over**

2 Find the equation of the curve which has a gradient of 4 at the point $(0, -3)$ and is such that $\frac{d^2y}{dx^2} = 5 + e^{2x}$. [5]

SAT PREP
SP
www.satprep.co.in

3 **(i)** On the axes below, sketch the graph of $y = |6 - 3x|$, showing the coordinates of the points where the graph meets the coordinate axes. [2]



(ii) Solve $|6 - 3x| = 2$. [3]

(iii) Hence find the values of x for which $|6 - 3x| > 2$. [1]

4 $$y = x^3 \ln(2x+1)$$

(i) Find the value of $\frac{dy}{dx}$ when $x = 0.3$. You must show all your working. [4]

(ii) Hence find the approximate increase in y when x increases from 0.3 to $0.3 + h$, where h is small. [1]

SAT PREP
SP
www.satprep.co.in

5 The 7th term in the expansion of $(a+bx)^{12}$ in ascending powers of x is $924x^6$. It is given that a and b are positive constants.

(i) Show that $b=\dfrac{1}{a}$. [2]

The 6th term in the expansion of $(a+bx)^{12}$ in ascending powers of x is $198x^5$.

(ii) Find the value of a and of b. [4]

SAT PREP www.satprep.co.in

6 **(i)** Find $\dfrac{\mathrm{d}}{\mathrm{d}x}(5x^2 - 125)^{\frac{2}{3}}$. [2]

(ii) Using your answer to part **(i)**, find $\int x(5x^2 - 125)^{-\frac{1}{3}}\mathrm{d}x$. [2]

(iii) Hence find $\int_6^{10} x(5x^2 - 125)^{-\frac{1}{3}}\mathrm{d}x$. [2]

© UCLES 2018

7 **(a)** The vector **v** has a magnitude of 39 units and is in the same direction as $\begin{pmatrix} -12 \\ 5 \end{pmatrix}$. Write **v** in the form $\begin{pmatrix} a \\ b \end{pmatrix}$, where a and b are constants. [2]

(b) Vectors **p** and **q** are such that $\mathbf{p} = \begin{pmatrix} r+s \\ r+6 \end{pmatrix}$ and $\mathbf{q} = \begin{pmatrix} 5r+1 \\ 2s-1 \end{pmatrix}$, where r and s are constants. Given that $2\mathbf{p} + 3\mathbf{q} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$, find the value of r and of s. [4]

8 $$\mathbf{A} = \begin{pmatrix} a & 3 \\ 4 & a+4 \end{pmatrix}$$

(i) Find the values of the constant a for which $\mathbf{A}^{-1}$ does not exist. [3]

(ii) Given that $a = 4$, find $\mathbf{A}^{-1}$. [2]

(iii) Hence find the matrix $\mathbf{B}$ such that $\mathbf{AB} = \begin{pmatrix} 2 & 3 \\ 4 & -5 \end{pmatrix}$. [3]

SAT PREP SP www.satprep.co.in

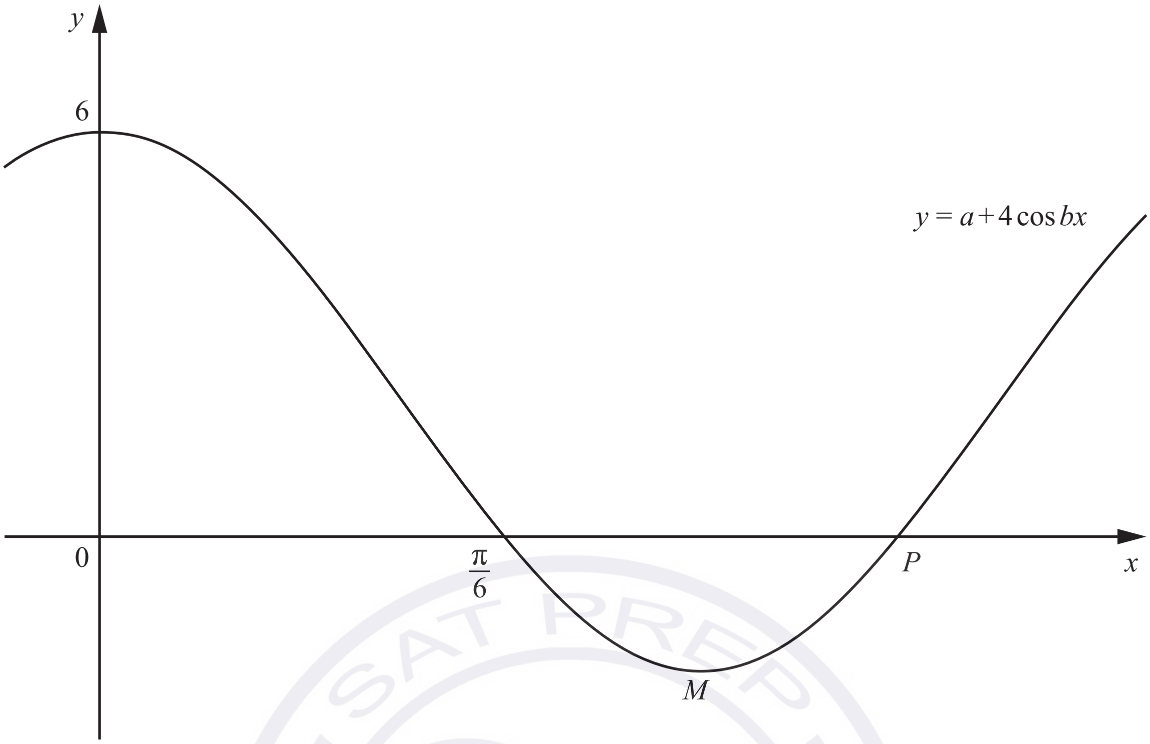
9 The polynomial $p(x) = ax^3 + bx^2 + cx - 9$ is divisible by $x + 3$. It is given that $p'(0) = 36$ and $p''(0) = 86$.

(i) Find the value of each of the constants a, b and c. [6]

(ii) Using your values of a, b and c, find the remainder when $p(x)$ is divided by $2x - 1$. [2]

www.satprep.co.in

10



The diagram shows part of the curve $y = a + 4\cos bx$, where a and b are positive constants. The curve meets the y-axis at the point $(0, 6)$ and the x-axis at the point $\left(\frac{\pi}{6}, 0\right)$. The curve meets the x-axis again at the point P and has a minimum at the point M.

(i) Find the value of a and of b. [3]

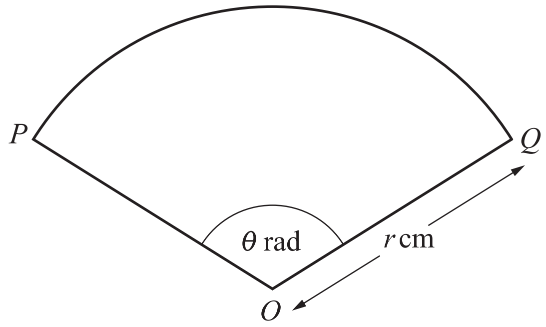
www.satprep.co.in

Using your values of a and b find,

(ii) the exact coordinates of P, [2]

(iii) the exact coordinates of M. [2]

11



The diagram shows the sector OPQ of a circle, centre O, radius r cm, where angle $POQ = \theta$ radians. The perimeter of the sector is 10 cm.

(i) Show that area, $A\,\text{cm}^2$, of the sector is given by $A = \dfrac{50\theta}{(2+\theta)^2}$. [5]

SAT PREP SP www.satprep.co.in

It is given that θ can vary and A has a maximum value.

(ii) Find the maximum value of A. [5]

Question 12 is printed on the next page.

12 The line $y = 2x + 5$ intersects the curve $y + xy = 5$ at the points A and B. Find the coordinates of the point where the perpendicular bisector of the line AB intersects the line $y = x$. [9]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2018

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

Cambridge IGCSE

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

3103611472

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (ST/JG) 153500/3
© UCLES 2018

CAMBRIDGE International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\ .$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}\,b + \binom{n}{2}a^{n-2}\,b^2 + \ldots + \binom{n}{r}a^{n-r}\,b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2}\,bc \sin A$$

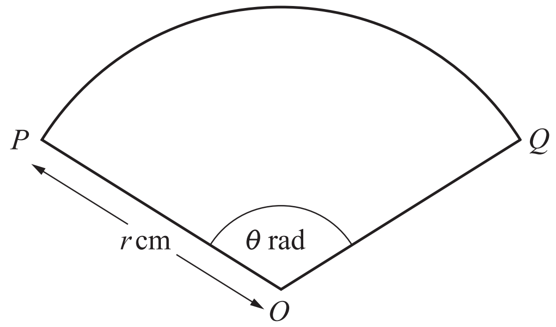
© UCLES 2018

1 **(a)** In the expansion of $(2+px)^5$ the coefficient of x^3 is equal to $-\frac{8}{25}$. Find the value of the constant p. [3]

(b) Find the term independent of x in the expansion of $\left(2x^2+\frac{1}{4x^2}\right)^8$. [3]

SAT PREP
SP
www.satprep.co.in

2



The diagram shows a sector POQ of a circle, centre O, radius r cm, where angle $POQ = \theta$ radians. The perimeter of the sector is 20 cm.

(i) Show that the area, $A\,\text{cm}^2$, of the sector is given by $A = 10r - r^2$. [3]

It is given that r can vary and that A has a maximum value.

(ii) Find the value of θ for which A has a maximum value. [3]

3 **Do not use a calculator in this question.**

In this question, all lengths are in centimetres.

A triangle ABC is such that angle $B = 90°$, $AB = 5\sqrt{3} + 5$ and $BC = 5\sqrt{3} - 5$.

(i) Find, in its simplest surd form, the length of AC. [3]

(ii) Find $\tan BCA$, giving your answer in the form $a + b\sqrt{3}$, where a and b are integers. [3]

www.satprep.co.in

4 In this question, the units of x are radians and the units of y are centimetres.

It is given that $y = (1 + \cos 3x)^{10}$.

(i) Find the value of $\frac{dy}{dx}$ when $x = \frac{\pi}{2}$. [4]

Given also that y is increasing at a rate of $6\,\text{cm}\,\text{s}^{-1}$ when $x = \frac{\pi}{2}$,

(ii) find the corresponding rate of change of x. [2]

SAT PREP SP www.satprep.co.in

5 **(i)** Show that $\log_9 4 = \log_3 2$. [2]

(ii) Hence solve $\log_9 4 + \log_3 x = 3$. [3]

6 A particle P is moving in a straight line such that its displacement, s m, from a fixed point O at time t s, is given by $s = 12e^{-0.5t} + 4t - 12$.

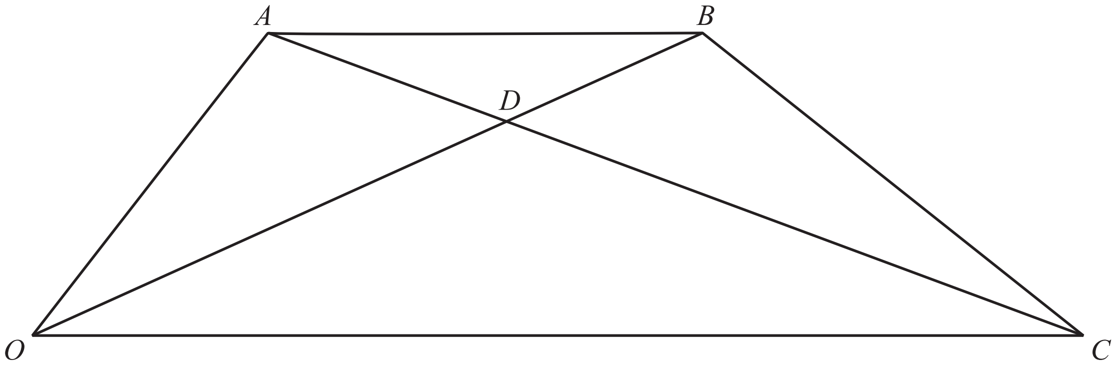
(i) Find the value of t when P is instantaneously at rest. [3]

(ii) Find an expression for the acceleration of P at time t s. [2]

(iii) Find the value of s when the acceleration of P is $0.3\,\text{ms}^{-2}$. [3]

(iv) Explain why the acceleration of the particle will always be positive. [1]

7



The diagram shows a quadrilateral *OABC*. The point *D* lies on *OB* such that $\overrightarrow{OD} = 2\overrightarrow{DB}$ and $\overrightarrow{AD} = m\overrightarrow{AC}$, where *m* is a scalar quantity.

$$\overrightarrow{OA} = \mathbf{a} \qquad \overrightarrow{OB} = \mathbf{b} \qquad \overrightarrow{OC} = \mathbf{c}$$

(i) Find $\overrightarrow{AD}$ in terms of m, **a** and **c**. [1]

(ii) Find $\overrightarrow{AD}$ in terms of **a** and **b**. [2]

(iii) Given that $15\mathbf{a} = 16\mathbf{b} - 9\mathbf{c}$, find the value of m. [3]

© UCLES 2018

8 $$f(x) = 5 + \sin\frac{x}{4} \quad \text{for} \quad 0 \leqslant x \leqslant 2\pi \text{ radians}$$

$$g(x) = x - \frac{\pi}{3} \quad \text{for} \quad x \in \mathbb{R}$$

(i) Write down the range of $f(x)$. [2]

(ii) Find $f^{-1}(x)$ and write down its range. [3]

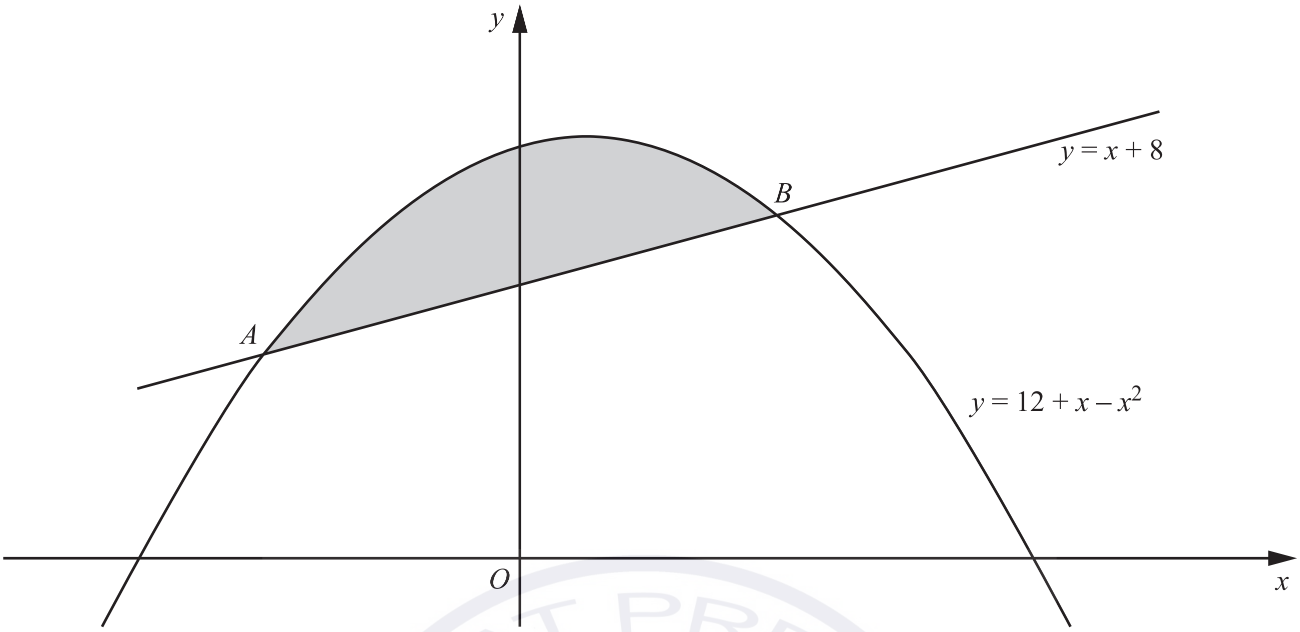
(iii) Solve $2fg(x) = 11$. [4]

© UCLES 2018

9 Find the equation of the normal to the curve $y = \dfrac{\ln(3x^2+1)}{x^2}$ at the point where $x = 2$, giving your answer in the form $y = mx + c$, where m and c are correct to 2 decimal places. You must show all your working. [8]

www.satprep.co.in SAT PREP SP

10



The diagram shows the curve $y = 12 + x - x^2$ intersecting the line $y = x + 8$ at the points A and B.

(i) Find the coordinates of the points A and B. [3]

(ii) Find $\int (12 + x - x^2)\,dx$. [2]

(iii) Showing all your working, find the area of the shaded region. [4]

SAT PREP
SP
www.satprep.co.in

11 The polynomial $p(x) = ax^3 + 17x^2 + bx - 8$ is divisible by $2x - 1$ and has a remainder of -35 when divided by $x + 3$.

(i) By finding the value of each of the constants a and b, verify that $a = b$. [4]

SAT PREP SP www.satprep.co.in

Using your values of a and b,

(ii) find $p(x)$ in the form $(2x-1)q(x)$, where $q(x)$ is a quadratic expression, [2]

(iii) factorise $\mathrm{p}(x)$ completely, [1]

(iv) solve $a\sin^3\theta + 17\sin^2\theta + b\sin\theta - 8 = 0$ for $0° < \theta < 180°$. [3]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

3936138431

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (SC/SG) 145845/2
© UCLES 2018

CAMBRIDGE International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2018

1 Solve the equations

$$y - x = 4,$$

$$x^2 + y^2 - 8x - 4y - 16 = 0.$$

[5]

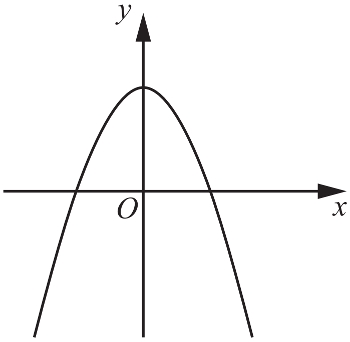
SAT PREP www.satprep.co.in

2 Find the equation of the perpendicular bisector of the line joining the points (1, 3) and (4, −5). Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

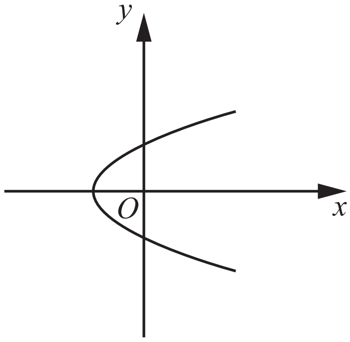
SAT PREP SP www.satprep.co.in

3 Diagrams **A** to **D** show four different graphs. In each case the whole graph is shown and the scales on the two axes are the same.

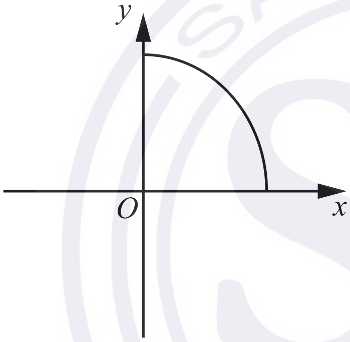
A



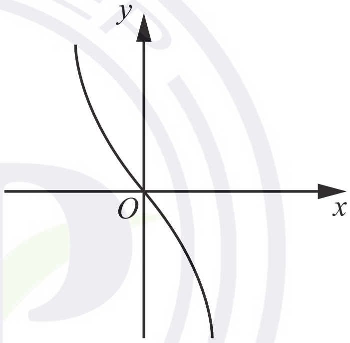
B



C



D



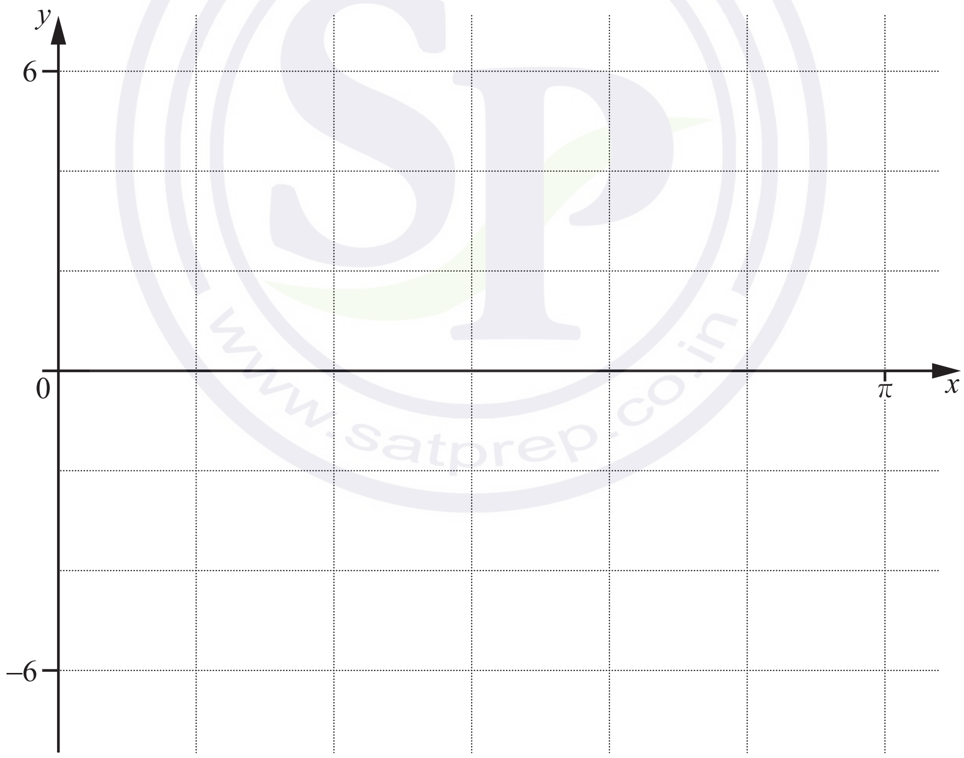
Place ticks in the boxes in the table to indicate which descriptions, if any, apply to each graph. There may be more than one tick in any row or column of the table. [4]

	A	**B**	**C**	**D**
Not a function				
One-one function				
A function that is its own inverse				
A function with no inverse				

SAT PREP www.satprep.co.in

4 **(i)** The curve $y = a + b\sin cx$ has an amplitude of 4 and a period of $\frac{\pi}{3}$. Given that the curve passes through the point $\left(\frac{\pi}{12}, 2\right)$, find the value of each of the constants a, b and c. [4]

(ii) Using your values of a, b and c, sketch the graph of $y = a + b\sin cx$ for $0 \leqslant x \leqslant \pi$ radians. [3]



5 The population, P, of a certain bacterium t days after the start of an experiment is modelled by $P = 800e^{kt}$, where k is a constant.

(i) State what the figure 800 represents in this experiment. [1]

(ii) Given that the population is 20 000 two days after the start of the experiment, calculate the value of k. [3]

SAT PREP SP www.satprep.co.in

(iii) Calculate the population three days after the start of the experiment. [2]

6 **(a)** Write $(\log_2 p)(\log_3 2) + \log_3 q$ as a single logarithm to base 3. [3]

(b) Given that $(\log_a 5)^2 - 4\log_a 5 + 3 = 0$, find the possible values of a. [3]

SAT PREP www.satprep.co.in

7 **(i)** Find the inverse of the matrix $\begin{pmatrix} 4 & -2 \\ -5 & 3 \end{pmatrix}$. [2]

(ii) Hence solve the simultaneous equations

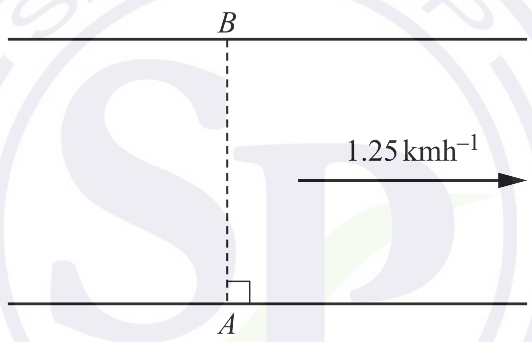
$$8x - 4y - 5 = 0,$$
$$-10x + 6y - 7 = 0.$$

[4]

SAT PREP
SP
www.satprep.co.in

8 **(a)** Given that $\mathbf{p} = 2\mathbf{i} - 5\mathbf{j}$ and $\mathbf{q} = \mathbf{i} - 3\mathbf{j}$, find the unit vector in the direction of $3\mathbf{p} - 4\mathbf{q}$. [4]

(b)



A river flows between parallel banks at a speed of $1.25\,\mathrm{km\,h^{-1}}$. A boy standing at point A on one bank sends a toy boat across the river to his father standing directly opposite at point B. The toy boat, which can travel at $v\,\mathrm{km\,h^{-1}}$ in still water, crosses the river with resultant speed $2.73\,\mathrm{km\,h^{-1}}$ along the line AB.

(i) Calculate the value of v. [2]

The direction in which the boy points the boat makes an angle θ with the line AB.

(ii) Find the value of θ. [2]

SAT PREP SP www.satprep.co.in

9 **(i)** Find the first 3 terms in the expansion of $\left(2x - \frac{1}{16x}\right)^8$ in descending powers of x. [3]

(ii) Hence find the coefficient of x^4 in the expansion of $\left(2x - \frac{1}{16x}\right)^8 \left(\frac{1}{x^2} + 1\right)^2$. [3]

SAT PREP SP www.satprep.co.in

10 Do not use a calculator in this question.

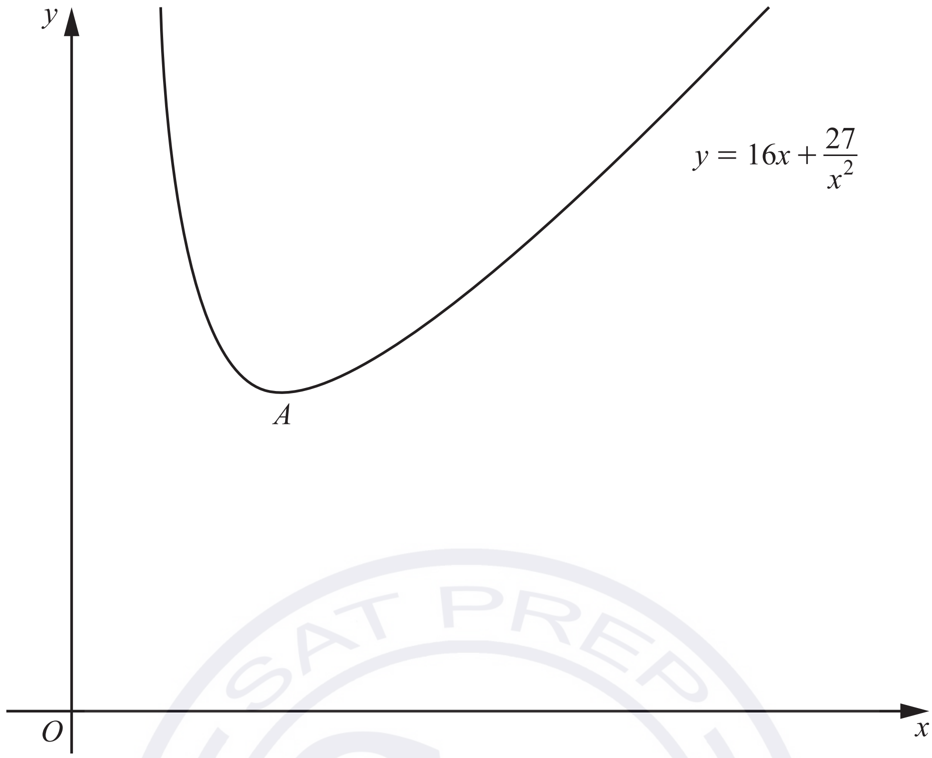
(a) Simplify $\dfrac{5+6\sqrt{5}}{6+\sqrt{5}}$. [3]

(b) Show that $3^{0.5} \times (\sqrt{2})^7$ can be written in the form $a\sqrt{b}$, where a and b are integers and $a > b$. [2]

(c) Solve the equation $x + \sqrt{2} = \dfrac{4}{x}$, giving your answers in simplest surd form. [4]

www.satprep.co.in

11



The diagram shows part of the graph of $y = 16x + \frac{27}{x^2}$, which has a minimum at A.

(i) Find the coordinates of A. [4]

www.satprep.co.in

The points P and Q lie on the curve $y = 16x + \frac{27}{x^2}$ and have x-coordinates 1 and 3 respectively.

(ii) Find the area enclosed by the curve and the line PQ. You must show all your working. [6]

Question 12 is printed on the next page.

12 A curve is such that $\frac{\mathrm{d}^2y}{\mathrm{d}x^2} = (2x-5)^{-\frac{1}{2}}$. Given that the curve has a gradient of 6 at the point $\left(\frac{9}{2}, \frac{2}{3}\right)$, find the equation of the curve. [8]

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2018

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

1239049889

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

www.satprep.co.in

DC (KN/SW) 145846/4
© UCLES 2018

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

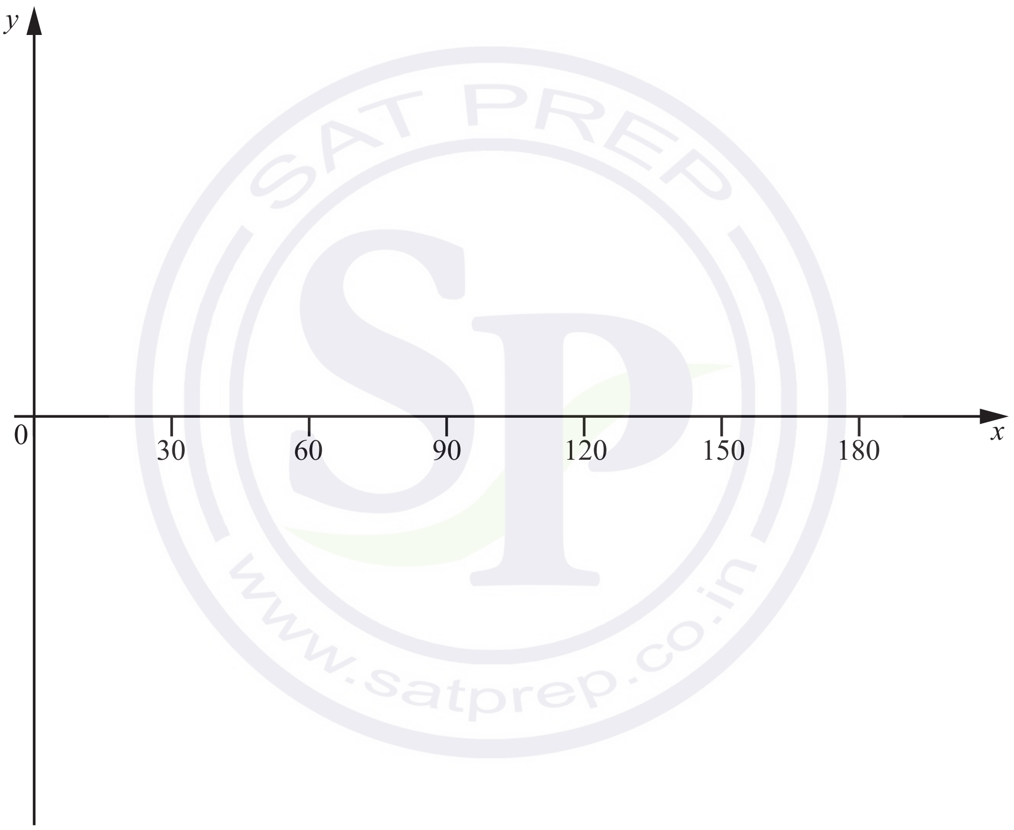
$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2018

1 It is given that $y = 1 + \tan 3x$.

(i) State the period of y. [1]

(ii) On the axes below, sketch the graph of $y = 1 + \tan 3x$ for $0° \leqslant x° \leqslant 180°$. [3]



2 Find the values of k for which the line $y = 1 - 2kx$ does not meet the curve $y = 9x^2 - (3k + 1)x + 5$. [5]

SAT PREP
SP
www.satprep.co.in

3 The variables x and y are such that when e^y is plotted against x^2, a straight line graph passing through the points (5, 3) and (3, 1) is obtained. Find y in terms of x. [5]

www.satprep.co.in

4 A particle P moves so that its displacement, x metres from a fixed point O, at time t seconds, is given by $x = \ln(5t+3)$.

(i) Find the value of t when the displacement of P is 3m. [2]

(ii) Find the velocity of P when $t = 0$. [2]

(iii) Explain why, after passing through O, the velocity of P is never negative. [1]

(iv) Find the acceleration of P when $t = 0$. [2]

SAT PREP
SP
www.satprep.co.in

5 **(i)** The first three terms in the expansion of $\left(3 - \frac{1}{9x}\right)^5$ can be written as $a + \frac{b}{x} + \frac{c}{x^2}$. Find the value of each of the constants a, b and c. [3]

(ii) Use your values of a, b and c to find the term independent of x in the expansion of

$$\left(3 - \frac{1}{9x}\right)^5 (2 + 9x)^2.$$ [3]

SAT PREP SP www.satprep.co.in

6 Find the coordinates of the stationary point of the curve $y = \dfrac{x+2}{\sqrt{2x-1}}$. [6]

SAT PREP
SP
www.satprep.co.in

7 A population, B, of a particular bacterium, t hours after measurements began, is given by $B = 1000\mathrm{e}^{\frac{t}{4}}$.

(i) Find the value of B when $t = 0$. [1]

(ii) Find the time taken for B to double in size. [3]

(iii) Find the value of B when $t = 8$. [1]

www.satprep.co.in

8 **(a)** Solve $3\cos^2\theta + 4\sin\theta = 4$ for $0° \leqslant \theta \leqslant 180°$. [4]

(b) Solve $\sin 2\phi = \sqrt{3}\cos 2\phi$ for $-\frac{\pi}{2} \leqslant \phi \leqslant \frac{\pi}{2}$ radians. [4]

SAT PREP SP www.satprep.co.in

9 **(a)** **(i)** Solve $\lg x = 3$. [1]

(ii) Write $\lg a - 2\lg b + 3$ as a single logarithm. [3]

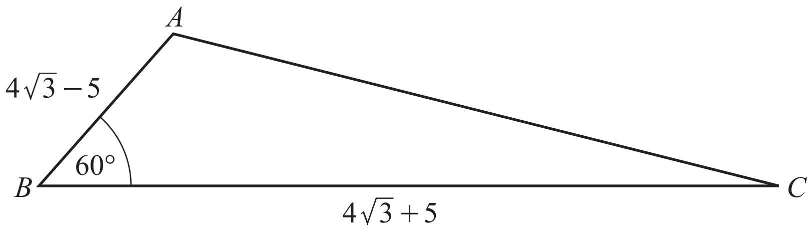
(b) **(i)** Solve $x - 5 + \frac{6}{x} = 0$. [2]

(ii) Hence, showing all your working, find the values of *a* such that $\log_4 a - 5 + 6\log_a 4 = 0$. [3]

SAT PREP SP www.satprep.co.in

10 Do not use a calculator in this question.

All lengths in this question are in centimetres.



The diagram shows the triangle *ABC*, where $AB = 4\sqrt{3} - 5$, $BC = 4\sqrt{3} + 5$ and angle $ABC = 60°$.

It is known that $\sin 60° = \frac{\sqrt{3}}{2}$, $\cos 60° = \frac{1}{2}$, $\tan 60° = \sqrt{3}$.

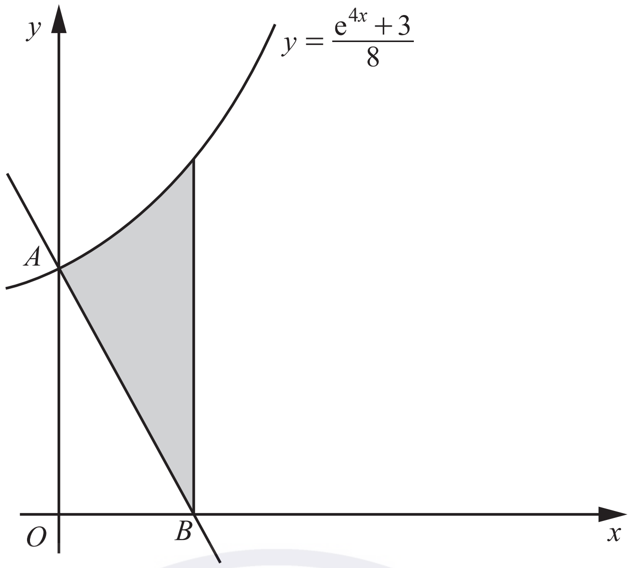
(i) Find the exact value of *AC*. [4]

SAT PREP SP www.satprep.co.in

(ii) Hence show that $\operatorname{cosec} ACB = \frac{2\sqrt{p}}{q}(4\sqrt{3} + 5)$, where p and q are integers. [4]

SAT PREP
SP
www.satprep.co.in

11



The diagram shows the graph of the curve $y = \frac{e^{4x} + 3}{8}$. The curve meets the y-axis at the point A.

The normal to the curve at A meets the x-axis at the point B. Find the area of the shaded region enclosed by the curve, the line AB and the line through B parallel to the y-axis. Give your answer in the form $\frac{e}{a}$, where a is a constant. You must show all your working.

[10]

© UCLES 2018

Question 12 is printed on the next page.

12 Do not use a calculator in this question.

(a) Given that $\dfrac{6^p \times 8^{p+2} \times 3^q}{9^{2q-3}}$ is equal to $2^7 \times 3^4$, find the value of each of the constants p and q. [3]

(b) Using the substitution $u = x^{\frac{1}{3}}$, or otherwise, solve $4x^{\frac{1}{3}} + x^{\frac{2}{3}} + 3 = 0$. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

5006741950

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (NF/SG) 162658
© UCLES 2018

CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2018

1 Solve the equations

$$y - x = 4,$$

$$x^2 + y^2 - 8x - 4y - 16 = 0.$$

[5]

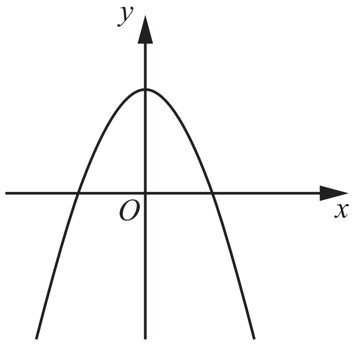
www.satprep.co.in

2 Find the equation of the perpendicular bisector of the line joining the points (1, 3) and (4, −5). Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

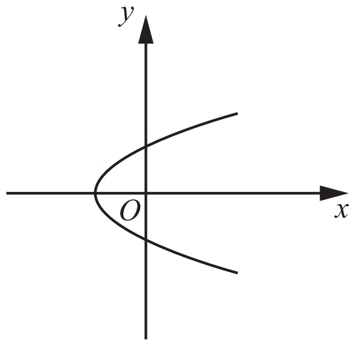
www.satprep.co.in

3 Diagrams **A** to **D** show four different graphs. In each case the whole graph is shown and the scales on the two axes are the same.

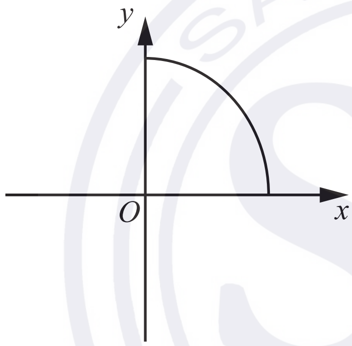
A



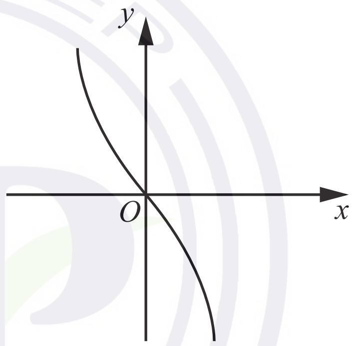
B



C



D



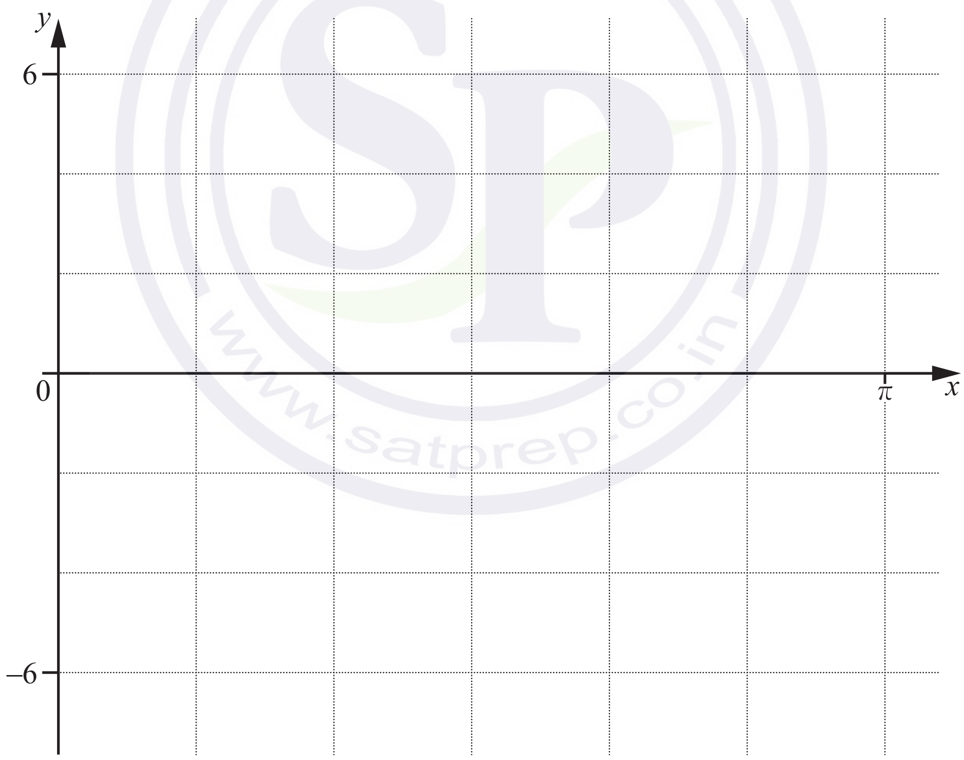
Place ticks in the boxes in the table to indicate which descriptions, if any, apply to each graph. There may be more than one tick in any row or column of the table. [4]

	A	**B**	**C**	**D**
Not a function				
One-one function				
A function that is its own inverse				
A function with no inverse				

SAT PREP www.satprep.co.in

4 **(i)** The curve $y = a + b\sin cx$ has an amplitude of 4 and a period of $\frac{\pi}{3}$. Given that the curve passes through the point $\left(\frac{\pi}{12}, 2\right)$, find the value of each of the constants a, b and c. [4]

(ii) Using your values of a, b and c, sketch the graph of $y = a + b\sin cx$ for $0 \leqslant x \leqslant \pi$ radians. [3]



© UCLES 2018

5 The population, P, of a certain bacterium t days after the start of an experiment is modelled by $P = 800e^{kt}$, where k is a constant.

(i) State what the figure 800 represents in this experiment. [1]

(ii) Given that the population is 20 000 two days after the start of the experiment, calculate the value of k. [3]

SAT PREP
SP
www.satprep.co.in

(iii) Calculate the population three days after the start of the experiment. [2]

6 **(a)** Write $(\log_2 p)(\log_3 2) + \log_3 q$ as a single logarithm to base 3. [3]

(b) Given that $(\log_a 5)^2 - 4\log_a 5 + 3 = 0$, find the possible values of a. [3]

SAT PREP
SP
www.satprep.co.in

7 **(i)** Find the inverse of the matrix $\begin{pmatrix} 4 & -2 \\ -5 & 3 \end{pmatrix}$. [2]

(ii) Hence solve the simultaneous equations

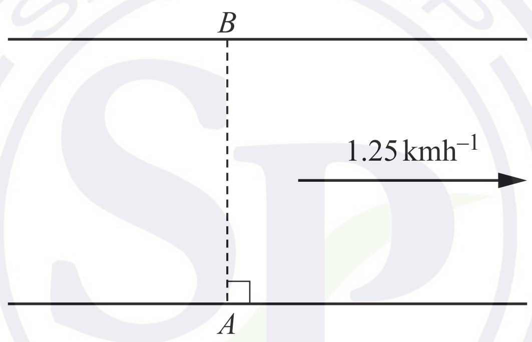
$$8x - 4y - 5 = 0,$$
$$-10x + 6y - 7 = 0.$$

[4]

SAT PREP SP www.satprep.co.in

8 **(a)** Given that $\mathbf{p} = 2\mathbf{i} - 5\mathbf{j}$ and $\mathbf{q} = \mathbf{i} - 3\mathbf{j}$, find the unit vector in the direction of $3\mathbf{p} - 4\mathbf{q}$. [4]

(b)



A river flows between parallel banks at a speed of $1.25\,\text{km}\,\text{h}^{-1}$. A boy standing at point A on one bank sends a toy boat across the river to his father standing directly opposite at point B. The toy boat, which can travel at $v\,\text{km}\,\text{h}^{-1}$ in still water, crosses the river with resultant speed $2.73\,\text{km}\,\text{h}^{-1}$ along the line AB.

(i) Calculate the value of v. [2]

© UCLES 2018

The direction in which the boy points the boat makes an angle θ with the line AB.

(ii) Find the value of θ. [2]

SAT PREP SP www.satprep.co.in

9 **(i)** Find the first 3 terms in the expansion of $\left(2x - \frac{1}{16x}\right)^8$ in descending powers of x. [3]

(ii) Hence find the coefficient of x^4 in the expansion of $\left(2x - \frac{1}{16x}\right)^8 \left(\frac{1}{x^2} + 1\right)^2$. [3]

SAT PREP SP www.satprep.co.in

© UCLES 2018

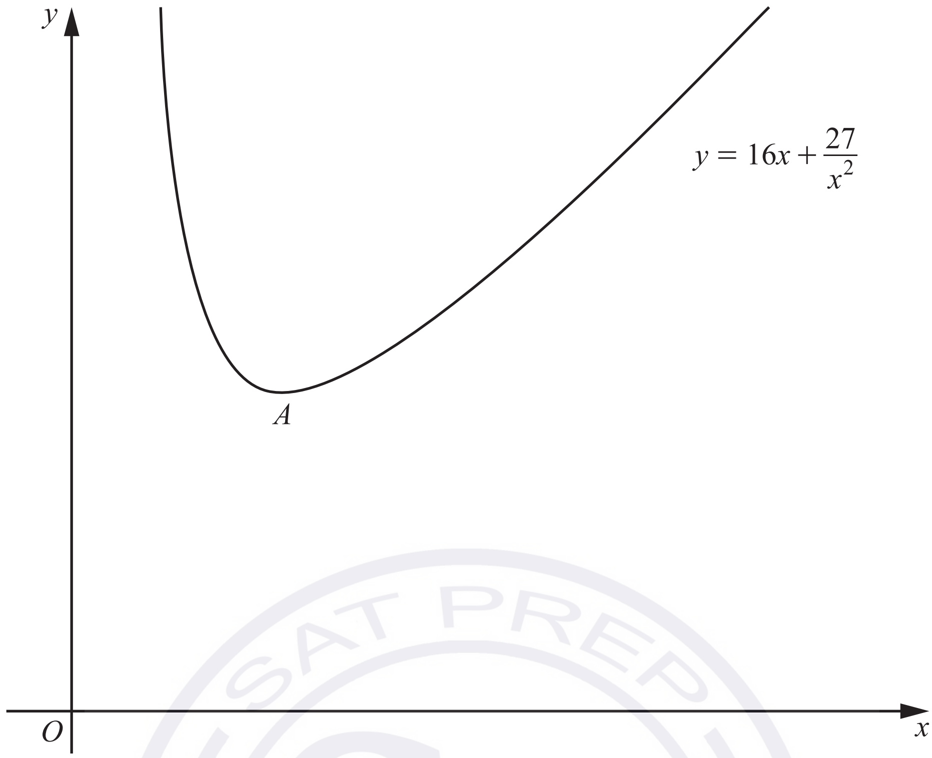
10 Do not use a calculator in this question.

