Extended Mathematics
Topic : Algebra -1
Year :May 2013 -May 2024
Paper - 4
Questions Booklet

Question 1

(i) Solve $2(3x - 7) = 13$.

Answer(a)(i) $x =$ .... [3]

(ii) Solve by factorising $x^2 - 7x + 6 = 0$.

Answer(a)(ii) $x =$ .... or $x =$ .... [3]

Question 2

Solve the simultaneous equations.

$$9x - 2y = 12$$
$$3x + 4y = -10$$

Answer(b) $x =$ ....

$y =$ .... [3]

Question 3

Paul buys a number of large sacks of fertiliser costing $x each.

He spends $27.

(a) Write down, in terms of x, an expression for the number of large sacks which Paul buys.

Answer(a) .... [1]

(b) Rula buys a number of small sacks of fertiliser.
Each small sack costs $2 less than a large sack.
Rula spends $25.

Write down, in terms of x, an expression for the number of small sacks which Rula buys.

Answer(b) .... [1]

(c) Rula buys 4 more sacks than Paul.
Write down an equation in x and show that it simplifies to $2x^2 - 3x - 27 = 0$.

Answer(c)

[4]

(d) Solve $2x^2 - 3x - 27 = 0$.

Answer(d) $x =$ .... or $x =$ .... [3]

(e) Calculate the number of sacks which Paul buys.

Answer(e) .... [1]

Question 4

$$f(x) = x^2 + x - 3 \qquad g(x) = 2x + 7 \qquad h(x) = 2^x$$

Solve the equation $f(x) = 0$.
Show all your working and give your answers correct to 2 decimal places.

Answer(a) $x =$ .... or $x =$ .... [4]

Question 5

Expand and simplify.

$$(2x - 3)^2 - 3x(x - 4)$$

Answer(b) .... [4]

Question 6

Factorise.

$$2x^2 + 5x - 3$$

Answer(c)(i) .... [2]

Question 7

(a) Solve the equation $8x^2 - 11x - 11 = 0$.
Show all your working and give your answers correct to 2 decimal places.

Answer(a) $x =$ .... or $x =$ .... [4]

3

Question 8

Solve the equation $2x^2 + 3x - 6 = 0$.

Show all your working and give your answers correct to 2 decimal places.

Answer(a)(ii) $x =$ .... or $x =$ .... [4]

Question 9

The distance a train travels on a journey is 600 km.

(a) Write down an expression, in terms of x, for the average speed of the train when

(i) the journey takes x hours,

Answer(a)(i) .... km/h [1]

(ii) the journey takes $(x + 1)$ hours.

Answer(a)(ii) .... km/h [1]

(b) The difference between the average speeds in **part(a)(i)** and **part(a)(ii)** is 20 km/h.

(i) Show that $x^2 + x - 30 = 0$.

Answer(b)(i)

[3]

(ii) Find the average speed of the train for the journey in **part(a)(ii)**.
Show all your working.

Answer(b)(ii) .... km/h [4]

Question 10

Solve the equation $2x^2 - 3x - 6 = 0$.

Give your answers correct to 2 decimal places.
Show all your working.

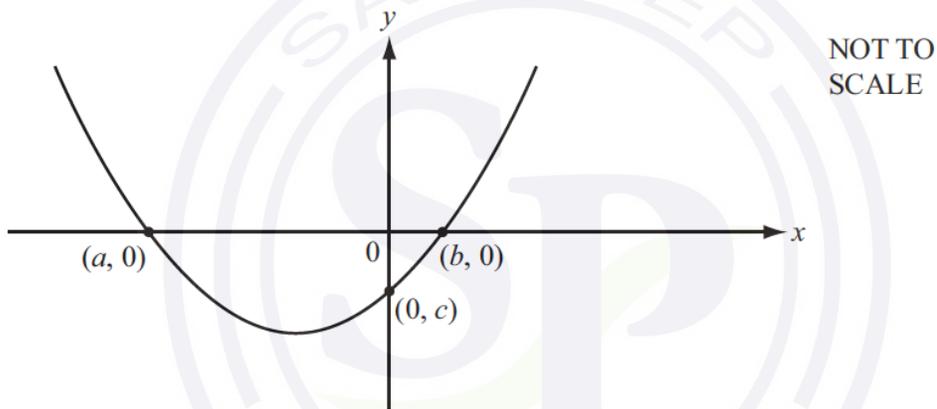*Answers x =* .... *or x* .... [4]

Question 11

(i) Factorise $x^2 + 3x - 10$.

Answer(b)(i) .... [2]

(ii) The graph of $y = x^2 + 3x - 10$ is sketched below.

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Write down the values of a, b and c.

Answer(b)(ii) $a =$ ....

$b =$ ....

$c =$ .... [3]

(iii) Write down the equation of the line of symmetry of the graph of $y = x^2 + 3x - 10$.

Answer(b)(iii) .... [1]

Question 12

(i) $x^2 + 12x - 7 = (x+p)^2 - q$

Find the value of p and the value of q.

Answer(d)(i) $p =$ ....

$q =$ .... [3]

(ii) Write down the minimum value of y for the graph of $y = x^2 + 12x - 7$.

Answer(d)(ii) .... [1]

Question 13

Solve $3x^2 - 7x - 12 = 0$.
Show your working and give your answers correct to 2 decimal places.

Answer(b) $x =$ .... or $x =$ .... [4]

Question 14

(i) Factorise completely.
$$pq - 2q - 8 + 4p$$

(ii) Factorise.
$$9p^2 - 25$$

Question 15

Solve this equation by factorising.
$$5x^2 + x - 18 = 0$$

Question 16

Factorise $121y^2 - m^2$.

Question 17

Solve the equation.
$$3x^2 + 2x - 7 = 0$$

Show all your working and give your answers correct to 2 decimal places.

Question 18

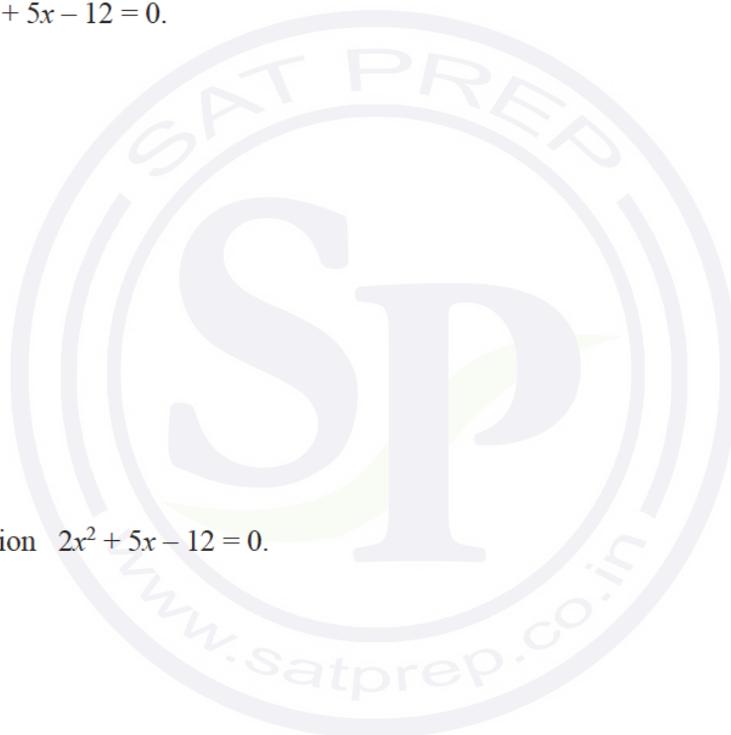In this part, all lengths are in centimetres.
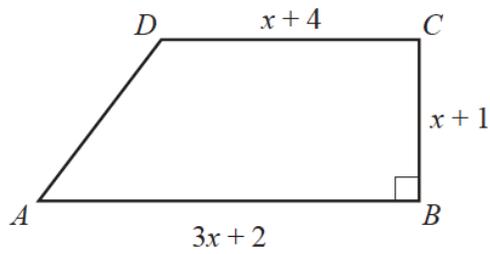
NOT TO SCALE

$ABCD$ is a trapezium with area $15\,\text{cm}^2$.

(i) Show that $2x^2 + 5x - 12 = 0$.

Answer(d)(i)

[3]

(ii) Solve the equation $2x^2 + 5x - 12 = 0$.

Answer(d)(ii) $x =$ .... or $x =$ .... [3]

Question 19

(a) Expand and simplify.
$$3x(x - 2) - 2x(3x - 5)$$

Answer(a) .... [3]

(b) Factorise the following completely.