(a) Simplify $\dfrac{5+6\sqrt{5}}{6+\sqrt{5}}$. [3]

(b) Show that $3^{0.5}\times(\sqrt{2})^7$ can be written in the form $a\sqrt{b}$, where a and b are integers and $a > b$. [2]

(c) Solve the equation $x+\sqrt{2}=\dfrac{4}{x}$, giving your answers in simplest surd form. [4]

11



The diagram shows part of the graph of $y = 16x + \frac{27}{x^2}$, which has a minimum at A.

(i) Find the coordinates of A. [4]

© UCLES 2018

The points P and Q lie on the curve $y = 16x + \frac{27}{x^2}$ and have x-coordinates 1 and 3 respectively.

(ii) Find the area enclosed by the curve and the line PQ. You must show all your working. [6]

SAT PREP SP www.satprep.co.in

Question 12 is printed on the next page.

12 A curve is such that $\dfrac{d^2y}{dx^2} = (2x-5)^{-\frac{1}{2}}$. Given that the curve has a gradient of 6 at the point $\left(\dfrac{9}{2}, \dfrac{2}{3}\right)$, find the equation of the curve. [8]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2018

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

5325132921

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2018**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (SC/CGW) 144843/3
© UCLES 2018

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2018

1 The remainder obtained when the polynomial $p(x) = x^3 + ax^2 - 3x + b$ is divided by $x + 3$ is twice the remainder obtained when $p(x)$ is divided by $x - 2$. Given also that $p(x)$ is divisible by $x + 1$, find the value of a and of b. [5]

SAT PREP www.satprep.co.in

2 A curve has equation $y = 4 + 5\sin 3x$.

(i) Find $\frac{dy}{dx}$. [2]

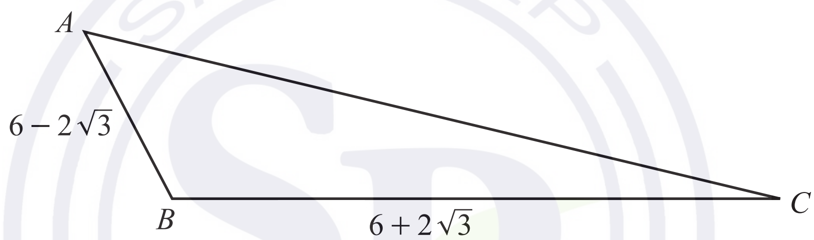
(ii) Hence find the equation of the tangent to the curve $y = 4 + 5\sin 3x$ at the point where $x = \frac{\pi}{3}$. [3]

SAT PREP SP www.satprep.co.in

3 Do not use a calculator in this question.

(a) Simplify $\dfrac{(3+2\sqrt{5})(6-2\sqrt{5})}{(4-\sqrt{5})}$, giving your answer in the form $a+b\sqrt{5}$, where a and b are integers. [3]

(b) In this part, all lengths are in centimetres.



The diagram shows the triangle ABC with $AB = 6-2\sqrt{3}$ and $BC = 6+2\sqrt{3}$. Given that $\cos ABC = -\dfrac{1}{2}$, find the length of AC in the form $c\sqrt{d}$, where c and d are integers. [3]

www.satprep.co.in

4 It is given that $y = \dfrac{\ln(4x^2 - 1)}{x + 2}$.

(i) Find the values of x for which y is not defined. [2]

(ii) Find $\dfrac{dy}{dx}$. [3]

SAT PREP
SP
www.satprep.co.in

(iii) Hence find the approximate increase in y when x increases from 2 to $2 + h$, where h is small. [2]

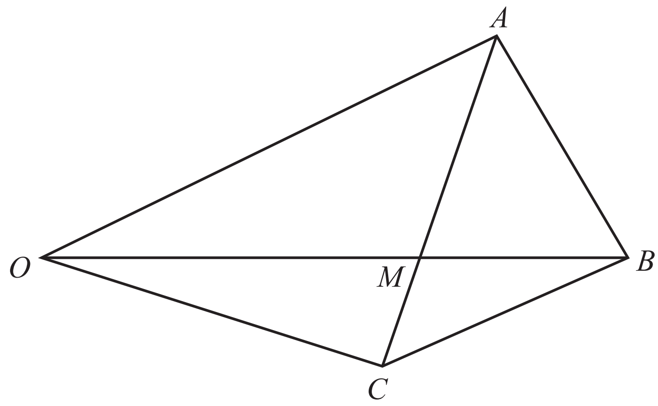
5 The first 3 terms in the expansion of $(2 + ax)^n$ are equal to $1024 - 1280x + bx^2$, where n, a and b are constants.

(i) Find the value of each of n, a and b. [5]

(ii) Hence find the term independent of x in the expansion of $(2 + ax)^n\left(x - \dfrac{1}{x}\right)^2$. [3]

SAT PREP SP www.satprep.co.in

6



The diagram shows the quadrilateral $OABC$ such that $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$. It is given that $AM : MC = 2 : 1$ and $OM : MB = 3 : 2$.

(i) Find $\overrightarrow{AC}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. [1]

(ii) Find $\overrightarrow{OM}$ in terms of $\mathbf{a}$ and $\mathbf{c}$. [2]

(iii) Find $\overrightarrow{OM}$ in terms of $\mathbf{b}$. [1]

(iv) Find $5\mathbf{a} + 10\mathbf{c}$ in terms of $\mathbf{b}$. [2]

(v) Find $\overrightarrow{AB}$ in terms of $\mathbf{a}$ and $\mathbf{c}$, giving your answer in its simplest form. [2]

SAT PREP
SP
www.satprep.co.in

7 **(a)** Find the values of a for which $\det\begin{pmatrix} 2a & 1 \\ 4a & a \end{pmatrix} = 6 - 3a$. [3]

(b) It is given that $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ 3 & 4 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & 0 \\ -3 & 5 \end{pmatrix}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Hence find the matrix $\mathbf{C}$ such that $\mathbf{AC} = \mathbf{B}$. [3]

(c) Find the 2×2 matrix $\mathbf{D}$ such that $4\mathbf{D} + 3\mathbf{I} = \mathbf{O}$. [1]

© UCLES 2018

8 A particle P, moving in a straight line, passes through a fixed point O at time $t = 0$ s. At time t s after leaving O, the displacement of the particle is x m and its velocity is v ms^{-1}, where $v = 12e^{2t} - 48t,\ t \geqslant 0$.

(i) Find x in terms of t. [4]

(ii) Find the value of t when the acceleration of P is zero. [3]

(iii) Find the velocity of P when the acceleration is zero. [2]

© UCLES 2018

9 The table shows values of the variables x and y.

x	2	4	6	8	10
y	736	271	100	37	13

The relationship between x and y is thought to be of the form $y = Ae^{bx}$, where A and b are constants.

(i) Transform this relationship into straight line form. [1]

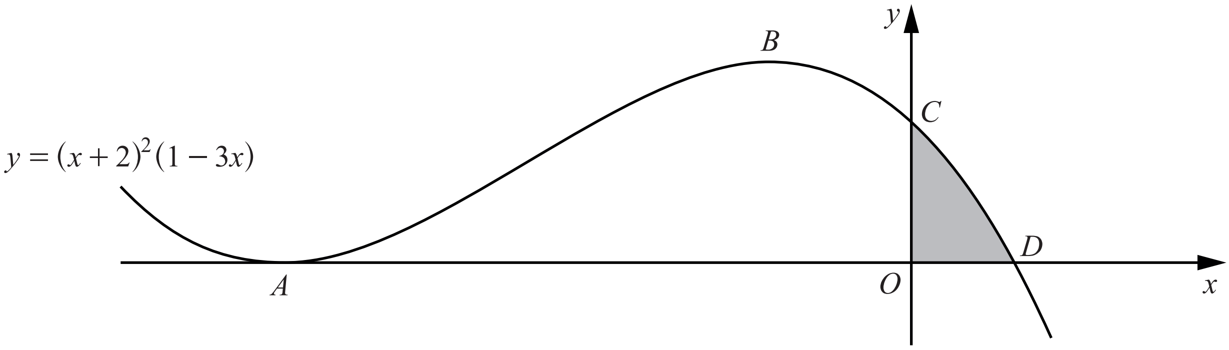
(ii) Hence, by plotting a suitable graph, show that the relationship $y = Ae^{bx}$ is correct. [2]

(iii) Use your graph to find the value of A and of b. [4]

(iv) Estimate the value of x when $y = 500$. [2]

(v) Estimate the value of y when $x = 5$. [2]

10



The diagram shows the graph of $y = (x+2)^2(1-3x)$. The curve has a minimum at the point A, a maximum at the point B and intersects the y-axis and the x-axis at the points C and D respectively.

(i) Find the x-coordinate of A and of B. [5]

SAT PREP SP www.satprep.co.in

(ii) Write down the coordinates of C and of D. [2]

(iii) Showing all your working, find the area of the shaded region. [5]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

1404301964

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (NH/FC) 135359/3
© UCLES 2017

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

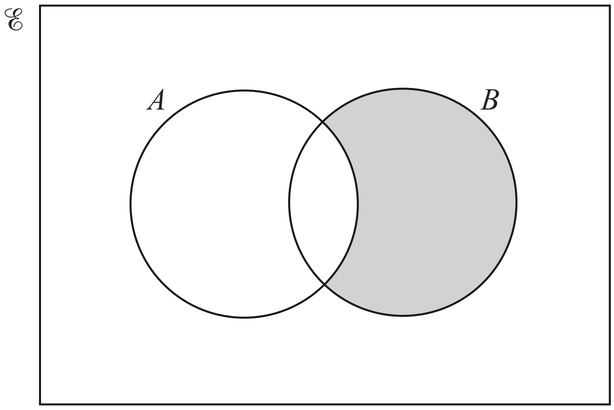
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2017

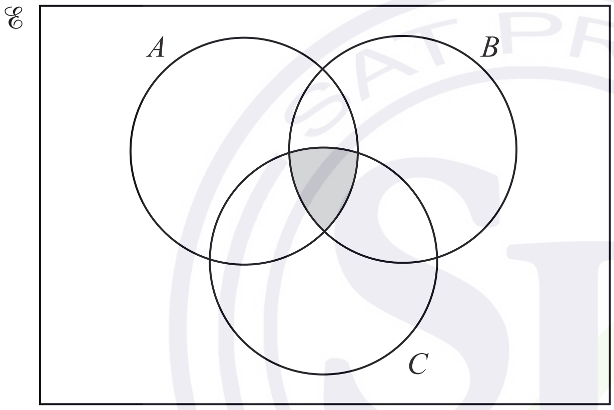
1 Express in set notation the shaded regions shown in the Venn diagrams below.

(i)



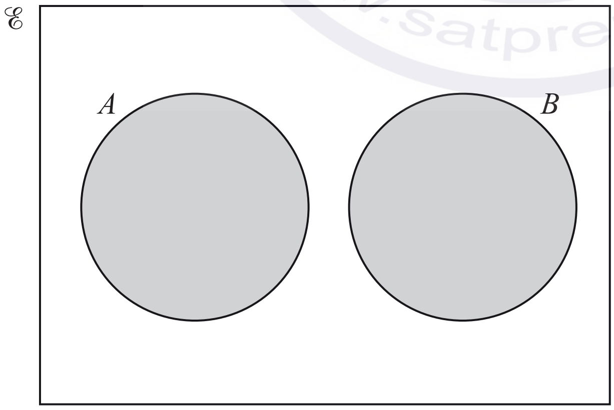
.... [1]

(ii)



.... [1]

(iii)



.... [1]

2 The polynomial $p(x)$ is $ax^3 + bx^2 - 13x + 4$, where a and b are integers. Given that $2x - 1$ is a factor of $p(x)$ and also a factor of $p'(x)$,

(i) find the value of a and of b. [5]

Using your values of a and b,

(ii) find the remainder when $p(x)$ is divided by $x + 1$. [2]

© UCLES 2017

3 **(a)** Given that $T = 2\pi l^{\frac{1}{2}} g^{-\frac{1}{2}}$, express l in terms of T, g and π. [2]

(b) By using the substitution $y = x^{\frac{1}{3}}$, or otherwise, solve $x^{\frac{2}{3}} - 4x^{\frac{1}{3}} + 3 = 0$. [4]

4 When $\lg y$ is plotted against x^2 a straight line is obtained which passes through the points (4, 3) and (12, 7).

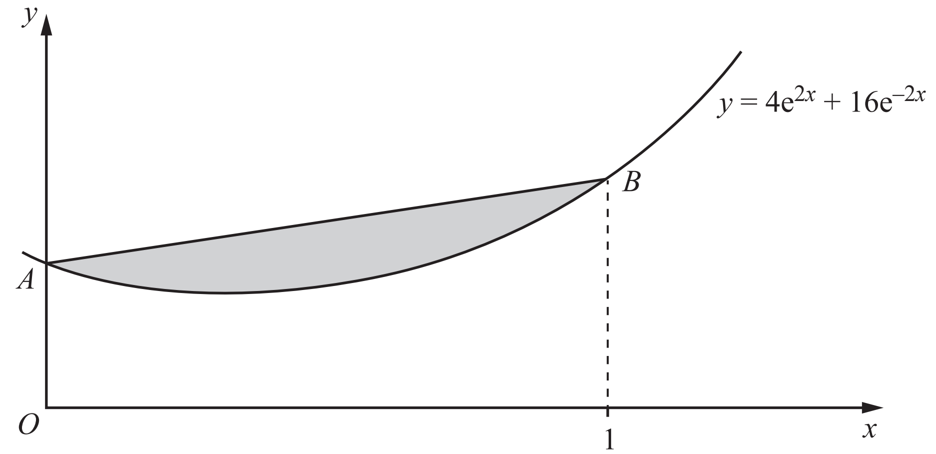
(i) Find the gradient of the line. [1]

(ii) Use your answer to part **(i)** to express $\lg y$ in terms of x. [2]

SAT PREP SP www.satprep.co.in

(iii) Hence express y in terms of x, giving your answer in the form $y = A\left(10^{bx^2}\right)$ where A and b are constants. [3]

5



The diagram shows part of the graph of $y = 4e^{2x} + 16e^{-2x}$ meeting the y-axis at the point A and the line $x = 1$ at the point B.

(i) Find the coordinates of A. [1]

(ii) Find the y-coordinate of B. [1]

(iii) Find $\int (4e^{2x} + 16e^{-2x})\,dx$. [2]

(iv) Hence find the area of the shaded region enclosed by the curve and the line AB. You must show all your working. [4]

© UCLES 2017

6 **(a)** Functions f and g are such that, for $x \in \mathbb{R}$,

$$f(x) = x^2 + 3,$$

$$g(x) = 4x - 1.$$

(i) State the range of f. [1]

(ii) Solve $fg(x) = 4$. [3]

SAT PREP
SP
www.satprep.co.in

(b) A function h is such that $\mathrm{h}(x)=\dfrac{2x+1}{x-4}$ for $x\in\mathbb{R},\ x\neq 4$.

(i) Find $\mathrm{h}^{-1}(x)$ and state its range. [4]

(ii) Find $\mathrm{h}^{2}(x)$, giving your answer in its simplest form. [3]

SAT PREP SP www.satprep.co.in

7 **(i)** Write $\ln\left(\dfrac{2x+1}{2x-1}\right)$ as the difference of two logarithms. [1]

A curve has equation $y = \ln\left(\dfrac{2x+1}{2x-1}\right) + 4x$ for $x > \dfrac{1}{2}$.

(ii) Using your answer to part **(i)** show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = \dfrac{ax^2+b}{4x^2-1}$, where a and b are integers. [4]

SAT PREP SP www.satprep.co.in

(iii) Hence find the x-coordinate of the stationary point on the curve. [2]

(iv) Determine the nature of this stationary point. [2]

SAT PREP
www.satprep.co.in

8 **(a)** 10 people are to be chosen, to receive concert tickets, from a group of 8 men and 6 women.

(i) Find the number of different ways the 10 people can be chosen if 6 of them are men and 4 of them are women. [2]

The group of 8 men and 6 women contains a man and his wife.

(ii) Find the number of different ways the 10 people can be chosen if both the man and his wife are chosen or neither of them is chosen. [3]

www.satprep.co.in

(b) Freddie has forgotten the 6-digit code that he uses to lock his briefcase. He knows that he did not repeat any digit and that he did not start his code with a zero.

(i) Find the number of different 6-digit numbers he could have chosen. [1]

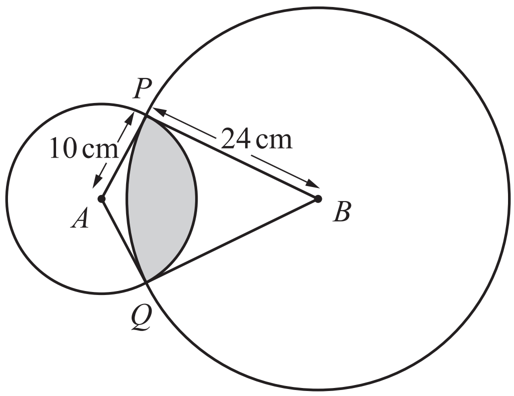
Freddie also remembers that his 6-digit code is divisible by 5.

(ii) Find the number of different 6-digit numbers he could have chosen. [3]

Freddie decides to choose a new 6-digit code for his briefcase once he has opened it. He plans to have the 6-digit number divisible by 2 and greater than 600 000, again with no repetitions of digits.

(iii) Find the number of different 6-digit numbers he can choose. [3]

9



The diagram shows a circle, centre A, radius 10 cm, intersecting a circle, centre B, radius 24 cm. The two circles intersect at the points P and Q. The radii AP and AQ are tangents to the circle with centre B. The radii BP and BQ are tangents to the circle with centre A.

(i) Show that angle PAQ is 2.35 radians, correct to 3 significant figures. [2]

(ii) Find angle PBQ in radians. [1]

(iii) Find the perimeter of the shaded region. [3]

(iv) Find the area of the shaded region. [4]

SAT PREP
SP
www.satprep.co.in

Question 10 is printed on the next page.

10 **(a)** Solve $3\operatorname{cosec} 2x - 4\sin 2x = 0$ for $0° \leqslant x \leqslant 180°$. [4]

(b) Solve $3\tan\left(y - \frac{\pi}{4}\right) = \sqrt{3}$ for $0 \leqslant y \leqslant 2\pi$ radians, giving your answers in terms of π. [4]

SAT PREP
SP
www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

4541912001

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

SAT PREP www.satprep.co.in

This document consists of **16** printed pages.

DC (KN/SG) 135362/4
© UCLES 2017

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\ .$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\mathrm{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

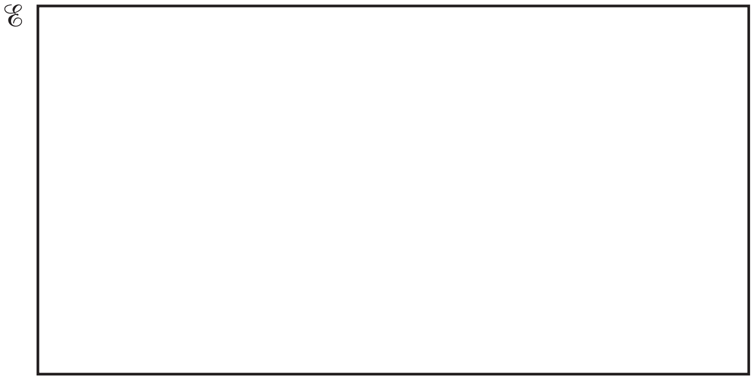
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2017

1 **(i)** On the Venn diagram below, draw sets X and Y such that $\mathrm{n}(X \cap Y) = 0$.



[1]

(ii) On the Venn diagram below, draw sets A, B and C such that $C \subset (A \cup B)'$.

[2]

SAT PREP www.satprep.co.in

2 The graph of $y = a\sin(bx) + c$ has an amplitude of 4, a period of $\frac{\pi}{3}$ and passes through the point $\left(\frac{\pi}{12},\ 2\right)$. Find the value of each of the constants a, b and c. [4]

SAT PREP SP www.satprep.co.in

3 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(2-\frac{x^2}{4}\right)^5$. [3]

(ii) Hence find the term independent of x in the expansion of $\left(2-\frac{x^2}{4}\right)^5\left(\frac{1}{x}-\frac{3}{x^2}\right)^2$. [3]

© UCLES 2017

4 Given that $y = \dfrac{\ln(3x^2 + 2)}{x^2 + 1}$, find the value of $\dfrac{dy}{dx}$ when $x = 2$, giving your answer as $a + b\ln 14$, where a and b are fractions in their simplest form. [6]

SAT PREP
SP
www.satprep.co.in

5 When $\lg y$ is plotted against x, a straight line is obtained which passes through the points (0.6, 0.3) and (1.1, 0.2).

(i) Find $\lg y$ in terms of x. [4]

(ii) Find y in terms of x, giving your answer in the form $y = A(10^{bx})$, where A and b are constants. [3]

www.satprep.co.in

6 Functions f and g are defined, for $x > 0$, by

$$f(x) = \ln x,$$
$$g(x) = 2x^2 + 3.$$

(i) Write down the range of f. [1]

(ii) Write down the range of g. [1]

(iii) Find the exact value of $f^{-1}g(4)$. [2]

(iv) Find $g^{-1}(x)$ and state its domain. [3]

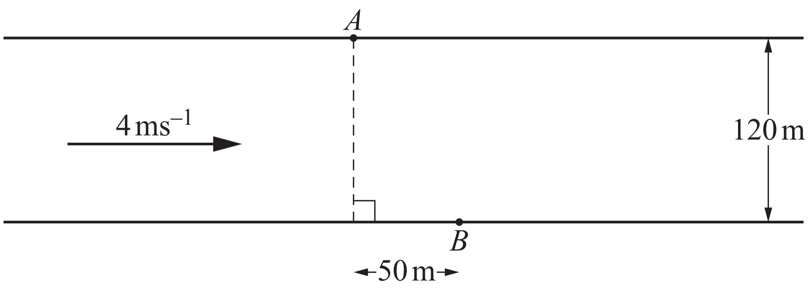
7 A polynomial $p(x)$ is $ax^3 + 8x^2 + bx + 5$, where a and b are integers. It is given that $2x - 1$ is a factor of $p(x)$ and that a remainder of –25 is obtained when $p(x)$ is divided by $x + 2$.

(i) Find the value of a and of b. [5]

SAT PREP SP www.satprep.co.in

(ii) Using your values of a and b, find the exact solutions of $p(x) = 5$. [2]

8



The diagram shows a river which is 120 m wide and is flowing at $4\,\text{ms}^{-1}$. Points A and B are on opposite sides of the river such that B is 50 m downstream from A. A man needs to cross the river from A to B in a boat which can travel at $5\,\text{ms}^{-1}$ in still water.

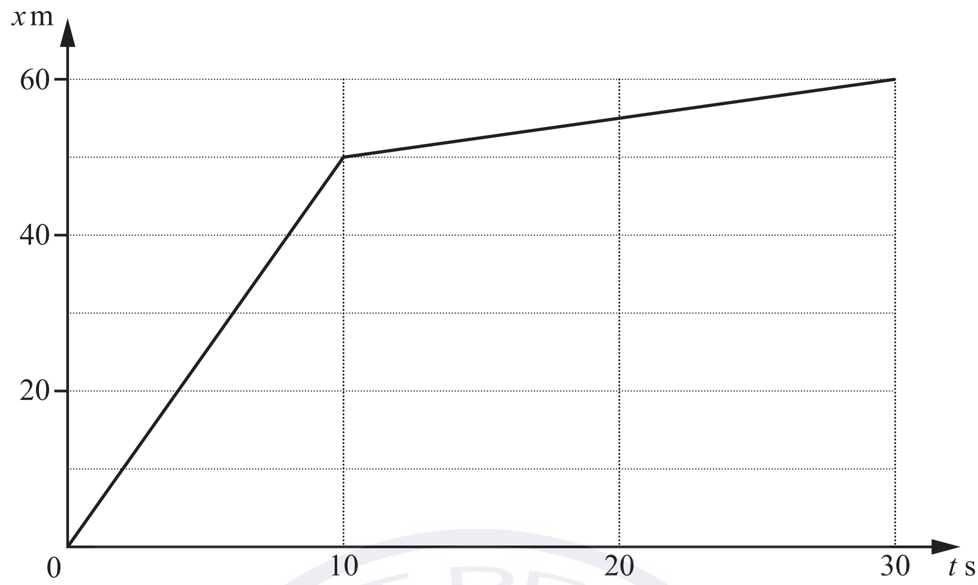
(i) Show that the man must point his boat upstream at an angle of approximately 65° to the bank. [4]

SAT PREP SP www.satprep.co.in

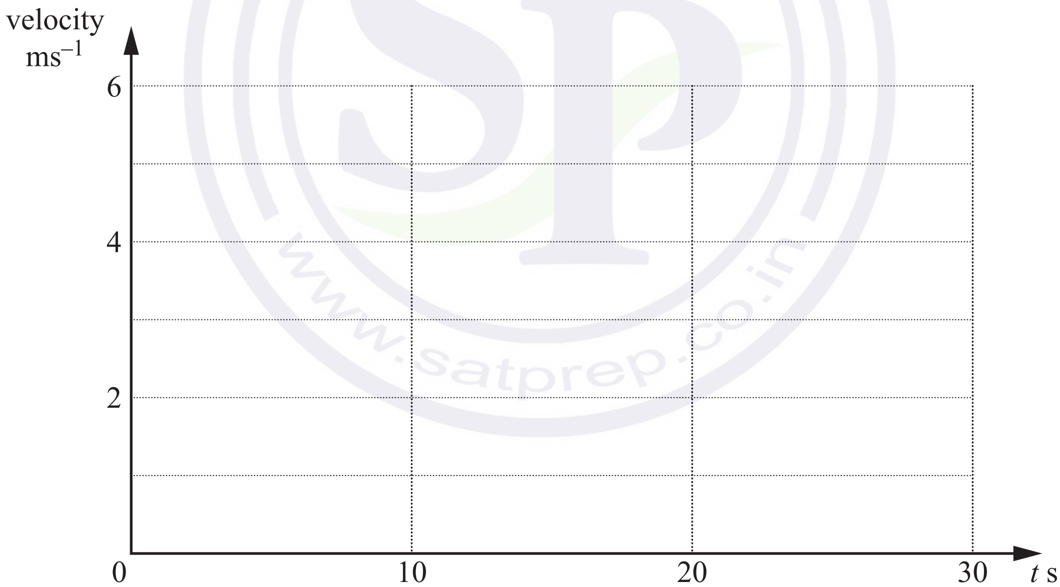
(ii) Find the time the man takes to cross the river from A to B. [6]

SAT PREP SP www.satprep.co.in

9 **(a)**



The diagram shows the displacement-time graph of a particle P which moves in a straight line such that, t s after leaving a fixed point O, its displacement from O is x m. On the axes below, draw the velocity-time graph of P.



[3]

© UCLES 2017

(b) A particle Q moves in a straight line such that its velocity, v ms^{-1}, t s after passing through a fixed point O, is given by $v = 3e^{-5t} + \frac{3t}{2}$, for $t \geqslant 0$.

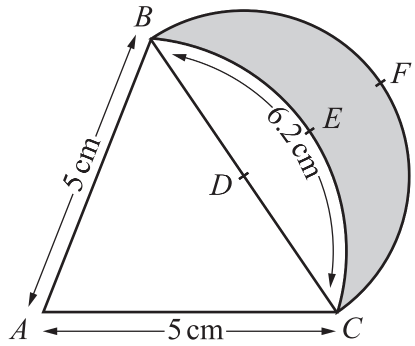
(i) Find the velocity of Q when $t = 0$. [1]

(ii) Find the value of t when the acceleration of Q is zero. [3]

(iii) Find the distance of Q from O when $t = 0.5$. [4]

SAT PREP SP www.satprep.co.in

10



The diagram shows an isosceles triangle ABC, where $AB = AC = 5$ cm. The arc BEC is part of the circle centre A and has length 6.2 cm. The point D is the midpoint of the line BC. The arc BFC is a semi-circle centre D.

(i) Show that angle BAC is 1.24 radians. [1]

(ii) Find the perimeter of the shaded region. [3]

(iii) Find the area of the shaded region. [4]

© UCLES 2017

11 **(a)** Solve $2\cot(\phi + 35^\circ) = 5$ for $0^\circ \leqslant \phi \leqslant 360^\circ$. [4]

Question 11(b) is printed on the next page.

SAT PREP SP www.satprep.co.in

(b) **(i)** Show that $\dfrac{\sec\theta}{\cot\theta + \tan\theta} = \sin\theta$. [3]

(ii) Hence solve $\dfrac{\sec 3\theta}{\cot 3\theta + \tan 3\theta} = -\dfrac{\sqrt{3}}{2}$ for $-\dfrac{\pi}{2} \leqslant \theta \leqslant \dfrac{\pi}{2}$, giving your answers in terms of π. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2017

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6581423218

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

SAT PREP www.satprep.co.in

This document consists of **15** printed pages and **1** blank page.

DC (LK/FC) 135366/3
© UCLES 2017

CAMBRIDGE
International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2017

1 Given that $y = 2\sec^2\theta$ and $x = \tan\theta - 5$, express y in terms of x. [2]

2 A curve is such that its gradient at the point (x, y) is given by $10e^{5x} + 3$. Given that the curve passes though the point (0, 9), find the equation of the curve. [4]

3 Find the set of values of k for which the equation $kx^2 + 3x - 4 + k = 0$ has no real roots. [4]

4 The graph of $y = a\cos(bx) + c$ has an amplitude of 3, a period of $\frac{\pi}{4}$ and passes through the point $\left(\frac{\pi}{12}, \frac{5}{2}\right)$. Find the value of each of the constants a, b and c. [4]

5 **(i)** Find $\int (7x-10)^{-\frac{3}{5}}\,dx$. [2]

(ii) Given that $\int_6^a (7x-10)^{-\frac{3}{5}}\,dx = \frac{25}{14}$, find the exact value of a. [3]

SAT PREP SP www.satprep.co.in

6 When $\ln y$ is plotted against x^2 a straight line is obtained which passes through the points (0.2, 2.4) and (0.8, 0.9).

(i) Express $\ln y$ in the form $px^2 + q$, where p and q are constants. [3]

(ii) Hence express y in terms of z, where $z = e^{x^2}$. [3]

www.satprep.co.in

7 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(2-\frac{x^2}{4}\right)^6$. Give each term in its simplest form. [3]

(ii) Hence find the coefficient of x^2 in the expansion of $\left(2-\frac{x^2}{4}\right)^6\left(\frac{1}{x}+x\right)^2$. [4]

8 It is given that $y = (x - 4)(3x - 1)^{\frac{5}{3}}$.

(i) Show that $\dfrac{\mathrm{d}y}{\mathrm{d}x} = (3x - 1)^{\frac{2}{3}}(Ax + B)$, where A and B are integers to be found. [5]

(ii) Hence find, in terms of h, where h is small, the approximate change in y when x increases from 3 to 3 + h. [3]

© UCLES 2017

9 **(a)** A 6-digit number is to be formed using the digits 1, 3, 5, 6, 8, 9. Each of these digits may be used only once in any 6-digit number. Find how many different 6-digit numbers can be formed if

(i) there are no restrictions, [1]

(ii) the number formed is even, [1]

(iii) the number formed is even and greater than 300 000. [3]

(b) Ruby wants to have a party for her friends. She can only invite 8 of her 15 friends.

(i) Find the number of different ways she can choose her friends for the party if there are no restrictions. [1]

Two of her 15 friends are twins who cannot be separated.

(ii) Find the number of different ways she can now choose her friends for the party. [3]

10 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 4 & -1 \\ a & b \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 2 & 3 \\ -5 & 4 \end{pmatrix}$ and $\mathbf{AB} = \begin{pmatrix} 13 & 8 \\ 18 & 4 \end{pmatrix}$, find the value of a and of b. [4]

SAT PREP
SP
www.satprep.co.in

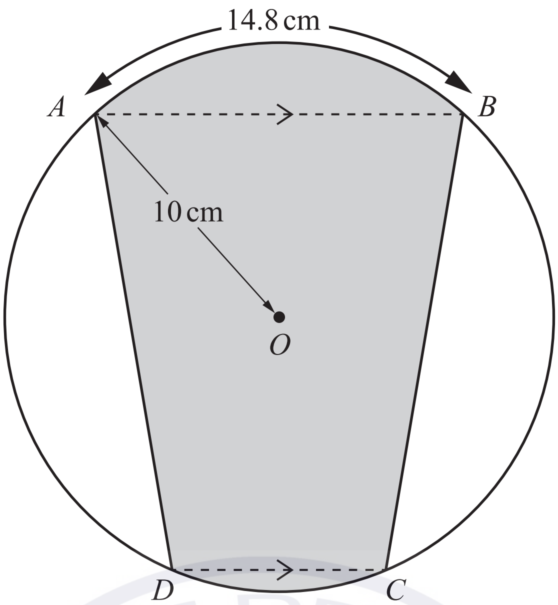
(b) It is given that $\mathbf{X} = \begin{pmatrix} 3 & -5 \\ -4 & 1 \end{pmatrix}$, $\mathbf{Y} = \begin{pmatrix} -1 & 2 \\ 4 & 0 \end{pmatrix}$ and $\mathbf{XZ} = \mathbf{Y}$.

(i) Find $\mathbf{X}^{-1}$. [2]

(ii) Hence find $\mathbf{Z}$. [3]

SAT PREP
SP
www.satprep.co.in

11



The diagram shows a circle, centre O, radius 10 cm. The points A, B, C and D lie on the circumference of the circle such that AB is parallel to DC. The length of the minor arc AB is 14.8 cm. The area of the minor sector ODC is 21.8 cm^2.

(i) Write down, in radians, angle AOB. [1]

(ii) Find, in radians, angle DOC. [2]

(iii) Find the perimeter of the shaded region. [4]

(iv) Find the area of the shaded region. [3]

SAT PREP SP www.satprep.co.in

12 The line $y = 2x + 1$ intersects the curve $xy = 14 - 2y$ at the points P and Q. The midpoint of the line PQ is the point M.

(i) Show that the point $\left(-10,\ \frac{23}{8}\right)$ lies on the perpendicular bisector of PQ. [9]

SAT PREP SP www.satprep.co.in

The line PQ intersects the y-axis at the point R. The perpendicular bisector of PQ intersects the y-axis at the point S.

(ii) Find the area of the triangle RSM. [3]

SAT PREP SP www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9272080016

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **12** printed pages.

DC (RW/FD) 129466/3
© UCLES 2017

CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

www.satprep.co.in

1 The line $y = kx - 5$, where k is a positive constant, is a tangent to the curve $y = x^2 + 4x$ at the point A.

(i) Find the exact value of k. [3]

(ii) Find the gradient of the normal to the curve at the point A, giving your answer in the form $a + b\sqrt{5}$, where a and b are constants. [2]

www.satprep.co.in

2 It is given that $p(x) = x^3 + ax^2 + bx - 48$. When $p(x)$ is divided by $x - 3$ the remainder is 6. Given that $p'(1) = 0$, find the value of a and of b. [5]

3 **(a)** Simplify $\sqrt{x^8y^{10}} \div \sqrt[3]{x^3y^{-6}}$, giving your answer in the form x^ay^b, where a and b are integers. [2]

(b) **(i)** Show that $4(t-2)^{\frac{1}{2}} + 5(t-2)^{\frac{3}{2}}$ can be written in the form $(t-2)^p(qt+r)$, where p, q and r are constants to be found. [3]

(ii) Hence solve the equation $4(t-2)^{\frac{1}{2}} + 5(t-2)^{\frac{3}{2}} = 0$. [1]

4 **(a)** It is given that $f(x) = 3e^{-4x} + 5$ for $x \in \mathbb{R}$.

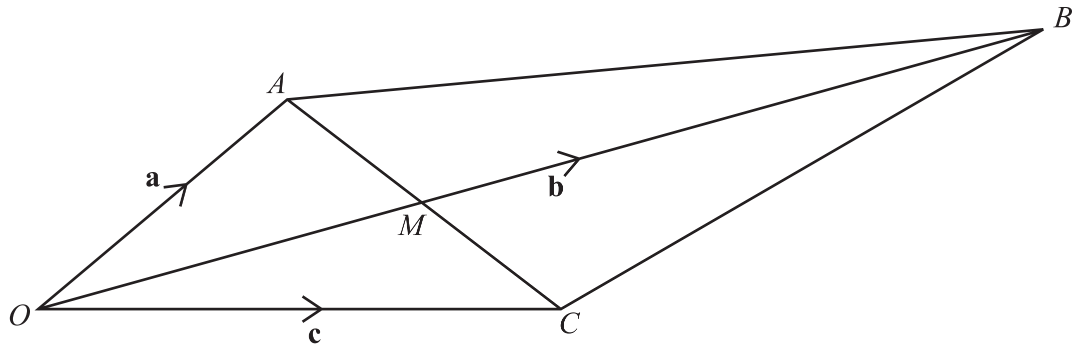
(i) State the range of f. [1]

(ii) Find f^{-1} and state its domain. [4]

(b) It is given that $g(x) = x^2 + 5$ and $h(x) = \ln x$ for $x > 0$. Solve $hg(x) = 2$. [3]

SAT PREP SP www.satprep.co.in

5 **(a)**



The diagram shows a figure $OABC$, where $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OB} = \mathbf{b}$ and $\overrightarrow{OC} = \mathbf{c}$. The lines AC and OB intersect at the point M where M is the midpoint of the line AC.

(i) Find, in terms of **a** and **c**, the vector $\overrightarrow{OM}$. [2]

(ii) Given that $OM : MB = 2:3$, find **b** in terms of **a** and **c**. [2]

SAT PREP
SP
www.satprep.co.in

(b) Vectors **i** and **j** are unit vectors parallel to the x-axis and y-axis respectively.

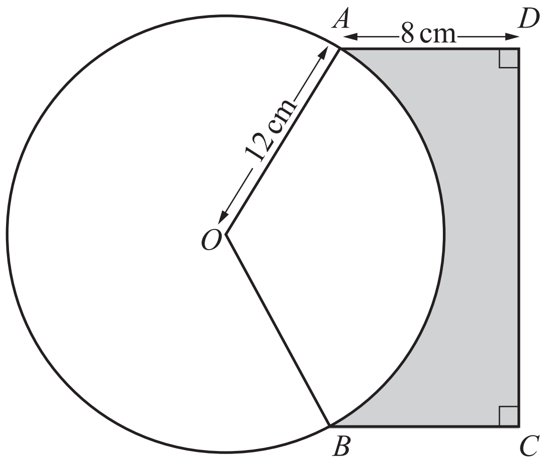
The vector **p** has a magnitude of 39 units and has the same direction as $-10\mathbf{i} + 24\mathbf{j}$.

(i) Find **p** in terms of **i** and **j**. [2]

(ii) Find the vector **q** such that $2\mathbf{p} + \mathbf{q}$ is parallel to the positive y-axis and has a magnitude of 12 units. [3]

(iii) Hence show that $|\mathbf{q}| = k\sqrt{5}$, where k is an integer to be found. [2]

6



The diagram shows a circle, centre O, radius 12 cm. The points A and B lie on the circumference of the circle and form a rectangle with the points C and D. The length of AD is 8 cm and the area of the minor sector AOB is 150 cm^2.

(i) Show that angle AOB is 2.08 radians, correct to 2 decimal places. [2]

(ii) Find the area of the shaded region $ADCB$. [6]

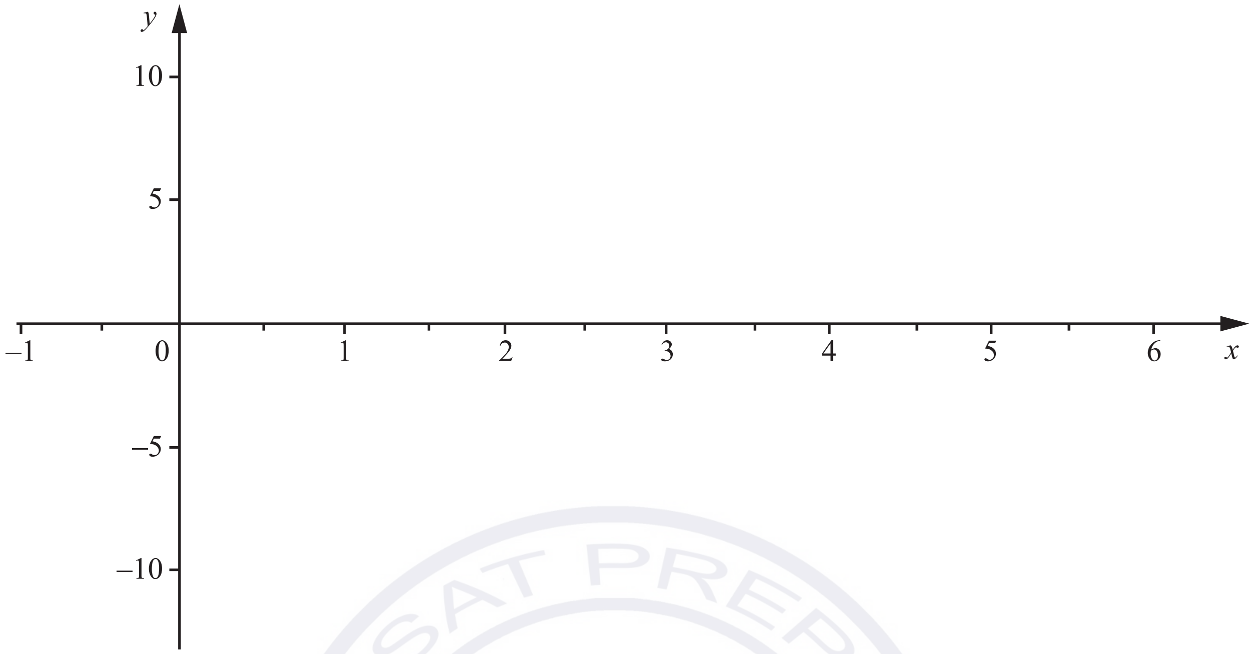
(iii) Find the perimeter of the shaded region $ADCB$. [3]

© UCLES 2017

7 Show that the curve $y = (3x^2 + 8)^{\frac{5}{3}}$ has only one stationary point. Find the coordinates of this stationary point and determine its nature. [8]

www.satprep.co.in

8 **(i)** On the axes below sketch the graphs of $y = |2x - 5|$ and $9y = 80x - 16x^2$. [5]



(ii) Solve $|2x - 5| = 4$. [3]

(iii) Hence show that the graphs of $y = |2x - 5|$ and $9y = 80x - 16x^2$ intersect at the points where $y = 4$. [1]

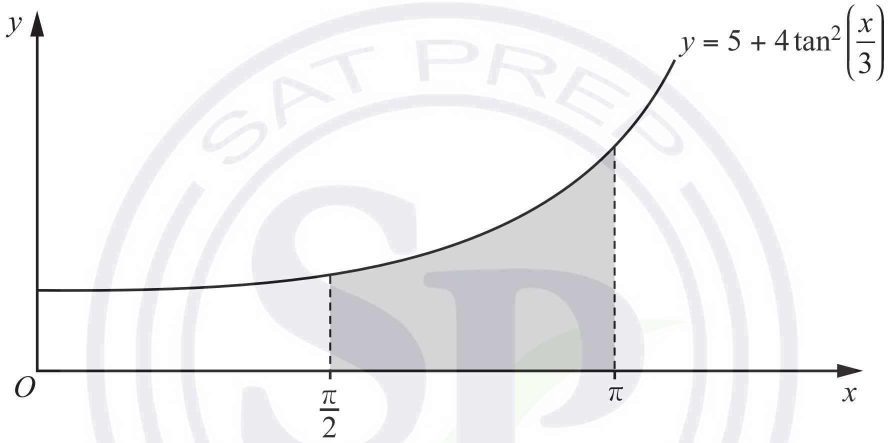
(iv) Hence find the values of x for which $9|2x - 5| \leqslant 80x - 16x^2$. [2]

SAT PREP SP www.satprep.co.ir

9 **(i)** Show that $5+4\tan^2\left(\frac{x}{3}\right)=4\sec^2\left(\frac{x}{3}\right)+1$. [1]

(ii) Given that $\frac{d}{dx}\left(\tan\left(\frac{x}{3}\right)\right)=\frac{1}{3}\sec^2\left(\frac{x}{3}\right)$, find $\int \sec^2\left(\frac{x}{3}\right)dx$. [1]

(iii)



The diagram shows part of the curve $y=5+4\tan^2\left(\frac{x}{3}\right)$. Using the results from parts **(i)** and **(ii)**, find the exact area of the shaded region enclosed by the curve, the x-axis and the lines $x=\frac{\pi}{2}$ and $x=\pi$. [5]

Question 10 is printed on the next page.

10 **(a)** Given that $y = \dfrac{e^{3x}}{4x^2 + 1}$, find $\dfrac{dy}{dx}$. [3]

(b) Variables x, y and t are such that $y = 4\cos\left(x + \dfrac{\pi}{3}\right) + 2\sqrt{3}\sin\left(x + \dfrac{\pi}{3}\right)$ and $\dfrac{dy}{dt} = 10$.

(i) Find the value of $\dfrac{dy}{dx}$ when $x = \dfrac{\pi}{2}$. [3]

(ii) Find the value of $\dfrac{dx}{dt}$ when $x = \dfrac{\pi}{2}$. [2]

SAT PREP SP www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2017

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0147311657

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **12** printed pages.

DC (LK/CGW) 129467/2
© UCLES 2017

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

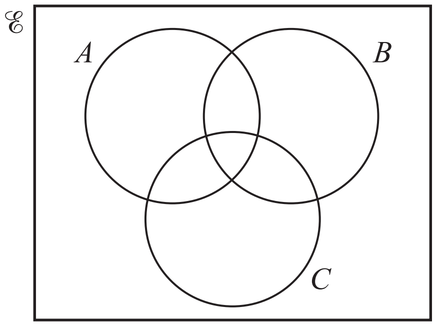
Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

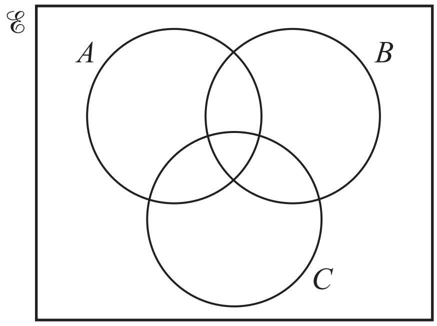
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

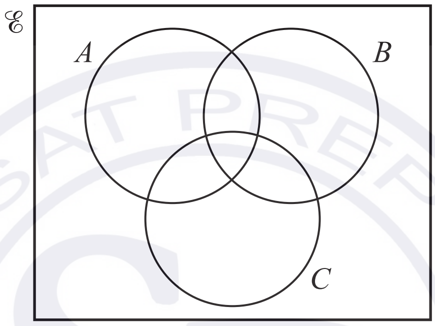
1 On each of the Venn diagrams below, shade the region which represents the given set.



$(A \cup B) \cap C$



$(A \cap B) \cup C$



$(A' \cap B') \cap C$

[3]

2 It is given that $y = \dfrac{(5x^2+4)^{\frac{1}{2}}}{x+1}$. Showing all your working, find the exact value of $\dfrac{dy}{dx}$ when $x = 3$. [5]

3 Vectors **i** and **j** are unit vectors parallel to the x-axis and y-axis respectively.

(a) The vector **v** has a magnitude of $3\sqrt{5}$ units and has the same direction as $\mathbf{i} - 2\mathbf{j}$. Find **v** giving your answer in the form $a\mathbf{i} + b\mathbf{j}$, where a and b are integers. [2]

(b) The velocity vector **w** makes an angle of 30° with the positive x-axis and is such that $|\mathbf{w}| = 2$. Find **w** giving your answer in the form $\sqrt{c}\,\mathbf{i} + d\mathbf{j}$, where c and d are integers. [2]

SAT PREP SP www.satprep.co.in

4 The first 3 terms in the expansion of $\left(3 - \frac{x}{6}\right)^n$ are $81 + ax + bx^2$. Find the value of each of the constants n, a and b. [5]

5 A particle P moves in a straight line, such that its displacement, x m, from a fixed point O, t s after passing O, is given by $x = 4\cos(3t) - 4$.