(i) $6w + 3wy - 4x - 2xy$

Answer(b)(i) .... [2]

(ii) $4x^2 - 25y^2$

Answer(b)(ii) .... [2]

Question 20

On the first part of a journey, Alan drove a distance of x km and his car used 6 litres of fuel.

The rate of fuel used by his car was $\frac{600}{x}$ litres per 100 km.

(a) Alan then drove another $(x + 20)$ km and his car used another 6 litres of fuel.

(i) Write down an expression, in terms of x, for the rate of fuel used by his car on this part
of the journey.
Give your answer in litres per 100 km.

Answer(a)(i) .... litres per 100 km [1]

(ii) On this part of the journey the rate of fuel used by the car **decreased** by 1.5 litres per 100 km.

Show that $x^2 + 20x - 8000 = 0$.

Answer(a)(ii)

[4]

(b) Solve the equation $x^2 + 20x - 8000 = 0$.

Answer(b) x = ... or $x =$ .... [3]

(c) Find the rate of fuel used by Alan's car for the complete journey.
Give your answer in litres per 100 km.

Answer(c) .... litres per 100 km [2]

10

Question 21

Find the value of a and the value of b when $x^2 - 16x + a = (x + b)^2$.

Answer(b) a = ...

b = ... [3]

Question 22

Jamil, Kiera and Luther collect badges.
Jamil has x badges.
Kiera has 12 badges more than Jamil.
Luther has 3 times as many badges as Kiera.
Altogether they have 123 badges.

Form an equation and solve it to find the value of x.

Answer .... [3]

Question 23

Solve the following equations.

(i) $\dfrac{21 - x}{x + 3} = 4$

Answer .... [3]

(ii) $3x^2 + 7x - 5 = 0$

Show all your working and give your answers correct to 2 decimal places.

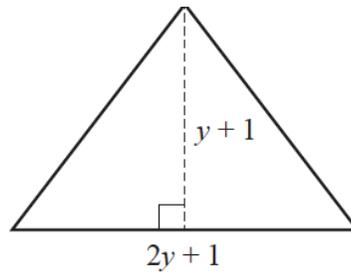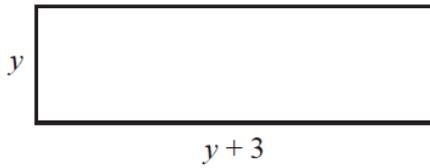*Answer x............or x.............. [3]*

Question 24

The cost of a loaf of bread is x cents.
The cost of a cake is $(x - 5)$ cents.
The total cost of 6 loaves of bread and 11 cakes is $13.56 .

Find the value of x.

Answer x.................[4]

Question 25

y
y + 3

y + 1
2y + 1

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The area of the rectangle and the area of the triangle are equal.

Find the value of y.

Answer y……………………………….[4]

Question 26

The cost of a bottle of water is (w – 1) cents.
The cost of a bottle of milk is (2w – 11) cents.
A certain number of bottles of water costs \$4.80 .
The same number of bottles of milk costs \$7.80 .

Find the value of w.

Answer w……..………………………[4]

Question 27

u cm

(3u – 2) cm

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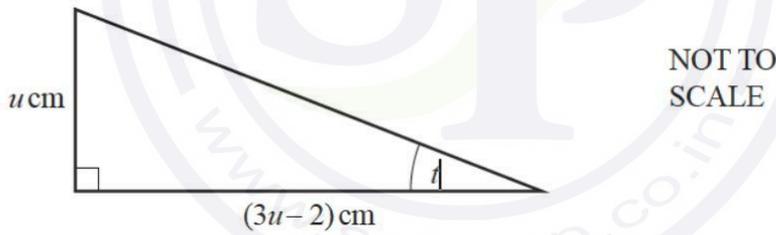
The area of the triangle is 2.5 cm².

(a)   Show that $3u^2 - 2u - 5$

[2]

(b)   Factorise $3u^2 - 2u - 5$.

Answer ……………………… [2]

Question 28

(a) The area of shape *ABCDEF* is 24 cm^2.
All lengths are in centimetres.
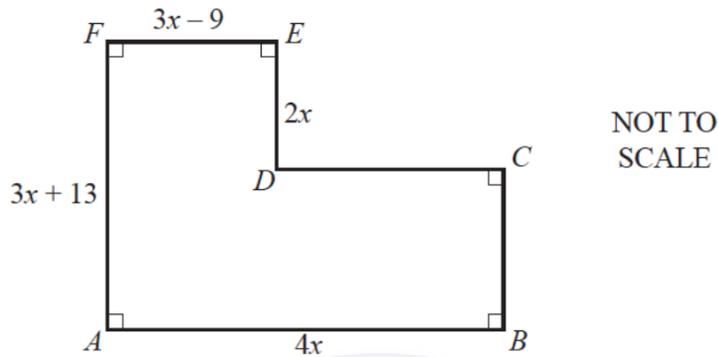
(i) Show that $5x^2 + 17x - 12 = 0$.