(i) Find the velocity of P at time t. [1]

(ii) Hence write down the maximum speed of P. [1]

(iii) Find the smallest value of t for which the acceleration of P is zero. [3]

(iv) For the value of t found in part **(iii)**, find the distance of P from O. [1]

SAT PREP SP www.satprep.co.in

6 **(i)** Show that $\dfrac{\operatorname{cosec}\theta}{\cot\theta + \tan\theta} = \cos\theta$. [4]

It is given that $\displaystyle\int_0^a \frac{\operatorname{cosec} 2\theta}{\cot 2\theta + \tan 2\theta}\,\mathrm{d}\theta = \frac{\sqrt{3}}{4}$, where $0 < a < \frac{\pi}{4}$.

(ii) Using your answer to part **(i)** find the value of a, giving your answer in terms of π. [4]

SAT PREP SP www.satprep.co.in

7 It is given that $y = A(10^{bx})$, where A and b are constants. The straight line graph obtained when $\lg y$ is plotted against x passes through the points $(0.5, 2.2)$ and $(1.0, 3.7)$.

(i) Find the value of A and of b. [5]

Using your values of A and b, find

(ii) the value of y when $x = 0.6$, [2]

(iii) the value of x when $y = 600$. [2]

SAT PREP SP www.satprep.co.in

8 **(a)** A 5-digit number is to be formed from the seven digits 1, 2, 3, 5, 6, 8 and 9. Each digit can only be used once in any 5-digit number. Find the number of different 5-digit numbers that can be formed if

(i) there are no restrictions, [1]

(ii) the number is divisible by 5, [1]

(iii) the number is greater than 60 000, [1]

(iv) the number is greater than 60 000 and even. [3]

(b) Ranjit has 25 friends of whom 15 are boys and 10 are girls. Ranjit wishes to hold a birthday party but can only invite 7 friends. Find the number of different ways these 7 friends can be selected if

(i) there are no restrictions, [1]

(ii) only 2 of the 7 friends are boys, [1]

(iii) the 25 friends include a boy and his sister who cannot be separated. [3]

© UCLES 2017

9 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ -1 & 2 \\ 4 & 5 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 1 & -2 \\ 3 & 0 \end{pmatrix}$ and $\mathbf{C} = \mathbf{AB}$,

(i) state the order of **A**, [1]

(ii) find **C**. [3]

(b) The matrix $\mathbf{X} = \begin{pmatrix} 5 & -12 \\ 4 & -7 \end{pmatrix}$.

(i) Find $\mathbf{X}^{-1}$. [2]

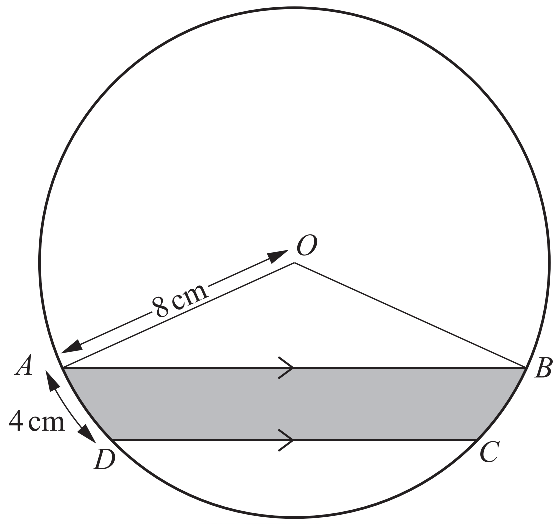
(ii) Using $\mathbf{X}^{-1}$, find the coordinates of the point of intersection of the lines

$$12y = 5x - 26,$$
$$7y = 4x - 52.$$

[4]

© UCLES 2017

10



The diagram shows a circle, centre O, radius 8 cm. The points A, B, C and D lie on the circumference of the circle such that AB is parallel to DC. The length of the arc AD is 4 cm and the length of the chord AB is 15 cm.

(i) Find, in radians, angle AOD. [1]

(ii) Hence show that angle $DOC = 1.43$ radians, correct to 2 decimal places. [3]

(iii) Find the perimeter of the shaded region. [3]

(iv) Find the area of the shaded region. [4]

SAT PREP
SP
www.satprep.co.in

Question 11 is printed on the next page.

11 The curve $y = \mathrm{f}(x)$ passes through the point $\left(\frac{1}{2}, \frac{7}{2}\right)$ and is such that $\mathrm{f}'(x) = \mathrm{e}^{2x-1}$.

(i) Find the equation of the curve. [4]

(ii) Find the value of x for which $\mathrm{f}''(x) = 4$, giving your answer in the form $a + b\ln\sqrt{2}$, where a and b are constants. [4]

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8262841617

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (KN/CGW) 129468/2
© UCLES 2017

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

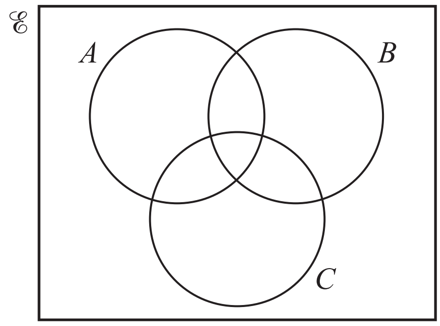
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

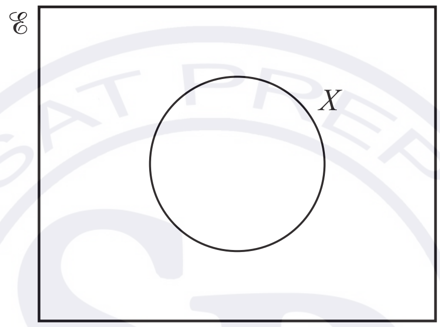
$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2017

1 **(a)** On the Venn diagram below, shade the region which represents $(A \cap B') \cup (C \cap B')$. [1]



(b) Complete the Venn diagram below to show the sets Y and Z such that $Z \subset X \subset Y$. [1]

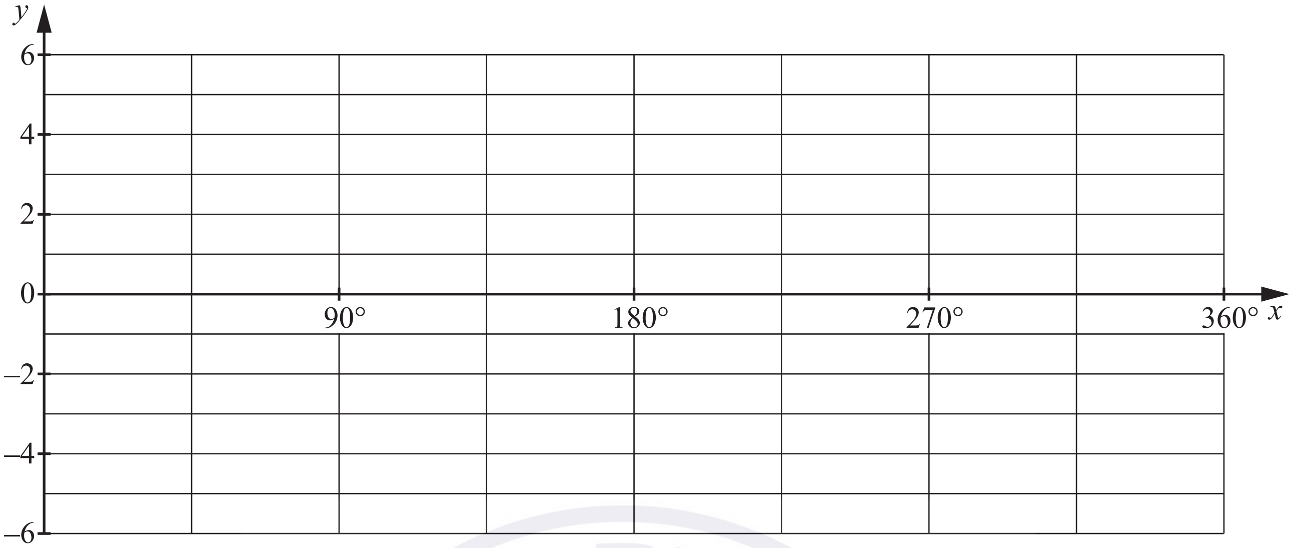


2 Given that $y = 3 + 4\cos 9x$, write down

(i) the amplitude of y, [1]

(ii) the period of y. [1]

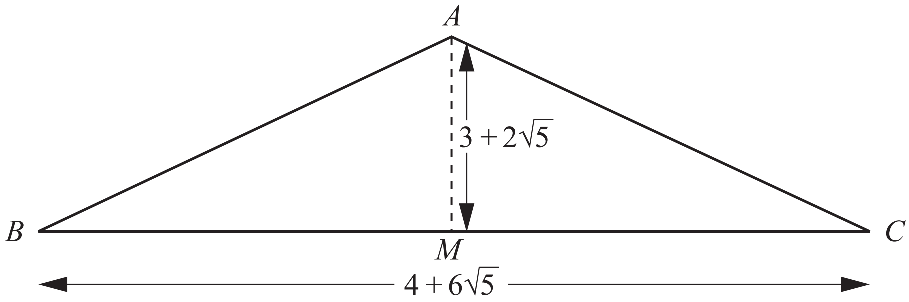
3 **(i)** On the axes below, sketch the graph of $y = 3\sin x - 2$ for $0° \leqslant \theta \leqslant 360°$. [3]



(ii) Given that $0 \leqslant |3\sin x - 2| \leqslant k$ for $0° \leqslant x \leqslant 360°$, write down the value of k. [1]

© UCLES 2017

4 In this question, all dimensions are in centimetres.



The diagram shows an isosceles triangle ABC, where $AB = AC$. The point M is the mid-point of BC. Given that $AM = 3 + 2\sqrt{5}$ and $BC = 4 + 6\sqrt{5}$, find, **without using a calculator**,

(i) the area of triangle ABC, [2]

(ii) $\tan ABC$, giving your answer in the form $\dfrac{a + b\sqrt{5}}{c}$ where a, b and c are positive integers. [3]

SAT PREP SP www.satprep.co.in

5 The normal to the curve $y = \sqrt{4x + 9}$, at the point where $x = 4$, meets the x- and y-axes at the points A and B. Find the coordinates of the mid-point of the line AB. [7]

SAT PREP
SP
www.satprep.co.in

6 **(a)** Given that $\mathbf{A} = \begin{pmatrix} 3 & 1 \\ 2 & 4 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} 5 & 1 \\ 2 & 4 \\ -1 & 0 \end{pmatrix}$ and $\mathbf{C} = \begin{pmatrix} -5 & 2 \\ 3 & 1 \end{pmatrix}$, find

(i) $\mathbf{A} + 3\mathbf{C}$, [2]

(ii) $\mathbf{BA}$. [2]

(b) **(i)** Given that $\mathbf{X} = \begin{pmatrix} 1 & -3 \\ 4 & -2 \end{pmatrix}$, find $\mathbf{X}^{-1}$. [2]

(ii) Hence find $\mathbf{Y}$, such that $\mathbf{XY} = \begin{pmatrix} 5 & -10 \\ 15 & 20 \end{pmatrix}$. [3]

7 **(a)** Show that $\dfrac{\tan^2\theta + \sin^2\theta}{\cos\theta + \sec\theta} = \tan\theta\sin\theta$. [4]

SAT PREP SP www.satprep.co.in

(b) Given that $x = 3\sin\phi$ and $y = \dfrac{3}{\cos\phi}$, find the numerical value of $9y^2 - x^2y^2$. [3]

www.satprep.co.in

8 It is given that $p(x) = 2x^3 + ax^2 + 4x + b$, where a and b are constants. It is given also that $2x + 1$ is a factor of $p(x)$ and that when $p(x)$ is divided by $x - 1$ there is a remainder of -12.

(i) Find the value of a and of b. [5]

(ii) Using your values of a and b, write $p(x)$ in the form $(2x + 1)q(x)$, where $q(x)$ is a quadratic expression. [2]

(iii) Hence find the exact solutions of the equation $p(x) = 0$. [2]

www.satprep.co.in

9 It is given that $\int_{-k}^{k}(15e^{5x} - 5e^{-5x})\mathrm{d}x = 6$.

(i) Show that $e^{5k} - e^{-5k} = 3$. [5]

(ii) Hence, using the substitution $y = e^{5k}$, or otherwise, find the value of k. [3]

www.satprep.co.in

10 It is given that $y = (10x + 2)\ln(5x + 1)$.

(i) Find $\frac{dy}{dx}$. [4]

(ii) Hence show that $\int \ln(5x+1)\,dx = \frac{(ax+b)}{5}\ln(5x+1) - x + c$, where a and b are integers and c is a constant of integration. [3]

SAT PREP SP www.satprep.co.in

© UCLES 2017

(iii) Hence find $\int_0^{\frac{1}{5}} \ln(5x+1)\,\mathrm{d}x$, giving your answer in the form $\frac{d+\ln f}{5}$, where d and f are integers. [2]

SAT PREP SP www.satprep.co.in

11 A curve has equation $y = 6x - x\sqrt{x}$.

(i) Find the coordinates of the stationary point of the curve. [4]

(ii) Determine the nature of this stationary point. [2]

(iii) Find the approximate change in y when x increases from 4 to $4 + h$, where h is small. [3]

SAT PREP SP www.satprep.co.in

12 A particle moves in a straight line, such that its velocity, v ms^{-1}, t s after passing a fixed point O, is given by $v = 2 + 6t + 3\sin 2t$.

(i) Find the acceleration of the particle at time t. [2]

(ii) Hence find the smallest value of t for which the acceleration of the particle is zero. [2]

(iii) Find the displacement, x m from O, of the particle at time t. [5]

SAT PREP SP www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5331723388

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2017**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **14** printed pages and **2** blank pages.

DC (LK/SG) 129474/2
© UCLES 2017

CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \dfrac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2017

1 **(a)** It is given that $\mathscr{E} = \{x : 0 < x < 35, x \in \mathbb{R}\}$ and sets A and B are such that

$$A = \{\text{multiples of } 5\} \text{ and } B = \{\text{multiples of } 7\}.$$

(i) Find $\mathrm{n}(A \cap B)$. [1]

(ii) Find $\mathrm{n}(A \cup B)$. [1]

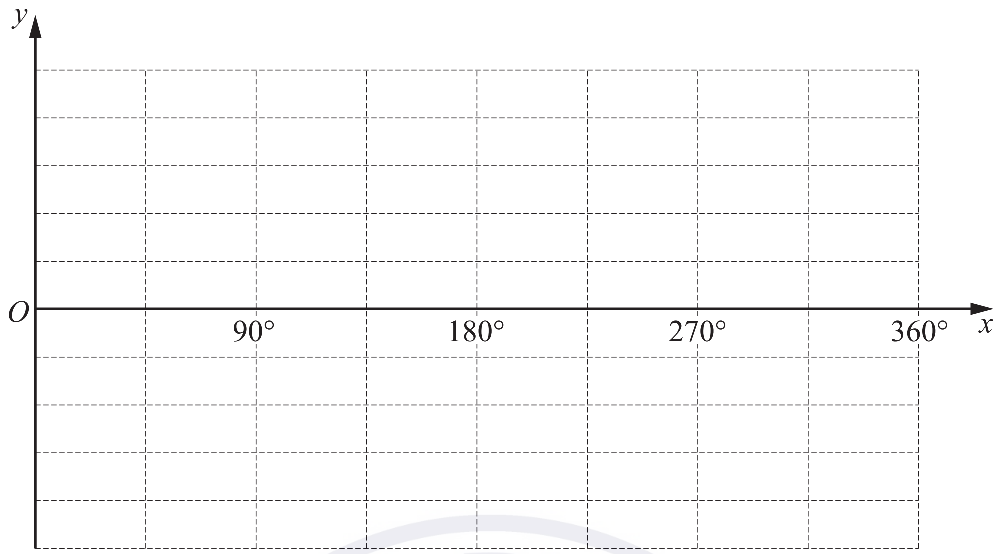
(b) It is given that sets X, Y and Z are such that

$$X \cap Y = Y, \quad X \cap Z = Z \quad \text{and } Y \cap Z = \varnothing.$$

On the Venn diagram below, illustrate sets X, Y and Z. [3]

SAT PREP
www.satprep.co.in

2 **(i)** On the axes below sketch, for $0° \leqslant x \leqslant 360°$, the graph of $y = 1 + 3\cos 2x$. [3]



(ii) Write down the coordinates of the point where this graph first has a minimum value. [1]

3 The first three terms in the expansion of $\left(a + \frac{x}{4}\right)^5$ are $32 + bx + cx^2$. Find the value of each of the constants a, b and c. [5]

4 **(a)** It is given that $\mathbf{A} = \begin{pmatrix} 1 & -3 \\ 2 & 4 \end{pmatrix}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Using your answer to part **(i)**, find the matrix **M** such that $\mathbf{AM} = \begin{pmatrix} -1 & -5 \\ 4 & 2 \end{pmatrix}$. [3]

(b) **X** is $\begin{pmatrix} a & -1 \\ 2 & -3 \end{pmatrix}$ and **Y** is $\begin{pmatrix} 2 & 1 \\ 4 & 3a \end{pmatrix}$, where a is a constant.

Given that $\det \mathbf{X} = 4 \det \mathbf{Y}$, find the value of a. [2]

© UCLES 2017

5 **(i)** Show that $\operatorname{cosec}\theta - \sin\theta = \cot\theta\cos\theta$. [3]

(ii) Hence solve the equation $\operatorname{cosec}\theta - \sin\theta = \frac{1}{3}\cos\theta$, for $0 \leqslant \theta \leqslant 2\pi$ radians. [4]

SAT PREP SP www.satprep.co.in

6 **(a)** The letters of the word THURSDAY are arranged in a straight line. Find the number of different arrangements of these letters if

(i) there are no restrictions, [1]

(ii) the arrangement must start with the letter T and end with the letter Y, [1]

(iii) the second letter in the arrangement must be Y. [1]

(b) 7 children have to be divided into two groups, one of 4 children and the other of 3 children. Given that there are 3 girls and 4 boys, find the number of different ways this can be done if

(i) there are no restrictions, [1]

(ii) all the boys are in one group, [1]

(iii) one boy and one girl are twins and must be in the same group. [3]

SAT PREP www.satprep.co.in

7 **(a)** A vector $\mathbf{v}$ has a magnitude of 102 units and has the same direction as $\begin{pmatrix} 8 \\ -15 \end{pmatrix}$. Find $\mathbf{v}$ in the form $\begin{pmatrix} a \\ b \end{pmatrix}$, where a and b are integers. [2]

(b) Vectors $\mathbf{c} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ and $\mathbf{d} = \begin{pmatrix} p - q \\ 5p + q \end{pmatrix}$ are such that $\mathbf{c} + 2\mathbf{d} = \begin{pmatrix} p^2 \\ 27 \end{pmatrix}$. Find the possible values of the constants p and q. [6]

SAT PREP www.satprep.co.in

8 A curve is such that $\frac{d^2y}{dx^2} = 4\sin 2x$. The curve has a gradient of 5 at the point where $x = \frac{\pi}{2}$.

(i) Find an expression for the gradient of the curve at the point (x, y). [4]

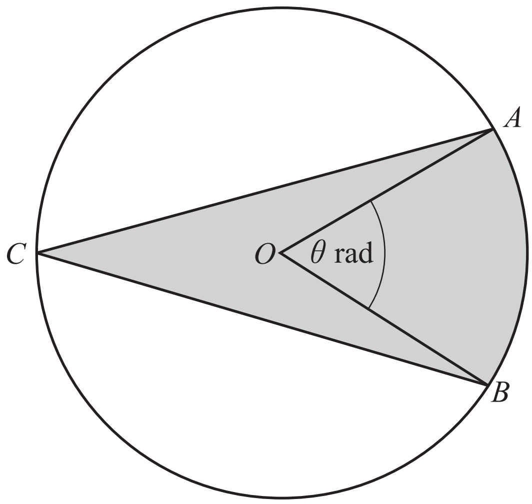
The curve passes through the point $P\left(\frac{\pi}{12}, -\frac{1}{2}\right)$.

(ii) Find the equation of the curve. [4]

(iii) Find the equation of the normal to the curve at the point P, giving your answer in the form $y = mx + c$, where m and c are constants correct to 3 decimal places. [3]

SAT PREP SP www.satprep.co.in

9



The diagram shows a circle, centre O, radius 10 cm. Points A, B and C lie on the circumference of the circle such that $AC = BC$. The area of the minor sector AOB is $20\pi\ \text{cm}^2$ and angle AOB is θ radians.

(i) Find the value of θ in terms of π. [2]

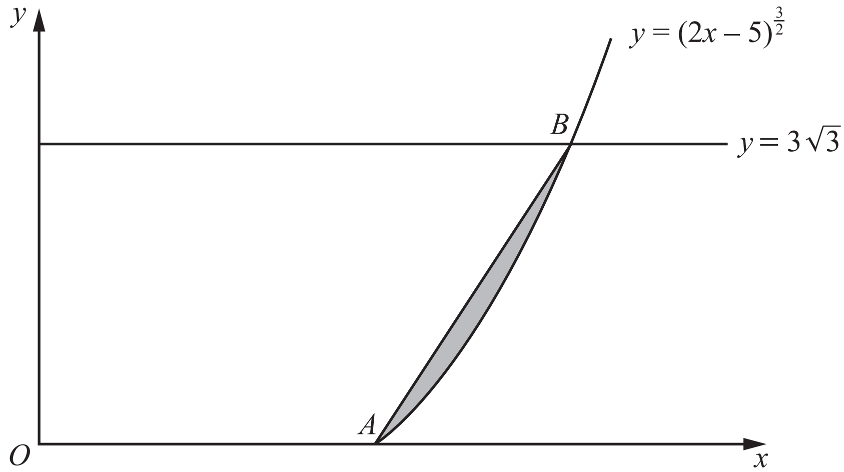
(ii) Find the perimeter of the shaded region. [4]

© UCLES 2017

(iii) Find the area of the shaded region. [3]

SAT PREP
SP
www.satprep.co.in

10



The diagram shows part of the curve $y = (2x - 5)^{\frac{3}{2}}$ and the line $y = 3\sqrt{3}$. The curve meets the x-axis at the point A and the line $y = 3\sqrt{3}$ at the point B. Find the area of the shaded region enclosed by the line AB and the curve, giving your answer in the form $\frac{p\sqrt{3}}{20}$, where p is an integer. You must show all your working. [8]

Question 11 is printed on the next page.

11 It is given that $y = Ae^{bx}$, where A and b are constants. When $\ln y$ is plotted against x a straight line graph is obtained which passes through the points (1.0, 0.7) and (2.5, 3.7).

(i) Find the value of A and of b. [6]

(ii) Find the value of y when $x = 2$. [2]

© UCLES 2017

BLANK PAGE

SAT PREP www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

0872690516

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (CW/SG) 116669/2
© UCLES 2016

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} .$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2016

1 **(a)** Sets $\mathscr{E}$, A and B are such that

$$n(\mathscr{E}) = 26,\ n(A \cap B') = 7,\ n(A \cap B) = 3 \text{ and } n(B) = 15\ .$$

Using a Venn diagram, or otherwise, find

(i) $n(A)$, [1]

(ii) $n(A \cup B)$, [1]

(iii) $n(A \cup B)'$. [1]

(b) It is given that $\mathscr{E} = \{x : 0 < x < 30\}$, $P = \{\text{multiples of } 5\}$, $Q = \{\text{multiples of } 6\}$ and $R = \{\text{multiples of } 2\}$. Use set notation to complete the following statements.

(i) Q .... R, [1]

(ii) $P \cap Q =$ .... [1]

© UCLES 2016

2 Given that $\dfrac{p^{\frac{1}{3}}q^{-\frac{1}{2}}r^{\frac{3}{2}}}{p^{-\frac{2}{3}}\sqrt{(qr)^5}} = p^a q^b r^c$, find the value of each of the integers a, b and c. [3]

3 By using the substitution $y = \log_3 x$, or otherwise, find the values of x for which

$$3(\log_3 x)^2 + \log_3 x^5 - \log_3 9 = 0\ .$$ [6]

SAT PREP SP www.satprep.co.in

4 **(i)** Find the first 3 terms in the expansion of $\left(2x^2 - \frac{1}{3x}\right)^5$, in descending powers of x. [3]

(ii) Hence find the coefficient of x^7 in the expansion of $\left(3 + \frac{1}{x^3}\right)\left(2x^2 - \frac{1}{3x}\right)^5$. [2]

SAT PREP SP www.satprep.co.in

5 **(i)** Find the equation of the normal to the curve $y = \frac{1}{2}\ln(3x+2)$ at the point P where $x = -\frac{1}{3}$. [4]

The normal to the curve at the point P intersects the y-axis at the point Q. The curve $y = \frac{1}{2}\ln(3x+2)$ intersects the y-axis at the point R .

(ii) Find the area of the triangle PQR. [3]

6 **(a)** Matrices **X**, **Y** and **Z** are such that

$$\mathbf{X} = \begin{pmatrix} 2 & 3 \\ 4 & -1 \\ 6 & 5 \end{pmatrix}, \ \mathbf{Y} = \begin{pmatrix} 1 & -1 & 0 \end{pmatrix} \text{ and } \mathbf{Z} = \begin{pmatrix} 0 & -1 \\ 5 & 3 \end{pmatrix}.$$

Write down all the matrix products which are possible using any two of these matrices. Do not evaluate these products. [2]

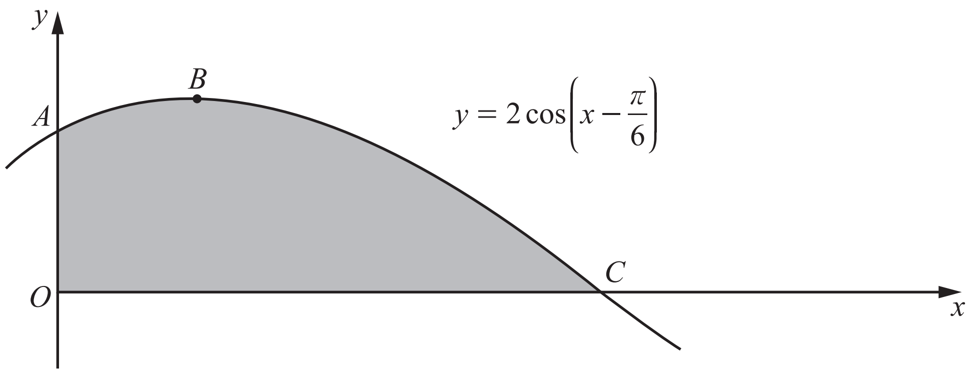
(b) Matrices **A**, **B** and **C** are such that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 4 & 7 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} -4 & 2 \\ 10 & 4 \end{pmatrix}$ and $\mathbf{AC} = \mathbf{B}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Hence find **C**. [3]

www.satprep.co.in

7



The diagram shows part of the graph of $y = 2\cos\left(x - \frac{\pi}{6}\right)$. The graph intersects the y-axis at the point A, has a maximum point at B and intersects the x-axis at the point C.

(i) Find the coordinates of A. [1]

(ii) Find the coordinates of B. [2]

© UCLES 2016

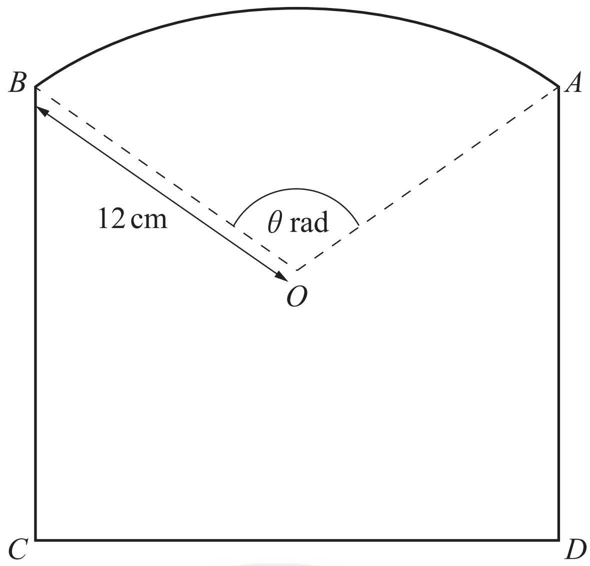
(iii) Find the coordinates of C. [2]

(iv) Find $\int 2\cos\left(x - \frac{\pi}{6}\right)\mathrm{d}x$. [1]

(v) Hence find the area of the shaded region. [2]

SAT PREP SP www.satprep.co.in

8



The diagram shows a sector *AOB* of the circle, centre *O*, radius 12 cm, together with points *C* and *D* such that *ABCD* is a rectangle. The angle *AOB* is θ radians and the perimeter of the sector *AOB* is 47 cm.

(i) Show that $\theta = 1.92$ radians correct to 2 decimal places. [2]

(ii) Find the length of *CD*. [2]

(iii) Given that the total area of the shape is 425 cm^2, find the length of *AD*. [5]

SAT PREP
SP
www.satprep.co.in

9 Do not use a calculator in this question.

The polynomial $\mathrm{p}(x)$ is $ax^3 - 4x^2 + bx + 18$. It is given that $\mathrm{p}(x)$ and $\mathrm{p}'(x)$ are both divisible by $2x - 3$.

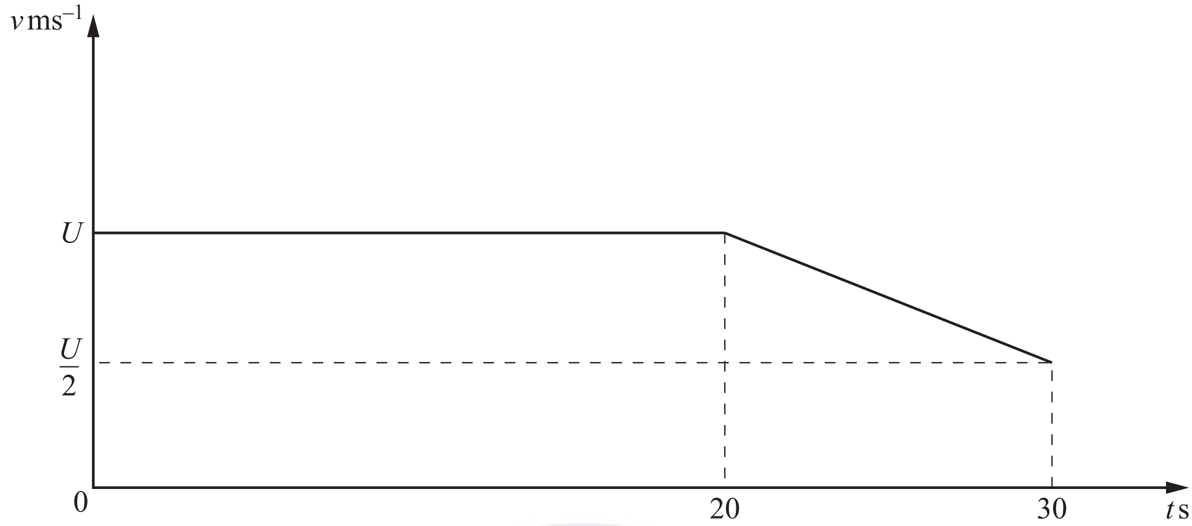
(i) Show that $a = 4$ and find the value of b. [4]

(ii) Using the values of a and b from part **(i)**, factorise $\mathrm{p}(x)$ completely. [2]

SAT PREP www.satprep.co.in

(iii) Hence find the values of x for which $\mathrm{p}(x) = x + 2$. [3]

10 (a)



The diagram shows part of the velocity-time graph for a particle, moving at $v\,\text{ms}^{-1}$ in a straight line, t s after passing through a fixed point. The particle travels at $U\,\text{ms}^{-1}$ for 20 s and then decelerates uniformly for 10 s to a velocity of $\frac{U}{2}\text{ms}^{-1}$. In this 30 s interval, the particle travels 165 m.

(i) Find the value of U. [3]

(ii) Find the acceleration of the particle between $t = 20$ and $t = 30$. [2]

(b) A particle P travels in a straight line such that, t s after passing through a fixed point O, its velocity, $v\,\text{ms}^{-1}$, is given by $v = \left(e^{\frac{t^2}{8}} - 4\right)^3$.

(i) Find the speed of P at O. [1]

(ii) Find the value of t for which P is instantaneously at rest. [2]

(iii) Find the acceleration of P when $t = 1$. [4]

Question 11 is printed on the next page.

11 The variables x and y are such that when $\ln y$ is plotted against x, a straight line graph is obtained. This line passes through the points $x = 4$, $\ln y = 0.20$ and $x = 12$, $\ln y = 0.08$.

(i) Given that $y = Ab^x$, find the value of A and of b. [5]

(ii) Find the value of y when $x = 6$. [2]

(iii) Find the value of x when $y = 1.1$. [2]

SAT PREP SP www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

3109594679

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (ST/SG) 126424
© UCLES 2016

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\ .$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \dfrac{n!}{(n-r)!r!}$.

SAT PREP www.satprep.co.in

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 **(a)** Sets $\mathscr{E}$, A and B are such that

$$n(\mathscr{E}) = 26,\ n(A \cap B') = 7,\ n(A \cap B) = 3 \text{ and } n(B) = 15\ .$$

Using a Venn diagram, or otherwise, find

(i) $n(A)$, [1]

(ii) $n(A \cup B)$, [1]

(iii) $n(A \cup B)'$. [1]

(b) It is given that $\mathscr{E} = \{x : 0 < x < 30\}$, $P = \{\text{multiples of } 5\}$, $Q = \{\text{multiples of } 6\}$ and $R = \{\text{multiples of } 2\}$. Use set notation to complete the following statements.

(i) Q .... R, [1]

(ii) $P \cap Q =$ .... [1]

2 Given that $\dfrac{p^{\frac{1}{3}}q^{-\frac{1}{2}}r^{\frac{3}{2}}}{p^{-\frac{2}{3}}\sqrt{(qr)^5}} = p^a q^b r^c$, find the value of each of the integers a, b and c. [3]

3 By using the substitution $y = \log_3 x$, or otherwise, find the values of x for which

$$3(\log_3 x)^2 + \log_3 x^5 - \log_3 9 = 0\ .$$ [6]

www.satprep.co.in

4 **(i)** Find the first 3 terms in the expansion of $\left(2x^2 - \dfrac{1}{3x}\right)^5$, in descending powers of x. [3]

(ii) Hence find the coefficient of x^7 in the expansion of $\left(3 + \dfrac{1}{x^3}\right)\left(2x^2 - \dfrac{1}{3x}\right)^5$. [2]

SAT PREP SP www.satprep.co.in

5 **(i)** Find the equation of the normal to the curve $y = \frac{1}{2}\ln(3x + 2)$ at the point P where $x = -\frac{1}{3}$. [4]

The normal to the curve at the point P intersects the y-axis at the point Q. The curve $y = \frac{1}{2}\ln(3x + 2)$ intersects the y-axis at the point R.

(ii) Find the area of the triangle PQR. [3]

SAT PREP www.satprep.co.in

© UCLES 2016

6 **(a)** Matrices **X**, **Y** and **Z** are such that

$$\mathbf{X} = \begin{pmatrix} 2 & 3 \\ 4 & -1 \\ 6 & 5 \end{pmatrix}, \ \mathbf{Y} = \begin{pmatrix} 1 & -1 & 0 \end{pmatrix} \text{ and } \mathbf{Z} = \begin{pmatrix} 0 & -1 \\ 5 & 3 \end{pmatrix}.$$

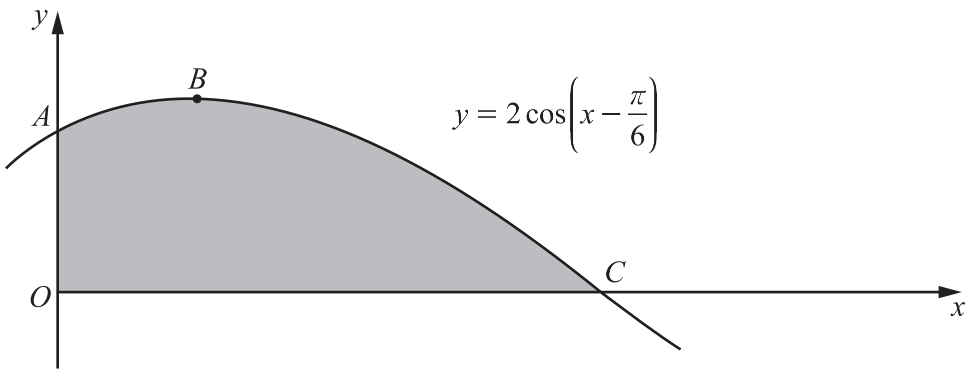
Write down all the matrix products which are possible using any two of these matrices. Do not evaluate these products. [2]

(b) Matrices **A**, **B** and **C** are such that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 4 & 7 \end{pmatrix}$, $\mathbf{B} = \begin{pmatrix} -4 & 2 \\ 10 & 4 \end{pmatrix}$ and $\mathbf{AC} = \mathbf{B}$.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Hence find **C**. [3]

7



The diagram shows part of the graph of $y = 2\cos\left(x - \frac{\pi}{6}\right)$. The graph intersects the y-axis at the point A, has a maximum point at B and intersects the x-axis at the point C.

(i) Find the coordinates of A. [1]

(ii) Find the coordinates of B. [2]

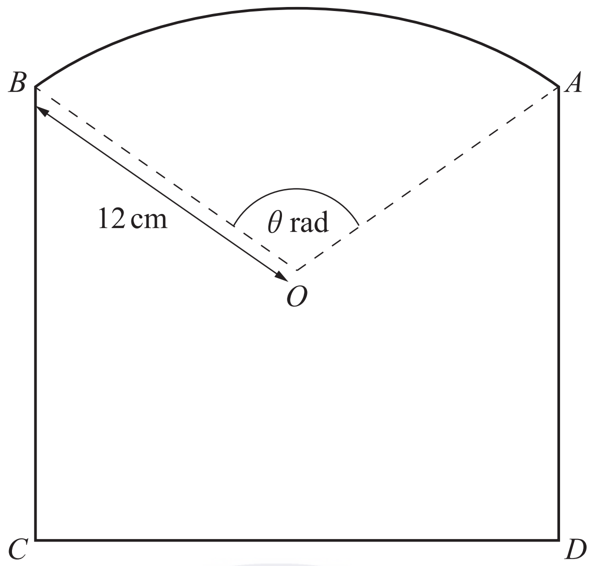
www.satprep.co.in

(iii) Find the coordinates of C. [2]

(iv) Find $\int 2\cos\left(x - \frac{\pi}{6}\right)\mathrm{d}x$. [1]

(v) Hence find the area of the shaded region. [2]

8



The diagram shows a sector AOB of the circle, centre O, radius 12 cm, together with points C and D such that $ABCD$ is a rectangle. The angle AOB is θ radians and the perimeter of the sector AOB is 47 cm.

(i) Show that $\theta = 1.92$ radians correct to 2 decimal places. [2]

(ii) Find the length of CD. [2]

(iii) Given that the total area of the shape is $425\,\text{cm}^2$, find the length of AD. [5]

SAT PREP SP www.satprep.co.in

9 Do not use a calculator in this question.

The polynomial $\mathrm{p}(x)$ is $ax^3 - 4x^2 + bx + 18$. It is given that $\mathrm{p}(x)$ and $\mathrm{p}'(x)$ are both divisible by $2x - 3$.

(i) Show that $a = 4$ and find the value of b. [4]

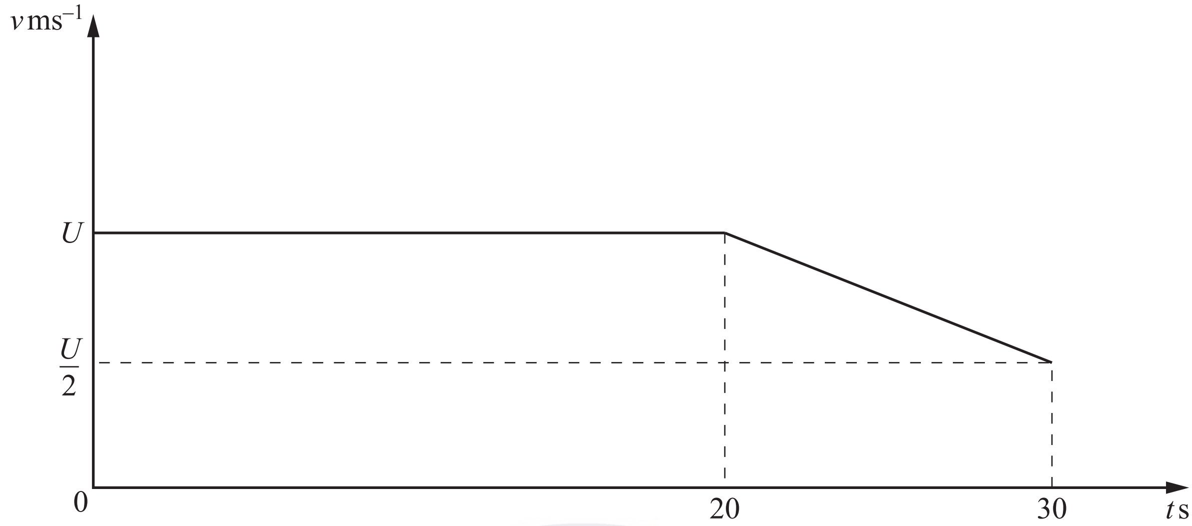
(ii) Using the values of a and b from part **(i)**, factorise $\mathrm{p}(x)$ completely. [2]

SAT PREP www.satprep.co.in

(iii) Hence find the values of x for which $p(x) = x + 2$. [3]

SAT PREP
SP
www.satprep.co.in

10 (a)



The diagram shows part of the velocity-time graph for a particle, moving at $v\,\text{ms}^{-1}$ in a straight line, t s after passing through a fixed point. The particle travels at $U\,\text{ms}^{-1}$ for 20 s and then decelerates uniformly for 10 s to a velocity of $\frac{U}{2}\,\text{ms}^{-1}$. In this 30 s interval, the particle travels 165 m.

(i) Find the value of U. [3]

(ii) Find the acceleration of the particle between $t = 20$ and $t = 30$. [2]

(b) A particle P travels in a straight line such that, t s after passing through a fixed point O, its velocity, $v\,\text{ms}^{-1}$, is given by $v = \left(e^{\frac{t^2}{8}} - 4\right)^3$.

(i) Find the speed of P at O. [1]

(ii) Find the value of t for which P is instantaneously at rest. [2]

(iii) Find the acceleration of P when $t = 1$. [4]

Question 11 is printed on the next page.

11 The variables x and y are such that when $\ln y$ is plotted against x, a straight line graph is obtained. This line passes through the points $x = 4$, $\ln y = 0.20$ and $x = 12$, $\ln y = 0.08$.

(i) Given that $y = Ab^x$, find the value of A and of b. [5]

(ii) Find the value of y when $x = 6$. [2]

(iii) Find the value of x when $y = 1.1$. [2]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2016

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

8767885461

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (RW/AR) 116667/2
© UCLES 2016

CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

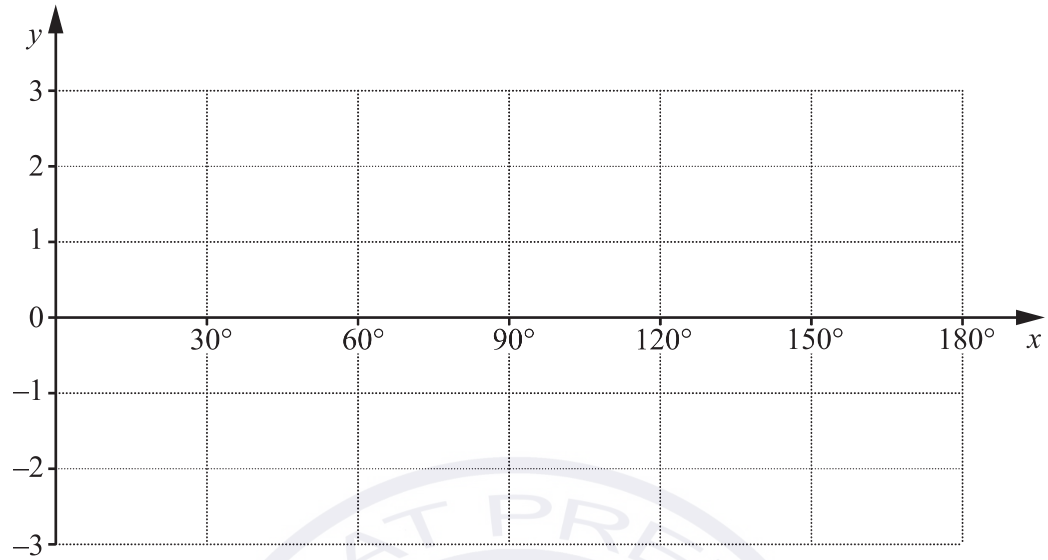
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2016

1 On the axes below, sketch the graph of $y = |2\cos 3x|$ for $0 \leqslant x \leqslant 180°$. [3]



2 Express $\dfrac{4m\sqrt{m} - \dfrac{9}{\sqrt{m}}}{2\sqrt{m} + \dfrac{3}{\sqrt{m}}}$ in the form $Am + B$, where A and B are integers to be found. [3]

3 **(i)** Given that $3x^2 + p(1 - 2x) = -3$, show that, for x to be real, $p^2 - 3p - 9 \geqslant 0$. [3]

(ii) Hence find the set of values of p for which x is real, expressing your answer in exact form. [3]

www.satprep.co.in

4 **(i)** Find, in ascending powers of x, the first 3 terms in the expansion of $\left(2-\frac{x}{4}\right)^6$. [3]

(ii) Hence find the term independent of x in the expansion of $\left(4+\frac{2}{x}+\frac{3}{x^2}\right)\left(2-\frac{x}{4}\right)^6$. [3]

SAT PREP
SP
www.satprep.co.in

5 **(i)** Given that $\log_9 xy = \frac{5}{2}$, show that $\log_3 x + \log_3 y = 5$. [3]

(ii) Hence solve the equations

$$\log_9 xy = \frac{5}{2},$$

$$\log_3 x \times \log_3 y = -6.$$ [5]

www.satprep.co.in SAT PREP SP

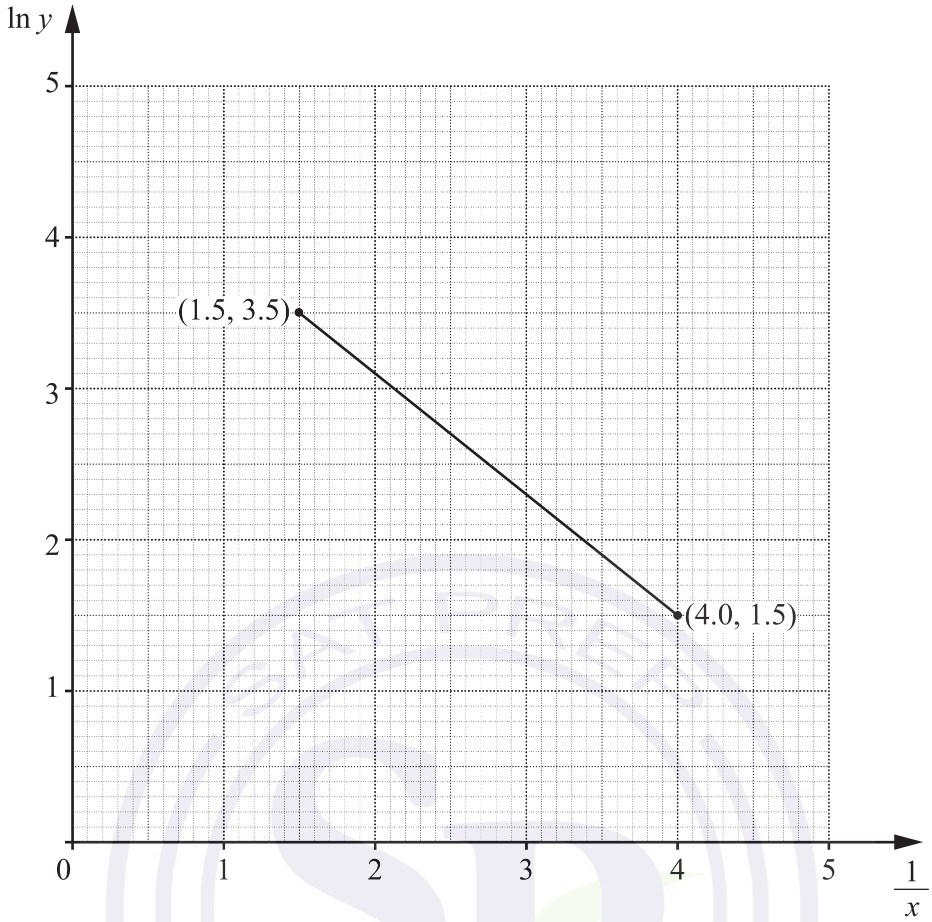
6 **(i)** Find $\frac{d}{dx}(\ln(3x^2 - 11))$. [2]

(ii) Hence show that $\int \frac{x}{3x^2 - 11} dx = p\ln(3x^2 - 11) + c$, where p is a constant to be found, and c is a constant of integration. [1]

(iii) Given that $\int_2^a \frac{x}{3x^2 - 11} dx = \ln 2$, where $a > 2$, find the value of a. [4]

© UCLES 2016

7



The variables x and y are such that when $\ln y$ is plotted against $\frac{1}{x}$ the straight line graph shown above is obtained.

(i) Given that $y = Ae^{\frac{b}{x}}$, find the value of A and of b. [4]

(ii) Find the value of y when $x = 0.32$. [2]

(iii) Find the value of x when $y = 20$. [2]

SAT PREP SP www.satprep.co.in

8 **(a)** **(i)** Show that $\dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta - \sin\theta} = \sec^2\theta$. [3]

(ii) Hence solve $\dfrac{\operatorname{cosec}\theta}{\operatorname{cosec}\theta - \sin\theta} = 4$ for $0° < \theta < 360°$. [3]

SAT PREP SP www.satprep.co.in

(b) Solve $\sqrt{3}\tan\left(x+\frac{\pi}{4}\right)=1$ for $0 < x < 2\pi$, giving your answers in terms of π. [3]

SAT PREP
www.satprep.co.in

9 **(a)** A team of 5 students is to be chosen from a class of 10 boys and 8 girls. Find the number of different teams that may be chosen if

(i) there are no restrictions, [1]

(ii) the team must contain at least one boy and one girl. [4]

SAT PREP SP www.satprep.co.in

(b) A computer password, which must contain 6 characters, is to be chosen from the following 10 characters:

Symbols	?	!	*	
Numbers	3	5	7	
Letters	W	X	Y	Z

Each character may be used once only in any password. Find the number of possible passwords that may be chosen if

(i) there are no restrictions, [1]

(ii) each password must start with a letter and finish with a number, [2]

(iii) each password must contain at least one symbol. [3]

www.satprep.co.in

10 A curve $y = \mathrm{f}(x)$ is such that $\mathrm{f}'(x) = 6x - 8\mathrm{e}^{2x}$.

(i) Given that the curve passes through the point $P\ (0, -3)$, find the equation of the curve. [5]

The normal to the curve $y = \mathrm{f}(x)$ at P meets the line $y = 2 - 3x$ at the point Q.

(ii) Find the area of the triangle OPQ, where O is the origin. [5]

© UCLES 2016

11 A particle moving in a straight line has a velocity of $v\,\text{ms}^{-1}$ such that, t s after leaving a fixed point, $v = 4t^2 - 8t + 3$.

(i) Find the acceleration of the particle when $t = 3$. [2]

(ii) Find the values of t for which the particle is momentarily at rest. [2]

(iii) Find the total distance the particle has travelled when $t = 1.5$. [5]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

SAT PREP
www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

5470312372

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (LK/SW) 106867/3
© UCLES 2016

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \dfrac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2016

1 Find the value of k for which the curve $y = 2x^2 - 3x + k$

(i) passes through the point $(4, -7)$, [1]

(ii) meets the x-axis at one point only. [2]

2 **(a)** Solve the equation $16^{3x-1} = 8^{x+2}$. [3]

(b) Given that $\dfrac{\left(a^{\frac{1}{3}}b^{-\frac{1}{2}}\right)^3}{a^{-\frac{2}{3}}b^{\frac{1}{2}}} = a^p b^q$, find the value of each of the constants p and q. [2]

3 Find the equation of the normal to the curve $y = \ln(2x^2 - 7)$ at the point where the curve crosses the positive x-axis. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

SAT PREP
SP
www.satprep.co.in

4 **(a)** Given the matrices $\mathbf{A} = \begin{pmatrix} -1 & 2 \\ 3 & 0 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 3 & 0 \\ 1 & 2 \end{pmatrix}$, find $\mathbf{A}^2 - 2\mathbf{B}$. [3]

(b) Using a matrix method, solve the equations

$$4x + y = 1,$$
$$10x + 3y = 1.$$

[4]

www.satprep.co.in SAT PREP

5 Do not use a calculator in this question.

(i) Show that $\dfrac{d}{dx}\left(\dfrac{e^{4x}}{4} - x e^{4x}\right) = pxe^{4x}$, where p is an integer to be found. [4]

(ii) Hence find the exact value of $\int_0^{\ln 2} xe^{4x}\,dx$, giving your answer in the form $a\ln 2 + \dfrac{b}{c}$, where a, b and c are integers to be found. [4]

© UCLES 2016

6 The function f is defined by $f(x) = 2 - \sqrt{x+5}$ for $-5 \leqslant x < 0$.

(i) Write down the range of f. [2]

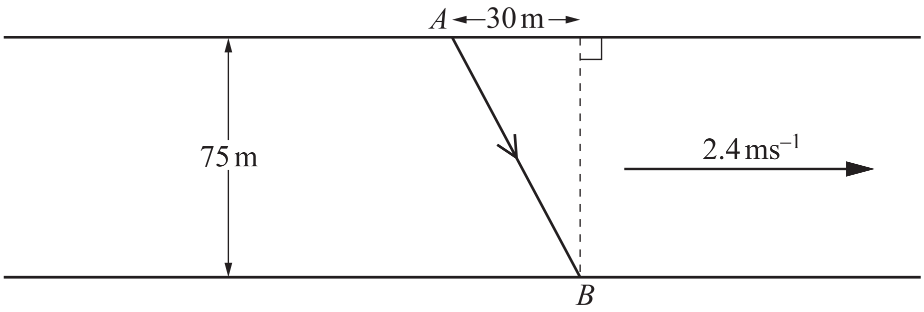
(ii) Find $f^{-1}(x)$ and state its domain and range. [4]

The function g is defined by $g(x) = \dfrac{4}{x}$ for $-5 \leqslant x < -1$.

(iii) Solve $fg(x) = 0$. [3]

www.satprep.co.in

7



The diagram shows a river with parallel banks. The river is 75 m wide and is flowing with a speed of 2.4 ms^{-1}. A speedboat travels in a straight line from a point *A* on one bank to a point *B* on the opposite bank, 30 m downstream from *A*. The speedboat can travel at a speed of 4.5 ms^{-1} in still water.

(i) Find the angle to the bank and the direction in which the speedboat is steered. [4]

SAT PREP SP www.satprep.co.in

(ii) Find the time the speedboat takes to travel from *A* to *B*. [4]

SAT PREP
SP
www.satprep.co.in

8 **Solutions to this question by accurate drawing will not be accepted.**

Three points have coordinates $A(-8, 6)$, $B(4, 2)$ and $C(-1, 7)$. The line through C perpendicular to AB intersects AB at the point P.

(i) Find the equation of the line AB. [2]

(ii) Find the equation of the line CP. [2]

(iii) Show that P is the midpoint of AB. [3]

SAT PREP www.satprep.co.in

(iv) Calculate the length of *CP*. [1]

(v) Hence find the area of the triangle *ABC*. [2]

SAT PREP
SP
www.satprep.co.in

9 **(i)** Show that $2\cos x \cot x + 1 = \cot x + 2\cos x$ can be written in the form $(a\cos x - b)(\cos x - \sin x) = 0$, where a and b are constants to be found. [4]

(ii) Hence, or otherwise, solve $2\cos x \cot x + 1 = \cot x + 2\cos x$ for $0 < x < \pi$. [3]

www.satprep.co.in

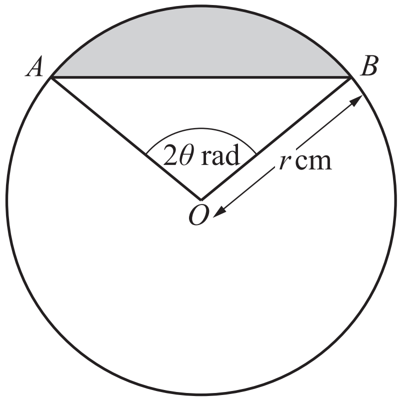
10 **(i)** Given that $f(x) = 4x^3 + kx + p$ is exactly divisible by $x + 2$ and $f'(x)$ is exactly divisible by $2x - 1$, find the value of k and of p. [4]

(ii) Using the values of k and p found in part **(i)**, show that $f(x) = (x+2)(ax^2 + bx + c)$, where a, b and c are integers to be found. [2]

(iii) Hence show that $f(x) = 0$ has only one solution and state this solution. [2]

© UCLES 2016

11



The diagram shows a circle, centre O, radius r cm. The points A and B lie on the circle such that angle $AOB = 2\theta$ radians.

(i) Find, in terms of r and θ, an expression for the length of the chord AB. [1]

(ii) Given that the perimeter of the shaded region is 20 cm, show that $r = \dfrac{10}{\theta + \sin\theta}$. [2]

www.satprep.co.in

(iii) Given that r and θ can vary, find the value of $\frac{\mathrm{d}r}{\mathrm{d}\theta}$ when $\theta = \frac{\pi}{6}$. [4]

SAT PREP
SP
www.satprep.co.in

(iv) Given that r is increasing at the rate of $15\,\mathrm{cm\,s^{-1}}$, find the corresponding rate of change of θ when $\theta = \frac{\pi}{6}$. [3]

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0993811310

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (ST/SW) 106862/3
© UCLES 2016

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2016

1 **(a)** The universal set $\mathscr{E}$ is the set of real numbers and sets X, Y and Z are such that

$X = \{\text{integer multiples of } 5\}$,

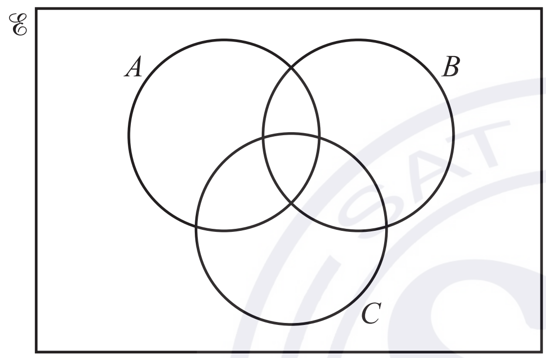
$Y = \{\text{integer multiples of } 10\}$,

$Z = \{\pi, \sqrt{2}, \text{e}\}$.

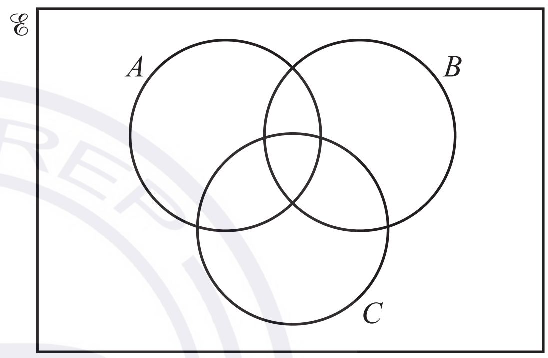
Use set notation to complete the two statements below.

Y .... X $\qquad\qquad$ $Y \cap Z =$ .... [2]

(b) On each of the Venn diagrams below, shade the region indicated.



$(A' \cap B) \cup C$



$A' \cap (B \cup C)$

[2]

2 **(i)** The first 3 terms in the expansion of $\left(2-\dfrac{1}{4x}\right)^5$ are $a+\dfrac{b}{x}+\dfrac{c}{x^2}$. Find the value of each of the integers a, b and c. [3]

(ii) Hence find the term independent of x in the expansion of $\left(2-\dfrac{1}{4x}\right)^5(3+4x)$. [2]

SAT PREP SP www.satprep.co.in

3 Vectors **a**, **b** and **c** are such that $\mathbf{a} = \begin{pmatrix} 2 \\ y \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 5 \end{pmatrix}$.

(i) Given that $|\mathbf{a}| = |\mathbf{b} - \mathbf{c}|$, find the possible values of y. [3]

(ii) Given that $\mu(\mathbf{b} + \mathbf{c}) + 4(\mathbf{b} - \mathbf{c}) = \lambda(2\mathbf{b} - \mathbf{c})$, find the value of μ and of λ. [3]

SAT PREP SP www.satprep.co.in

4 Do not use a calculator in this question.

Find the positive value of x for which $(4+\sqrt{5})x^2+(2-\sqrt{5})x-1=0$, giving your answer in the form $\frac{a+\sqrt{5}}{b}$, where a and b are integers. [6]

SAT PREP SP www.satprep.co.in

5 **(i)** Show that $(1-\cos\theta)(1+\sec\theta)=\sin\theta\tan\theta$. [4]

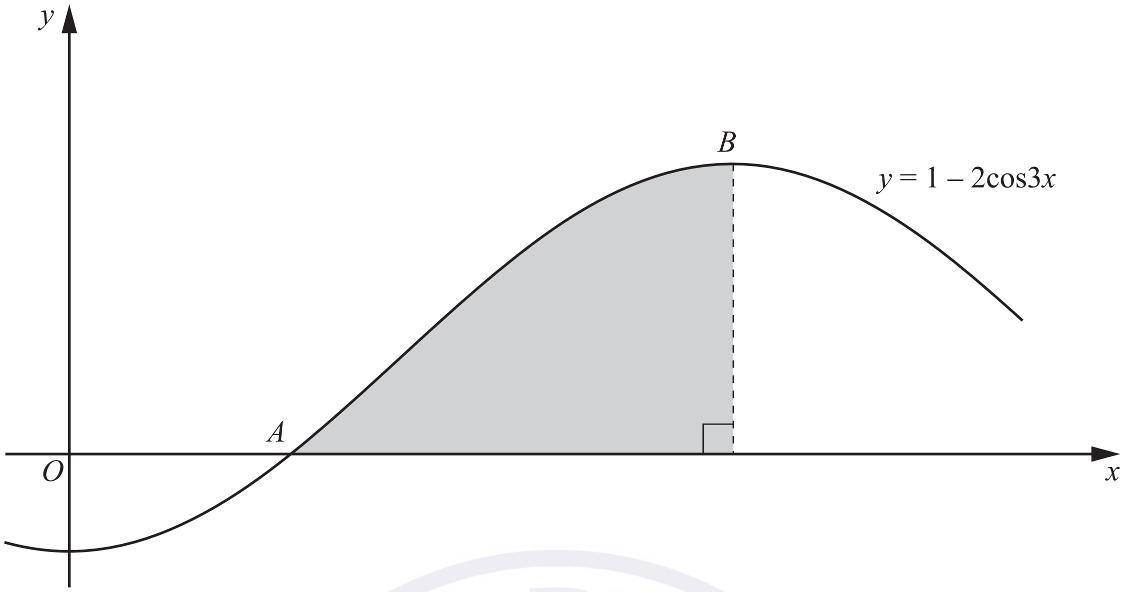
(ii) Hence solve the equation $(1-\cos\theta)(1+\sec\theta)=\sin\theta$ for $0\leqslant\theta\leqslant\pi$ radians. [3]

SAT PREP SP www.satprep.co.in

6 Show that $\frac{\mathrm{d}}{\mathrm{d}x}(\mathrm{e}^{3x}\sqrt{4x+1})$ can be written in the form $\frac{\mathrm{e}^{3x}(px+q)}{\sqrt{4x+1}}$, where p and q are integers to be found. [5]

www.satprep.co.in

7



The diagram shows part of the graph of $y = 1 - 2\cos 3x$, which crosses the x-axis at the point A and has a maximum at the point B.

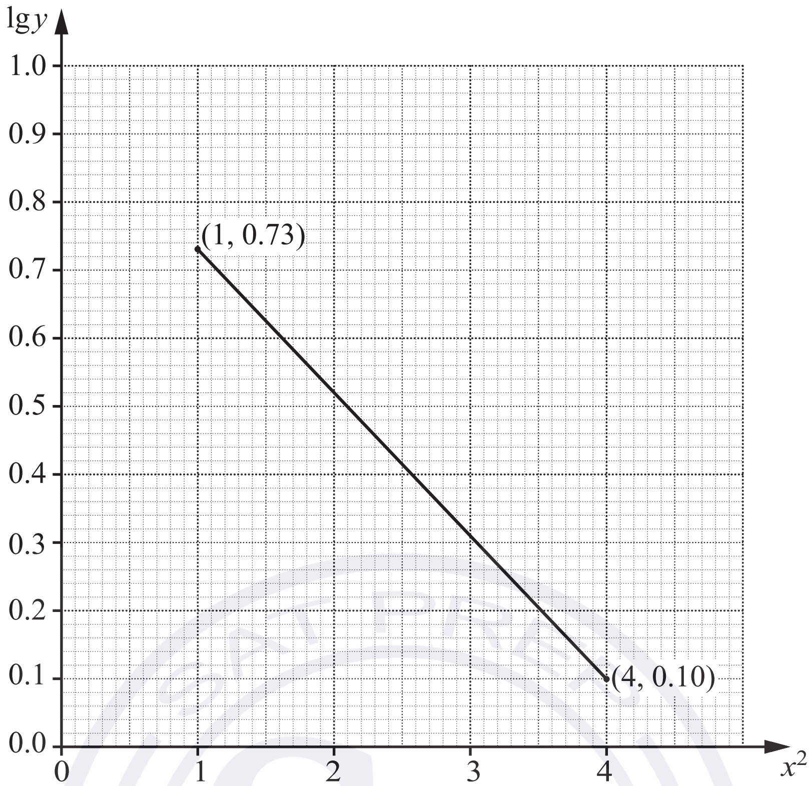
(i) Find the coordinates of A. [2]

(ii) Find the coordinates of B. [2]

(iii) Showing all your working, find the area of the shaded region bounded by the curve, the x-axis and the perpendicular from B to the x-axis. [4]

© UCLES 2016

8



Variables x and y are such that when $\lg y$ is plotted against x^2, the straight line graph shown above is obtained.

(i) Given that $y = Ab^{x^2}$, find the value of A and of b. [4]

(ii) Find the value of y when $x = 1.5$. [2]

(iii) Find the positive value of x when $y = 2$. [2]

© UCLES 2016

9 A curve passes through the point $\left(2, -\frac{4}{3}\right)$ and is such that $\frac{dy}{dx} = (3x + 10)^{-\frac{1}{2}}$.

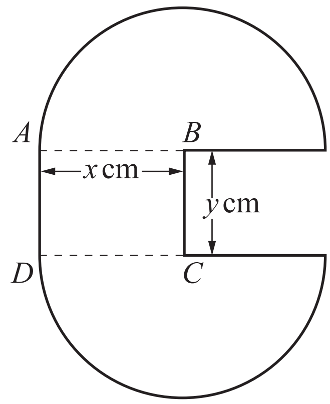
(i) Find the equation of the curve. [4]

The normal to the curve, at the point where $x = 5$, meets the line $y = -\frac{5}{3}$ at the point P.

(ii) Find the x-coordinate of P. [6]

© UCLES 2016

10



The diagram shows a badge, made of thin sheet metal, consisting of two semi-circular pieces, centres B and C, each of radius x cm. They are attached to each other by a rectangular piece of thin sheet metal, $ABCD$, such that AB and CD are the radii of the semi-circular pieces and $AD = BC = y$ cm.

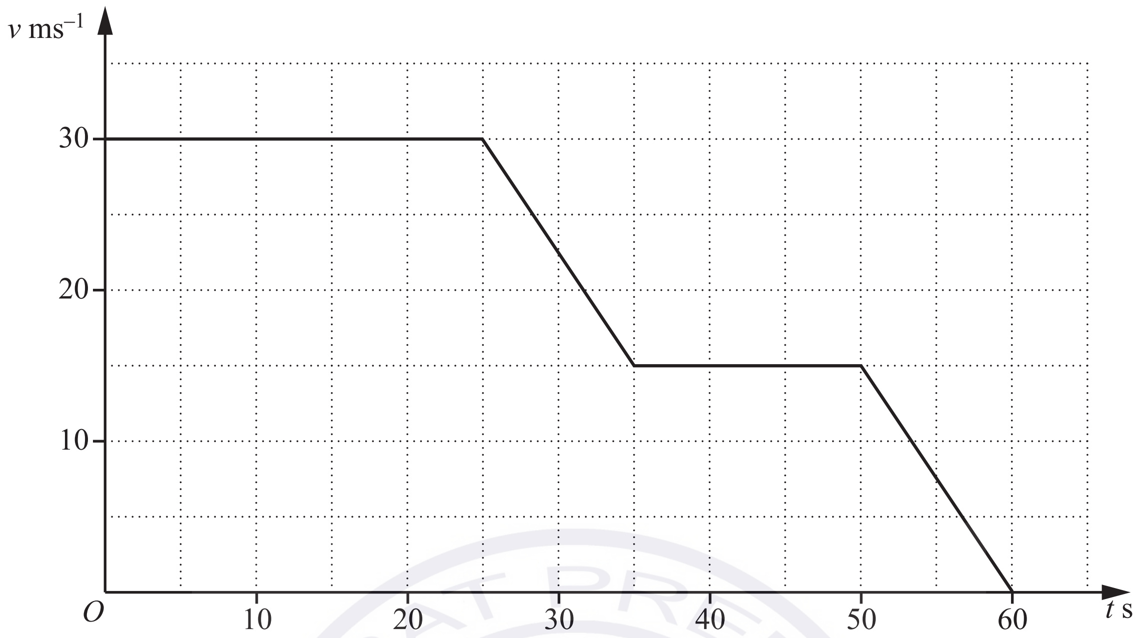
(i) Given that the area of the badge is $20\,\text{cm}^2$, show that the perimeter, P cm, of the badge is given by $P = 2x + \dfrac{40}{x}$. [4]

© UCLES 2016

(ii) Given that x can vary, find the minimum value of P, justifying that this value is a minimum. [5]

SAT PREP SP www.satprep.co.in

11 (a)

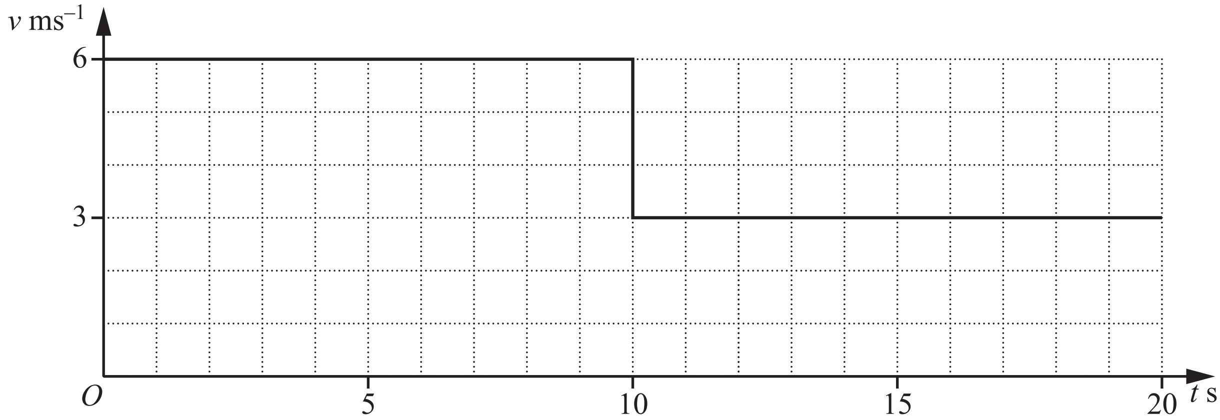


The diagram shows the velocity-time graph of a particle P moving in a straight line with velocity $v\ \mathrm{ms}^{-1}$ at time t s after leaving a fixed point.

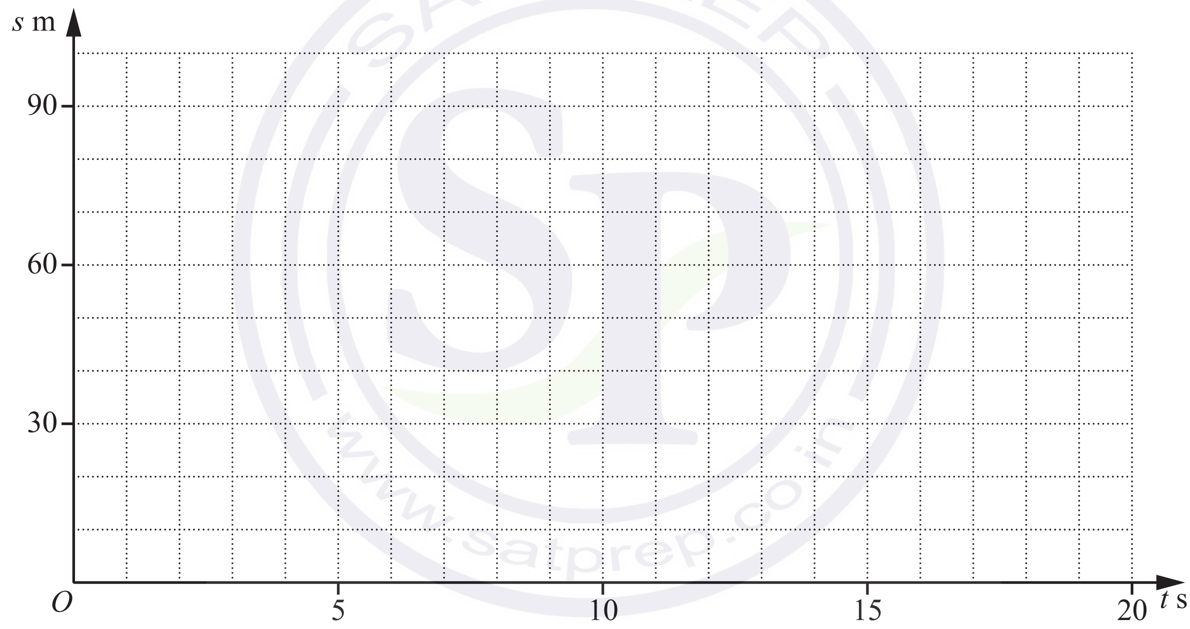
(i) Find the distance travelled by the particle P. [2]

(ii) Write down the deceleration of the particle when $t = 30$. [1]

(b) The diagram shows a velocity-time graph of a particle Q moving in a straight line with velocity v ms^{-1}, at time t s after leaving a fixed point.



The displacement of Q at time t s is s m. On the axes below, draw the corresponding displacement-time graph for Q. [2]



Question 11(c) is printed on the next page.

(c) The velocity, v ms^{-1}, of a particle R moving in a straight line, t s after passing through a fixed point O, is given by $v = 4e^{2t} + 6$.

(i) Explain why the particle is never at rest. [1]

(ii) Find the exact value of t for which the acceleration of R is 12 ms^{-2}. [2]

(iii) Showing all your working, find the distance travelled by R in the interval between $t = 0.4$ and $t = 0.5$. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

5870438435

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (SLM) 122174
© UCLES 2016

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

1 Find the value of k for which the curve $y = 2x^2 - 3x + k$

(i) passes through the point $(4, -7)$, [1]

(ii) meets the x-axis at one point only. [2]

2 **(a)** Solve the equation $16^{3x-1} = 8^{x+2}$. [3]

(b) Given that $\dfrac{\left(a^{\frac{1}{3}}b^{-\frac{1}{2}}\right)^3}{a^{-\frac{2}{3}}b^{\frac{1}{2}}} = a^p b^q$, find the value of each of the constants p and q. [2]

3 Find the equation of the normal to the curve $y = \ln(2x^2 - 7)$ at the point where the curve crosses the positive x-axis. Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. [5]

SAT PREP
SP
www.satprep.co.in

4 **(a)** Given the matrices $\mathbf{A} = \begin{pmatrix} -1 & 2 \\ 3 & 0 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 3 & 0 \\ 1 & 2 \end{pmatrix}$, find $\mathbf{A}^2 - 2\mathbf{B}$. [3]

(b) Using a matrix method, solve the equations

$$4x + y = 1,$$
$$10x + 3y = 1.$$

[4]

www.satprep.co.in SAT PREP SP

5 Do not use a calculator in this question.

(i) Show that $\frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{\mathrm{e}^{4x}}{4} - x\,\mathrm{e}^{4x}\right) = px\mathrm{e}^{4x}$, where p is an integer to be found. [4]

(ii) Hence find the exact value of $\int_0^{1\mathrm{n}2} x\mathrm{e}^{4x}\,\mathrm{d}x$, giving your answer in the form $a\ln 2 + \frac{b}{c}$, where a, b and c are integers to be found. [4]

SAT PREP SP www.satprep.co.in

6 The function f is defined by $\mathrm{f}(x) = 2 - \sqrt{x+5}$ for $-5 \leqslant x < 0$.

(i) Write down the range of f. [2]

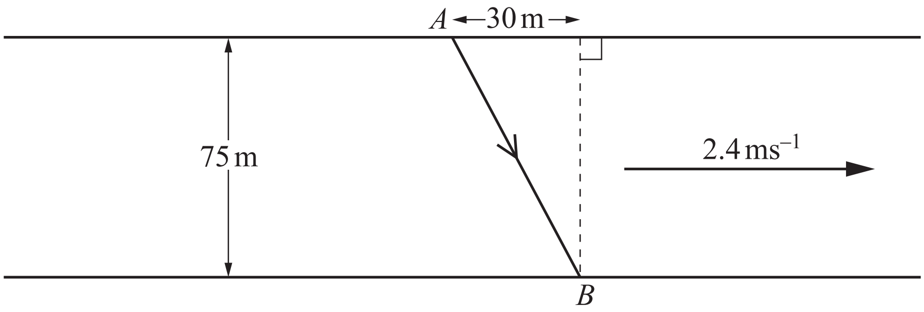
(ii) Find $\mathrm{f}^{-1}(x)$ and state its domain and range. [4]

SAT PREP
SP
www.satprep.co.in

The function g is defined by $\mathrm{g}(x) = \dfrac{4}{x}$ for $-5 \leqslant x < -1$.

(iii) Solve $\mathrm{fg}(x) = 0$. [3]

7



The diagram shows a river with parallel banks. The river is 75 m wide and is flowing with a speed of 2.4 ms^{-1}. A speedboat travels in a straight line from a point *A* on one bank to a point *B* on the opposite bank, 30 m downstream from *A*. The speedboat can travel at a speed of 4.5 ms^{-1} in still water.

(i) Find the angle to the bank and the direction in which the speedboat is steered. [4]

SAT PREP SP www.satprep.co.in

(ii) Find the time the speedboat takes to travel from A to B. [4]

SAT PREP
SP
www.satprep.co.in

8 Solutions to this question by accurate drawing will not be accepted.

Three points have coordinates $A(-8, 6)$, $B(4, 2)$ and $C(-1, 7)$. The line through C perpendicular to AB intersects AB at the point P.

(i) Find the equation of the line AB. [2]

(ii) Find the equation of the line CP. [2]

(iii) Show that P is the midpoint of AB. [3]

SAT PREP www.satprep.co.in

(iv) Calculate the length of *CP*. [1]

(v) Hence find the area of the triangle *ABC*. [2]

SAT PREP
SP
www.satprep.co.in

9 **(i)** Show that $2\cos x\cot x + 1 = \cot x + 2\cos x$ can be written in the form $(a\cos x - b)(\cos x - \sin x) = 0$, where a and b are constants to be found. [4]

(ii) Hence, or otherwise, solve $2\cos x\cot x + 1 = \cot x + 2\cos x$ for $0 < x < \pi$. [3]

www.satprep.co.in SAT PREP SP

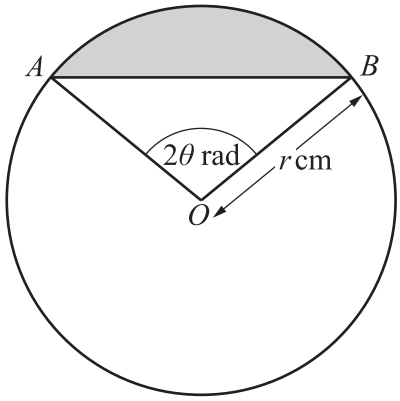
10 **(i)** Given that $f(x) = 4x^3 + kx + p$ is exactly divisible by $x + 2$ and $f'(x)$ is exactly divisible by $2x - 1$, find the value of k and of p. [4]

(ii) Using the values of k and p found in part **(i)**, show that $f(x) = (x+2)(ax^2 + bx + c)$, where a, b and c are integers to be found. [2]

(iii) Hence show that $f(x) = 0$ has only one solution and state this solution. [2]

© UCLES 2016

11



The diagram shows a circle, centre O, radius r cm. The points A and B lie on the circle such that angle $AOB = 2\theta$ radians.

(i) Find, in terms of r and θ, an expression for the length of the chord AB. [1]

(ii) Given that the perimeter of the shaded region is 20 cm, show that $r = \dfrac{10}{\theta + \sin\theta}$. [2]

SAT PREP www.satprep.co.in

(iii) Given that r and θ can vary, find the value of $\frac{\mathrm{d}r}{\mathrm{d}\theta}$ when $\theta = \frac{\pi}{6}$. [4]

(iv) Given that r is increasing at the rate of $15\,\mathrm{cm\,s^{-1}}$, find the corresponding rate of change of θ when $\theta = \frac{\pi}{6}$. [3]

© UCLES 2016

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

9242819072

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2016**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (LEG/FD) 106873/3
© UCLES 2016

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

SAT PREP
SP
www.satprep.co.in

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2016

1 Find the values of a for which the line $y = ax + 9$ intersects the curve $y = -2x^2 + 3x + 1$ at 2 distinct points. [4]

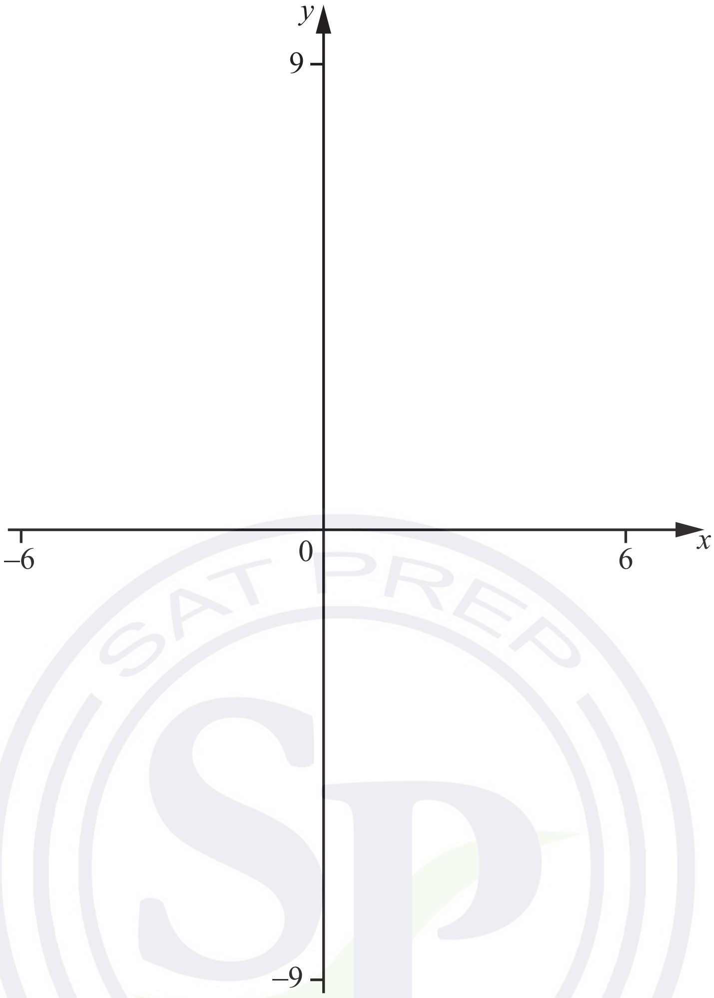
2 Given that $\dfrac{p^{-2}qr^{-\frac{1}{2}}}{\sqrt{p^{\frac{1}{3}}q^{2}r^{-3}}} = p^{a}q^{b}r^{c}$, find the values of a, b and c. [3]

SAT PREP SP www.satprep.co.in

3 Solve $\log_5 \sqrt{x} + \log_{25} x = 3$. [3]

SAT PREP SP www.satprep.co.in

4 **(i)** On the axes below, sketch the graphs of $y = 2 - x$ and $y = |3 + 2x|$. [4]



(ii) Solve $|3 + 2x| = 2 - x$. [3]

SAT PREP www.satprep.co.in

5 **(a)** A 6-character password is to be chosen from the following 9 characters.

letters	A	B	E	F
numbers	5	8	9	
symbols	*	$		

Each character may be used only once in any password.

Find the number of different 6-character passwords that may be chosen if

(i) there are no restrictions, [1]

(ii) the password must consist of 2 letters, 2 numbers and 2 symbols, in that order, [2]

(iii) the password must start and finish with a symbol. [2]

© UCLES 2016

(b) An examination consists of a section A, containing 10 short questions, and a section B, containing 5 long questions. Candidates are required to answer 6 questions from section A and 3 questions from section B. Find the number of different selections of questions that can be made if

(i) there are no further restrictions, [2]

(ii) candidates must answer the first 2 questions in section A and the first question in section B. [2]

SAT PREP
SP
www.satprep.co.in

6 A function f is such that $\mathrm{f}(x) = 6 + \mathrm{e}^{4x}$ for $x \in \mathbb{R}$.

(i) Write down the range of f. [1]

(ii) Find $\mathrm{f}^{-1}(x)$ and state its domain and range. [4]

(iii) Find $\mathrm{f}'(x)$. [1]

(iv) Hence find the exact solution of $\mathrm{f}(x) = \mathrm{f}'(x)$. [2]

SAT PREP SP www.satprep.co.in

7 The polynomial $f(x) = ax^3 + 7x^2 - 9x + b$ is divisible by $2x - 1$. The remainder when $f(x)$ is divided by $x - 2$ is 5 times the remainder when $f(x)$ is divided by $x + 1$.

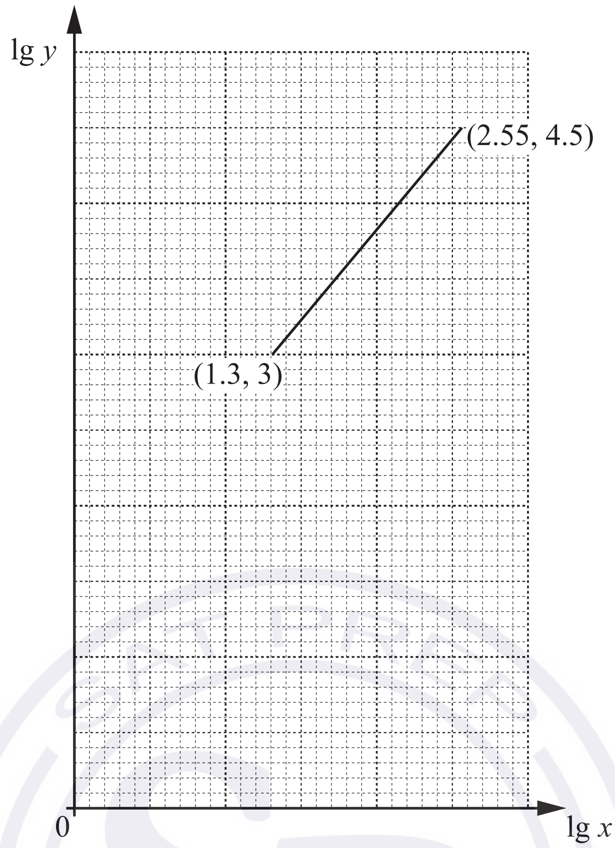
(i) Show that $a = 6$ and find the value of b. [4]

(ii) Using the values from part **(i)**, show that $f(x) = (2x - 1)(cx^2 + dx + e)$, where c, d and e are integers to be found. [2]

(iii) Hence factorise $f(x)$ completely. [2]

www.satprep.co.in

8



The variables x and y are such that when $\lg y$ is plotted against $\lg x$ the straight line graph shown above is obtained.

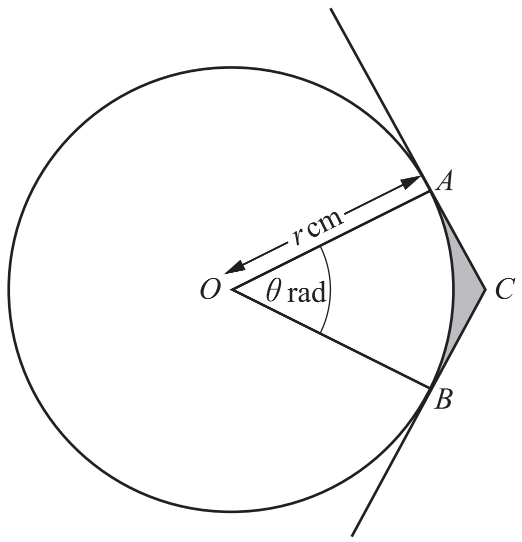
(i) Given that $y = Ax^b$, find the value of A and of b. [5]

(ii) Find the value of lg y when $x = 100$. [2]

(iii) Find the value of x when $y = 8000$. [2]

SAT PREP
SP
www.satprep.co.in

9



The diagram shows a circle, centre O, radius r cm. Points A, B and C are such that A and B lie on the circle and the tangents at A and B meet at C. Angle $AOB = \theta$ radians.

(i) Given that the area of the major sector AOB is 7 times the area of the minor sector AOB, find the value of θ. [2]

(ii) Given also that the perimeter of the minor sector AOB is 20 cm, show that the value of r, correct to 2 decimal places, is 7.18. [2]

© UCLES 2016

(iii) Using the values of θ and r from parts **(i)** and **(ii)**, find the perimeter of the shaded region ABC. [3]

(iv) Find the area of the shaded region ABC. [3]

SAT PREP
SP
www.satprep.co.in

10 **(i)** Find $\frac{\mathrm{d}}{\mathrm{d}x}\left(x(2x-1)^{\frac{3}{2}}\right)$. [3]

(ii) Hence, show that $\int x(2x-1)^{\frac{1}{2}}\mathrm{d}x = \frac{(2x-1)^{\frac{3}{2}}}{15}(px+q)+c$, where c is a constant of integration, and p and q are integers to be found. [6]

SAT PREP
www.satprep.co.in

(iii) Hence find $\int_{0.5}^{1} x(2x-1)^{\frac{1}{2}}\,\mathrm{d}x$. [2]

SAT PREP SP www.satprep.co.in

Question 11 is printed on the next page.

11 **(i)** Show that $\dfrac{1}{\operatorname{cosec}\theta - 1} - \dfrac{1}{\operatorname{cosec}\theta + 1} = 2\tan^2\theta$. [4]

(ii) Hence solve $\dfrac{1}{\operatorname{cosec}\theta - 1} - \dfrac{1}{\operatorname{cosec}\theta + 1} = 6 + \tan\theta$ for $0° < \theta < 360°$. [4]

www.satprep.co.in SAT PREP SP

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6133606886

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (LEG/CGW) 98539/3
© UCLES 2015

UNIVERSITY of CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2015

1 Find the range of values of k for which the equation $kx^2 + k = 8x - 2xk$ has 2 real distinct roots. [4]

© UCLES 2015

2 A curve, showing the relationship between two variables x and y, passes through the point $P(-1, 3)$.

The curve has a gradient of 2 at P. Given that $\frac{d^2y}{dx^2} = -5$, find the equation of the curve. [4]

www.satprep.co.in

3 Show that $\sqrt{\sec^2\theta - 1} + \sqrt{\operatorname{cosec}^2\theta - 1} = \sec\theta \operatorname{cosec}\theta$. [5]

SAT PREP
SP
www.satprep.co.in

4 **(a)** 6 books are to be chosen from 8 different books.

(i) Find the number of different selections of 6 books that could be made. [1]

A clock is to be displayed on a shelf with 3 of the 8 different books on each side of it. Find the number of ways this can be done if

(ii) there are no restrictions on the choice of books, [1]

(iii) 3 of the 8 books are music books which have to be kept together. [2]

(b) A team of 6 tennis players is to be chosen from 10 tennis players consisting of 7 men and 3 women. Find the number of different teams that could be chosen if the team must include at least 1 woman. [3]

SAT PREP www.satprep.co.in

5 Variables x and y are such that $y = (x-3)\ln(2x^2+1)$.

(i) Find the value of $\frac{dy}{dx}$ when $x = 2$. [4]

SAT PREP SP www.satprep.co.in

(ii) Hence find the approximate change in y when x changes from 2 to 2.03. [2]

6 It is given that $\mathscr{E} = \{x : 1 \leqslant x \leqslant 12, \text{where } x \text{ is an integer}\}$ and that sets A, B, C and D are such that

$A = \{\text{multiples of } 3\}$,
$B = \{\text{prime numbers}\}$,
$C = \{\text{odd integers}\}$,
$D = \{\text{even integers}\}$.

Write down the following sets in terms of their elements.

(i) $A \cap B$ [1]

(ii) $A \cup C$ [1]

(iii) $A' \cap C$ [1]

(iv) $(D \cup B)'$ [1]

(v) Write down a set E such that $E \subset D$. [1]

© UCLES 2015

7 Two variables, x and y, are such that $y = Ax^b$, where A and b are constants. When $\ln y$ is plotted against $\ln x$, a straight line graph is obtained which passes through the points $(1.4, 5.8)$ and $(2.2, 6.0)$.

(i) Find the value of A and of b. [4]

SAT PREP
SP
www.satprep.co.in

(ii) Calculate the value of y when $x = 5$. [2]

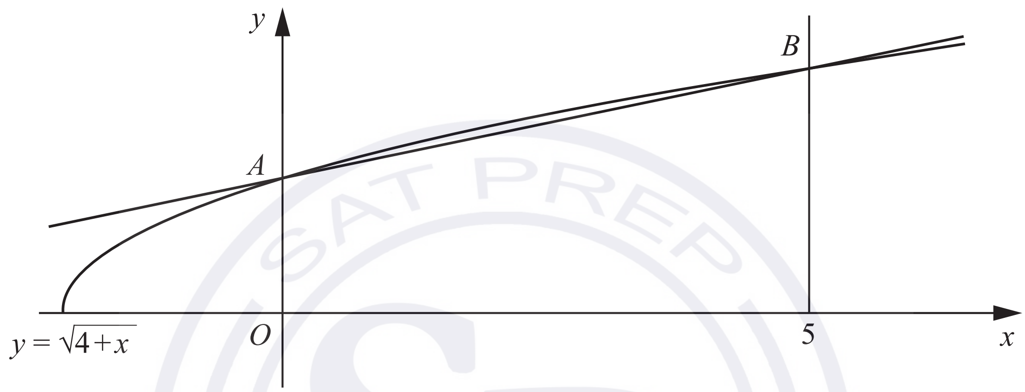
8 Find the equation of the tangent to the curve $y = \dfrac{2x-1}{\sqrt{x^2+5}}$ at the point where $x = 2$. [7]

SAT PREP SP www.satprep.co.in

9 You are not allowed to use a calculator in this question.

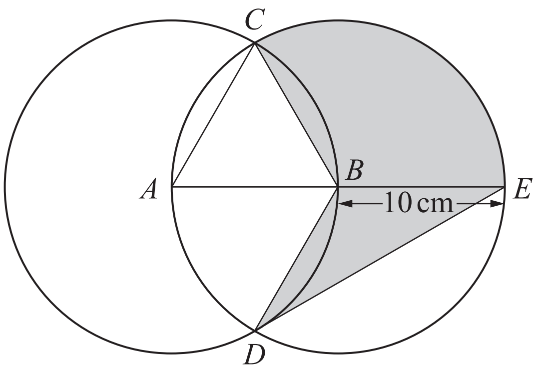
(i) Find $\int \sqrt{4+x}\,dx$. [2]

(ii)



The diagram shows the graph of $y = \sqrt{4+x}$, which meets the y-axis at the point A and the line $x = 5$ at the point B. Using your answer to part **(i)**, find the area of the region enclosed by the curve and the straight line AB. [5]

10



The diagram shows two circles, centres A and B, each of radius 10 cm. The point B lies on the circumference of the circle with centre A. The two circles intersect at the points C and D. The point E lies on the circumference of the circle centre B such that ABE is a diameter.