Answer(a)(i)

[3]

(ii) Solve, by factorising, the equation $5x^2 + 17x - 12 = 0$.
You must show all your working.

Answer(a)(ii) $x =$ .... or $x =$ .... [3]

(b) Solve the simultaneous equations.
You must show all your working.

$$3x - 2y = 23$$
$$-4x - y = -5$$

Answer(b) $x =$ ....

$y =$ .... [3]

Question 29

(a) Factorise $x^2 - 3x - 10$.

Answer(a) .... [2]

(b) **(i)** Show that $\dfrac{x+2}{x+1} + \dfrac{3}{x} = 3$ simplifies to $2x^2 - 2x - 3 = 0$.

Answer(b)(i)

[3]

(ii) Solve $2x^2 - 2x - 3 = 0$.
Give your answers correct to 3 decimal places.
Show all your working.

Answer(b)(ii) $x =$ .... or $x =$ .... [4]

Question 30

Alfonso runs $10\,\text{km}$ at an average speed of x km/h.
The next day he runs $12\,\text{km}$ at an average speed of $(x - 1)$ km/h.

The time taken for the $10\,\text{km}$ run is 30 minutes less than the time taken for the $12\,\text{km}$ run.

(a) (i) Write down an equation in x and show that it simplifies to $x^2 - 5x - 20 = 0$.

[4]

(ii) Use the quadratic formula to solve the equation $x^2 - 5x - 20 = 0$.
Show your working and give your answers correct to 2 decimal places.

$x = $ .... or $x = $ .... [4]

(iii) Find the time that Alfonso takes to complete the $12\,\text{km}$ run.
Give your answer in hours and minutes correct to the nearest minute.

.... hours .... minutes [2]

Question 31

Factorise completely.

(i) $xy - 18 + 3y - 6x$

.... [2]

(ii) $8x^2 - 72y^2$

.... [3]

Question 32

Solve $5x^2 - 8x - 25 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x = $ .... or $x = $ .... [4]

Question 33

Solve by factorisation.
$$y^2 - 7y - 30 = 0$$

Show your working.

$y = $ .... or $y = $ .... [3]

Question 34

(a)

x cm

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The perimeter of the rectangle is 80 cm.
The area of the rectangle is A cm^2.

(i) Show that $x^2 - 40x + A = 0$.

[3]

(ii) When $A = 300$, solve, by factorising, the equation $x^2 - 40x + A = 0$.

$x =$ .... or $x =$ ....[3]

(iii) When $A = 200$, solve, by using the quadratic formula, the equation $x^2 - 40x + A = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ .... or $x =$ ....[4]

Continue on the next page...

(b) A car completes a 200 km journey with an average speed of x km/h.
The car completes the return journey of 200 km with an average speed of $(x + 10)$ km/h.

(i) Show that the difference between the time taken for each of the two journeys is $\dfrac{2000}{x(x+10)}$ hours.

[3]

(ii) Find the difference between the time taken for each of the two journeys when $x = 80$.
Give your answer in **minutes** and **seconds**.

.... min .... s [3]

Question 35

Solve.
$$8x - 5 = 22 - 4x$$

$x = $ .... [2]

Question 36

Expand the brackets and simplify.
$$(3x - 2y)(4x + 3y)$$

.... [3]

Question 37

Factorise.
$$x^2 - 4x - 21$$

.... [2]

18
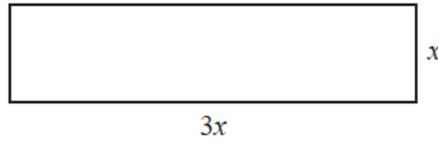
Question 38

The **perimeter** of each of the three shapes is 60 cm.

Find x in each part.