(i) Explain why triangle ABC is equilateral. [1]

(ii) Write down, in terms of π, angle CBE. [1]

(iii) Find the perimeter of the shaded region. [5]

SAT PREP SP www.satprep.co.in

(iv) Find the area of the shaded region. [3]

11 **(a)** A function f is such that $\mathrm{f}(x) = x^2 + 6x + 4$ for $x \geqslant 0$.

(i) Show that $x^2 + 6x + 4$ can be written in the form $(x + a)^2 + b$, where a and b are integers. [2]

(ii) Write down the range of f. [1]

(iii) Find f^{-1} and state its domain. [3]

SAT PREP SP www.satprep.co.in

(b) Functions g and h are such that, for $x \in \mathbb{R}$,

$$g(x) = e^x \quad \text{and} \quad h(x) = 5x + 2.$$

Solve $h^2g(x) = 37$. [4]

SAT PREP SP www.satprep.co.in

Question 12 is printed on the next page.

12 The line $2x - y + 1 = 0$ meets the curve $x^2 + 3y = 19$ at the points A and B. The perpendicular bisector of the line AB meets the x-axis at the point C. Find the area of the triangle ABC. [9]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8947266472

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

SAT PREP www.satprep.co.in

This document consists of **16** printed pages.

DC (SLM) 115230
© UCLES 2015

UNIVERSITY *of* CAMBRIDGE International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2015

1 Find the range of values of k for which the equation $kx^2 + k = 8x - 2xk$ has 2 real distinct roots. [4]

SAT PREP
www.satprep.co.in

2 A curve, showing the relationship between two variables x and y, passes through the point $P(-1, 3)$. The curve has a gradient of 2 at P. Given that $\frac{d^2y}{dx^2} = -5$, find the equation of the curve. [4]

SAT PREP
SP
www.satprep.co.in

© UCLES 2015

3 Show that $\sqrt{\sec^2\theta - 1} + \sqrt{\operatorname{cosec}^2\theta - 1} = \sec\theta\operatorname{cosec}\theta$. [5]

4 **(a)** 6 books are to be chosen from 8 different books.

(i) Find the number of different selections of 6 books that could be made. [1]

A clock is to be displayed on a shelf with 3 of the 8 different books on each side of it. Find the number of ways this can be done if

(ii) there are no restrictions on the choice of books, [1]

(iii) 3 of the 8 books are music books which have to be kept together. [2]

(b) A team of 6 tennis players is to be chosen from 10 tennis players consisting of 7 men and 3 women. Find the number of different teams that could be chosen if the team must include at least 1 woman. [3]

SAT PREP www.satprep.co.in

5 Variables x and y are such that $y = (x-3)\ln(2x^2+1)$.

(i) Find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = 2$. [4]

(ii) Hence find the approximate change in y when x changes from 2 to 2.03. [2]

SAT PREP SP www.satprep.co.in

6 It is given that $\mathscr{E} = \{x : 1 \leqslant x \leqslant 12, \text{where } x \text{ is an integer}\}$ and that sets A, B, C and D are such that

$A = \{\text{multiples of } 3\}$,

$B = \{\text{prime numbers}\}$,

$C = \{\text{odd integers}\}$,

$D = \{\text{even integers}\}$.

Write down the following sets in terms of their elements.

(i) $A \cap B$ [1]

(ii) $A \cup C$ [1]

(iii) $A' \cap C$ [1]

(iv) $(D \cup B)'$ [1]

(v) Write down a set E such that $E \subset D$. [1]

SAT PREP SP www.satprep.co.in

7 Two variables, x and y, are such that $y = Ax^b$, where A and b are constants. When $\ln y$ is plotted against $\ln x$, a straight line graph is obtained which passes through the points $(1.4, 5.8)$ and $(2.2, 6.0)$.

(i) Find the value of A and of b. [4]

SAT PREP SP www.satprep.co.in

(ii) Calculate the value of y when $x = 5$. [2]

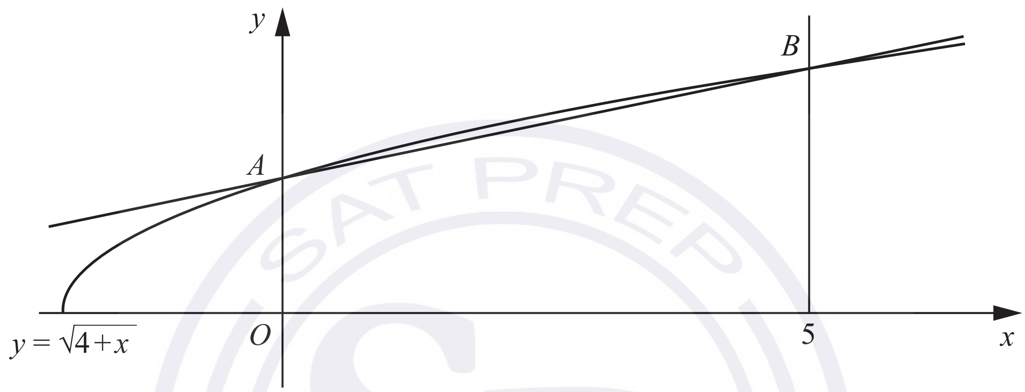
8 Find the equation of the tangent to the curve $y = \dfrac{2x - 1}{\sqrt{x^2 + 5}}$ at the point where $x = 2$. [7]

SAT PREP
SP
www.satprep.co.in

9 You are not allowed to use a calculator in this question.

(i) Find $\int \sqrt{4+x}\,\mathrm{d}x$. [2]

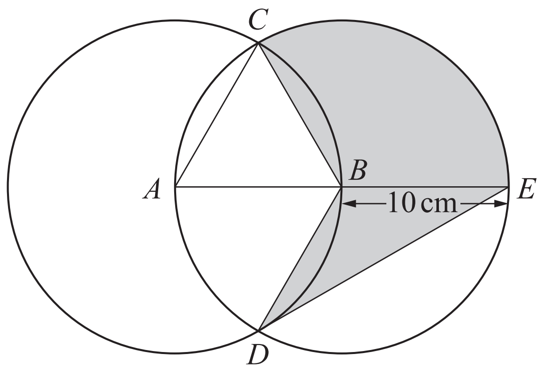
(ii)



The diagram shows the graph of $y = \sqrt{4+x}$, which meets the y-axis at the point A and the line $x = 5$ at the point B. Using your answer to part **(i)**, find the area of the region enclosed by the curve and the straight line AB. [5]

© UCLES 2015

10



The diagram shows two circles, centres A and B, each of radius 10 cm. The point B lies on the circumference of the circle with centre A. The two circles intersect at the points C and D. The point E lies on the circumference of the circle centre B such that ABE is a diameter.

(i) Explain why triangle ABC is equilateral. [1]

(ii) Write down, in terms of π, angle CBE. [1]

(iii) Find the perimeter of the shaded region. [5]

www.satprep.co.in SAT PREP SP

(iv) Find the area of the shaded region. [3]

11 **(a)** A function f is such that $f(x) = x^2 + 6x + 4$ for $x \geqslant 0$.

(i) Show that $x^2 + 6x + 4$ can be written in the form $(x + a)^2 + b$, where a and b are integers. [2]

(ii) Write down the range of f. [1]

(iii) Find f^{-1} and state its domain. [3]

SAT PREP SP www.satprep.co.in

(b) Functions g and h are such that, for $x \in \mathbb{R}$,

$$g(x) = e^x \quad \text{and} \quad h(x) = 5x + 2.$$

Solve $h^2g(x) = 37$. [4]

Question 12 is printed on the next page.

12 The line $2x - y + 1 = 0$ meets the curve $x^2 + 3y = 19$ at the points A and B. The perpendicular bisector of the line AB meets the x-axis at the point C. Find the area of the triangle ABC. [9]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1807045491

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (AC/CGW) 98537/3
© UCLES 2015

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

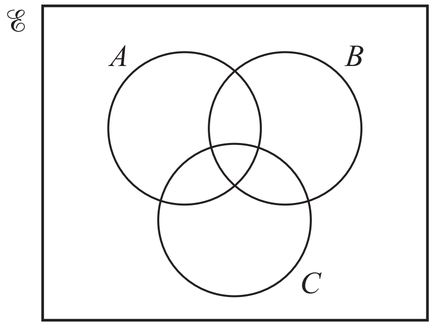
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 On the Venn diagrams below, shade the regions indicated.

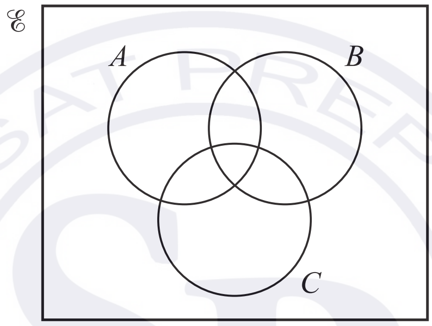
(i)



$A \cap (B \cup C)$

[1]

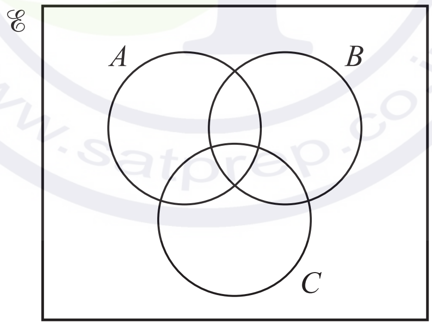
(ii)



$A \cup (B \cap C)$

[1]

(iii)



$(A \cup B)' \cap C$

[1]

© UCLES 2015

2 Solve $2\cos^2\left(3x - \frac{\pi}{4}\right) = 1$ for $0 \leqslant x \leqslant \frac{\pi}{3}$. [4]

SAT PREP SP www.satprep.co.in

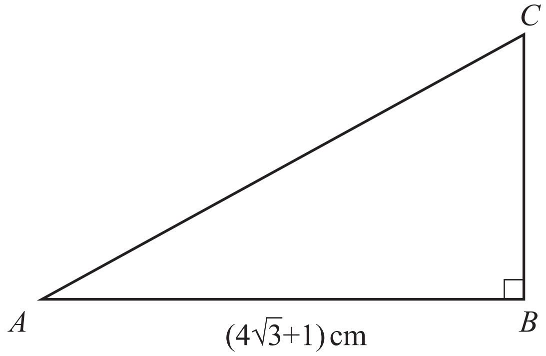
3 **(a)** Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 3 & 8 & 1 \\ 6 & 0 & 2 \end{pmatrix}$. Find **AB**. [2]

(b) Given that matrix $\mathbf{X} = \begin{pmatrix} 4 & 6 \\ 2 & -8 \end{pmatrix}$, find the integer value of m and of n such that $\mathbf{X}^2 = m\mathbf{X} + n\mathbf{I}$, where **I** is the identity matrix. [5]

SAT PREP SP www.satprep.co.in

(c) Given that matrix $\mathbf{Y} = \begin{pmatrix} a & 2 \\ 3 & a \end{pmatrix}$, find the values of a for which det $\mathbf{Y} = 0$. [2]

4 **You are not allowed to use a calculator in this question**.



The diagram shows triangle ABC with side $AB = (4\sqrt{3} + 1)$ cm. Angle B is a right angle. It is given that the area of this triangle is $\frac{47}{2}$ cm^2.

(i) Find the length of the side BC in the form $(a\sqrt{3} + b)$ cm, where a and b are integers. [3]

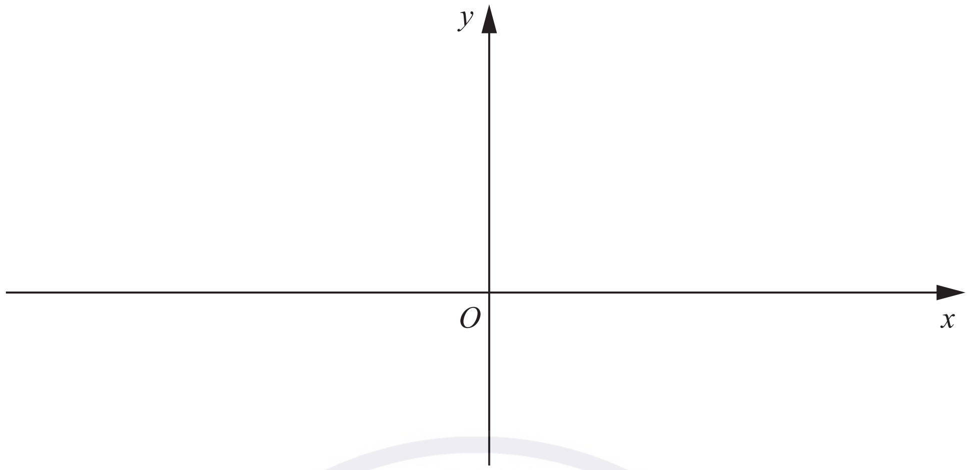
(ii) Hence find the length of the side AC in the form $p\sqrt{2}$ cm, where p is an integer. [2]

© UCLES 2015

5 Find the equation of the normal to the curve $y = 5\tan x - 3$ at the point where $x = \frac{\pi}{4}$. [5]

SAT PREP
SP
www.satprep.co.in

6 **(i)** On the axes below, sketch the graph of $y = |x^2 - 4x - 12|$ showing the coordinates of the points where the graph meets the axes. [3]



(ii) Find the coordinates of the stationary point on the curve $y = |x^2 - 4x - 12|$. [2]

(iii) Find the values of k such that the equation $|x^2 - 4x - 12| = k$ has only 2 solutions. [2]

SAT PREP www.satprep.co.in

© UCLES 2015

7 A curve, showing the relationship between two variables x and y, is such that $\dfrac{\mathrm{d}^2y}{\mathrm{d}x^2} = 6\cos 3x$. Given that the curve has a gradient of $4\sqrt{3}$ at the point $\left(\dfrac{\pi}{9},\ -\dfrac{1}{3}\right)$, find the equation of the curve. [6]

www.satprep.co.in SAT PREP SP

8 **(a)** Given that the first 4 terms in the expansion of $(2+kx)^8$ are $256+256x+px^2+qx^3$, find the value of k, of p and of q. [3]

(b) Find the term that is independent of x in the expansion of $\left(x-\dfrac{2}{x^2}\right)^9$. [3]

SAT PREP
www.satprep.co.in

9 **(a)** Five different books are to be arranged on a shelf. There are 2 Mathematics books and 3 History books. Find the number of different arrangements of books if

(i) the Mathematics books are next to each other, [2]

(ii) the Mathematics books are not next to each other. [2]

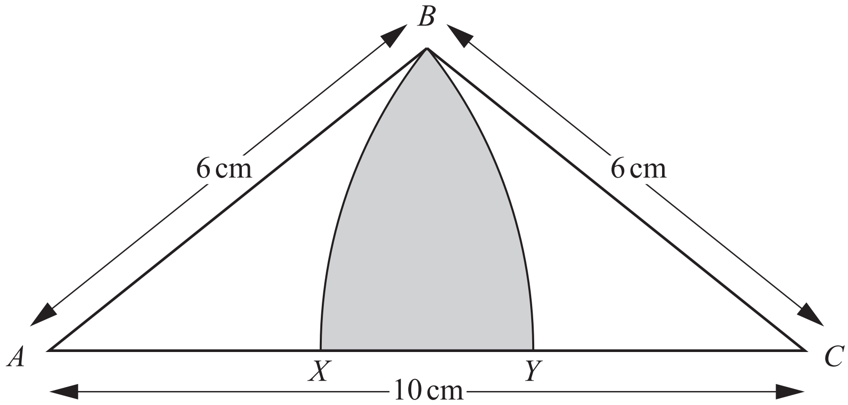
(b) To compete in a quiz, a team of 5 is to be chosen from a group of 9 men and 6 women. Find the number of different teams that can be chosen if

(i) there are no restrictions, [1]

(ii) at least two men must be on the team. [3]

SAT PREP www.satprep.co.in

10



The diagram shows an isosceles triangle ABC such that $AC = 10$ cm and $AB = BC = 6$ cm. BX is an arc of a circle, centre C, and BY is an arc of a circle, centre A.

(i) Show that angle $ABC = 1.970$ radians, correct to 3 decimal places. [2]

(ii) Find the perimeter of the shaded region. [4]

(iii) Find the area of the shaded region. [3]

SAT PREP
SP
www.satprep.co.in

11 The line $x - y + 2 = 0$ intersects the curve $2x^2 - y^2 + 2x + 1 = 0$ at the points A and B. The perpendicular bisector of the line AB intersects the curve at the points C and D. Find the length of the line CD in the form $a\sqrt{5}$, where a is an integer. [10]

© UCLES 2015

Question 12 is printed on the next page.

12 **(a)** Given that $2^{2x-1} \times 4^{x+y} = 128$ and $\dfrac{9^{2y-x}}{27^{y-4}} = 1$, find the value of each of the integers x and y. [4]

(b) Solve $2(5)^{2z} + 5^{z} - 1 = 0.$ [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2015

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

1112016069

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (RW/SW) 91459/2
© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2015

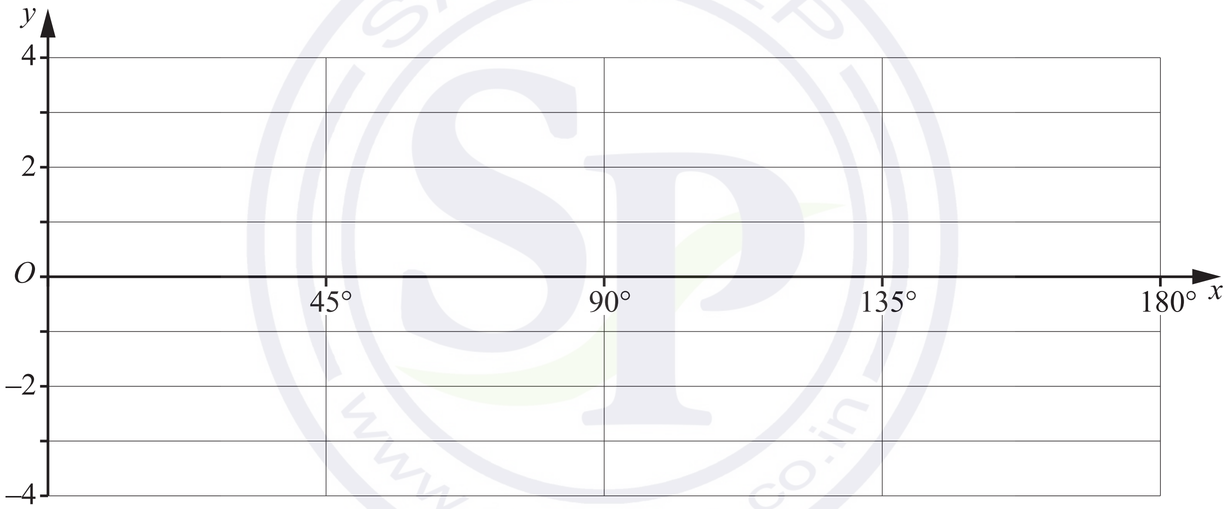
1 **(i)** State the period of $\sin 2x$. [1]

(ii) State the amplitude of $1 + 2\cos 3x$. [1]

(iii) On the axes below, sketch the graph of

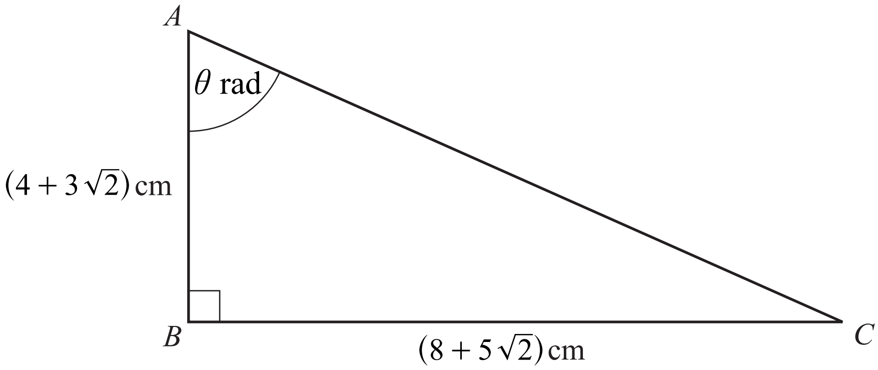
(a) $y = \sin 2x$ for $0° \leqslant x \leqslant 180°$, [1]

(b) $y = 1 + 2\cos 3x$ for $0° \leqslant x \leqslant 180°$. [2]



(iv) State the number of solutions of $\sin 2x - 2\cos 3x = 1$ for $0° \leqslant x \leqslant 180°$. [1]

2 Do not use a calculator in this question.



The diagram shows the triangle ABC where angle B is a right angle, $AB = (4 + 3\sqrt{2})$ cm, $BC = (8 + 5\sqrt{2})$ cm and angle $BAC = \theta$ radians. Showing all your working, find

(i) $\tan\theta$ in the form $a + b\sqrt{2}$, where a and b are integers, [2]

(ii) $\sec^2\theta$ in the form $c + d\sqrt{2}$, where c and d are integers. [3]

www.satprep.co.in SAT PREP SP

3 **(i)** Find the first 4 terms in the expansion of $(2+x^2)^6$ in ascending powers of x. [3]

(ii) Find the term independent of x in the expansion of $(2+x^2)^6\left(1-\frac{3}{x^2}\right)^2$. [3]

SAT PREP SP www.satprep.co.in

4 **(a)** Given that the matrix $\mathbf{X} = \begin{pmatrix} 2 & -4 \\ k & 0 \end{pmatrix}$, find $\mathbf{X}^2$ in terms of the constant k. [2]

(b) Given that the matrix $\mathbf{A} = \begin{pmatrix} a & 1 \\ b & 5 \end{pmatrix}$ and the matrix $\mathbf{A}^{-1} = \begin{pmatrix} \frac{5}{6} & -\frac{1}{6} \\ -\frac{2}{3} & \frac{1}{3} \end{pmatrix}$, find the value of each of the integers a and b. [3]

www.satprep.co.in

5 The curve $y = xy + x^2 - 4$ intersects the line $y = 3x - 1$ at the points A and B. Find the equation of the perpendicular bisector of the line AB. [8]

© UCLES 2015

6 The polynomial $f(x) = ax^3 - 15x^2 + bx - 2$ has a factor of $2x - 1$ and a remainder of 5 when divided by $x - 1$.

(i) Show that $b = 8$ and find the value of a. [4]

(ii) Using the values of a and b from part **(i)**, express $f(x)$ in the form $(2x - 1)\,g(x)$, where $g(x)$ is a quadratic factor to be found. [2]

SAT PREP SP www.satprep.co.in

(iii) Show that the equation $f(x) = 0$ has only one real root. [2]

7 The point A, where $x = 0$, lies on the curve $y = \dfrac{\ln(4x^2 + 3)}{x - 1}$. The normal to the curve at A meets the x-axis at the point B.

(i) Find the equation of this normal. [7]

(ii) Find the area of the triangle AOB, where O is the origin. [2]

SAT PREP
SP
www.satprep.co.in

8 It is given that $f(x) = 3e^{2x}$ for $x \geqslant 0$,
$g(x) = (x+2)^2 + 5$ for $x \geqslant 0$.

(i) Write down the range of f and of g. [2]

(ii) Find g^{-1}, stating its domain. [3]

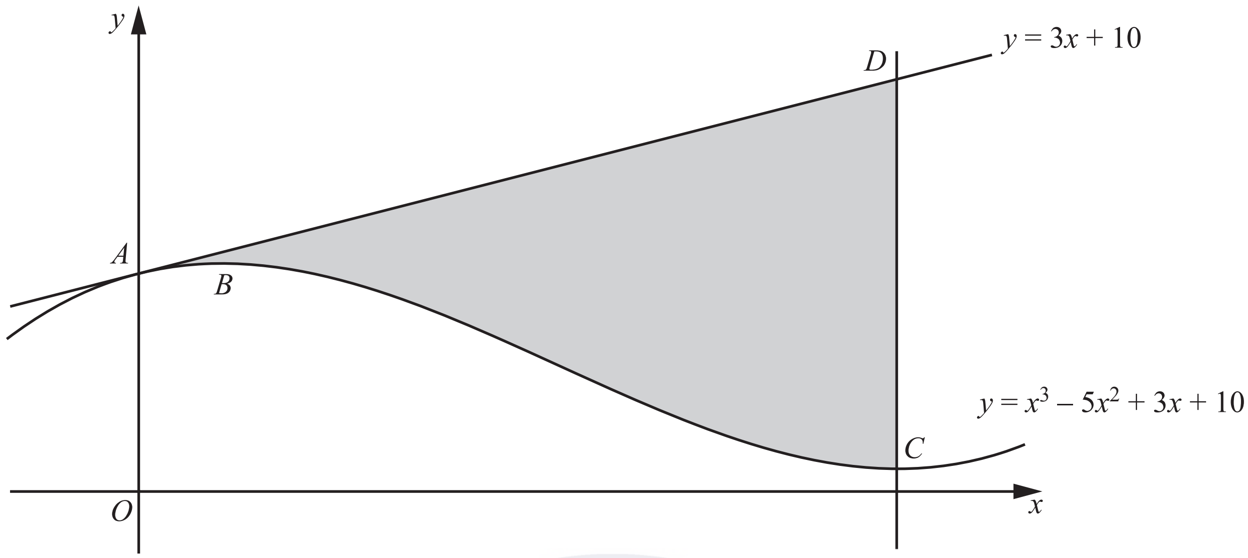
(iii) Find the exact solution of $gf(x) = 41$. [4]

SAT PREP SP www.satprep.co.in

(iv) Evaluate $f'(\ln 4)$. [2]

SAT PREP
SP
www.satprep.co.in

9



The diagram shows parts of the line $y = 3x + 10$ and the curve $y = x^3 - 5x^2 + 3x + 10$. The line and the curve both pass through the point A on the y-axis. The curve has a maximum at the point B and a minimum at the point C. The line through C, parallel to the y-axis, intersects the line $y = 3x + 10$ at the point D.

(i) Show that the line AD is a tangent to the curve at A. [2]

(ii) Find the x-coordinate of B and of C. [3]

(iii) Find the area of the shaded region *ABCD*, showing all your working. [5]

10 **(a)** Solve $4\sin x = \operatorname{cosec} x$ for $0° \leqslant x \leqslant 360°$. [3]

(b) Solve $\tan^2 3y - 2\sec 3y - 2 = 0$ for $0° \leqslant y \leqslant 180°$. [6]

SAT PREP
SP
www.satprep.co.in

(c) Solve $\tan\left(z - \frac{\pi}{3}\right) = \sqrt{3}$ for $0 \leqslant z \leqslant 2\pi$ radians. [3]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2015

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

9937848414

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (CW/JG) 91463/2
© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2015

1 Given that the graph of $y = (2k+5)x^2 + kx + 1$ does not meet the x-axis, find the possible values of k. [4]

2 Show that $\dfrac{\tan\theta + \cot\theta}{\operatorname{cosec}\theta} = \sec\theta$. [4]

SAT PREP SP www.satprep.co.in

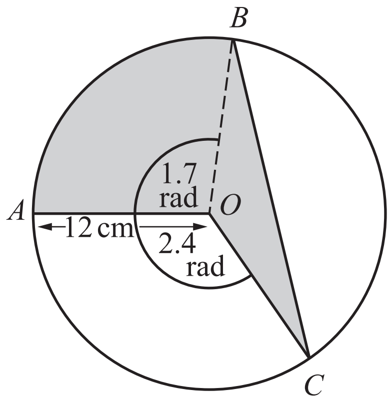
3 Find the inverse of the matrix $\begin{pmatrix} 4 & 2 \\ 5 & 3 \end{pmatrix}$ and hence solve the simultaneous equations

$$4x + 2y - 8 = 0,$$
$$5x + 3y - 9 = 0.$$

[5]

SAT PREP SP www.satprep.co.in

4



The diagram shows a circle, centre O, radius 12 cm. The points A, B and C lie on the circumference of this circle such that angle AOB is 1.7 radians and angle AOC is 2.4 radians.

(i) Find the area of the shaded region. [4]

(ii) Find the perimeter of the shaded region. [5]

5 **(a)** A security code is to be chosen using 6 of the following:
- the letters A, B and C
- the numbers 2, 3 and 5
- the symbols * and $.

None of the above may be used more than once. Find the number of different security codes that may be chosen if

(i) there are no restrictions, [1]

(ii) the security code starts with a letter and finishes with a symbol, [2]

(iii) the two symbols are next to each other in the security code. [3]

SAT PREP
SP
www.satprep.co.in

(b) Two teams, each of 4 students, are to be selected from a class of 8 boys and 6 girls. Find the number of different ways the two teams may be selected if

(i) there are no restrictions, [2]

(ii) one team is to contain boys only and the other team is to contain girls only. [2]

SAT PREP
www.satprep.co.in

6 A particle moves in a straight line such that its displacement, x m, from a fixed point O after t s, is given by $x = 10\ln(t^2 + 4) - 4t$.

(i) Find the initial displacement of the particle from O. [1]

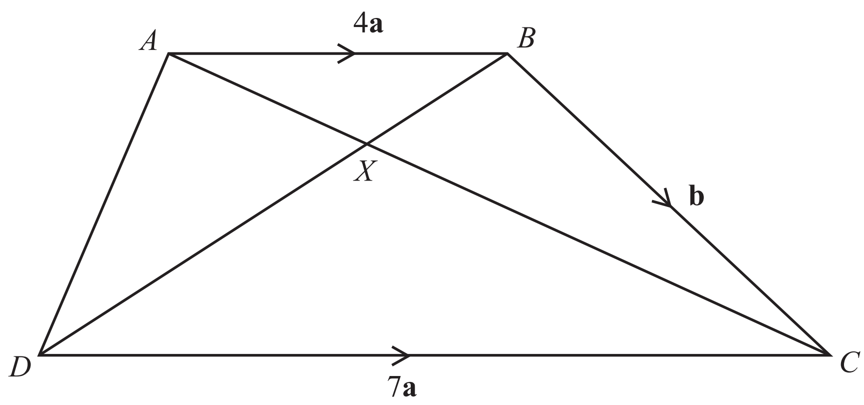
(ii) Find the values of t when the particle is instantaneously at rest. [4]

SAT PREP SP www.satprep.co.in

(iii) Find the value of t when the acceleration of the particle is zero. [5]

SAT PREP
SP
www.satprep.co.in

7



In the diagram $\overrightarrow{AB} = 4\mathbf{a}$, $\overrightarrow{BC} = \mathbf{b}$ and $\overrightarrow{DC} = 7\mathbf{a}$. The lines AC and DB intersect at the point X. Find, in terms of **a** and **b**,

(i) $\overrightarrow{DA}$, [1]

(ii) $\overrightarrow{DB}$. [1]

Given that $\overrightarrow{AX} = \lambda\overrightarrow{AC}$, find, in terms of **a**, **b** and λ,

(iii) $\overrightarrow{AX}$, [1]

(iv) $\overrightarrow{DX}$. [2]

© UCLES 2015

Given that $\overrightarrow{DX} = \mu\overrightarrow{DB}$,

(v) find the value of λ and of μ. [4]

www.satprep.co.in

8 **(i)** Find $\int(10e^{2x} + e^{-2x})\,dx$. [2]

(ii) Hence find $\int_{-k}^{k}(10e^{2x} + e^{-2x})\,dx$ in terms of the constant k. [2]

(iii) Given that $\int_{-k}^{k}(10e^{2x} + e^{-2x})\,dx = -60$, show that $11e^{2k} - 11e^{-2k} + 120 = 0$. [2]

www.satprep.co.in

(iv) Using a substitution of $y = e^{2k}$ or otherwise, find the value of k in the form $a \ln b$, where a and b are constants. [3]

www.satprep.co.in

9 A curve has equation $y = 4x + 3\cos 2x$. The normal to the curve at the point where $x = \frac{\pi}{4}$ meets the x- and y-axes at the points A and B respectively. Find the exact area of the triangle AOB, where O is the origin. [8]

SAT PREP
SP
www.satprep.co.in

10 **(a)** Solve $2\cos 3x = \sec 3x$ for $0° \leqslant x \leqslant 120°$. [3]

(b) Solve $3\operatorname{cosec}^2 y + 5\cot y - 5 = 0$ for $0° \leqslant y \leqslant 360°$. [5]

Question 10(c) is printed on the next page.

(c) Solve $2\sin\left(z+\frac{\pi}{3}\right)=1$ for $0 \leqslant z \leqslant 2\pi$ radians. [4]

www.satprep.co.in SAT PREP

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2015

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER		CANDIDATE NUMBER	

7552659088

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (ST/SW) 105918
© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2015

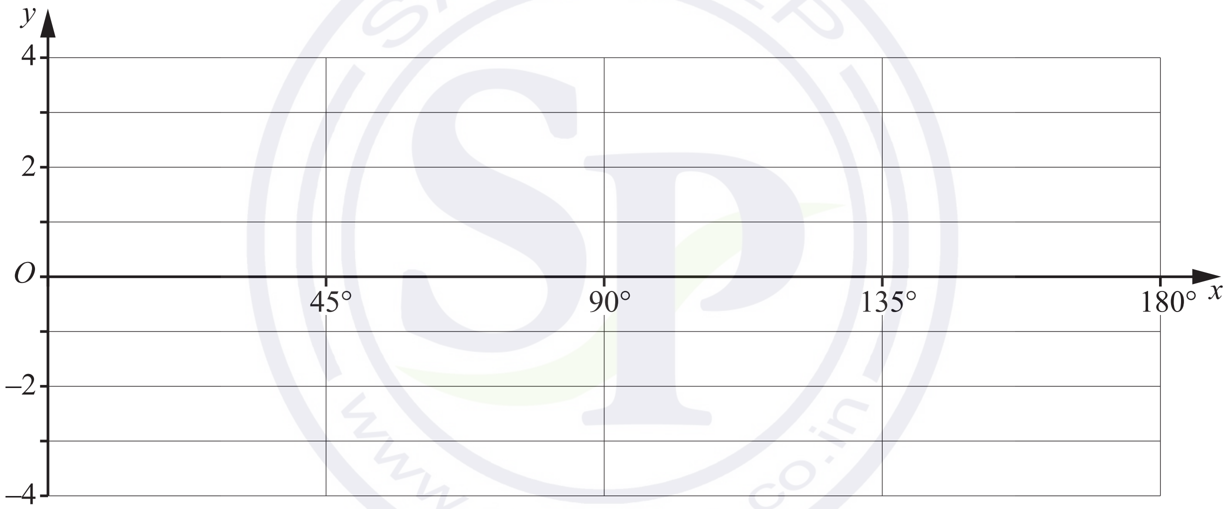
1 **(i)** State the period of $\sin 2x$. [1]

(ii) State the amplitude of $1 + 2\cos 3x$. [1]

(iii) On the axes below, sketch the graph of

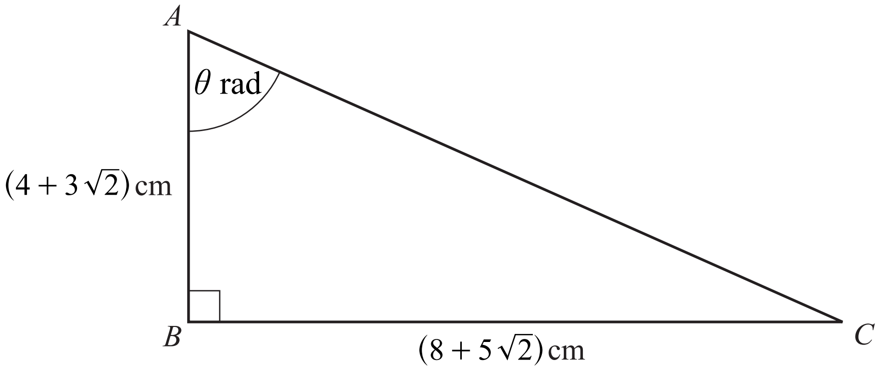
(a) $y = \sin 2x$ for $0° \leqslant x \leqslant 180°$, [1]

(b) $y = 1 + 2\cos 3x$ for $0° \leqslant x \leqslant 180°$. [2]



(iv) State the number of solutions of $\sin 2x - 2\cos 3x = 1$ for $0° \leqslant x \leqslant 180°$. [1]

2 Do not use a calculator in this question.



The diagram shows the triangle ABC where angle B is a right angle, $AB = (4+3\sqrt{2})$ cm, $BC = (8+5\sqrt{2})$ cm and angle $BAC = \theta$ radians. Showing all your working, find

(i) $\tan\theta$ in the form $a + b\sqrt{2}$, where a and b are integers, [2]

(ii) $\sec^2\theta$ in the form $c + d\sqrt{2}$, where c and d are integers. [3]

3 **(i)** Find the first 4 terms in the expansion of $(2+x^2)^6$ in ascending powers of x. [3]

(ii) Find the term independent of x in the expansion of $(2+x^2)^6\left(1-\dfrac{3}{x^2}\right)^2$. [3]

SAT PREP SP www.satprep.co.in

4 **(a)** Given that the matrix $\mathbf{X} = \begin{pmatrix} 2 & -4 \\ k & 0 \end{pmatrix}$, find $\mathbf{X}^2$ in terms of the constant k. [2]

(b) Given that the matrix $\mathbf{A} = \begin{pmatrix} a & 1 \\ b & 5 \end{pmatrix}$ and the matrix $\mathbf{A}^{-1} = \begin{pmatrix} \frac{5}{6} & -\frac{1}{6} \\ -\frac{2}{3} & \frac{1}{3} \end{pmatrix}$, find the value of each of the integers a and b. [3]

www.satprep.co.in

5 The curve $y = xy + x^2 - 4$ intersects the line $y = 3x - 1$ at the points A and B. Find the equation of the perpendicular bisector of the line AB. [8]

SAT PREP SP www.satprep.co.in

6 The polynomial $f(x) = ax^3 - 15x^2 + bx - 2$ has a factor of $2x - 1$ and a remainder of 5 when divided by $x - 1$.

(i) Show that $b = 8$ and find the value of a. [4]

(ii) Using the values of a and b from part **(i)**, express $f(x)$ in the form $(2x - 1)\,g(x)$, where $g(x)$ is a quadratic factor to be found. [2]

(iii) Show that the equation $f(x) = 0$ has only one real root. [2]

www.satprep.co.in

7 The point A, where $x = 0$, lies on the curve $y = \dfrac{\ln(4x^2 + 3)}{x - 1}$. The normal to the curve at A meets the x-axis at the point B.

(i) Find the equation of this normal. [7]

(ii) Find the area of the triangle AOB, where O is the origin. [2]

SAT PREP SP www.satprep.co.in

8 It is given that $f(x) = 3e^{2x}$ for $x \geqslant 0$,
$g(x) = (x+2)^2 + 5$ for $x \geqslant 0$.

(i) Write down the range of f and of g. [2]

(ii) Find g^{-1}, stating its domain. [3]

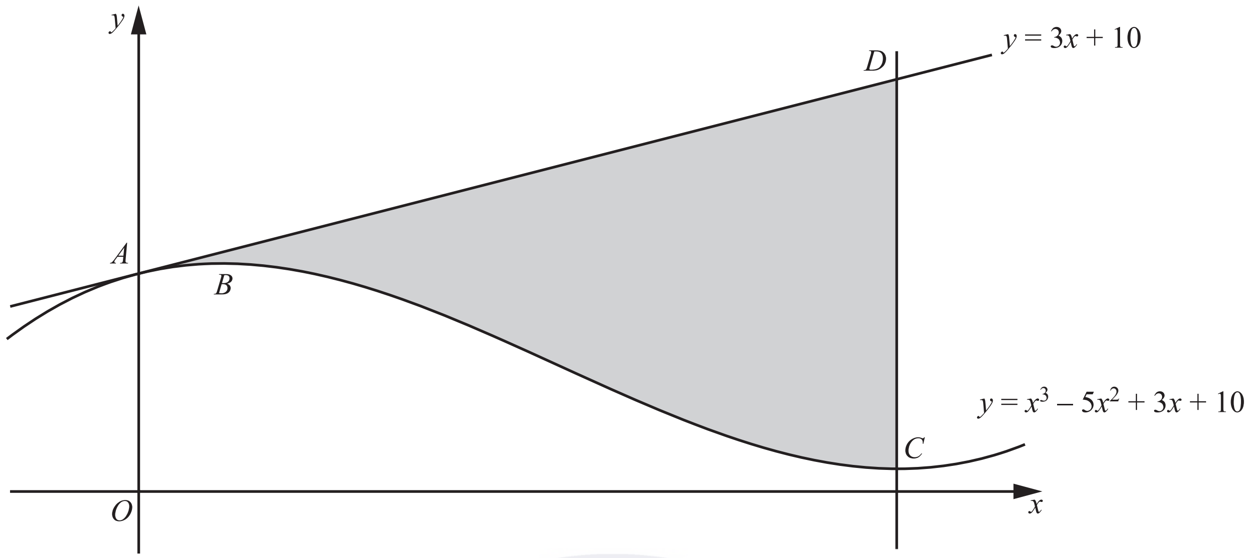
(iii) Find the exact solution of $gf(x) = 41$. [4]

SAT PREP SP www.satprep.co.in

(iv) Evaluate $f'(\ln 4)$. [2]

© UCLES 2015

9



The diagram shows parts of the line $y = 3x + 10$ and the curve $y = x^3 - 5x^2 + 3x + 10$. The line and the curve both pass through the point A on the y-axis. The curve has a maximum at the point B and a minimum at the point C. The line through C, parallel to the y-axis, intersects the line $y = 3x + 10$ at the point D.

(i) Show that the line AD is a tangent to the curve at A. [2]

(ii) Find the x-coordinate of B and of C. [3]

(iii) Find the area of the shaded region *ABCD*, showing all your working. [5]

SAT PREP
SP
www.satprep.co.in

10 **(a)** Solve $4\sin x = \operatorname{cosec} x$ for $0° \leqslant x \leqslant 360°$. [3]

(b) Solve $\tan^2 3y - 2\sec 3y - 2 = 0$ for $0° \leqslant y \leqslant 180°$. [6]

SAT PREP
SP
www.satprep.co.in

(c) Solve $\tan\left(z - \frac{\pi}{3}\right) = \sqrt{3}$ for $0 \leqslant z \leqslant 2\pi$ radians. [3]

SAT PREP SP www.satprep.co.in

© UCLES 2015

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0985148755

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **February/March 2015**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (CW/SG) 99296/4
© UCLES 2015

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2015

1 A sports club has members who play a variety of sports. Sets C, F and T are such that

C = { members who play cricket},
F = { members who play football},
T = { members who play tennis}.

Describe the following in words.

(i) $C \cup F$ [1]

(ii) T' [1]

(iii) $F \cap T = \varnothing$ [1]

(iv) $n(C \cap T) = 10$ [1]

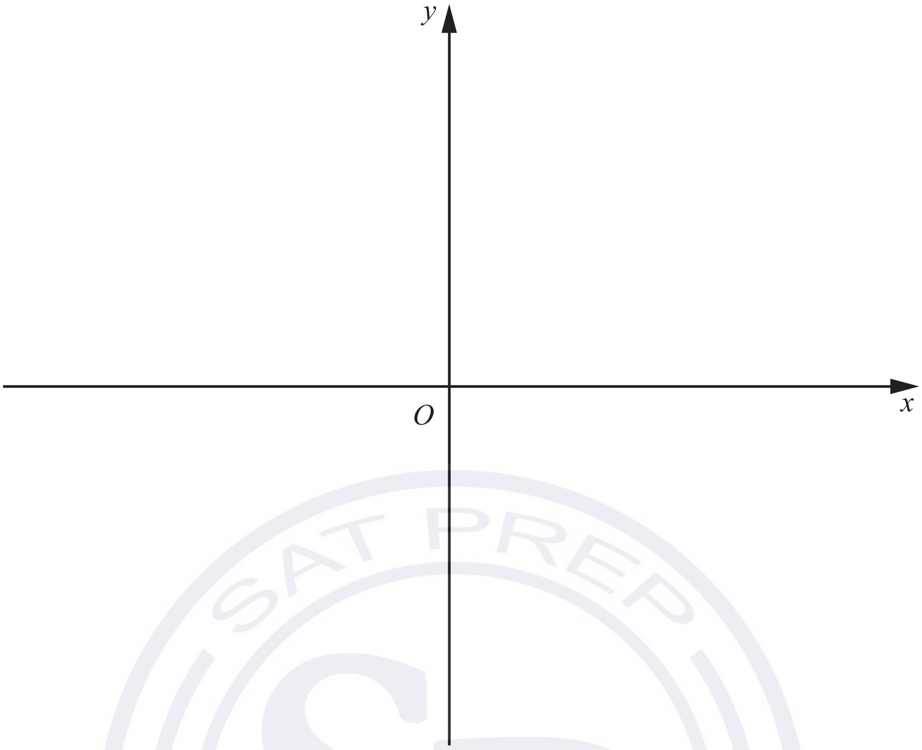
SAT PREP SP www.satprep.co.in

2 Find the values of k for which the line $y = kx - 3$ does not meet the curve $y = 2x^2 - 3x + k$. [5]

www.satprep.co.in

© UCLES 2015

3 **(i)** On the axes below sketch the graph of $y = |4 - 5x|$, stating the coordinates of the points where the graph meets the coordinate axes. [3]



(ii) Solve $|4 - 5x| = 9$. [3]

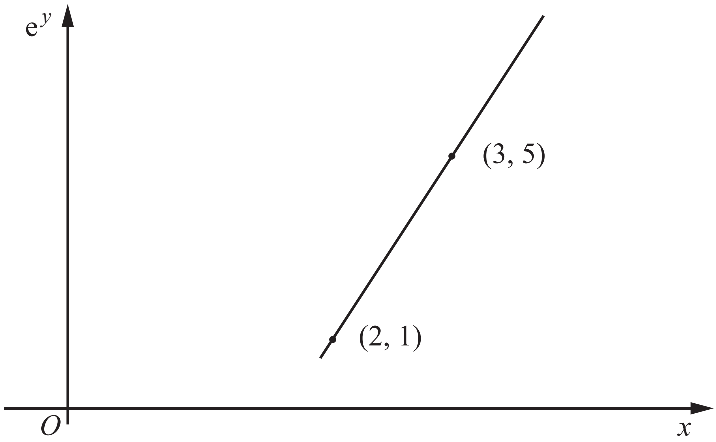
SAT PREP
SP
www.satprep.co.in

4 **(i)** Write down, in ascending powers of x, the first 3 terms in the expansion of $(3+2x)^6$. Give each term in its simplest form. [3]

(ii) Hence find the coefficient of x^2 in the expansion of $(2-x)(3+2x)^6$. [2]

SAT PREP www.satprep.co.in

5



Variables x and y are such that when e^y is plotted against x a straight line graph is obtained. The diagram shows this straight line graph which passes through the points (2, 1) and (3, 5).

(i) Express y in terms of x. [4]

(ii) State the values of x for which y exists. [1]

(iii) Find the value of x when $y = \ln 6$. [1]

© UCLES 2015

6 **(i)** Given that $y = \frac{\tan 2x}{x}$, find $\frac{dy}{dx}$. [3]

(ii) Hence find the equation of the normal to the curve $y = \frac{\tan 2x}{x}$ at the point where $x = \frac{\pi}{8}$. [3]

SAT PREP SP www.satprep.co.in

7 The polynomial $p(x) = ax^3 + bx^2 - 3x - 4$ has a factor of $2x - 1$ and leaves a remainder of -10 when divided by $x + 2$.

(i) Show that $a = 10$ and find the value of b. [4]

(ii) Given that $p(x) = (2x - 1)(rx^2 + sx + t)$, find the value of each of the integers r, s and t. [2]

(iii) Hence find the exact solutions of $p(x) = 0$. [3]

www.satprep.co.in SAT PREP

8 **(a)** A function f is such that $f(\theta) = \sin 2\theta$ for $0 \leqslant \theta \leqslant \frac{\pi}{2}$.