(a)

Rectangle

x

$3x$

NOT TO SCALE

$x =$ .... cm [2]

(b)

Triangle $3x$

$4x$
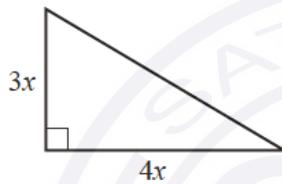
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$x =$ .... cm [3]

(c)

Sector

x

O x
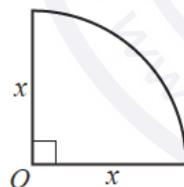
NOT TO SCALE

$x =$ .... cm [3]

Question 39

(i) Write as a single fraction, in its simplest form.

$$\frac{1000}{x} - \frac{1000}{x+1}$$

.... [3]

(ii) One day in 2014, 1 euro was worth x rand.
One year later, 1 euro was worth $(x+1)$ rand.

Winston changed 1000 rand into euros in both years.
In 2014 he received 4.50 euros more than in 2015.

Write an equation in terms of x and show that it simplifies to

$$9x^2 + 9x - 2000 = 0.$$

[3]

(iii) Use the quadratic formula to solve the equation $9x^2 + 9x - 2000 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ .... or $x =$ .... [4]

Question 40

Apples cost x cents each and oranges cost $(x+2)$ cents each.
Dylan spends \$3.23 on apples and \$3.23 on oranges.
The **total** of the number of apples and the number of oranges Dylan buys is 36.

(a) Write an equation in x and show that it simplifies to $18x^2 - 287x - 323 = 0$.

[4]

(b) (i) Find the two prime factors of 323.

.... , ...[1]

(ii) Complete the statement.

$18x^2 - 287x - 323 = (18x \quad ....)(x \quad ....)$ [2]

(iii) Solve the equation $18x^2 - 287x - 323 = 0$.

$x = ...$ or $x = ...$[1]

(c) Find the largest number of apples Dylan can buy for \$2.

.... [1]

Question 41

(a) (i) Factorise $3x^2 + 11x - 4$.

....[2]

(ii) Solve the equation $3x^2 + 11x - 4 = 0$.

$x =$ .... or $x =$ ....[1]

(b) (i) Show that $\dfrac{2}{2x+11} - \dfrac{1}{x-4} = \dfrac{1}{2}$ simplifies to $2x^2 + 3x - 6 = 0$.

[4]

(ii) Solve the equation $2x^2 + 3x - 6 = 0$.
You must show all your working and give your answers correct to 2 decimal places.

$x =$ .... or $x =$ ....[4]

Question 42

$$x^2 - 12x + a = (x+b)^2$$

Find the value of a and the value of b.

$a =$ ....

$b =$ ....[3]

Question 43

Solve the simultaneous equations.
You must show all your working.

$$2x + 3y = 11$$
$$3x - 5y = -50$$

$x =$ ....

$y =$ ....[4]

22

Question 44

(a) In this part, all lengths are in centimetres.

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$2x + 1$

$2x + 6$

$3x - 1$

$3x - 1$
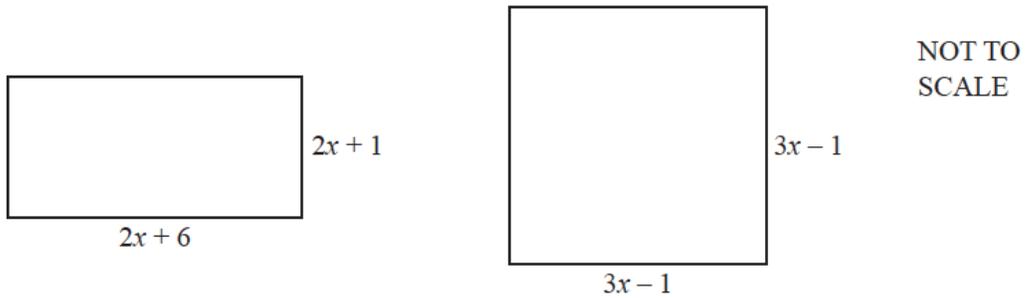
    (i) Find the value of x when the perimeter of the rectangle is equal to the perimeter of the square.

                                                    $x =$ .... [3]

    (ii) Find the value of x when the area of the rectangle is equal to the area of the square.
          Show all your working.

                                                      $x =$ .... [7]

(b) **(i)** Factorise $x^2 + 4x - 5$.

                                                       .... [2]

    (ii) Solve the equation $\dfrac{5}{x} - \dfrac{8}{x+1} = 1$.

          Show all your working.

                  $x =$ .... or $x =$ .... [4]

Question 45

Town A has a rectangular park.
The length of the park is x m.
The width of the park is 25 m shorter than the length.
The area of the park is 2200 m^2.

(i) Show that $x^2 - 25x - 2200 = 0$.

[1]

(ii) Solve $x^2 - 25x - 2200 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ .... or $x =$ .... [4]

Question 46

(a) Expand the brackets and simplify.

(i) $4(2x+5)-5(3x-7)$

.... [2]

(ii) $(x-7)^2$

.... [2]

(b) Solve.

(i) $\frac{2x}{3}+5=-7$

$x = $ .... [3]

(ii) $4x+9=3(2x-7)$

$x = $ .... [3]

(iii) $3x^2-1=74$

$x = $ .... or $x = $ .... [3]

Question 47

Luigi and Alfredo run in a 10 km race.
Luigi's average speed was x km/h.
Alfredo's average speed was 0.5 km/h slower than Luigi's average speed.

(a) Luigi took $\dfrac{10}{x}$ hours to run the race.

Write down an expression, in terms of x, for the time that Alfredo took to run the race.

.... h [1]

(b) Alfredo took 0.25 hours longer than Luigi to run the race.

(i) Show that $2x^2 - x - 40 = 0$.

[4]
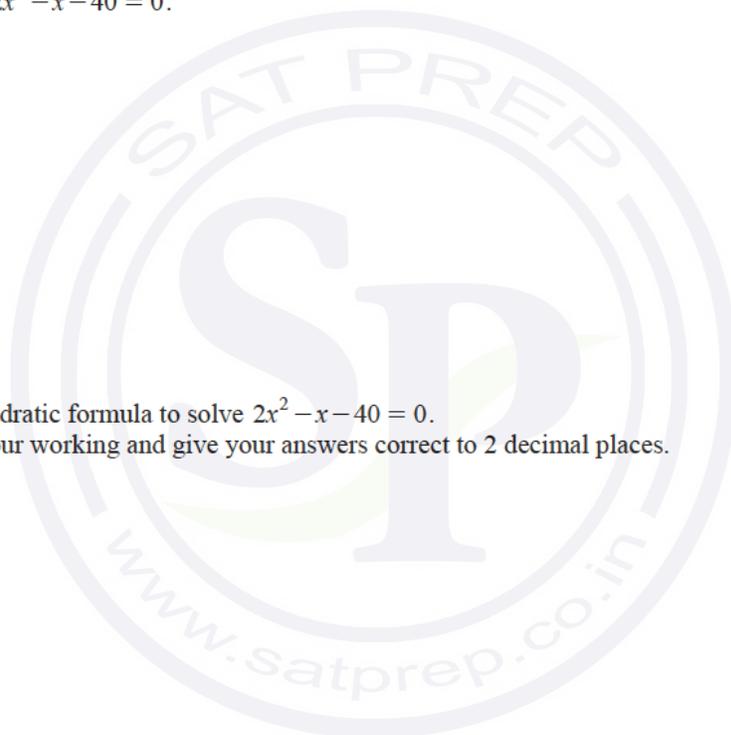
(ii) Use the quadratic formula to solve $2x^2 - x - 40 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ .... or $x =$ .... [4]

(iii) Work out the time that Luigi took to run the 10 km race.
Give your answer in hours and minutes, correct to the nearest minute.

.... h .... min [3]

Question 48

Solve.

$$\frac{x}{7} = 49$$

$x =$ .... [1]

Question 49

Factorise completely.

$$2x^2 - 18$$

.... [2]

Question 50

(a) The cost of 1 apple is a cents.
The cost of 1 pear is p cents.
The total cost of 7 apples and 9 pears is 354 cents.

(i) Write down an equation in terms of a and p.

.... [1]

(ii) The cost of 1 pear is 2 cents more than the cost of 1 apple.

Find the value of a and the value of p.

$a =$ ....

$p =$ .... [3]

(b) Rowena walks 2 km at an average speed of x km/h.

(i) Write down an expression, in terms of x, for the time taken.

.... h [1]

(ii) Rowena then walks 3 km at an average speed of $(x - 1)$ km/h.
The total time taken to walk the 5 km is 2 hours.

(a) Show that $2x^2 - 7x + 2 = 0$.

[3]

(b) Find the value of x.
Show all your working and give your answer correct to 2 decimal places.

$x =$ .... [4]

Question 51

(i) Factorise $x^2 - 25$.

.... [1]

(ii) Simplify $\dfrac{x^2 - 25}{x^2 - 2x - 35}$.