(i) Write down the range of f. [1]

(ii) Write down a suitable restricted domain for f such that f^{-1} exists. [1]

(b) Functions g and h are such that

$$g(x) = 2 + 4\ln x \text{ for } x > 0,$$
$$h(x) = x^2 + 4 \text{ for } x > 0.$$

(i) Find g^{-1}, stating its domain and its range. [4]

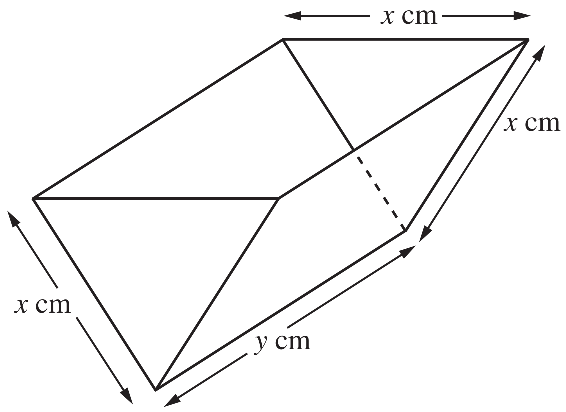
(ii) Solve $gh(x) = 10$. [3]

SAT PREP SP www.satprep.co.in

(iii) Solve $g'(x) = h'(x)$. [3]

© UCLES 2015

9



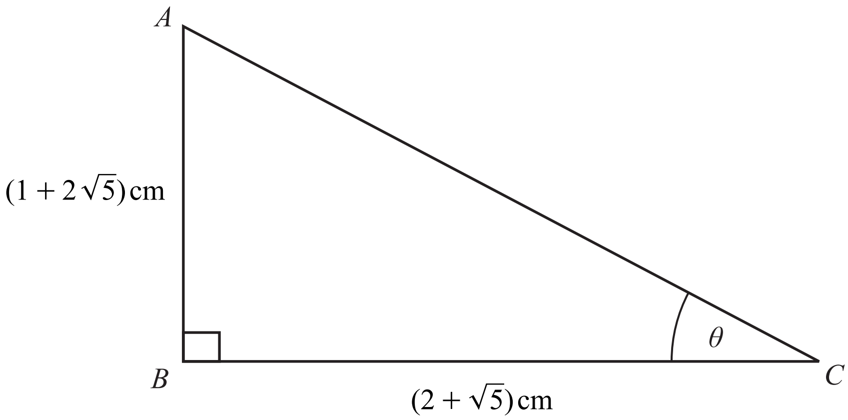
The diagram shows an empty container in the form of an open triangular prism. The triangular faces are equilateral with a side of x cm and the length of each rectangular face is y cm. The container is made from thin sheet metal. When full, the container holds $200\sqrt{3}\ \text{cm}^3$.

(i) Show that $A\ \text{cm}^2$, the total area of the thin sheet metal used, is given by $A = \dfrac{\sqrt{3}x^2}{2} + \dfrac{1600}{x}$. [5]

(ii) Given that x and y can vary, find the stationary value of A and determine its nature. [6]

SAT PREP
SP
www.satprep.co.in

10 Do not use a calculator in this question.



The diagram shows triangle ABC which is right-angled at the point B. The side $AB = (1 + 2\sqrt{5})$ cm and the side $BC = (2 + \sqrt{5})$ cm. Angle $BCA = \theta$.

(i) Find $\tan\theta$ in the form $a + b\sqrt{5}$, where a and b are integers to be found. [3]

(ii) Hence find $\sec^2\theta$ in the form $c + d\sqrt{5}$, where c and d are integers to be found. [3]

© UCLES 2015

11 **(a)** **(i)** Show that $\dfrac{\operatorname{cosec} x}{\cot x + \tan x} = \cos x$. [3]

(ii) Hence solve $\dfrac{\operatorname{cosec} 3y}{\cot 3y + \tan 3y} = 0.5$ for $0 \leqslant y \leqslant \pi$ radians, giving your answers in terms of π. [3]

Question 11(b) is printed on the next page.

(b) Solve $2\sin z + 8\cos^2 z = 5$ for $0° < z < 360°$. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

8023652713

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (LK/SLM) 81862/3
© UCLES 2014

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\,.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}\,b + \binom{n}{2}a^{n-2}\,b^2 + \ldots + \binom{n}{r}a^{n-r}\,b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

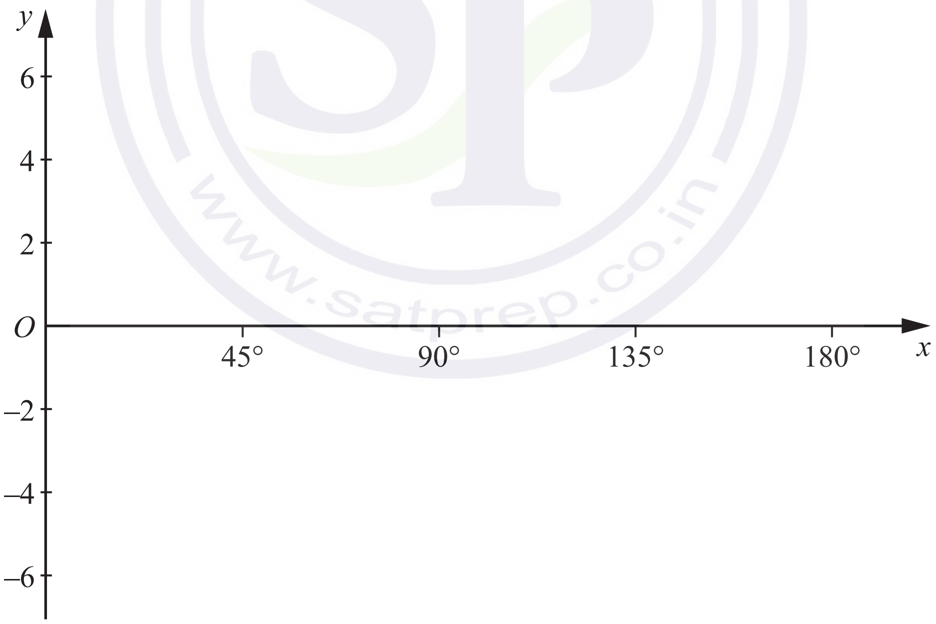
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2}\,bc \sin A$$

© UCLES 2014

1 Find the coordinates of the stationary point on the curve $y = x^2 + \frac{16}{x}$. [4]

2 **(a)** On the axes below, sketch the curve $y = 3\cos 2x - 1$ for $0° \leqslant x \leqslant 180°$. [3]



(b) **(i)** State the amplitude of $1 - 4\sin 2x$. [1]

(ii) State the period of $5\tan 3x + 1$. [1]

3 A curve is such that $\dfrac{dy}{dx} = \dfrac{2}{\sqrt{x+3}}$ for $x > -3$. The curve passes through the point $(6, 10)$.

(i) Find the equation of the curve. [4]

(ii) Find the x-coordinate of the point on the curve where $y = 6$. [1]

www.satprep.co.in

© UCLES 2014

4 **(i)** Using the substitution $y = 5^x$, show that the equation $5^{2x+1} - 5^{x+1} + 2 = 2(5^x)$ can be written in the form $ay^2 + by + 2 = 0$, where a and b are constants to be found. [2]

(ii) Hence solve the equation $5^{2x+1} - 5^{x+1} + 2 = 2(5^x)$. [4]

SAT PREP SP www.satprep.co.in

5 **(i)** Find the equation of the tangent to the curve $y = x^3 - \ln x$ at the point on the curve where $x = 1$. [4]

(ii) Show that this tangent bisects the line joining the points $(-2, 16)$ and $(12, 2)$. [2]

www.satprep.co.in SAT PREP SP

6 **(i)** Given that the coefficient of x^2 in the expansion of $(2 + px)^6$ is 60, find the value of the positive constant p. [3]

(ii) Using your value of p, find the coefficient of x^2 in the expansion of $(3 - x)(2 + px)^6$. [3]

SAT PREP www.satprep.co.in

7 Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} 3a & 2b \\ -a & b \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -a & b \\ 2a & 2b \end{pmatrix}$, where a and b are non-zero constants.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Using your answer to part **(i)**, find the matrix **X** such that $\mathbf{XA} = \mathbf{B}$. [4]

SAT PREP SP www.satprep.co.in

8 The point P lies on the line joining $A(-2, 3)$ and $B(10, 19)$ such that $AP:PB = 1:3$.

(i) Show that the x-coordinate of P is 1 and find the y-coordinate of P. [2]

(ii) Find the equation of the line through P which is perpendicular to AB. [3]

SAT PREP
SP
www.satprep.co.in

The line through P which is perpendicular to AB meets the y-axis at the point Q.

(iii) Find the area of the triangle AQB. [3]

9 The table shows experimental values of variables x and y.

x	2	2.5	3	3.5	4
y	18.8	29.6	46.9	74.1	117.2

(i) By plotting a suitable straight line graph on the grid below, show that x and y are related by the equation $y = ab^x$, where a and b are constants. [4]

© UCLES 2014

(ii) Use your graph to find the value of a and of b. [4]

10 (a) (i) Find how many different 4-digit numbers can be formed using the digits 1, 2, 3, 4, 5 and 6 if no digit is repeated. [1]

(ii) How many of the 4-digit numbers found in part **(i)** are greater than 6000? [1]

(iii) How many of the 4-digit numbers found in part **(i)** are greater than 6000 and are odd? [1]

(b) A quiz team of 10 players is to be chosen from a class of 8 boys and 12 girls.

(i) Find the number of different teams that can be chosen if the team has to have equal numbers of girls and boys. [3]

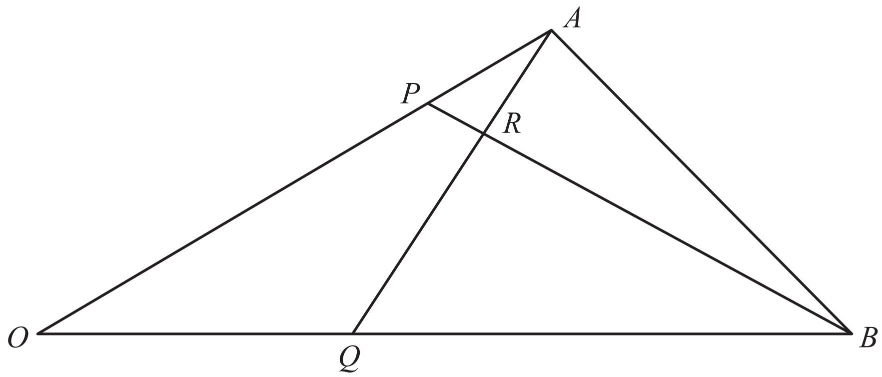
(ii) Find the number of different teams that can be chosen if the team has to include the youngest and oldest boy and the youngest and oldest girl. [2]

11 **(a)** Solve $2\cos 3x = \cot 3x$ for $0° \leqslant x \leqslant 90°$. [5]

(b) Solve $\sec\left(y+\frac{\pi}{2}\right)=-2$ for $0 \leqslant y \leqslant \pi$ radians. [4]

SAT PREP
www.satprep.co.in

12



The position vectors of points A and B relative to an origin O are **a** and **b** respectively. The point P is such that $\overrightarrow{OP} = \mu\overrightarrow{OA}$. The point Q is such that $\overrightarrow{OQ} = \lambda\overrightarrow{OB}$. The lines AQ and BP intersect at the point R.

(i) Express $\overrightarrow{AQ}$ in terms of λ, **a** and **b**. [1]

(ii) Express $\overrightarrow{BP}$ in terms of μ, **a** and **b**. [1]

It is given that $3\overrightarrow{AR} = \overrightarrow{AQ}$ and $8\overrightarrow{BR} = 7\overrightarrow{BP}$.

(iii) Express $\overrightarrow{OR}$ in terms of λ, **a** and **b**. [2]

(iv) Express $\overrightarrow{OR}$ in terms of μ, **a** and **b**. [2]

(v) Hence find the value of μ and of λ. [3]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2014

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

6941654349

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (LK/SLM) 97555
© UCLES 2014

CAMBRIDGE International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

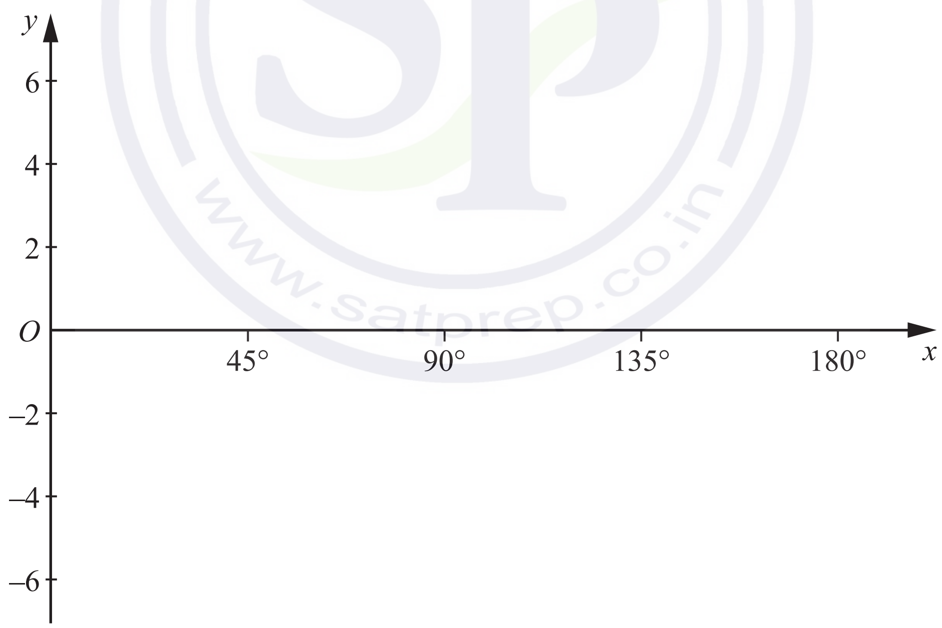
$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2014

1 Find the coordinates of the stationary point on the curve $y = x^2 + \frac{16}{x}$. [4]

---

2 **(a)** On the axes below, sketch the curve $y = 3\cos 2x - 1$ for $0° \leqslant x \leqslant 180°$. [3]



(b) **(i)** State the amplitude of $1 - 4\sin 2x$. [1]

(ii) State the period of $5\tan 3x + 1$. [1]

SAT PREP
www.satprep.co.in

3 A curve is such that $\frac{dy}{dx} = \frac{2}{\sqrt{x+3}}$ for $x > -3$. The curve passes through the point $(6, 10)$.

(i) Find the equation of the curve. [4]

(ii) Find the x-coordinate of the point on the curve where $y = 6$. [1]

www.satprep.co.in

4 **(i)** Using the substitution $y = 5^x$, show that the equation $5^{2x+1} - 5^{x+1} + 2 = 2(5^x)$ can be written in the form $ay^2 + by + 2 = 0$, where a and b are constants to be found. [2]

(ii) Hence solve the equation $5^{2x+1} - 5^{x+1} + 2 = 2(5^x)$. [4]

SAT PREP SP www.satprep.co.in

5 **(i)** Find the equation of the tangent to the curve $y = x^3 - \ln x$ at the point on the curve where $x = 1$. [4]

(ii) Show that this tangent bisects the line joining the points $(-2, 16)$ and $(12, 2)$. [2]

SAT PREP SP www.satprep.co.in

6 **(i)** Given that the coefficient of x^2 in the expansion of $(2+px)^6$ is 60, find the value of the positive constant p. [3]

(ii) Using your value of p, find the coefficient of x^2 in the expansion of $(3-x)(2+px)^6$. [3]

SAT PREP
SP
www.satprep.co.in

7 Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} 3a & 2b \\ -a & b \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} -a & b \\ 2a & 2b \end{pmatrix}$, where a and b are non-zero constants.

(i) Find $\mathbf{A}^{-1}$. [2]

(ii) Using your answer to part **(i)**, find the matrix **X** such that $\mathbf{XA} = \mathbf{B}$. [4]

SAT PREP SP www.satprep.co.in

8 The point P lies on the line joining $A(-2, 3)$ and $B(10, 19)$ such that $AP:PB = 1:3$.

(i) Show that the x-coordinate of P is 1 and find the y-coordinate of P. [2]

(ii) Find the equation of the line through P which is perpendicular to AB. [3]

The line through P which is perpendicular to AB meets the y-axis at the point Q.

(iii) Find the area of the triangle AQB. [3]

SAT PREP SP www.satprep.co.in

9 The table shows experimental values of variables x and y.

x	2	2.5	3	3.5	4
y	18.8	29.6	46.9	74.1	117.2

(i) By plotting a suitable straight line graph on the grid below, show that x and y are related by the equation $y = ab^x$, where a and b are constants. [4]

(ii) Use your graph to find the value of a and of b. [4]

SAT PREP SP www.satprep.co.in

10 **(a)** **(i)** Find how many different 4-digit numbers can be formed using the digits 1, 2, 3, 4, 5 and 6 if no digit is repeated. [1]

(ii) How many of the 4-digit numbers found in part **(i)** are greater than 6000? [1]

(iii) How many of the 4-digit numbers found in part **(i)** are greater than 6000 and are odd? [1]

(b) A quiz team of 10 players is to be chosen from a class of 8 boys and 12 girls.

(i) Find the number of different teams that can be chosen if the team has to have equal numbers of girls and boys. [3]

(ii) Find the number of different teams that can be chosen if the team has to include the youngest and oldest boy and the youngest and oldest girl. [2]

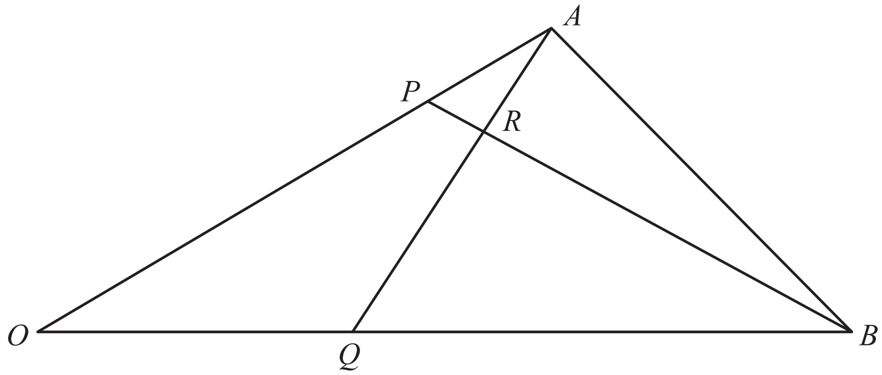
© UCLES 2014

11 **(a)** Solve $2\cos 3x = \cot 3x$ for $0° \leqslant x \leqslant 90°$. [5]

(b) Solve $\sec\left(y+\frac{\pi}{2}\right)=-2$ for $0 \leqslant y \leqslant \pi$ radians. [4]

SAT PREP SP www.satprep.co.in

12



The position vectors of points A and B relative to an origin O are **a** and **b** respectively. The point P is such that $\overrightarrow{OP} = \mu\overrightarrow{OA}$. The point Q is such that $\overrightarrow{OQ} = \lambda\overrightarrow{OB}$. The lines AQ and BP intersect at the point R.

(i) Express $\overrightarrow{AQ}$ in terms of λ, **a** and **b**. [1]

(ii) Express $\overrightarrow{BP}$ in terms of μ, **a** and **b**. [1]

It is given that $3\overrightarrow{AR} = \overrightarrow{AQ}$ and $8\overrightarrow{BR} = 7\overrightarrow{BP}$.

(iii) Express $\overrightarrow{OR}$ in terms of λ, **a** and **b**. [2]

© UCLES 2014

(iv) Express $\overrightarrow{OR}$ in terms of μ, **a** and **b**. [2]

(v) Hence find the value of μ and of λ. [3]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8538827950

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (LK/SLM) 81861/3
© UCLES 2014

CAMBRIDGE
International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

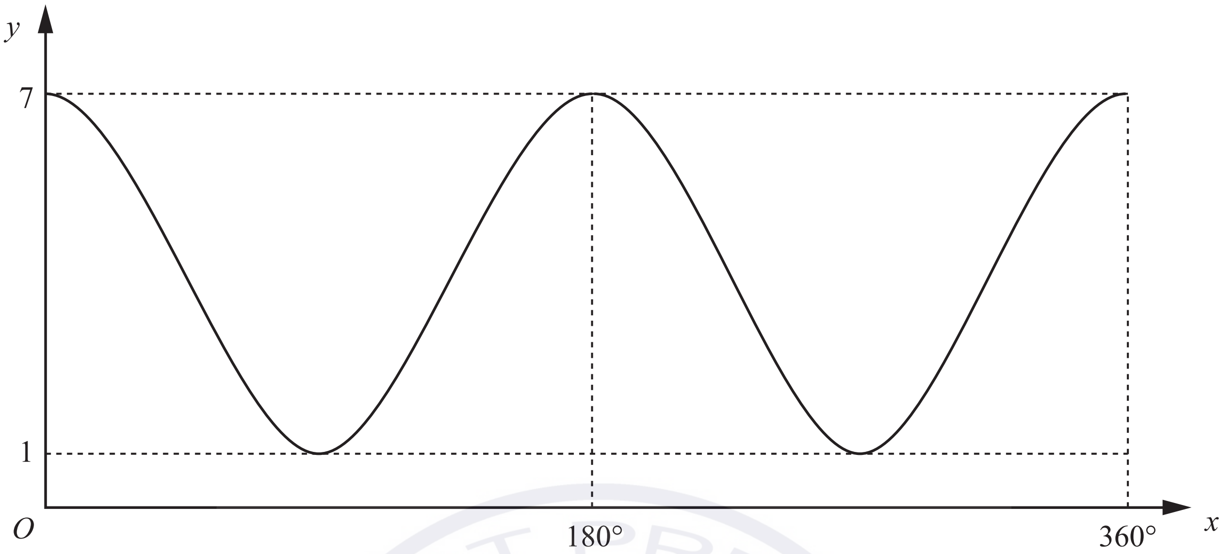
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

www.satprep.co.in

1 The diagram shows the graph of $y = a\cos bx + c$ for $0° \leqslant x \leqslant 360°$, where a, b and c are positive integers.



State the value of each of a, b and c. [3]

$a =$

$b =$

$c =$

www.satprep.co.in SAT PREP

2 The line $4y = x + 8$ cuts the curve $xy = 4 + 2x$ at the points A and B. Find the exact length of AB. [5]

© UCLES 2014

3 The universal set $\mathscr{E}$ is the set of real numbers. Sets A, B and C are such that

$$A = \{x : x^2 + 5x + 6 = 0\},$$

$$B = \{x : (x-3)(x+2)(x+1) = 0\},$$

$$C = \{x : x^2 + x + 3 = 0\}.$$

(i) State the value of each of n(A), n(B) and n(C). [3]

n(A) =

n(B) =

n(C) =

(ii) List the elements in the set $A \cup B$. [1]

(iii) List the elements in the set $A \cap B$. [1]

(iv) Describe the set C'. [1]

© UCLES 2014

4 **(a)** Solve $3\sin x + 5\cos x = 0$ for $0° \leqslant x \leqslant 360°$. [3]

(b) Solve $\operatorname{cosec}\left(3y + \frac{\pi}{4}\right) = 2$ for $0 \leqslant y \leqslant \pi$ radians. [5]

SAT PREP SP www.satprep.co.in

5 **(a)** A drinks machine sells coffee, tea and cola. Coffee costs \$0.50, tea costs \$0.40 and cola costs \$0.45. The table below shows the numbers of drinks sold over a 4-day period.

	Coffee	Tea	Cola
Tuesday	12	2	1
Wednesday	9	3	0
Thursday	8	5	1
Friday	11	2	0

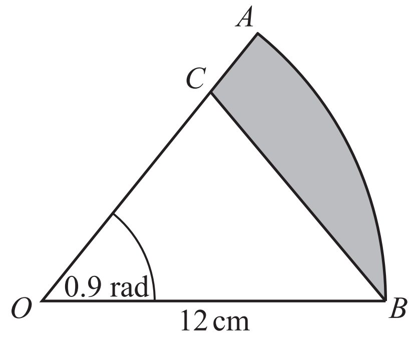
(i) Write down 2 matrices whose product will give the amount of money the drinks machine took each day and evaluate this product. [4]

(ii) Hence write down the total amount of money taken by the machine for this 4-day period. [1]

SAT PREP SP www.satprep.co.in

(b) Matrices **X** and **Y** are such that $\mathbf{X} = \begin{pmatrix} 2 & 4 \\ -5 & 1 \end{pmatrix}$ and $\mathbf{XY} = \mathbf{I}$, where **I** is the identity matrix. Find the matrix **Y**. [3]

6 The diagram shows a sector, AOB, of a circle centre O, radius 12 cm. Angle $AOB = 0.9$ radians. The point C lies on OA such that $OC = CB$.



(i) Show that $OC = 9.65$ cm correct to 3 significant figures. [2]

SAT PREP
SP
www.satprep.co.in

(ii) Find the perimeter of the shaded region. [3]

© UCLES 2014

(iii) Find the area of the shaded region. [3]

---

7 Solve the equation $1 + 2\log_5 x = \log_5(18x - 9)$. [5]

SAT PREP www.satprep.co.in

8 **(i)** Given that $f(x) = x\ln x^3$, show that $f'(x) = 3(1 + \ln x)$. [3]

(ii) Hence find $\int (1 + \ln x)\,dx$. [2]

(iii) Hence find $\int_1^2 \ln x\,dx$ in the form $p + \ln q$, where p and q are integers. [3]

© UCLES 2014

9 **(a)** Given that the first 3 terms in the expansion of $(5 - qx)^p$ are $625 - 1500x + rx^2$, find the value of each of the integers p, q and r. [5]

(b) Find the value of the term that is independent of x in the expansion of $\left(2x + \frac{1}{4x^3}\right)^{12}$. [3]

SAT PREP SP www.satprep.co.in

10 **(a)** Solve the following simultaneous equations.

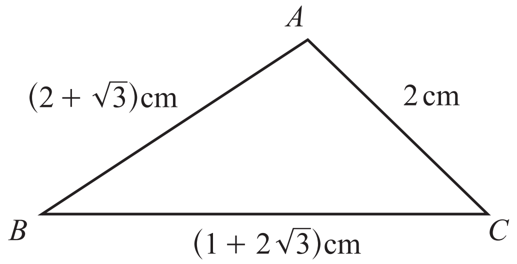
$$\frac{5^x}{25^{3y-2}} = 1$$

$$\frac{3^x}{27^{y-1}} = 81$$

[5]

www.satprep.co.in SAT PREP SP

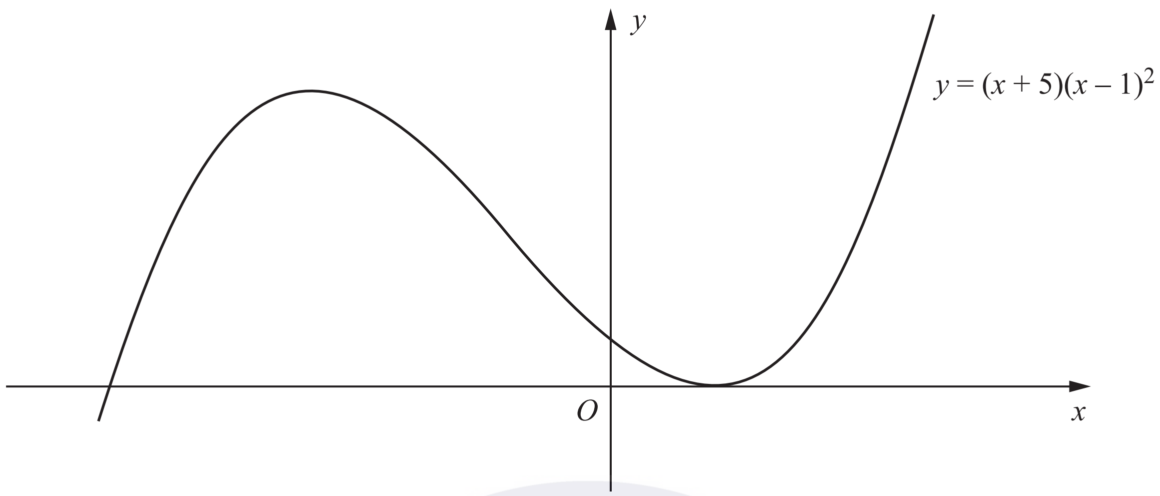
(b) The diagram shows a triangle ABC such that $AB = (2 + \sqrt{3})$ cm, $BC = (1 + 2\sqrt{3})$ cm and $AC = 2$ cm.



Without using a calculator, find the value of $\cos A$ in the form $a + b\sqrt{3}$, where a and b are constants to be found. [4]

© UCLES 2014

11 The diagram shows part of the curve $y = (x+5)(x-1)^2$.



(i) Find the x-coordinates of the stationary points of the curve. [5]

(ii) Find $\int (x+5)(x-1)^2 \, dx$. [3]

(iii) Hence find the area enclosed by the curve and the x-axis. [2]

SAT PREP
SP
www.satprep.co.in

(iv) Find the set of positive values of k for which the equation $(x+5)(x-1)^2 = k$ has only one real solution. [2]

© UCLES 2014

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

9780710677

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (LK/CGW) 73326/4
© UCLES 2014

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2014

1 Show that $\tan\theta + \dfrac{\cos\theta}{1+\sin\theta} = \sec\theta.$ [4]

SAT PREP
SP
www.satprep.co.in

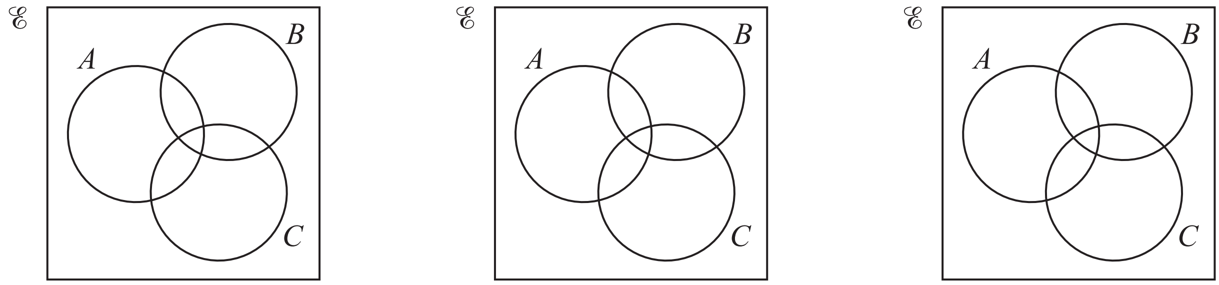
2 Vectors **a**, **b** and **c** are such that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$.

(i) Show that $|\mathbf{a}| = |\mathbf{b} + \mathbf{c}|$. [2]

(ii) Given that $\lambda\mathbf{a} + \mu\mathbf{b} = 7\mathbf{c}$, find the value of λ and of μ. [3]

SAT PREP SP www.satprep.co.in

3 **(a)** On the Venn diagrams below, shade the regions indicated.



(i) $A \cap B \cap C$ **(ii)** $(A \cup B) \cap C'$ **(iii)** $A \cup (B \cap C')$ [3]

(b) Sets P and Q are such that

$$P = \{x : x^2 + 2x = 0\} \text{ and } Q = \{x : x^2 + 2x + 7 = 0\}, \text{ where } x \in \mathbb{R}.$$

(i) Find $n(P)$. [1]

(ii) Find $n(Q)$. [1]

4 Find the set of values of k for which the line $y = k(4x - 3)$ does not intersect the curve $y = 4x^2 + 8x - 8$. [5]

SAT PREP
SP
www.satprep.co.in

5 **(i)** Given that $y = \mathrm{e}^{x^2}$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$. [2]

(ii) Use your answer to part **(i)** to find $\int x\mathrm{e}^{x^2}\mathrm{d}x$. [2]

SAT PREP
SP
www.satprep.co.in

(iii) Hence evaluate $\int_0^2 x\mathrm{e}^{x^2}\mathrm{d}x$. [2]

6 Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} -1 & 4 \\ 7 & 6 \\ 4 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & 1 \\ 3 & 5 \end{pmatrix}$.

(i) Find **AB**. [2]

(ii) Find $\mathbf{B}^{-1}$. [2]

(iii) Using your answer to part **(ii)**, solve the simultaneous equations

$$4x + 2y = -3,$$
$$6x + 10y = -22.$$

[3]

www.satprep.co.in SAT PREP SP

7 A curve is such that $\dfrac{dy}{dx} = 4x + \dfrac{1}{(x+1)^2}$ for $x > 0$. The curve passes through the point $\left(\dfrac{1}{2}, \dfrac{5}{6}\right)$.

(i) Find the equation of the curve. [4]

(ii) Find the equation of the normal to the curve at the point where $x = 1$. [4]

SAT PREP
SP
www.satprep.co.in

8 The table shows values of variables V and p.

V	10	50	100	200
p	95.0	8.5	3.0	1.1

(i) By plotting a suitable straight line graph, show that V and p are related by the equation $p = kV^n$, where k and n are constants. [4]

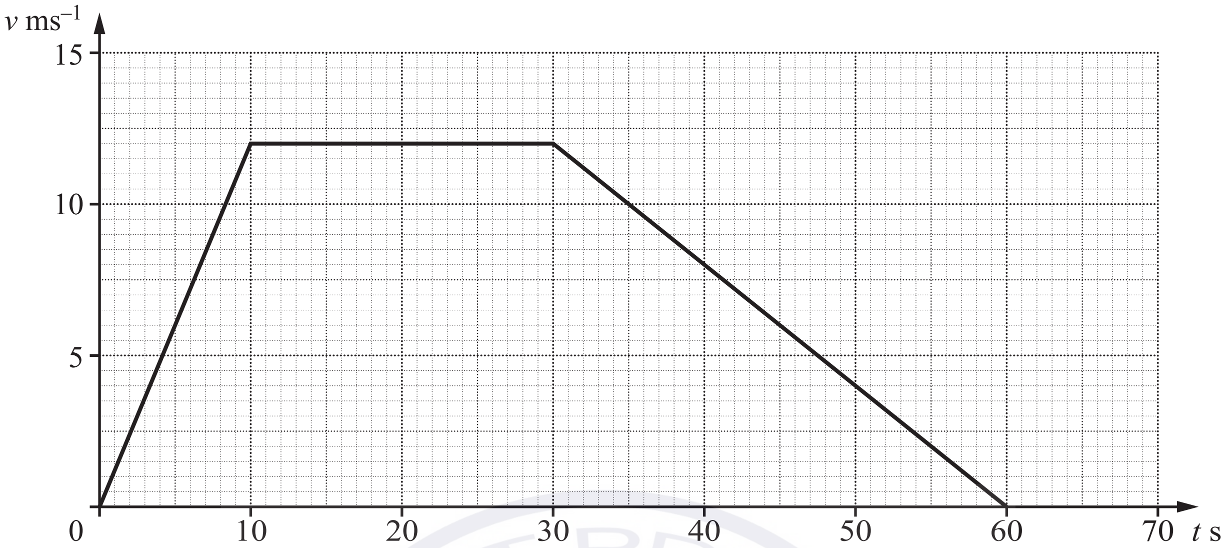
Use your graph to find

(ii) the value of n, [2]

(iii) the value of p when $V = 35$. [2]

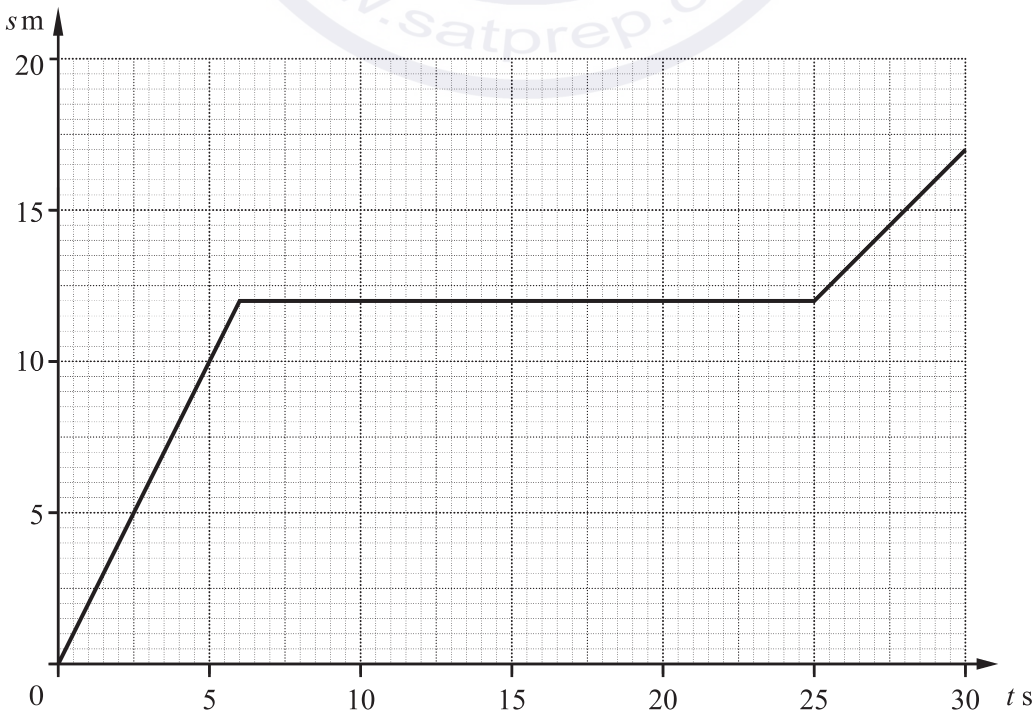
SAT PREP SP www.satprep.co.in

9 **(a)** The diagram shows the velocity-time graph of a particle P moving in a straight line with velocity $v\ \text{ms}^{-1}$ at time t s after leaving a fixed point.

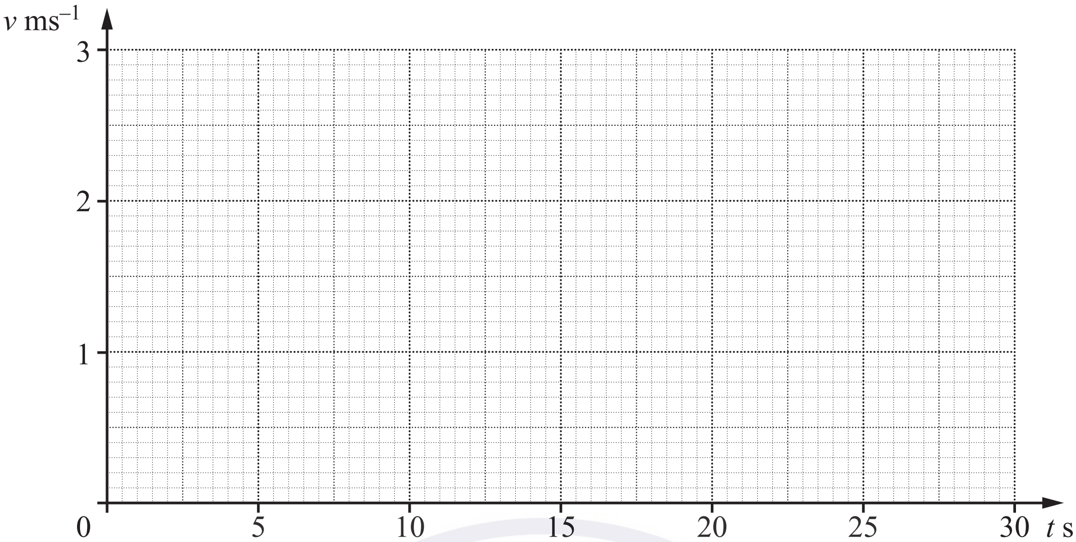


Find the distance travelled by the particle P. [2]

(b) The diagram shows the displacement-time graph of a particle Q moving in a straight line with displacement s m from a fixed point at time t s.



On the axes below, plot the corresponding velocity-time graph for the particle Q. [3]



(c) The displacement s m of a particle R, which is moving in a straight line, from a fixed point at time t s is given by $s = 4t - 16\ln(t+1) + 13$.

(i) Find the value of t for which the particle R is instantaneously at rest. [3]

(ii) Find the value of t for which the acceleration of the particle R is 0.25ms^{-2}. [2]

10 **(a)** How many even numbers less than 500 can be formed using the digits 1, 2, 3, 4 and 5? Each digit may be used only once in any number. [4]

(b) A committee of 8 people is to be chosen from 7 men and 5 women. Find the number of different committees that could be selected if

(i) the committee contains at least 3 men and at least 3 women, [4]

SAT PREP
SP
www.satprep.co.in

(ii) the oldest man or the oldest woman, but not both, must be included in the committee. [2]

11 **(a)** Solve $5\sin 2x + 3\cos 2x = 0$ for $0^\circ \leqslant x \leqslant 180^\circ$. [4]

(b) Solve $2\cot^2 y + 3\operatorname{cosec} y = 0$ for $0^\circ \leqslant y \leqslant 360^\circ$. [4]

SAT PREP
SP
www.satprep.co.in

Question 11(c) is printed on the next page.

(c) Solve $3\cos(z+1.2)=2$ for $0 \leqslant z \leqslant 6$ radians. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2014

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

2806846665

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (NF/CGW) 73328/3
© UCLES 2014

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\text{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

www.satprep.co.in

1 Show that $\dfrac{\cos A}{1+\sin A}+\dfrac{1+\sin A}{\cos A}$ can be written in the form $p\sec A$, where p is an integer to be found. [4]

www.satprep.co.in

2 **(a)** On the Venn diagrams below, draw sets A and B as indicated.

(i)

$A \cap B = \varnothing$

(ii)

$A \subset B$

[2]

(b) The universal set ℰ and sets P and Q are such that $\mathrm{n}(\mathscr{E}) = 20$, $\mathrm{n}(P \cup Q) = 15$, $\mathrm{n}(P) = 13$ and $\mathrm{n}(P \cap Q) = 4$. Find

(i) $\mathrm{n}(Q)$, [1]

(ii) $\mathrm{n}((P \cup Q)')$, [1]

(iii) $\mathrm{n}(P \cap Q')$. [1]

SAT PREP SP www.satprep.co.in

© UCLES 2014

3 **(i)** Sketch the graph of $y = |(2x+1)(x-2)|$ for $-2 \leqslant x \leqslant 3$, showing the coordinates of the points where the curve meets the x- and y-axes. [3]

(ii) Find the non-zero values of k for which the equation $|(2x+1)(x-2)| = k$ has two solutions only. [2]

SAT PREP
www.satprep.co.in

4 The region enclosed by the curve $y = 2\sin 3x$, the x-axis and the line $x = a$, where $0 < a < 1$ radian, lies entirely above the x-axis. Given that the area of this region is $\frac{1}{3}$ square unit, find the value of a. [6]

SAT PREP
SP
www.satprep.co.in

5 **(i)** Given that $2^{5x} \times 4^{y} = \frac{1}{8}$, show that $5x + 2y = -3$. [3]

(ii) Solve the simultaneous equations $2^{5x} \times 4^{y} = \frac{1}{8}$ and $7^{x} \times 49^{2y} = 1$. [4]

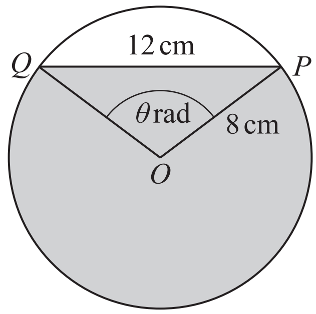
© UCLES 2014

6 **(a)** Matrices **X**, **Y** and **Z** are such that $\mathbf{X} = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$, $\mathbf{Y} = \begin{pmatrix} 1 & 3 \\ 4 & 5 \\ 6 & 7 \end{pmatrix}$ and $\mathbf{Z} = \begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$. Write down all the matrix products which are possible using any two of these matrices. Do not evaluate these products. [2]

(b) Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} 5 & -2 \\ -4 & 1 \end{pmatrix}$ and $\mathbf{AB} = \begin{pmatrix} 3 & 9 \\ -6 & -3 \end{pmatrix}$. Find the matrix **B**. [5]

SAT PREP SP www.satprep.co.in

7 The diagram shows a circle, centre O, radius 8 cm. Points P and Q lie on the circle such that the chord $PQ = 12$ cm and angle $POQ = \theta$ radians.



(i) Show that $\theta = 1.696$, correct to 3 decimal places. [2]

(ii) Find the perimeter of the shaded region. [3]

(iii) Find the area of the shaded region. [3]

© UCLES 2014

8 **(a)** **(i)** How many different 5-digit numbers can be formed using the digits 1, 2, 4, 5, 7 and 9 if no digit is repeated? [1]

(ii) How many of these numbers are even? [1]

(iii) How many of these numbers are less than 60 000 and even? [3]

(b) How many different groups of 6 children can be chosen from a class of 18 children if the class contains one set of twins who must not be separated? [3]

© UCLES 2014

9 A solid circular cylinder has a base radius of r cm and a volume of $4000\,\text{cm}^3$.

(i) Show that the total surface area, $A\,\text{cm}^2$, of the cylinder is given by $A = \dfrac{8000}{r} + 2\pi r^2$. [3]

(ii) Given that r can vary, find the minimum total surface area of the cylinder, justifying that this area is a minimum. [6]

www.satprep.co.in

10 In this question **i** is a unit vector due East and **j** is a unit vector due North.
At 12 00 hours, a ship leaves a port P and travels with a speed of $26\,\text{km}\,\text{h}^{-1}$ in the direction $5\mathbf{i} + 12\mathbf{j}$.

(i) Show that the velocity of the ship is $(10\mathbf{i} + 24\mathbf{j})\,\text{km}\,\text{h}^{-1}$. [2]

(ii) Write down the position vector of the ship, relative to P, at 16 00 hours. [1]

(iii) Find the position vector of the ship, relative to P, t hours after 16 00 hours. [2]

At 16 00 hours, a speedboat leaves a lighthouse which has position vector $(120\mathbf{i} + 81\mathbf{j})\,\text{km}$, relative to P, to intercept the ship. The speedboat has a velocity of $(-22\mathbf{i} + 30\mathbf{j})\,\text{km}\,\text{h}^{-1}$.

(iv) Find the position vector, relative to P, of the speedboat t hours after 16 00 hours. [1]

© UCLES 2014

(v) Find the time at which the speedboat intercepts the ship and the position vector, relative to P, of the point of interception. [4]

www.satprep.co.in

11 **(a)** Solve $\tan^2 x + 5\tan x = 0$ for $0° \leqslant x \leqslant 180°$. [3]

(b) Solve $2\cos^2 y - \sin y - 1 = 0$ for $0° \leqslant y \leqslant 360°$. [4]

SAT PREP SP www.satprep.co.in

(c) Solve $\sec\left(2z - \frac{\pi}{6}\right) = 2$ for $0 \leqslant z \leqslant \pi$ radians. [4]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2014

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (CW/CGW) 73329/3
© UCLES 2014

CAMBRIDGE
International Examinations

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 **(i)** Show that $y = 3x^2 - 6x + 5$ can be written in the form $y = a(x-b)^2 + c$, where a, b and c are constants to be found. [3]

(ii) Hence, or otherwise, find the coordinates of the stationary point of the curve $y = 3x^2 - 6x + 5$. [1]

2 Given that $2^{4x} \times 4^{y} \times 8^{x-y} = 1$ and $3^{x+y} = \frac{1}{3}$, find the value of x and of y. [4]

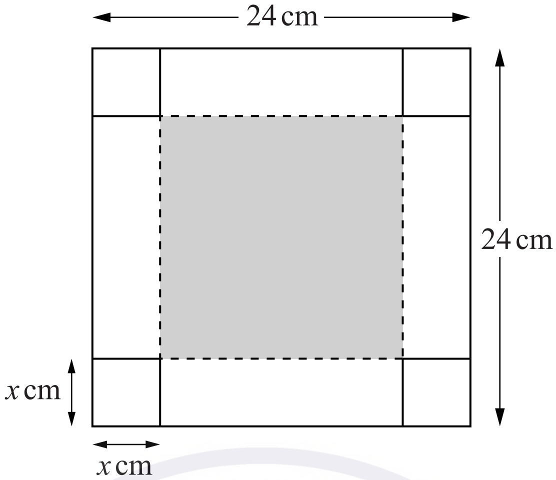
www.satprep.co.in SAT PREP SP

3 **(i)** Find, in terms of p, the remainder when $x^3 + px^2 + p^2x + 21$ is divided by $x + 3$. [2]

(ii) Hence find the set of values of p for which this remainder is negative. [3]

www.satprep.co.in

4 The diagram shows a thin square sheet of metal measuring 24 cm by 24 cm. A square of side x cm is cut off from each corner. The remainder is then folded to form an open box, x cm deep, whose square base is shown shaded in the diagram.