.... [3]

Question 52

(a) At a football match, the price of an adult ticket is $x and the price of a child ticket is $(x - 2.50).
There are 18 500 adults and 2400 children attending the football match.
The total amount paid for the tickets is $320 040.

Find the price of an adult ticket.

$... [4]

(b) (i) Factorise $y^2 + 5y - 84$.

.... [2]

(ii)

NOT TO
y cm   SCALE

$(y + 5)$ cm
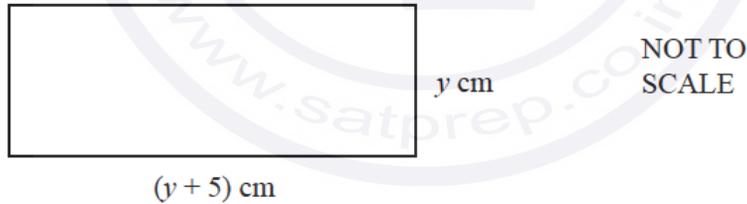
The area of the rectangle is 84 cm^2.

Find the perimeter.

.... cm [3]

Continue on the next page..

(c) In a shop, the price of a monthly magazine is m and the price of a weekly magazine is $(m - 0.75)$.
One day, the shop receives
• $168 from selling monthly magazines
• $207 from selling weekly magazines.
The total number of these magazines sold during this day is 100.

(i) Show that $50m^2 - 225m + 63 = 0$.

[3]

(ii) Find the price of a monthly magazine.
Show all your working.

$ .... [3]

Question 53

In this question, all measurements are in metres.

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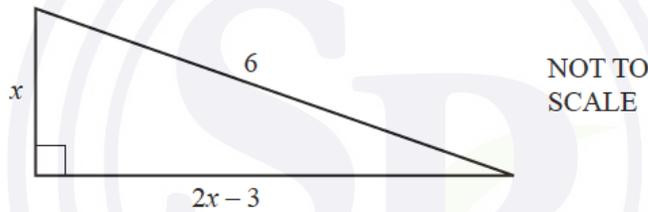
The diagram shows a right-angled triangle.

(a) Show that $5x^2 - 12x - 27 = 0$.

[3]

(b) Solve $5x^2 - 12x - 27 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x = ...$ or $x = ...$ [4]

Continue on the next page..

(c) Calculate the perimeter of the triangle.

.... m [2]

(d) Calculate the smallest angle of the triangle.

.... [2]

Question 54

In this part, all measurements are in metres.

$5x - 9$

w

NOT TO
SCALE

$3x + 7$
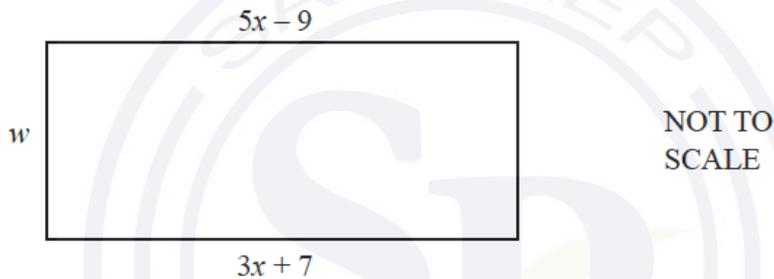
The diagram shows a rectangle.
The area of the rectangle is $310\,\text{m}^2$.

Work out the value of w.

$w =$ .... [4]

Question 55

Factorise.

(i) $2mn + m^2 - 6n - 3m$

.... [2]

(ii) $4y^2 - 81$

.... [1]

(iii) $t^2 - 6t + 8$

.... [2]

Question 56

Solve the simultaneous equations.
You must show all your working.

$$\tfrac{1}{2}x - 3y = 9$$
$$5x + y = 28$$

$x = $ ....

$y = $ .... [3]

Question 57

$$\frac{3}{m+4} - \frac{4}{m} = 6$$

(i) Show that this equation can be written as $6m^2 + 25m + 16 = 0$.

[3]

(ii) Solve the equation $6m^2 + 25m + 16 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$m = $ .... or $m = $ .... [4]

Question 58

The diagram shows a right-angled triangle ABC.
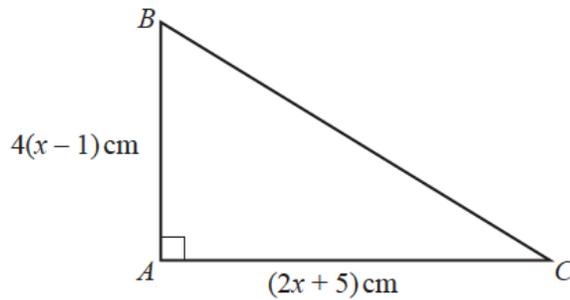
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The area of this triangle is $30\,\text{cm}^2$.