(i) Show that the volume, $V\,\text{cm}^3$, of the box is given by $V = 4x^3 - 96x^2 + 576x$. [2]

(ii) Given that x can vary, find the maximum volume of the box. [4]

5 **(i)** The first three terms in the expansion of $(2-5x)^6$, in ascending powers of x, are $p+qx+rx^2$. Find the value of each of the integers p, q and r. [3]

(ii) In the expansion of $(2-5x)^6(a+bx)^3$, the constant term is equal to 512 and the coefficient of x is zero. Find the value of each of the constants a and b. [4]

© UCLES 2014

6 Find the equation of the normal to the curve $y = x(x^2 - 12)^{\frac{1}{3}}$ at the point on the curve where $x = 2$. [6]

SAT PREP
www.satprep.co.in

7 **(a)** A 5-character password is to be chosen from the letters A, B, C, D, E and the digits 4, 5, 6, 7. Each letter or digit may be used only once. Find the number of different passwords that can be chosen if

(i) there are no restrictions, [1]

(ii) the password contains 2 letters followed by 3 digits. [2]

(b) A school has 3 concert tickets to give out at random to a class of 18 boys and 15 girls. Find the number of ways in which this can be done if

(i) there are no restrictions, [1]

(ii) 2 of the tickets are given to boys and 1 ticket is given to a girl, [2]

© UCLES 2014

(iii) at least 1 boy gets a ticket. [2]

8 A particle moves in a straight line such that, t s after passing through a fixed point O, its velocity, $v\,\text{ms}^{-1}$, is given by $v = 5 - 4e^{-2t}$.

(i) Find the velocity of the particle at O. [1]

(ii) Find the value of t when the acceleration of the particle is $6\,\text{ms}^{-2}$. [3]

(iii) Find the distance of the particle from O when $t = 1.5$. [5]

(iv) Explain why the particle does not return to O. [1]

SAT PREP www.satprep.co.in

9 Solve

(i) $3\sin x \cos x = 2\cos x$ for $0° \leqslant x \leqslant 180°$, [4]

(ii) $10\sin^2 y + \cos y = 8$ for $0° \leqslant y \leqslant 360°$. [5]

SAT PREP SP www.satprep.co.in

10 The table shows experimental values of x and y.

x	1.50	1.75	2.00	2.25
y	3.9	8.3	19.5	51.7

(i) Complete the following table.

x^2				
lg y				

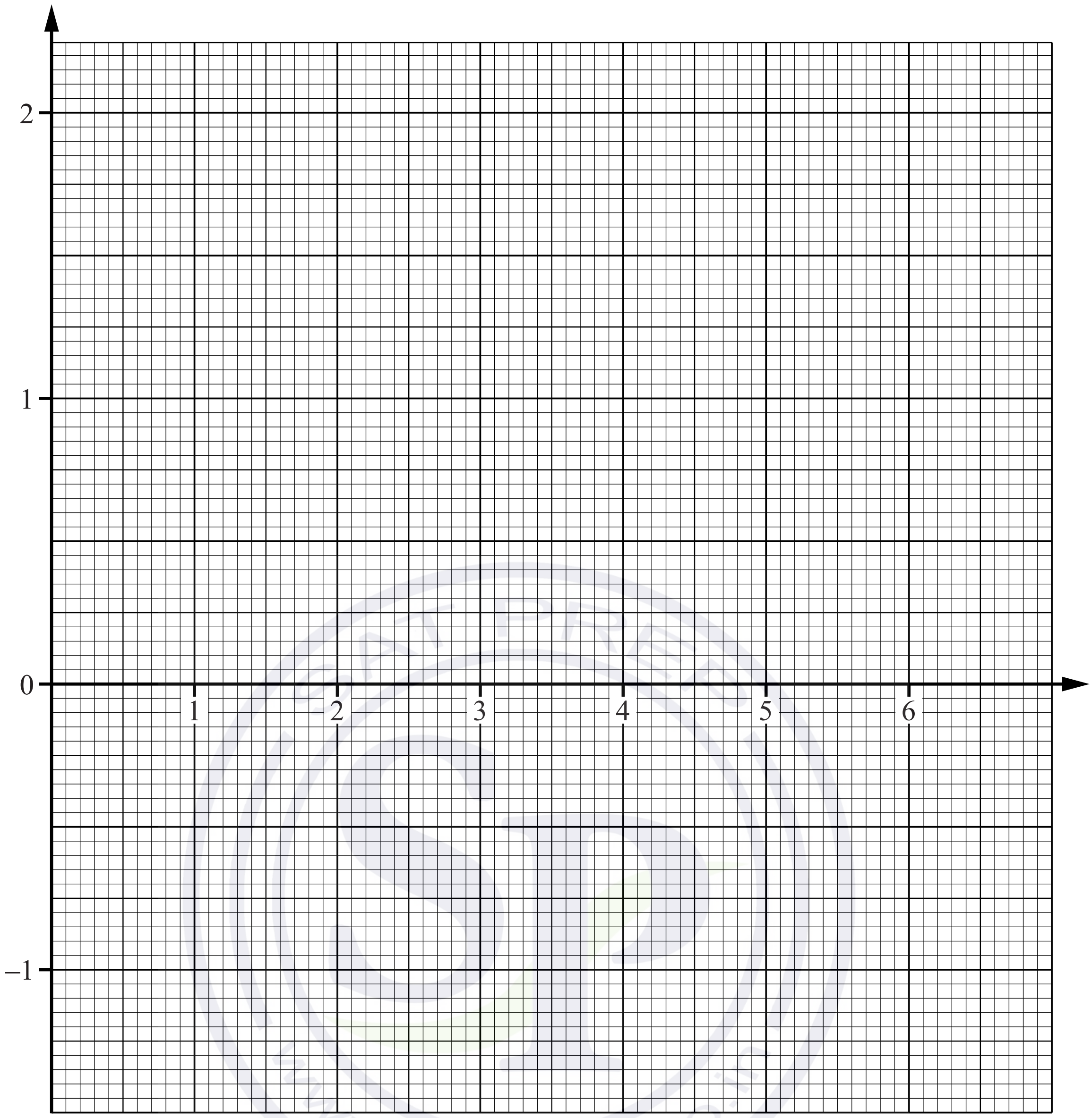
[1]

(ii) By plotting a suitable straight line graph on the grid on page 13, show that x and y are related by the equation $y = Ab^{x^2}$, where A and b are constants. [2]

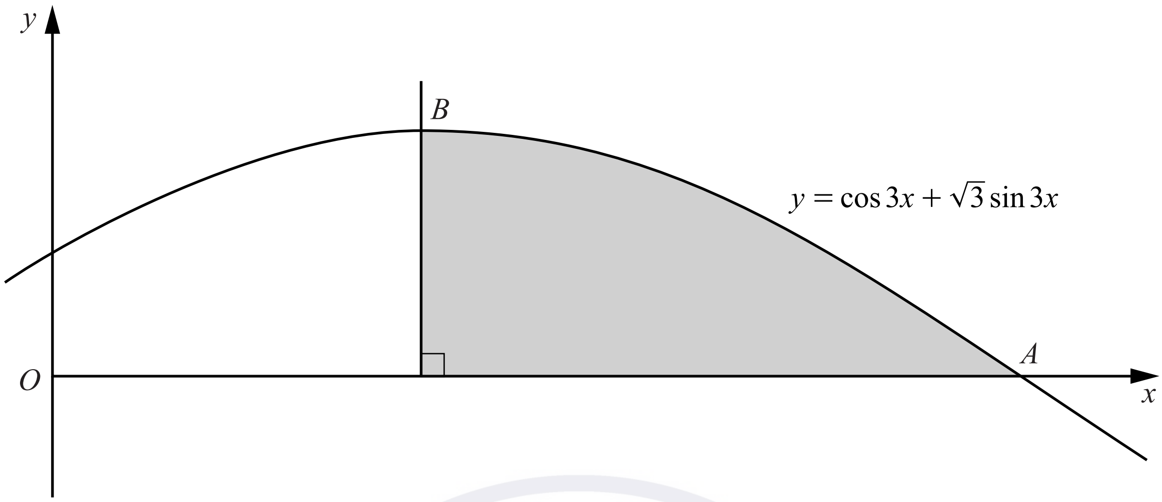
(iii) Use your graph to find the value of A and of b. [4]

(iv) Estimate the value of y when $x = 1.25$. [2]

© UCLES 2014


2
1
0
–1
1
2
3
4
5
6

11 The diagram shows the graph of $y = \cos 3x + \sqrt{3}\sin 3x$, which crosses the x-axis at A and has a maximum point at B.



(i) Find the x-coordinate of A. [3]

SAT PREP SP www.satprep.co.in

(ii) Find $\frac{dy}{dx}$ and hence find the x-coordinate of B. [4]

© UCLES 2014

(iii) Showing all your working, find the area of the shaded region bounded by the curve, the x-axis and the line through B parallel to the y-axis. [5]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

SAT PREP
www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

9780710677

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (LK/CGW) 73326/4
© UCLES 2014

CAMBRIDGE International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2014

1 Show that $\tan\theta + \dfrac{\cos\theta}{1+\sin\theta} = \sec\theta.$ [4]

SAT PREP
SP
www.satprep.co.in

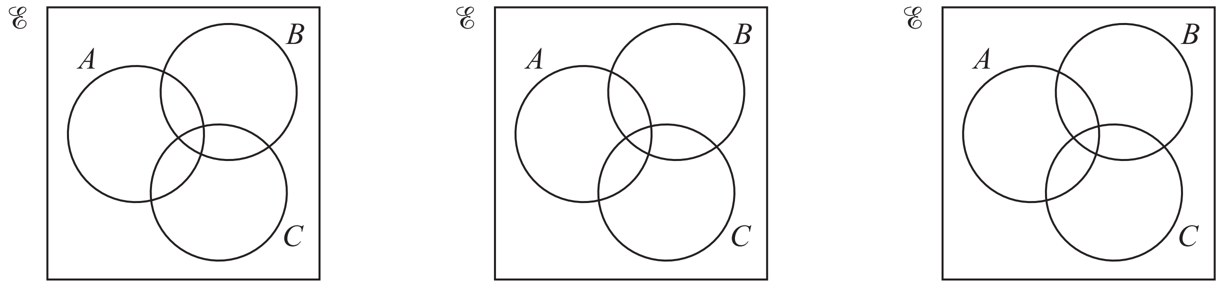
2 Vectors **a**, **b** and **c** are such that $\mathbf{a} = \begin{pmatrix} 4 \\ 3 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 2 \\ 2 \end{pmatrix}$ and $\mathbf{c} = \begin{pmatrix} -5 \\ 2 \end{pmatrix}$.

(i) Show that $|\mathbf{a}| = |\mathbf{b} + \mathbf{c}|$. [2]

(ii) Given that $\lambda\mathbf{a} + \mu\mathbf{b} = 7\mathbf{c}$, find the value of λ and of μ. [3]

SAT PREP
SP
www.satprep.co.in

3 **(a)** On the Venn diagrams below, shade the regions indicated.



(i) $A \cap B \cap C$ **(ii)** $(A \cup B) \cap C'$ **(iii)** $A \cup (B \cap C')$

[3]

(b) Sets P and Q are such that

$$P = \{x : x^2 + 2x = 0\} \text{ and } Q = \{x : x^2 + 2x + 7 = 0\}, \text{ where } x \in \mathbb{R}.$$

(i) Find $n(P)$. [1]

(ii) Find $n(Q)$. [1]

4 Find the set of values of k for which the line $y = k(4x - 3)$ does not intersect the curve $y = 4x^2 + 8x - 8$. [5]

© UCLES 2014

5 **(i)** Given that $y = \mathrm{e}^{x^2}$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$. [2]

(ii) Use your answer to part **(i)** to find $\int x\mathrm{e}^{x^2}\,\mathrm{d}x$. [2]

(iii) Hence evaluate $\int_0^2 x\mathrm{e}^{x^2}\,\mathrm{d}x$. [2]

SAT PREP SP www.satprep.co.in

6 Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} -1 & 4 \\ 7 & 6 \\ 4 & 2 \end{pmatrix}$ and $\mathbf{B} = \begin{pmatrix} 2 & 1 \\ 3 & 5 \end{pmatrix}$.

(i) Find **AB**. [2]

(ii) Find $\mathbf{B}^{-1}$. [2]

(iii) Using your answer to part **(ii)**, solve the simultaneous equations

$$4x + 2y = -3,$$
$$6x + 10y = -22.$$ [3]

www.satprep.co.in SAT PREP SP

7 A curve is such that $\frac{dy}{dx} = 4x + \frac{1}{(x+1)^2}$ for $x > 0$. The curve passes through the point $\left(\frac{1}{2}, \frac{5}{6}\right)$.

(i) Find the equation of the curve. [4]

(ii) Find the equation of the normal to the curve at the point where $x = 1$. [4]

www.satprep.co.in

8 The table shows values of variables V and p.

V	10	50	100	200
p	95.0	8.5	3.0	1.1

(i) By plotting a suitable straight line graph, show that V and p are related by the equation $p = kV^n$, where k and n are constants. [4]

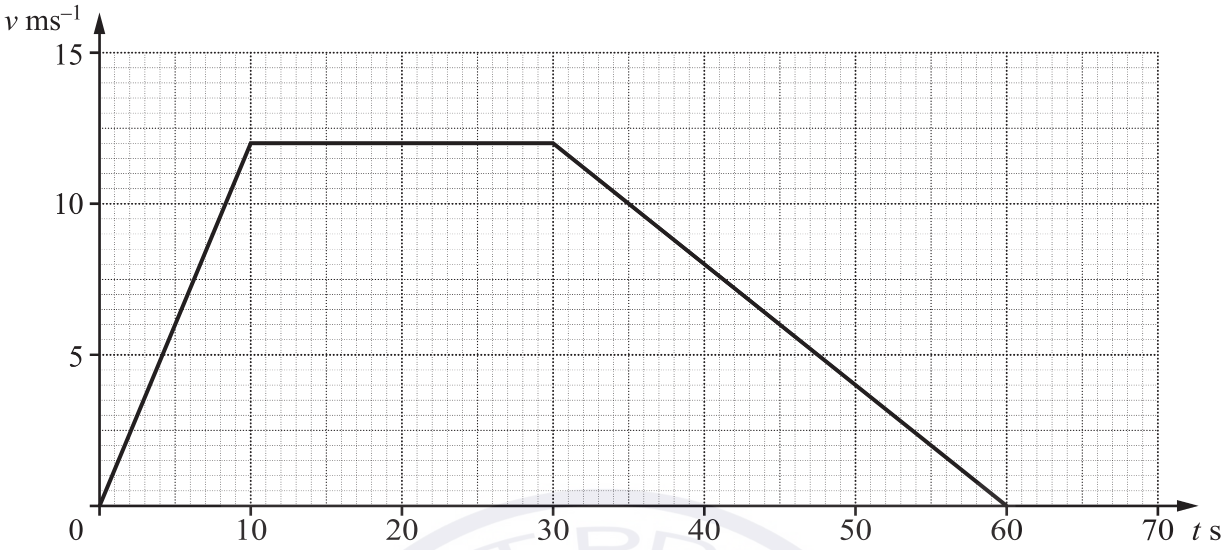
Use your graph to find

(ii) the value of n, [2]

(iii) the value of p when $V = 35$. [2]

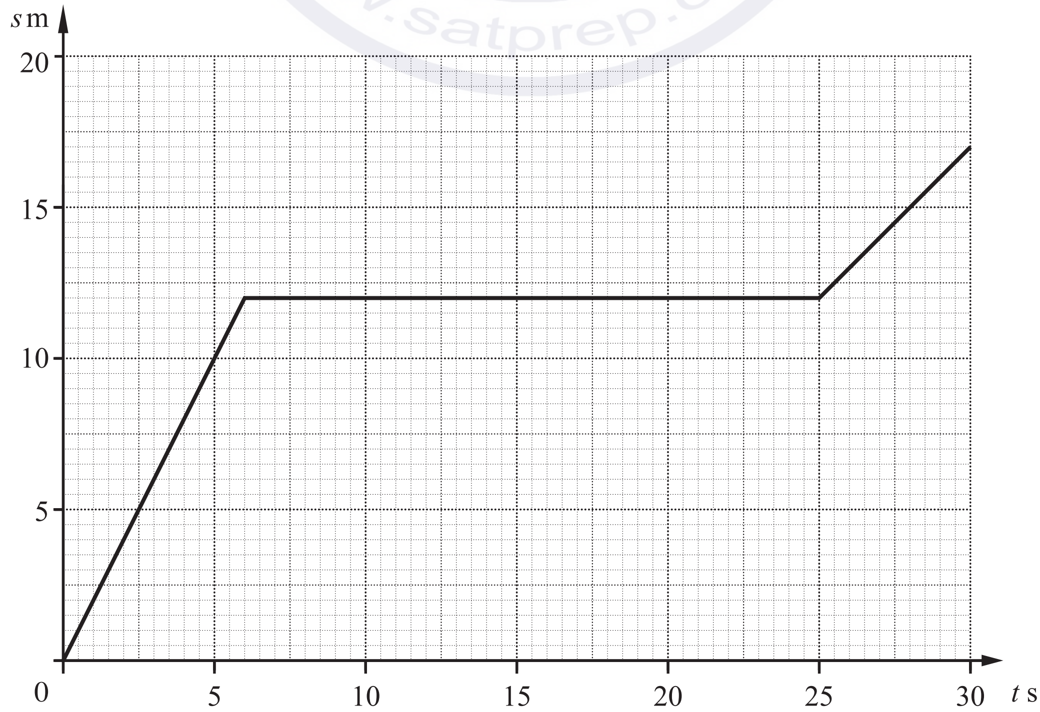
SAT PREP
SP
www.satprep.co.in

9 **(a)** The diagram shows the velocity-time graph of a particle P moving in a straight line with velocity $v\ \mathrm{ms}^{-1}$ at time t s after leaving a fixed point.

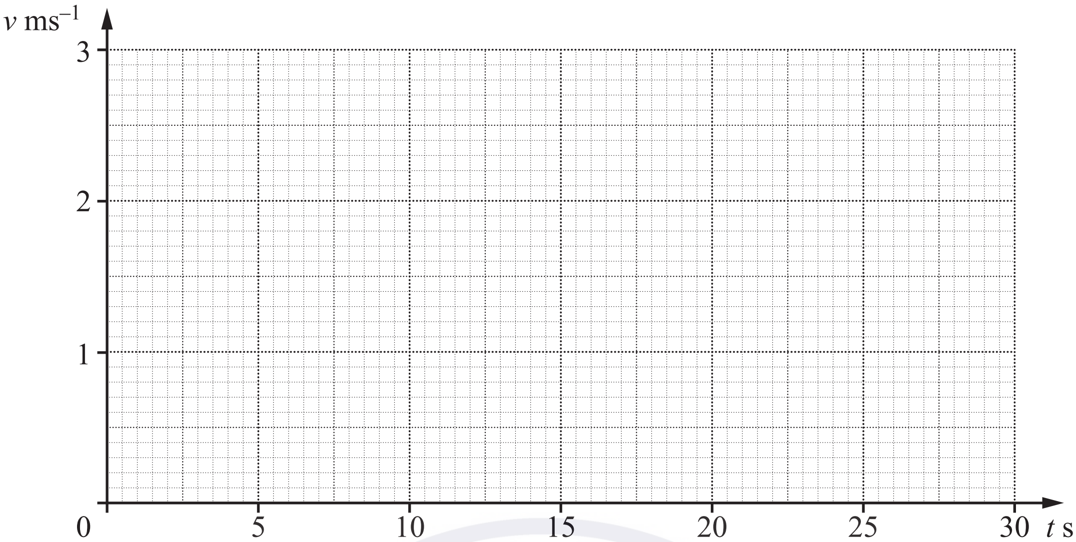


Find the distance travelled by the particle P. [2]

(b) The diagram shows the displacement-time graph of a particle Q moving in a straight line with displacement s m from a fixed point at time t s.



On the axes below, plot the corresponding velocity-time graph for the particle Q. [3]



(c) The displacement s m of a particle R, which is moving in a straight line, from a fixed point at time t s is given by $s = 4t - 16\ln(t+1) + 13$.

(i) Find the value of t for which the particle R is instantaneously at rest. [3]

www.satprep.co.in

(ii) Find the value of t for which the acceleration of the particle R is 0.25ms^{-2}. [2]

10 **(a)** How many even numbers less than 500 can be formed using the digits 1, 2, 3, 4 and 5? Each digit may be used only once in any number. [4]

(b) A committee of 8 people is to be chosen from 7 men and 5 women. Find the number of different committees that could be selected if

(i) the committee contains at least 3 men and at least 3 women, [4]

(ii) the oldest man or the oldest woman, but not both, must be included in the committee. [2]

www.satprep.co.in

11 **(a)** Solve $5\sin 2x + 3\cos 2x = 0$ for $0° \leqslant x \leqslant 180°$. [4]

(b) Solve $2\cot^2 y + 3\operatorname{cosec} y = 0$ for $0° \leqslant y \leqslant 360°$. [4]

SAT PREP
SP
www.satprep.co.in

Question 11(c) is printed on the next page.

(c) Solve $3\cos(z+1.2)=2$ for $0 \leqslant z \leqslant 6$ radians. [4]

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2014

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

2806846665

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (NF/CGW) 73328/3
© UCLES 2014

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2014

1 Show that $\dfrac{\cos A}{1+\sin A}+\dfrac{1+\sin A}{\cos A}$ can be written in the form $p\sec A$, where p is an integer to be found. [4]

SAT PREP
SP
www.satprep.co.in

2 **(a)** On the Venn diagrams below, draw sets A and B as indicated.

(i)

$A \cap B = \varnothing$

(ii)

$A \subset B$

[2]

(b) The universal set ℰ and sets P and Q are such that $\mathrm{n}(\mathscr{E}) = 20$, $\mathrm{n}(P \cup Q) = 15$, $\mathrm{n}(P) = 13$ and $\mathrm{n}(P \cap Q) = 4$. Find

(i) $\mathrm{n}(Q)$, [1]

(ii) $\mathrm{n}((P \cup Q)')$, [1]

(iii) $\mathrm{n}(P \cap Q')$. [1]

SAT PREP SP www.satprep.co.in

3 **(i)** Sketch the graph of $y = |(2x+1)(x-2)|$ for $-2 \leqslant x \leqslant 3$, showing the coordinates of the points where the curve meets the x- and y-axes. [3]

SAT PREP
SP
www.satprep.co.in

(ii) Find the non-zero values of k for which the equation $|(2x+1)(x-2)| = k$ has two solutions only. [2]

4 The region enclosed by the curve $y = 2\sin 3x$, the x-axis and the line $x = a$, where $0 < a < 1$ radian, lies entirely above the x-axis. Given that the area of this region is $\frac{1}{3}$ square unit, find the value of a. [6]

SAT PREP www.satprep.co.in

5 **(i)** Given that $2^{5x} \times 4^{y} = \frac{1}{8}$, show that $5x + 2y = -3$. [3]

(ii) Solve the simultaneous equations $2^{5x} \times 4^{y} = \frac{1}{8}$ and $7^{x} \times 49^{2y} = 1$. [4]

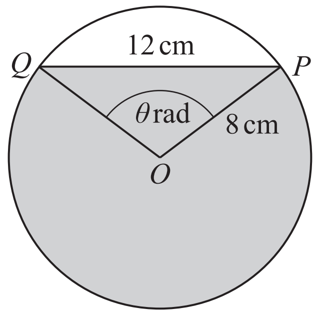
SAT PREP
SP
www.satprep.co.in

6 **(a)** Matrices **X**, **Y** and **Z** are such that $\mathbf{X} = \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}$, $\mathbf{Y} = \begin{pmatrix} 1 & 3 \\ 4 & 5 \\ 6 & 7 \end{pmatrix}$ and $\mathbf{Z} = \begin{pmatrix} 1 & 2 & 3 \end{pmatrix}$. Write down all the matrix products which are possible using any two of these matrices. Do not evaluate these products. [2]

(b) Matrices **A** and **B** are such that $\mathbf{A} = \begin{pmatrix} 5 & -2 \\ -4 & 1 \end{pmatrix}$ and $\mathbf{AB} = \begin{pmatrix} 3 & 9 \\ -6 & -3 \end{pmatrix}$. Find the matrix **B**. [5]

SAT PREP SP www.satprep.co.in

7 The diagram shows a circle, centre O, radius 8 cm. Points P and Q lie on the circle such that the chord $PQ = 12$ cm and angle $POQ = \theta$ radians.



(i) Show that $\theta = 1.696$, correct to 3 decimal places. [2]

(ii) Find the perimeter of the shaded region. [3]

(iii) Find the area of the shaded region. [3]

www.satprep.co.in

8 **(a)** **(i)** How many different 5-digit numbers can be formed using the digits 1, 2, 4, 5, 7 and 9 if no digit is repeated? [1]

(ii) How many of these numbers are even? [1]

(iii) How many of these numbers are less than 60 000 and even? [3]

(b) How many different groups of 6 children can be chosen from a class of 18 children if the class contains one set of twins who must not be separated? [3]

SAT PREP SP www.satprep.co.in

9 A solid circular cylinder has a base radius of r cm and a volume of $4000\,\text{cm}^3$.

(i) Show that the total surface area, $A\,\text{cm}^2$, of the cylinder is given by $A = \dfrac{8000}{r} + 2\pi r^2$. [3]

(ii) Given that r can vary, find the minimum total surface area of the cylinder, justifying that this area is a minimum. [6]

SAT PREP SP www.satprep.co.in

10 In this question **i** is a unit vector due East and **j** is a unit vector due North.
At 12 00 hours, a ship leaves a port P and travels with a speed of $26\,\text{km}\,\text{h}^{-1}$ in the direction $5\mathbf{i} + 12\mathbf{j}$.

(i) Show that the velocity of the ship is $(10\mathbf{i} + 24\mathbf{j})\,\text{km}\,\text{h}^{-1}$. [2]

(ii) Write down the position vector of the ship, relative to P, at 16 00 hours. [1]

(iii) Find the position vector of the ship, relative to P, t hours after 16 00 hours. [2]

At 16 00 hours, a speedboat leaves a lighthouse which has position vector $(120\mathbf{i} + 81\mathbf{j})$ km, relative to P, to intercept the ship. The speedboat has a velocity of $(-22\mathbf{i} + 30\mathbf{j})\,\text{km}\,\text{h}^{-1}$.

(iv) Find the position vector, relative to P, of the speedboat t hours after 16 00 hours. [1]

© UCLES 2014

(v) Find the time at which the speedboat intercepts the ship and the position vector, relative to P, of the point of interception. [4]

11 **(a)** Solve $\tan^2 x + 5\tan x = 0$ for $0° \leqslant x \leqslant 180°$. [3]

(b) Solve $2\cos^2 y - \sin y - 1 = 0$ for $0° \leqslant y \leqslant 360°$. [4]

www.satprep.co.in

(c) Solve $\sec\left(2z - \frac{\pi}{6}\right) = 2$ for $0 \leqslant z \leqslant \pi$ radians. [4]

www.satprep.co.in

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2014

Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

4354645867

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2014**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **15** printed pages and **1** blank page.

DC (CW/CGW) 73329/3
© UCLES 2014

CAMBRIDGE
International Examinations

[Turn over

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

1 **(i)** Show that $y = 3x^2 - 6x + 5$ can be written in the form $y = a(x-b)^2 + c$, where a, b and c are constants to be found. [3]

(ii) Hence, or otherwise, find the coordinates of the stationary point of the curve $y = 3x^2 - 6x + 5$. [1]

---

2 Given that $2^{4x} \times 4^y \times 8^{x-y} = 1$ and $3^{x+y} = \frac{1}{3}$, find the value of x and of y. [4]

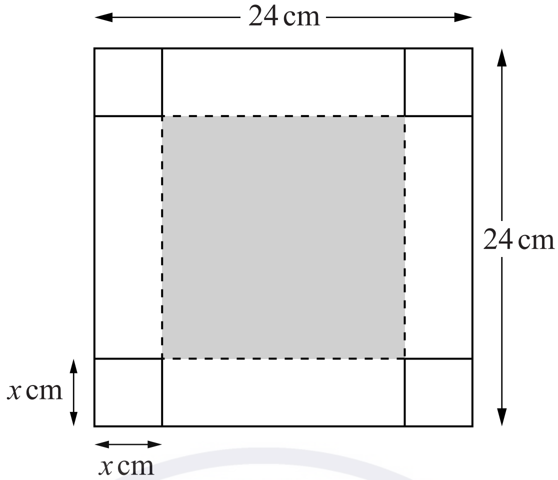
www.satprep.co.in SAT PREP SP

3 **(i)** Find, in terms of p, the remainder when $x^3 + px^2 + p^2x + 21$ is divided by $x + 3$. [2]

(ii) Hence find the set of values of p for which this remainder is negative. [3]

SAT PREP SP www.satprep.co.in

4 The diagram shows a thin square sheet of metal measuring 24 cm by 24 cm. A square of side x cm is cut off from each corner. The remainder is then folded to form an open box, x cm deep, whose square base is shown shaded in the diagram.



(i) Show that the volume, $V\,\text{cm}^3$, of the box is given by $V = 4x^3 - 96x^2 + 576x$. [2]

(ii) Given that x can vary, find the maximum volume of the box. [4]

© UCLES 2014

5 **(i)** The first three terms in the expansion of $(2-5x)^6$, in ascending powers of x, are $p+qx+rx^2$. Find the value of each of the integers p, q and r. [3]

(ii) In the expansion of $(2-5x)^6(a+bx)^3$, the constant term is equal to 512 and the coefficient of x is zero. Find the value of each of the constants a and b. [4]

6 Find the equation of the normal to the curve $y = x(x^2 - 12)^{\frac{1}{3}}$ at the point on the curve where $x = 2$. [6]

SAT PREP www.satprep.co.in

7 **(a)** A 5-character password is to be chosen from the letters A, B, C, D, E and the digits 4, 5, 6, 7. Each letter or digit may be used only once. Find the number of different passwords that can be chosen if

(i) there are no restrictions, [1]

(ii) the password contains 2 letters followed by 3 digits. [2]

(b) A school has 3 concert tickets to give out at random to a class of 18 boys and 15 girls. Find the number of ways in which this can be done if

(i) there are no restrictions, [1]

(ii) 2 of the tickets are given to boys and 1 ticket is given to a girl, [2]

SAT PREP SP www.satprep.co.in

(iii) at least 1 boy gets a ticket. [2]

SAT PREP
SP
www.satprep.co.in

8 A particle moves in a straight line such that, t s after passing through a fixed point O, its velocity, $v\,\text{ms}^{-1}$, is given by $v = 5 - 4\text{e}^{-2t}$.

(i) Find the velocity of the particle at O. [1]

(ii) Find the value of t when the acceleration of the particle is $6\,\text{ms}^{-2}$. [3]

(iii) Find the distance of the particle from O when $t = 1.5$. [5]

(iv) Explain why the particle does not return to O. [1]

SAT PREP www.satprep.co.in

9 Solve

(i) $3\sin x\cos x = 2\cos x$ for $0° \leqslant x \leqslant 180°$, [4]

(ii) $10\sin^2 y + \cos y = 8$ for $0° \leqslant y \leqslant 360°$. [5]

SAT PREP SP www.satprep.co.in

10 The table shows experimental values of x and y.

x	1.50	1.75	2.00	2.25
y	3.9	8.3	19.5	51.7

(i) Complete the following table.

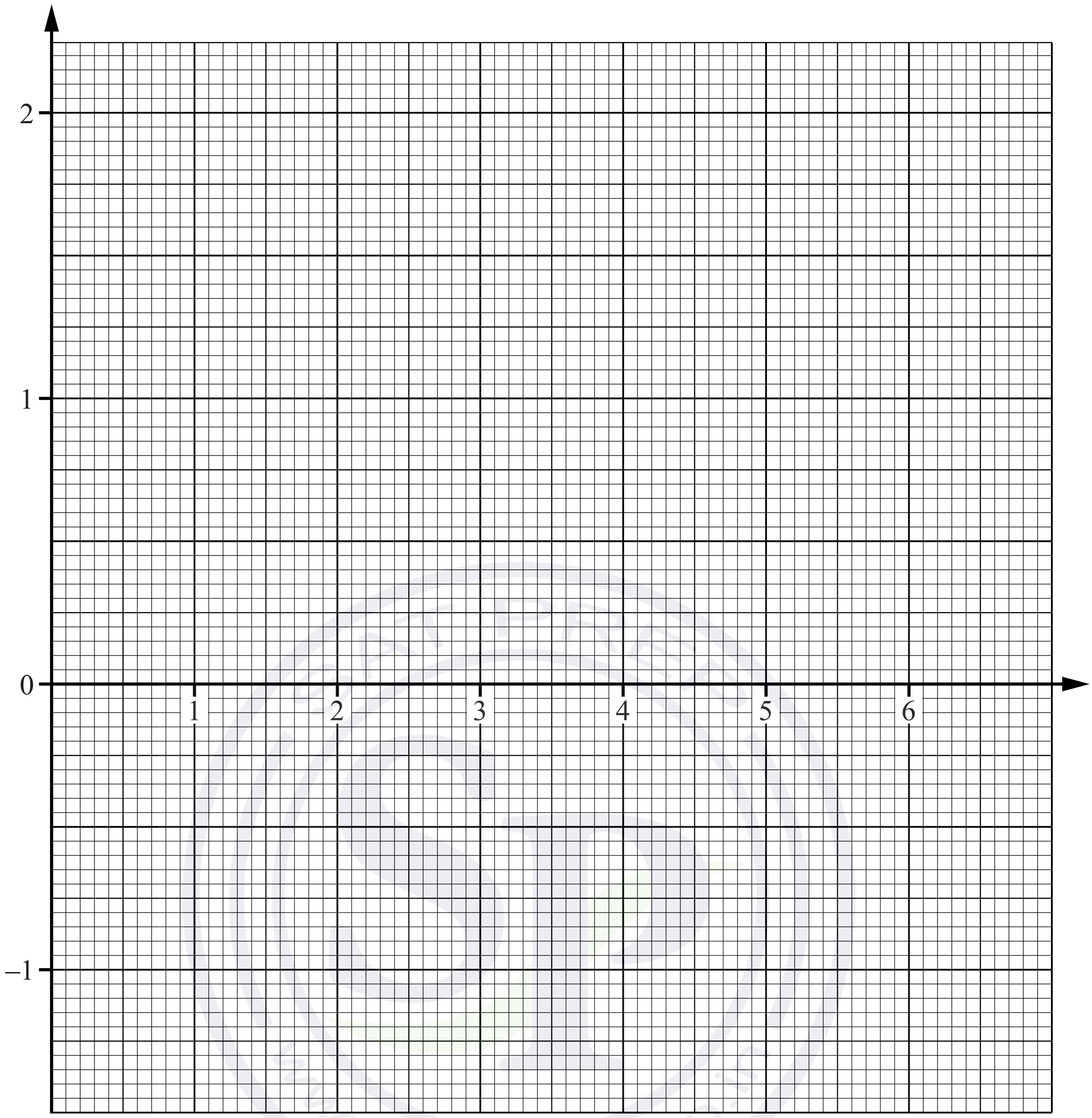
x^2				
$\lg y$				

[1]

(ii) By plotting a suitable straight line graph on the grid on page 13, show that x and y are related by the equation $y = Ab^{x^2}$, where A and b are constants. [2]

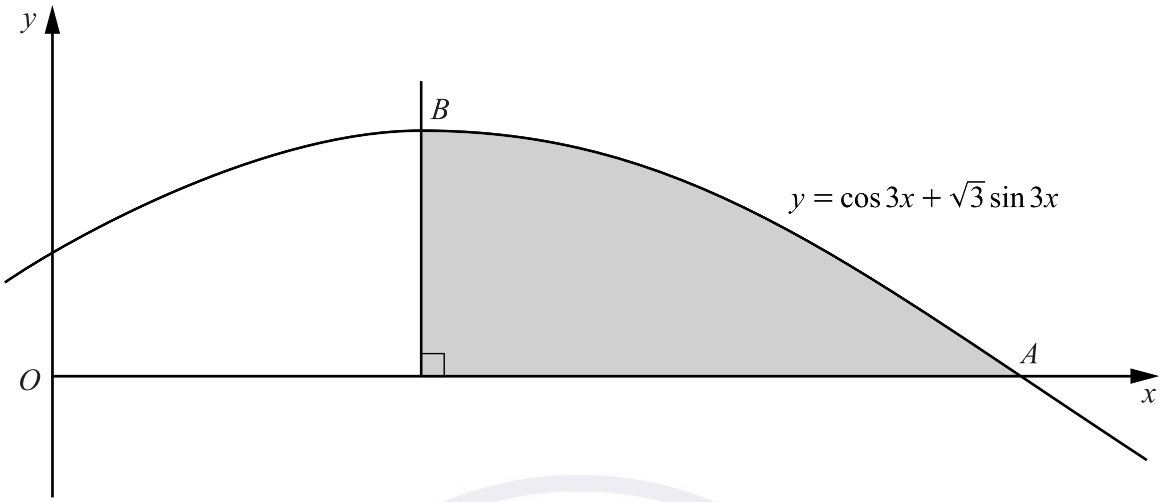
(iii) Use your graph to find the value of A and of b. [4]

(iv) Estimate the value of y when $x = 1.25$. [2]



www.satprep.co.in

11 The diagram shows the graph of $y = \cos 3x + \sqrt{3}\sin 3x$, which crosses the x-axis at A and has a maximum point at B.



(i) Find the x-coordinate of A. [3]

(ii) Find $\frac{dy}{dx}$ and hence find the x-coordinate of B. [4]

(iii) Showing all your working, find the area of the shaded region bounded by the curve, the x-axis and the line through B parallel to the y-axis. [5]

SAT PREP
SP
www.satprep.co.in

BLANK PAGE

www.satprep.co.in

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

2647385246

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (CW/CGW) 67138/4
© UCLES 2013

UNIVERSITY of CAMBRIDGE International Examinations

[Turn over

www.theallpapers.com

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc\cos A$$

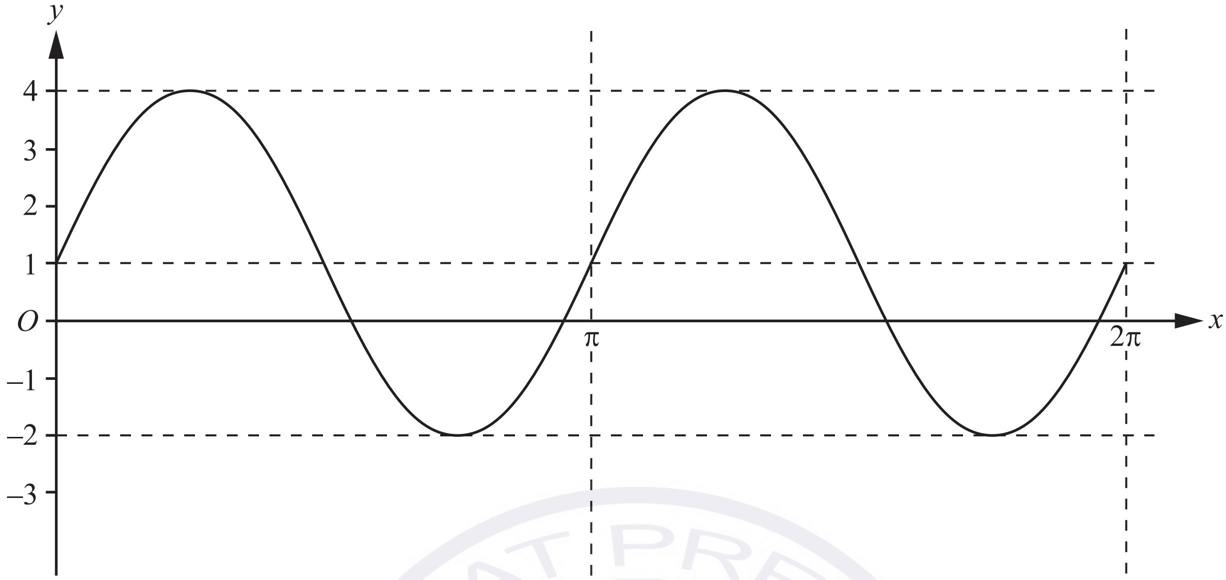
$$\Delta = \frac{1}{2}bc\sin A$$

© UCLES 2013

www.theallpapers.com

For Examiner's Use

1 The diagram shows the graph of $y = a\sin(bx) + c$ for $0 \leqslant x \leqslant 2\pi$, where a, b and c are positive integers.



State the value of a, of b and of c. [3]

$a =$ $b =$ $c =$

---

2 Find the set of values of k for which the curve $y = (k+1)x^2 - 3x + (k+1)$ lies below the x-axis. [4]

www.theallpapers.com

3 Show that $\dfrac{1+\sin\theta}{\cos\theta}+\dfrac{\cos\theta}{1+\sin\theta}=2\sec\theta$. [4]

For Examiner's Use

www.satprep.co.in

© UCLES 2013

www.theallpapers.com

For Examiner's Use

4 The sets A and B are such that

$$A = \left\{x : \cos x = \frac{1}{2},\ 0° \leqslant x \leqslant 620°\right\},$$

$$B = \{x : \tan x = \sqrt{3},\ 0° \leqslant x \leqslant 620°\}.$$

(i) Find n(A). [1]

(ii) Find n(B). [1]

(iii) Find the elements of $A \cup B$. [1]

(iv) Find the elements of $A \cap B$. [1]

www.theallpapers.com

5 **(i)** Find $\int (9 + \sin 3x)\,dx$. [3]

For Examiner's Use

(ii) Hence show that $\int_{\frac{\pi}{9}}^{\pi} (9 + \sin 3x)\,dx = a\pi + b$, where a and b are constants to be found. [3]

© UCLES 2013

www.theallpapers.com

6 The function $f(x) = ax^3 + 4x^2 + bx - 2$, where a and b are constants, is such that $2x - 1$ is a factor. Given that the remainder when $f(x)$ is divided by $x - 2$ is twice the remainder when $f(x)$ is divided by $x + 1$, find the value of a and of b. [6]

For Examiner's Use

© UCLES 2013

[Turn over
www.theallpapers.com

7 **(a)** **(i)** Find how many different 4-digit numbers can be formed from the digits 1, 3, 5, 6, 8 and 9 if each digit may be used only once. [1]

For Examiner's Use

(ii) Find how many of these 4-digit numbers are even. [1]

(b) A team of 6 people is to be selected from 8 men and 4 women. Find the number of different teams that can be selected if

(i) there are no restrictions, [1]

(ii) the team contains all 4 women, [1]

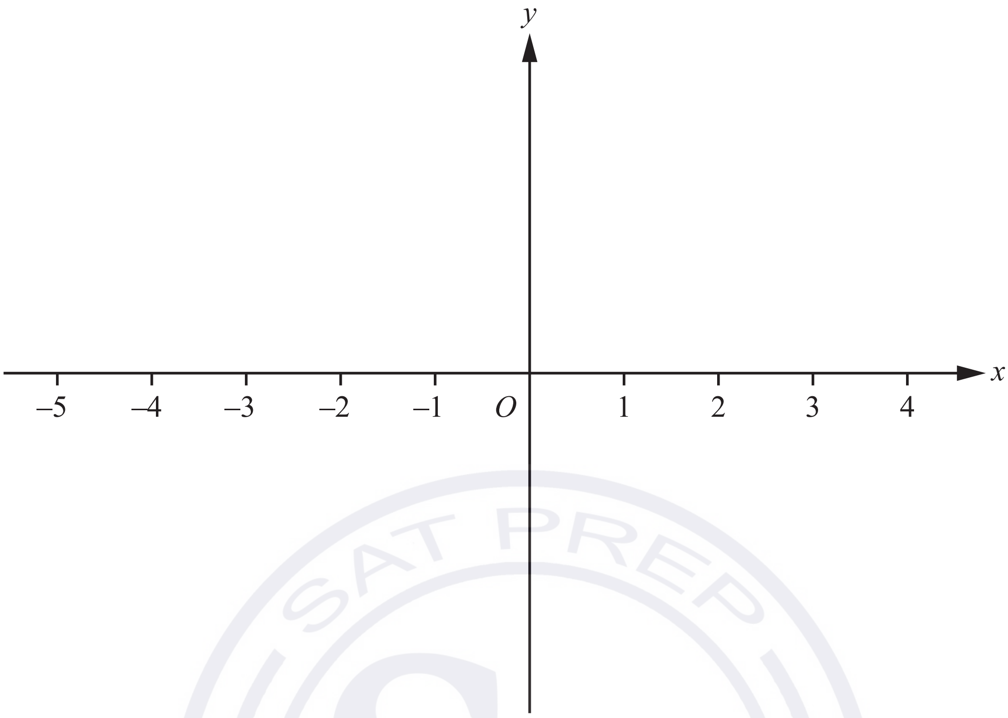
(iii) the team contains at least 4 men. [3]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

For Examiner's Use

8 **(i)** On the grid below, sketch the graph of $y = |(x - 2)(x + 3)|$ for $-5 \leqslant x \leqslant 4$, and state the coordinates of the points where the curve meets the coordinate axes. [4]



(ii) Find the coordinates of the stationary point on the curve $y = |(x - 2)(x + 3)|$. [2]

(iii) Given that k is a positive constant, state the set of values of k for which $|(x - 2)(x + 3)| = k$ has 2 solutions only. [1]

SAT PREP www.satprep.co.in

www.theallpapers.com

For Examiner's Use

9 **(a)** Differentiate $4x^3\ln(2x+1)$ with respect to x. [3]

(b) **(i)** Given that $y = \dfrac{2x}{\sqrt{x+2}}$, show that $\dfrac{dy}{dx} = \dfrac{x+4}{(\sqrt{x+2})^3}$. [4]

www.satprep.co.in

www.theallpapers.com

(ii) Hence find $\int \frac{5x+20}{(\sqrt{x}+2)^3}\,dx$. [2]

For Examiner's Use

(iii) Hence evaluate $\int_2^7 \frac{5x+20}{(\sqrt{x}+2)^3}\,dx$. [2]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

10 Solutions to this question by accurate drawing will not be accepted.

For Examiner's Use

The points $A(-3, 2)$ and $B(1, 4)$ are vertices of an isosceles triangle ABC, where angle $B = 90°$.

(i) Find the length of the line AB. [1]

(ii) Find the equation of the line BC. [3]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

(iii) Find the coordinates of each of the two possible positions of C. [6]

For Examiner's Use

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

For Examiner's Use

11 **(a)** It is given that the matrix $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$.

(i) Find $\mathbf{A} + 2\mathbf{I}$. [1]

(ii) Find $\mathbf{A}^2$. [2]

(iii) Using your answer to part **(ii)** find the matrix $\mathbf{B}$ such that $\mathbf{A}^2\mathbf{B} = \mathbf{I}$. [2]

www.satprep.co.in

www.theallpapers.com

(b) Given that the matrix $\mathbf{C} = \begin{pmatrix} x & -1 \\ x^2 - x + 1 & x - 1 \end{pmatrix}$, show that $\det \mathbf{C} \neq 0$. [4]

For Examiner's Use

---

12 (a) A function f is such that $f(x) = 3x^2 - 1$ for $-10 \leqslant x \leqslant 8$.

(i) Find the range of f. [3]

(ii) Write down a suitable domain for f for which f^{-1} exists. [1]

Question 12(b) is printed on the next page.

www.theallpapers.com

(b) Functions g and h are defined by

$$g(x) = 4e^x - 2 \text{ for } x \in \mathbb{R},$$

$$h(x) = \ln 5x \text{ for } x > 0.$$

For Examiner's Use

(i) Find $g^{-1}(x)$. [2]

(ii) Solve $gh(x) = 18$. [3]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2013

www.theallpapers.com

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME		
CENTRE NUMBER		CANDIDATE NUMBER

0986610475

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (SJW/CGW) 80816
© UCLES 2013

UNIVERSITY *of* CAMBRIDGE International Examinations

[Turn over

www.theallpapers.com

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a+b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

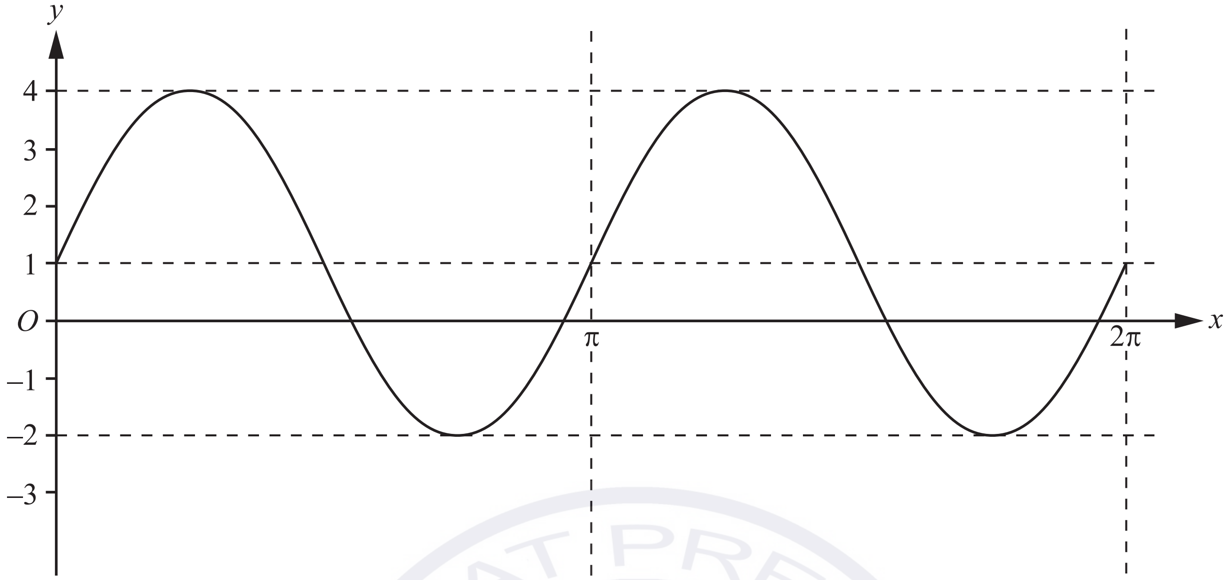
$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2013

www.theallpapers.com

For Examiner's Use

1 The diagram shows the graph of $y = a\sin(bx) + c$ for $0 \leqslant x \leqslant 2\pi$, where a, b and c are positive integers.



State the value of a, of b and of c. [3]

$a =$ $b =$ $c =$

---

2 Find the set of values of k for which the curve $y = (k+1)x^2 - 3x + (k+1)$ lies below the x-axis. [4]

© UCLES 2013

[Turn over
www.theallpapers.com

3 Show that $\frac{1+\sin\theta}{\cos\theta}+\frac{\cos\theta}{1+\sin\theta}=2\sec\theta$. [4]

For Examiner's Use

www.satprep.co.in

www.theallpapers.com

For Examiner's Use

4 The sets A and B are such that

$$A = \left\{x : \cos x = \frac{1}{2}, 0° \leqslant x \leqslant 620°\right\},$$

$$B = \{x : \tan x = \sqrt{3}, 0° \leqslant x \leqslant 620°\}.$$

(i) Find n(A). [1]

(ii) Find n(B). [1]

(iii) Find the elements of $A \cup B$. [1]

(iv) Find the elements of $A \cap B$. [1]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

5 **(i)** Find $\int (9 + \sin 3x)\,\mathrm{d}x$. [3]

For Examiner's Use

(ii) Hence show that $\int_{\frac{\pi}{9}}^{\pi} (9 + \sin 3x)\,\mathrm{d}x = a\pi + b$, where a and b are constants to be found. [3]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

6 The function $f(x) = ax^3 + 4x^2 + bx - 2$, where a and b are constants, is such that $2x - 1$ is a factor. Given that the remainder when $f(x)$ is divided by $x - 2$ is twice the remainder when $f(x)$ is divided by $x + 1$, find the value of a and of b. [6]

For Examiner's Use

www.satprep.co.in

www.theallpapers.com

For Examiner's Use

7 **(a)** **(i)** Find how many different 4-digit numbers can be formed from the digits 1, 3, 5, 6, 8 and 9 if each digit may be used only once. [1]

(ii) Find how many of these 4-digit numbers are even. [1]

(b) A team of 6 people is to be selected from 8 men and 4 women. Find the number of different teams that can be selected if

(i) there are no restrictions, [1]

(ii) the team contains all 4 women, [1]

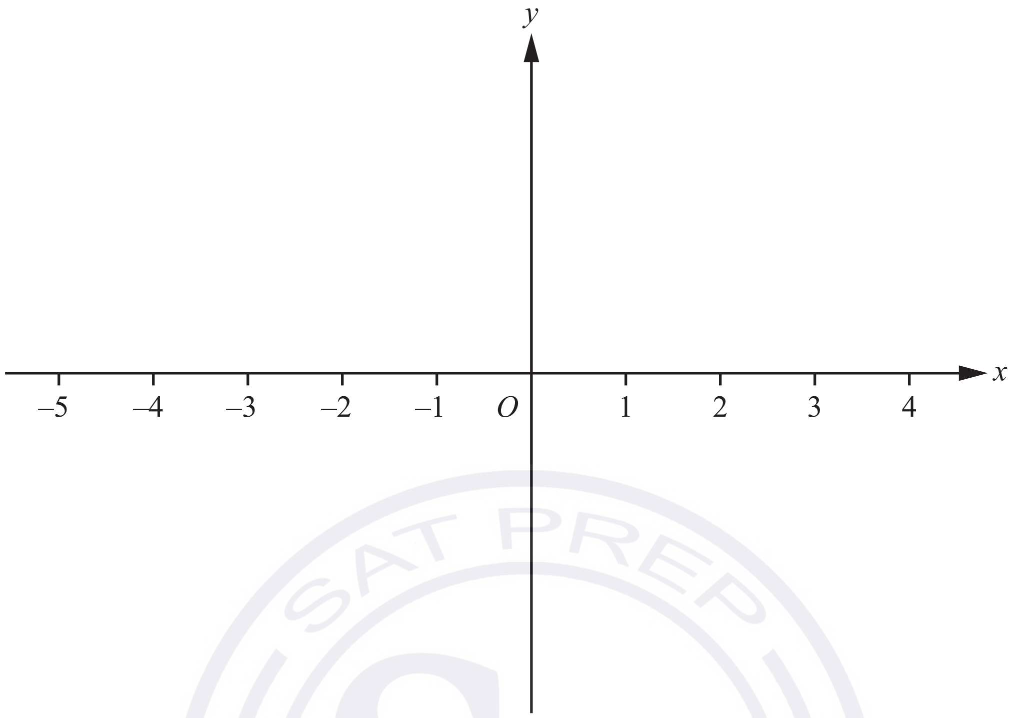
(iii) the team contains at least 4 men. [3]

SAT PREP www.satprep.co.in

www.theallpapers.com

8 **(i)** On the grid below, sketch the graph of $y = |(x-2)(x+3)|$ for $-5 \leqslant x \leqslant 4$, and state the coordinates of the points where the curve meets the coordinate axes. [4]

For Examiner's Use



(ii) Find the coordinates of the stationary point on the curve $y = |(x-2)(x+3)|$. [2]

SAT PREP
www.satprep.co.in

(iii) Given that k is a positive constant, state the set of values of k for which $|(x-2)(x+3)| = k$ has 2 solutions only. [1]

www.theallpapers.com

9 **(a)** Differentiate $4x^3 \ln(2x+1)$ with respect to x. [3]

For Examiner's Use

(b) **(i)** Given that $y = \frac{2x}{\sqrt{x+2}}$, show that $\frac{dy}{dx} = \frac{x+4}{(\sqrt{x+2})^3}$. [4]

www.satprep.co.in

www.theallpapers.com

For Examiner's Use

(ii) Hence find $\int \frac{5x+20}{(\sqrt{x}+2)^3}\,dx$. [2]

(iii) Hence evaluate $\int_2^7 \frac{5x+20}{(\sqrt{x}+2)^3}\,dx$. [2]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

10 Solutions to this question by accurate drawing will not be accepted.

For Examiner's Use

The points $A(-3, 2)$ and $B(1, 4)$ are vertices of an isosceles triangle ABC, where angle $B = 90°$.

(i) Find the length of the line AB. [1]

(ii) Find the equation of the line BC. [3]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

(iii) Find the coordinates of each of the two possible positions of C. [6]

For Examiner's Use

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

For Examiner's Use

11 **(a)** It is given that the matrix $\mathbf{A} = \begin{pmatrix} 2 & 3 \\ 4 & 1 \end{pmatrix}$.

(i) Find $\mathbf{A} + 2\mathbf{I}$. [1]

(ii) Find $\mathbf{A}^2$. [2]

(iii) Using your answer to part **(ii)** find the matrix $\mathbf{B}$ such that $\mathbf{A}^2\mathbf{B} = \mathbf{I}$. [2]

www.satprep.co.in

www.theallpapers.com

For Examiner's Use

(b) Given that the matrix $\mathbf{C} = \begin{pmatrix} x & -1 \\ x^2 - x + 1 & x - 1 \end{pmatrix}$, show that det $\mathbf{C} \neq 0$. [4]

---

12 (a) A function f is such that $f(x) = 3x^2 - 1$ for $-10 \leqslant x \leqslant 8$.

(i) Find the range of f. [3]

(ii) Write down a suitable domain for f for which f^{-1} exists. [1]

Question 12(b) is printed on the next page.

www.theallpapers.com

(b) Functions g and h are defined by

$$g(x) = 4e^x - 2 \text{ for } x \in \mathbb{R},$$

$$h(x) = \ln 5x \text{ for } x > 0.$$

For Examiner's Use

(i) Find $g^{-1}(x)$. [2]

(ii) Solve $gh(x) = 18$. [3]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2013

www.theallpapers.com

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

0748000447

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **October/November 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (NH/CGW) 67137/4
© UCLES 2013

UNIVERSITY *of* CAMBRIDGE International Examinations

[Turn over

www.theallpapers.com

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \ldots + \binom{n}{r}a^{n-r}b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

© UCLES 2013

www.theallpapers.com

1 The coefficient of x^2 in the expansion of $(2 + px)^6$ is 60.

For Examiner's Use

(i) Find the value of the positive constant p. [3]

(ii) Using your value of p, find the coefficient of x^2 in the expansion of $(3 - x)(2 + px)^6$. [3]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

2 Solve $2\lg y - \lg(5y + 60) = 1.$ [5]

For Examiner's Use

www.theallpapers.com

3 Show that $\tan^2\theta - \sin^2\theta = \sin^4\theta\sec^2\theta$. [4]

For Examiner's Use

www.satprep.co.in SAT PREP SP

www.theallpapers.com

For Examiner's Use

4 A curve has equation $y = \dfrac{e^{2x}}{(x+3)^2}$.

(i) Show that $\dfrac{dy}{dx} = \dfrac{Ae^{2x}(x+2)}{(x+3)^3}$, where A is a constant to be found. [4]

(ii) Find the exact coordinates of the point on the curve where $\dfrac{dy}{dx} = 0$. [2]

www.theallpapers.com

5 For $x \in \mathbb{R}$, the functions f and g are defined by

$$f(x) = 2x^3,$$

$$g(x) = 4x - 5x^2.$$

(i) Express $f^2\left(\frac{1}{2}\right)$ as a power of 2. [2]

(ii) Find the values of x for which f and g are increasing at the same rate with respect to x. [4]

For Examiner's Use

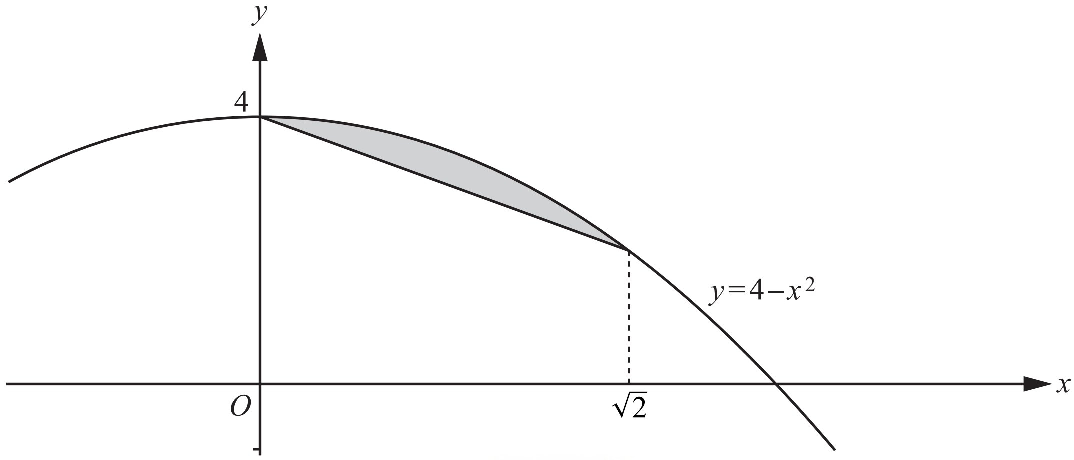
SAT PREP SP www.satprep.co.in

www.theallpapers.com

6 Do not use a calculator in this question.

For Examiner's Use

The diagram shows part of the curve $y = 4 - x^2$.



Show that the area of the shaded region can be written in the form $\dfrac{\sqrt{2}}{p}$, where p is an integer to be found. [6]

www.satprep.co.in

www.theallpapers.com

7 It is given that $\mathbf{A} = \begin{pmatrix} 2t & 2 \\ t^2 - t + 1 & t \end{pmatrix}$.

For Examiner's Use

(i) Find the value of t for which det $\mathbf{A} = 1$. [3]

(ii) In the case when $t = 3$, find $\mathbf{A}^{-1}$ and hence solve

$$3x + y = 5,$$
$$7x + 3y = 11.$$

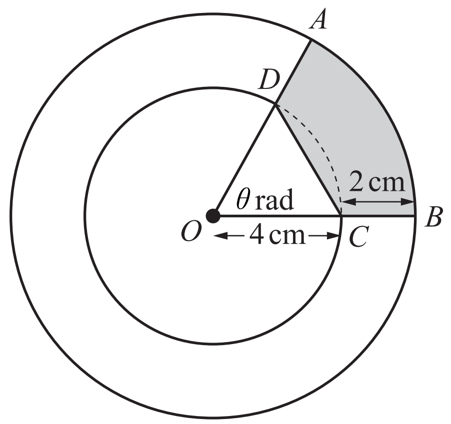
[5]

www.satprep.co.in SAT PREP

www.theallpapers.com

For Examiner's Use

8 The diagram shows two concentric circles, centre O, radii 4 cm and 6 cm. The points A and B lie on the larger circle and the points C and D lie on the smaller circle such that ODA and OCB are straight lines.



(i) Given that the area of triangle OCD is $7.5\,\text{cm}^2$, show that $\theta = 1.215$ radians, to 3 decimal places. [2]

(ii) Find the perimeter of the shaded region. [4]

www.satprep.co.in

www.theallpapers.com

(iii) Find the area of the shaded region. [3]

For Examiner's Use

www.theallpapers.com

For Examiner's Use

9 **(a)** **(i)** Solve $6\sin^2 x = 5 + \cos x$ for $0° < x < 180°$. [4]

(ii) Hence, or otherwise, solve $6\cos^2 y = 5 + \sin y$ for $0° < y < 180°$. [3]

SAT PREP www.satprep.co.in

www.theallpapers.com

(b) Solve $4\cot^2 z - 3\cot z = 0$ for $0 < z < \pi$ radians. [4]

For Examiner's Use

www.theallpapers.com

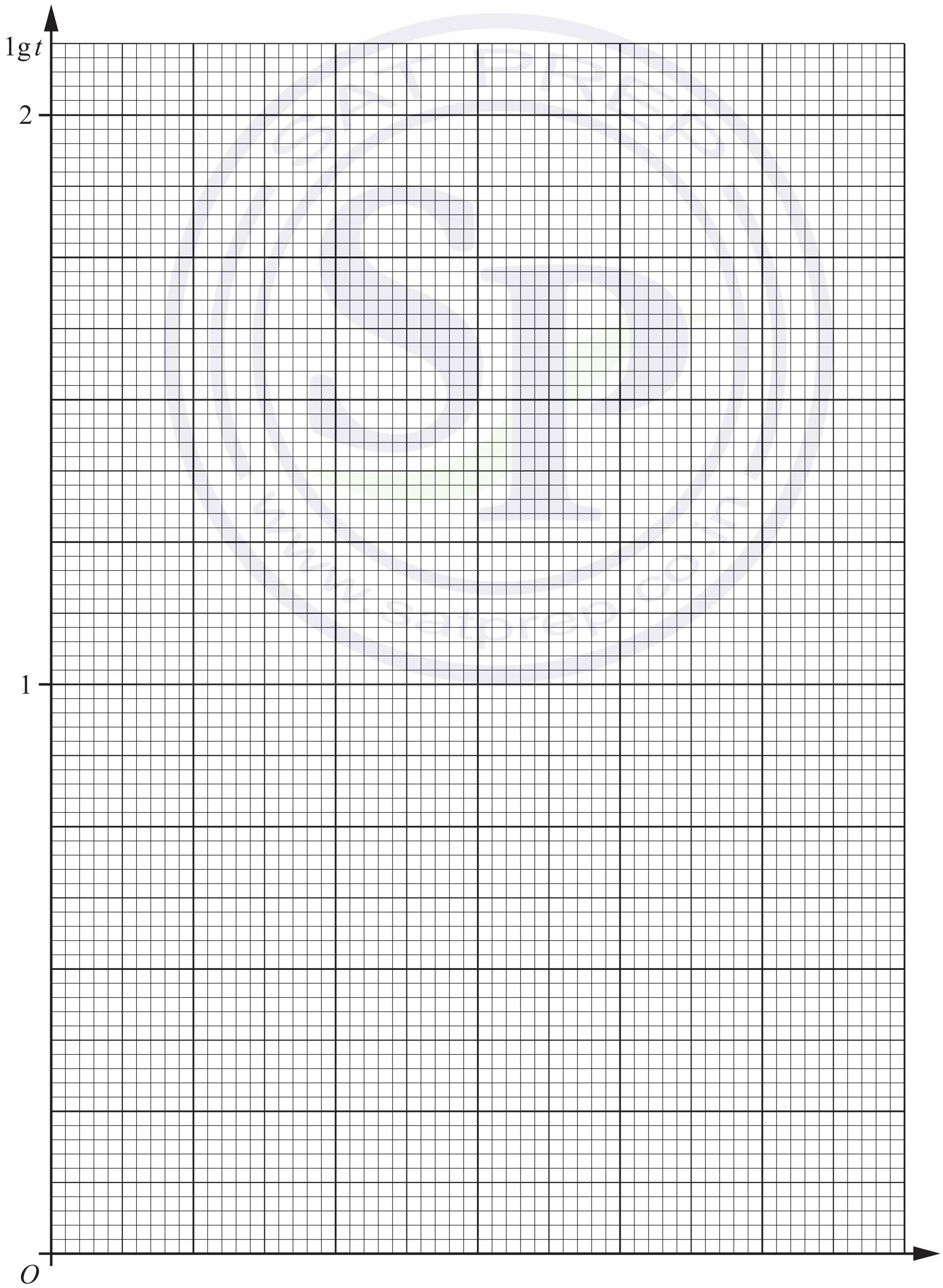
For Examiner's Use

10 The variables s and t are related by the equation $t = ks^n$, where k and n are constants. The table below shows values of variables s and t.

s	2	4	6	8
t	25.00	6.25	2.78	1.56

(i) A straight line graph is to be drawn for this information with $\lg t$ plotted on the vertical axis. State the variable which must be plotted on the horizontal axis. [1]

(ii) Draw this straight line graph on the grid below. [3]



www.theallpapers.com

(iii) Use your graph to find the value of k and of n. [4]

For Examiner's Use

(iv) Estimate the value of s when $t = 4$. [2]

SAT PREP www.satprep.co.in

Question 11 is printed on the next page.

www.theallpapers.com

11 **(i)** Given that $\int_0^k \left(2e^{2x} - \frac{5}{2}e^{-2x}\right) dx = \frac{3}{4}$, where k is a constant, show that

For Examiner's Use

$$4e^{4k} - 12e^{2k} + 5 = 0.$$ [5]

(ii) Using a substitution of $y = e^{2k}$, or otherwise, find the possible values of k. [4]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2013

www.theallpapers.com

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER | CANDIDATE NUMBER

5544652315

ADDITIONAL MATHEMATICS **0606/11**

Paper 1 **May/June 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

DC (RW/SW) 57083/4
© UCLES 2013

UNIVERSITY *of* CAMBRIDGE
International Examinations

www.theallpapers.com

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

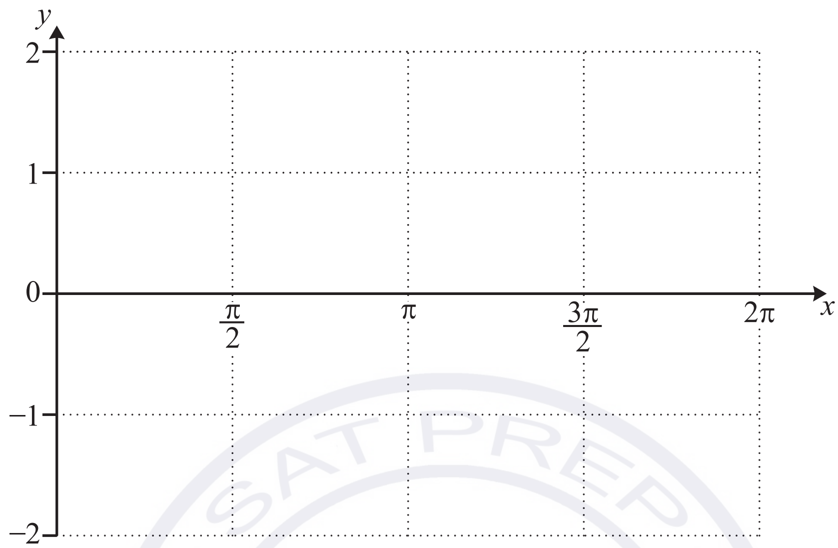
www.theallpapers.com

1 On the axes below sketch, for $0 \leqslant x \leqslant 2\pi$, the graph of

For Examiner's Use

(i) $y = \cos x - 1$, [2]

(ii) $y = \sin 2x$. [2]

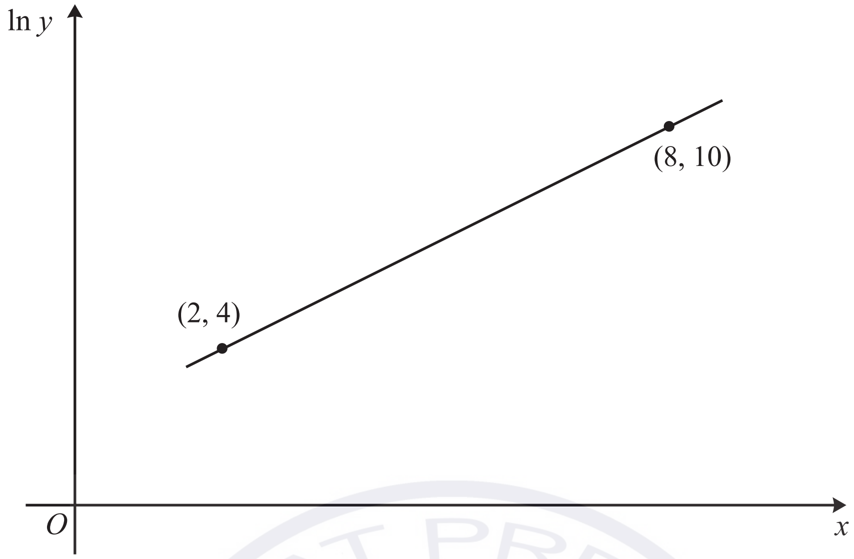


SAT PREP www.satprep.co.in

(iii) State the number of solutions of the equation $\cos x - \sin 2x = 1$, for $0 \leqslant x \leqslant 2\pi$. [1]

www.theallpapers.com

2 Variables x and y are such that $y = Ab^x$, where A and b are constants. The diagram shows the graph of $\ln y$ against x, passing through the points (2, 4) and (8, 10).



Find the value of A and of b. [5]

www.satprep.co.in

www.theallpapers.com

3 A committee of 6 members is to be selected from 5 men and 9 women. Find the number of different committees that could be selected if

For Examiner's Use

(i) there are no restrictions, [1]

(ii) there are exactly 3 men and 3 women on the committee, [2]

SAT PREP SP www.satprep.co.in

(iii) there is at least 1 man on the committee. [3]

www.theallpapers.com

4 **(i)** Given that $\log_4 x = \frac{1}{2}$, find the value of x. [1]

For Examiner's Use

(ii) Solve $2\log_4 y - \log_4(5y - 12) = \frac{1}{2}$. [4]

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

5 **(i)** Find $\int\left(1-\frac{6}{x^2}\right)\mathrm{d}x$. [2]

For Examiner's Use

(ii) Hence find the value of the positive constant k for which $\int_k^{3k}\left(1-\frac{6}{x^2}\right)\mathrm{d}x = 2$. [4]

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

6 **(i)** Given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 3 & 5 \end{pmatrix}$, find $\mathbf{A}^{-1}$. [2]

For Examiner's Use

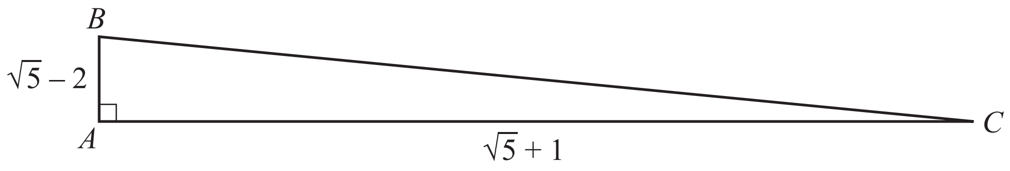
(ii) Using your answer from part **(i)**, or otherwise, find the values of a, b, c and d such that

$$\mathbf{A}\begin{pmatrix} a & b \\ c & -1 \end{pmatrix} = \begin{pmatrix} 7 & 5 \\ 17 & d \end{pmatrix}.$$ [5]

www.satprep.co.in

www.theallpapers.com

7 Calculators must not be used in this question.



The diagram shows a triangle ABC in which angle $A = 90°$. Sides AB and AC are $\sqrt{5} - 2$ and $\sqrt{5} + 1$ respectively. Find

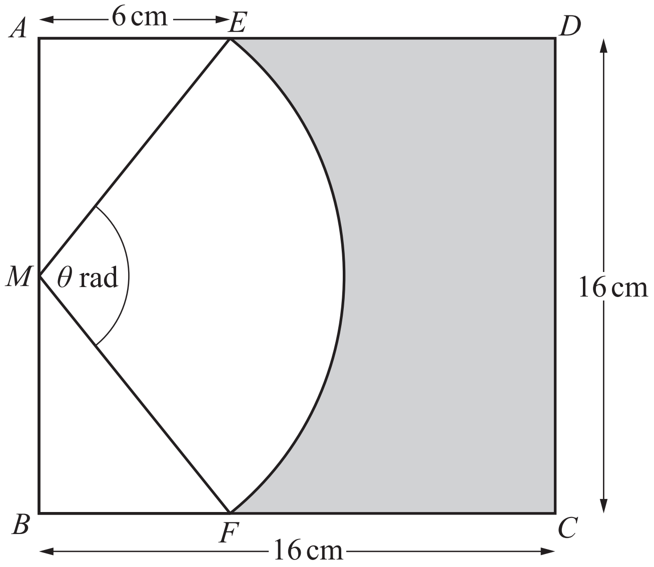
(i) $\tan B$ in the form $a + b\sqrt{5}$, where a and b are integers, [3]

(ii) $\sec^2 B$ in the form $c + d\sqrt{5}$, where c and d are integers. [4]

www.satprep.co.in SAT PREP SP

www.theallpapers.com

8



The diagram shows a square *ABCD* of side 16 cm. *M* is the mid-point of *AB*. The points *E* and *F* are on *AD* and *BC* respectively such that $AE = BF = 6$ cm. *EF* is an arc of the circle centre *M*, such that angle *EMF* is θ radians.

(i) Show that $\theta = 1.855$ radians, correct to 3 decimal places. [2]

(ii) Calculate the perimeter of the shaded region. [4]

For Examiner's Use

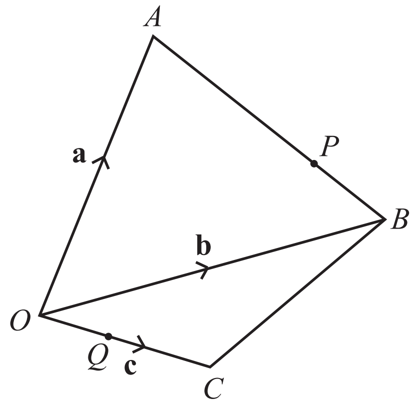
www.theallpapers.com

(iii) Calculate the area of the shaded region. [3]

For Examiner's Use

www.theallpapers.com

9



For Examiner's Use

The figure shows points A, B and C with position vectors **a**, **b** and **c** respectively, relative to an origin O. The point P lies on AB such that $AP : AB = 3 : 4$. The point Q lies on OC such that $OQ : QC = 2 : 3$.

(i) Express $\overrightarrow{AP}$ in terms of **a** and **b** and hence show that $\overrightarrow{OP} = \frac{1}{4}(\mathbf{a} + 3\mathbf{b})$. [3]

(ii) Find $\overrightarrow{PQ}$ in terms of **a**, **b** and **c**. [3]

www.theallpapers.com

(iii) Given that $5\overrightarrow{PQ} = 6\overrightarrow{BC}$, find **c** in terms of **a** and **b**. [2]

For Examiner's Use

www.theallpapers.com

10 The point A, whose x-coordinate is 2, lies on the curve with equation $y = x^3 - 4x^2 + x + 1$.

For Examiner's Use

(i) Find the equation of the tangent to the curve at A. [4]

This tangent meets the curve again at the point B.

(ii) Find the coordinates of B. [4]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

(iii) Find the equation of the perpendicular bisector of the line *AB*. [4]

For Examiner's Use

SAT PREP
SP
www.satprep.co.in

Question 11 is printed on the next page.

www.theallpapers.com

11 **(a)** Solve $2\sin\left(x+\frac{\pi}{3}\right)=-1$ for $0 \leqslant x \leqslant 2\pi$ radians. [4]

For Examiner's Use

(b) Solve $\tan y - 2 = \cot y$ for $0° \leqslant y \leqslant 180°$. [6]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2013

www.theallpapers.com

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME	
CENTRE NUMBER	
CANDIDATE NUMBER	

6111639065

ADDITIONAL MATHEMATICS **0606/12**

Paper 1 **May/June 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **17** printed pages and **3** blank pages.

DC (LEO/SW) 57088/3
© UCLES 2013

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

www.theallpapers.com

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1} a^{n-1} b + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{r} a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

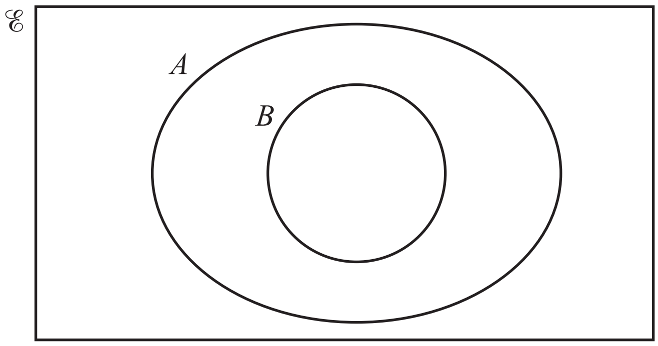
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

www.theallpapers.com

1



The Venn diagram shows the universal set ℰ, the set A and the set B. Given that $n(B) = 5$, $n(A') = 10$ and $n(ℰ) = 26$, find

(i) $n(A \cap B)$, [1]

(ii) $n(A)$, [1]

(iii) $n(B' \cap A)$. [1]

www.theallpapers.com

2 A 4-digit number is to be formed from the digits 1, 2, 5, 7, 8 and 9. Each digit may only be used once. Find the number of different 4-digit numbers that can be formed if

For Examiner's Use

(i) there are no restrictions, [1]

(ii) the 4-digit numbers are divisible by 5, [2]

(iii) the 4-digit numbers are divisible by 5 and are greater than 7000. [2]

www.satprep.co.in

www.theallpapers.com

3 Show that $(1 - \cos\theta - \sin\theta)^2 - 2(1 - \sin\theta)(1 - \cos\theta) = 0$. [3]

For Examiner's Use

www.satprep.co.in

www.theallpapers.com

4 Find the set of values of k for which the curve $y = 2x^2 + kx + 2k - 6$ lies above the x-axis for all values of x. [4]

For Examiner's Use

www.satprep.co.in

© UCLES 2013

www.theallpapers.com

5 The line $3x + 4y = 15$ cuts the curve $2xy = 9$ at the points A and B. Find the length of the line AB. [6]

For Examiner's Use

www.theallpapers.com

6 The normal to the curve $y + 2 = 3 \tan x$, at the point on the curve where $x = \dfrac{3\pi}{4}$, cuts the y-axis at the point P. Find the coordinates of P. [6]

For Examiner's Use

SAT PREP SP www.satprep.co.in

www.theallpapers.com

For Examiner's Use

7 It is given that $f(x) = 6x^3 - 5x^2 + ax + b$ has a factor of $x + 2$ and leaves a remainder of 27 when divided by $x - 1$.

(i) Show that $b = 40$ and find the value of a. [4]

(ii) Show that $f(x) = (x + 2)(px^2 + qx + r)$, where p, q and r are integers to be found. [2]

(iii) Hence solve $f(x) = 0$. [2]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

8 **(a)** Given that the matrix $\mathbf{A} = \begin{pmatrix} 4 & 2 \\ 3 & -5 \end{pmatrix}$, find

For Examiner's Use

(i) $\mathbf{A}^2$, [2]

(ii) $3\mathbf{A} + 4\mathbf{I}$, where $\mathbf{I}$ is the identity matrix. [2]

SAT PREP www.satprep.co.in

www.theallpapers.com

(b) **(i)** Find the inverse matrix of $\begin{pmatrix} 6 & 1 \\ -9 & 3 \end{pmatrix}$. [2]

For Examiner's Use

(ii) Hence solve the equations

$$6x + y = 5,$$
$$-9x + 3y = \frac{3}{2}.$$

[3]

www.theallpapers.com

9 **(i)** Given that n is a positive integer, find the first 3 terms in the expansion of $\left(1 + \frac{1}{2}x\right)^n$ in ascending powers of x. [2]

For Examiner's Use

(ii) Given that the coefficient of x^2 in the expansion of $(1 - x)\left(1 + \frac{1}{2}x\right)^n$ is $\frac{25}{4}$, find the value of n. [5]

www.satprep.co.in SAT PREP SP

www.theallpapers.com

10 **(a)** **(i)** Find $\int \sqrt{2x-5}\,dx$. [2]

For Examiner's Use

(ii) Hence evaluate $\int_3^{15} \sqrt{2x-5}\,dx$. [2]

www.satprep.co.in

www.theallpapers.com

For Examiner's Use

(b) **(i)** Find $\frac{d}{dx}(x^3 \ln x)$. [2]

(ii) Hence find $\int x^2 \ln x \, dx$. [3]

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

For Examiner's Use

11 **(a)** Solve $\cos 2x + 2\sec 2x + 3 = 0$ for $0° \leqslant x \leqslant 360°$. [5]

(b) Solve $2\sin^2\left(y - \frac{\pi}{6}\right) = 1$ for $0 \leqslant y \leqslant \pi$. [4]

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

12 A particle P moves in a straight line such that, t s after leaving a point O, its velocity $v\,\text{m}\,\text{s}^{-1}$ is given by $v = 36t - 3t^2$ for $t \geqslant 0$.

For Examiner's Use

(i) Find the value of t when the velocity of P stops increasing. [2]

(ii) Find the value of t when P comes to instantaneous rest. [2]

SAT PREP SP www.satprep.co.in

(iii) Find the distance of P from O when P is at instantaneous rest. [3]

www.theallpapers.com

(iv) Find the speed of P when P is again at O. [4]

For Examiner's Use

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

BLANK PAGE

SAT PREP SP www.satprep.co.in

www.theallpapers.com

BLANK PAGE

© UCLES 2013

www.theallpapers.com

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

www.theallpapers.com

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME			
CENTRE NUMBER		CANDIDATE NUMBER	

6607517764

ADDITIONAL MATHEMATICS **0606/13**

Paper 1 **May/June 2013**

2 hours

Candidates answer on the Question Paper.

Additional Materials: Electronic calculator

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use a pencil for any diagrams or graphs.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** the questions.
Give non-exact numerical answers correct to 3 significant figures, or 1 decimal place in the case of angles in degrees, unless a different level of accuracy is specified in the question.
The use of an electronic calculator is expected, where appropriate.
You are reminded of the need for clear presentation in your answers.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 80.

This document consists of **16** printed pages.

DC (TL/SW) 71814
© UCLES 2013

UNIVERSITY *of* CAMBRIDGE
International Examinations

[Turn over

www.theallpapers.com

Mathematical Formulae

1. ALGEBRA

Quadratic Equation

For the equation $ax^2 + bx + c = 0$,

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$$

Binomial Theorem

$$(a + b)^n = a^n + \binom{n}{1}a^{n-1} b + \binom{n}{2}a^{n-2} b^2 + \ldots + \binom{n}{r}a^{n-r} b^r + \ldots + b^n,$$

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

2. TRIGONOMETRY

Identities

$$\sin^2 A + \cos^2 A = 1$$

$$\sec^2 A = 1 + \tan^2 A$$

$$\operatorname{cosec}^2 A = 1 + \cot^2 A$$

Formulae for ΔABC

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\Delta = \frac{1}{2} bc \sin A$$

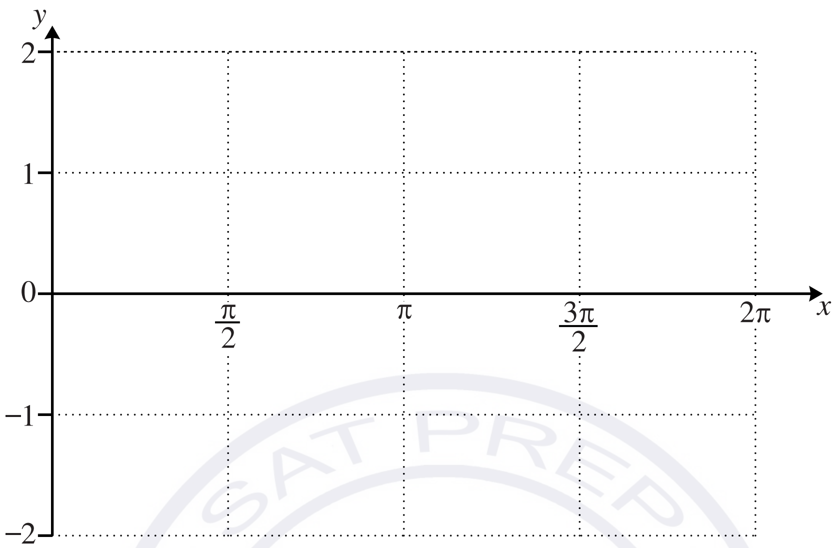
© UCLES 2013

www.theallpapers.com

1 On the axes below sketch, for $0 \leqslant x \leqslant 2\pi$, the graph of

(i) $y = \cos x - 1$, [2]

(ii) $y = \sin 2x$. [2]



(iii) State the number of solutions of the equation $\cos x - \sin 2x = 1$, for $0 \leqslant x \leqslant 2\pi$. [1]

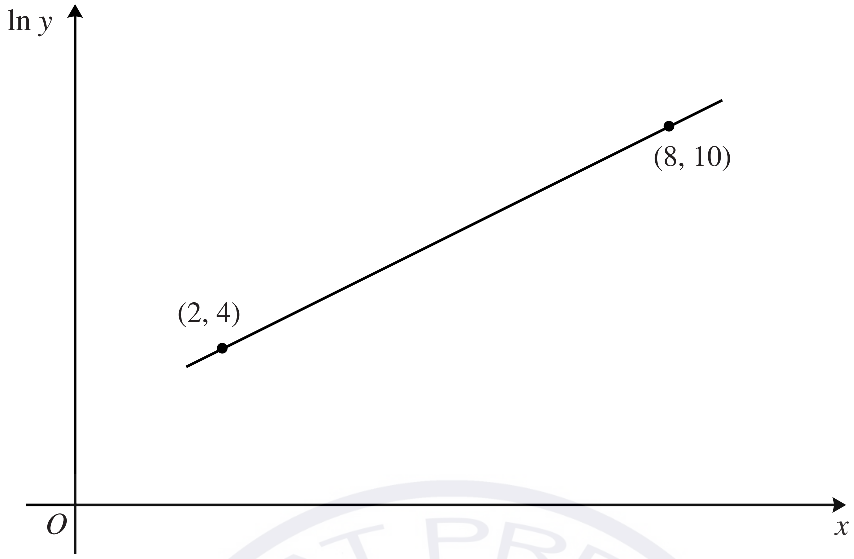
For Examiner's Use

SATPREP www.satprep.co.in

www.theallpapers.com

For Examiner's Use

2 Variables x and y are such that $y = Ab^x$, where A and b are constants. The diagram shows the graph of $\ln y$ against x, passing through the points (2, 4) and (8, 10).



Find the value of A and of b. [5]

SAT PREP
SP
www.satprep.co.in

www.theallpapers.com

For Examiner's Use

3 A committee of 6 members is to be selected from 5 men and 9 women. Find the number of different committees that could be selected if

(i) there are no restrictions, [1]

(ii) there are exactly 3 men and 3 women on the committee, [2]

(iii) there is at least 1 man on the committee. [3]

www.theallpapers.com

For Examiner's Use

4 **(i)** Given that $\log_4 x = \frac{1}{2}$, find the value of x. [1]

(ii) Solve $2\log_4 y - \log_4(5y - 12) = \frac{1}{2}$. [4]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

5 **(i)** Find $\int\left(1-\frac{6}{x^2}\right)\mathrm{d}x$. [2]

For Examiner's Use

(ii) Hence find the value of the positive constant k for which $\int_k^{3k}\left(1-\frac{6}{x^2}\right)\mathrm{d}x = 2$. [4]

SAT PREP SP www.satprep.co.in

www.theallpapers.com

6 **(i)** Given that $\mathbf{A} = \begin{pmatrix} 2 & -1 \\ 3 & 5 \end{pmatrix}$, find $\mathbf{A}^{-1}$. [2]

For Examiner's Use

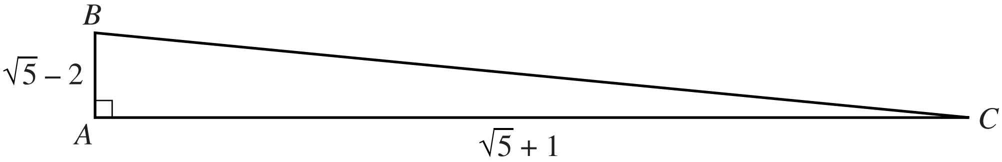
(ii) Using your answer from part **(i)**, or otherwise, find the values of a, b, c and d such that

$$\mathbf{A}\begin{pmatrix} a & b \\ c & -1 \end{pmatrix} = \begin{pmatrix} 7 & 5 \\ 17 & d \end{pmatrix}.$$ [5]

www.theallpapers.com

For Examiner's Use

7 Calculators must not be used in this question.



The diagram shows a triangle ABC in which angle $A = 90°$. Sides AB and AC are $\sqrt{5} - 2$ and $\sqrt{5} + 1$ respectively. Find

(i) $\tan B$ in the form $a + b\sqrt{5}$, where a and b are integers, [3]

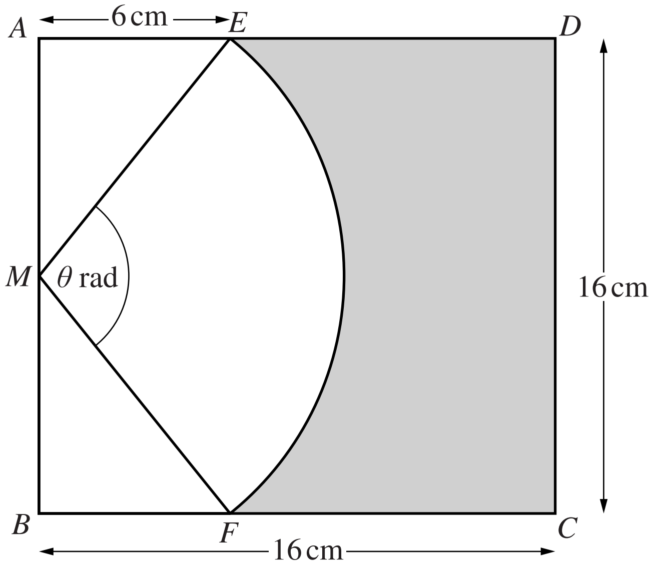
(ii) $\sec^2 B$ in the form $c + d\sqrt{5}$, where c and d are integers. [4]

www.satprep.co.in

www.theallpapers.com

For Examiner's Use

8



The diagram shows a square *ABCD* of side 16 cm. *M* is the mid-point of *AB*. The points *E* and *F* are on *AD* and *BC* respectively such that $AE = BF = 6$ cm. *EF* is an arc of the circle centre *M*, such that angle *EMF* is θ radians.

(i) Show that $\theta = 1.855$ radians, correct to 3 decimal places. [2]

(ii) Calculate the perimeter of the shaded region. [4]

www.theallpapers.com

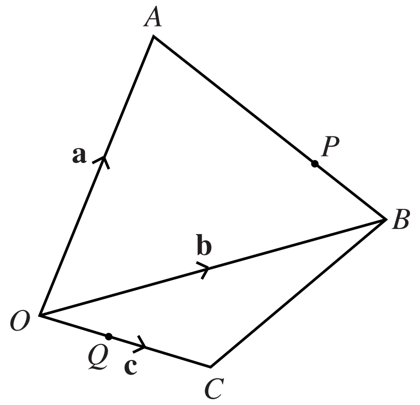
(iii) Calculate the area of the shaded region. [3]

For Examiner's Use

www.theallpapers.com

For Examiner's Use

9



The figure shows points A, B and C with position vectors **a**, **b** and **c** respectively, relative to an origin O. The point P lies on AB such that $AP : AB = 3 : 4$. The point Q lies on OC such that $OQ : QC = 2 : 3$.

(i) Express $\overrightarrow{AP}$ in terms of **a** and **b** and hence show that $\overrightarrow{OP} = \frac{1}{4}(\mathbf{a} + 3\mathbf{b})$. [3]

(ii) Find $\overrightarrow{PQ}$ in terms of **a**, **b** and **c**. [3]

www.theallpapers.com

(iii) Given that $5\overrightarrow{PQ} = 6\overrightarrow{BC}$, find **c** in terms of **a** and **b**. [2]

For Examiner's Use

www.theallpapers.com

For Examiner's Use

10 The point A, whose x-coordinate is 2, lies on the curve with equation $y = x^3 - 4x^2 + x + 1$.

(i) Find the equation of the tangent to the curve at A. [4]

This tangent meets the curve again at the point B.

(ii) Find the coordinates of B. [4]

SAT PREP www.satprep.co.in

www.theallpapers.com

For Examiner's Use

(iii) Find the equation of the perpendicular bisector of the line *AB*. [4]

Question 11 is printed on the next page.

www.theallpapers.com

11 **(a)** Solve $2\sin\left(x+\frac{\pi}{3}\right)=-1$ for $0 \leqslant x \leqslant 2\pi$ radians. [4]

For Examiner's Use

(b) Solve $\tan y - 2 = \cot y$ for $0° \leqslant y \leqslant 180°$. [6]

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

University of Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

www.theallpapers.com