(a) Show that $2x^2 + 3x - 20 = 0$.

[3]

(b) Use factorisation to solve the equation $2x^2 + 3x - 20 = 0$.

$x = $ .... or $x = $ .... [3]

(c) Calculate BC.

$BC = $ .... cm [3]

Question 59

(a) Solve $30 + 2x = 3(3 - 4x)$.

$x =$ .... [3]

(b) Factorise $12ab^3 + 18a^3b^2$.

.... [2]

Question 60

Factorise $5m^2 - 20p^4$.

.... [3]

Question 61

Paulo and Jim each buy sacks of rice but from different shops.
Paulo pays \$72 for sacks costing \$$m$ each.
Jim pays \$72 for sacks costing \$$(m + 0.9)$ each.

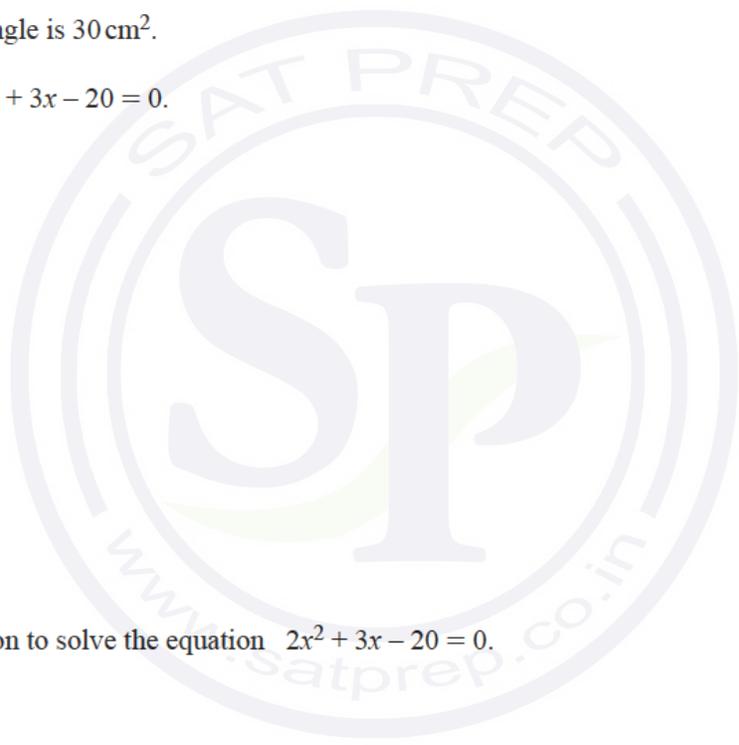(a) (i)   Find an expression, in terms of m, for the number of sacks Paulo buys.

.... [1]

(ii)   Find an expression, in terms of m, for the number of sacks Jim buys.

.... [1]

(b) Paulo buys 4 more sacks than Jim.

Write down an equation, in terms of m, and show that it simplifies to $10m^2 + 9m - 162 = 0$.

[4]

(c) (i)   Solve $10m^2 + 9m - 162 = 0$.

$m =$ .... or $m =$ .... [3]

(ii)   Find the number of sacks of rice that Paulo buys.

.... [1]

Question 62

Solve the simultaneous equations.
You must show all your working.

$$6x + 5y = 27$$
$$5x - 3y = 44$$

$x = $ ....

$y = $ .... [4]

Question 63

Solve.

$$5x - 17 = 7x + 3$$

$x = $ .... [2]

Question 64

(a) Expand and simplify.

$$(x + 7)(x - 3)$$

.... [2]

(b) Factorise completely.

(i) $15p^2q^2 - 25q^3$

.... [2]

(ii) $4fg + 6gh + 10fk + 15hk$

.... [2]

(iii) $81k^2 - m^2$

.... [2]

Question 65

b)

$(x-1)\,\mathrm{cm}$ — $(2x+3)\,\mathrm{cm}$ — $(x-2)\,\mathrm{cm}$ — $(x+1)\,\mathrm{cm}$ — NOT TO SCALE
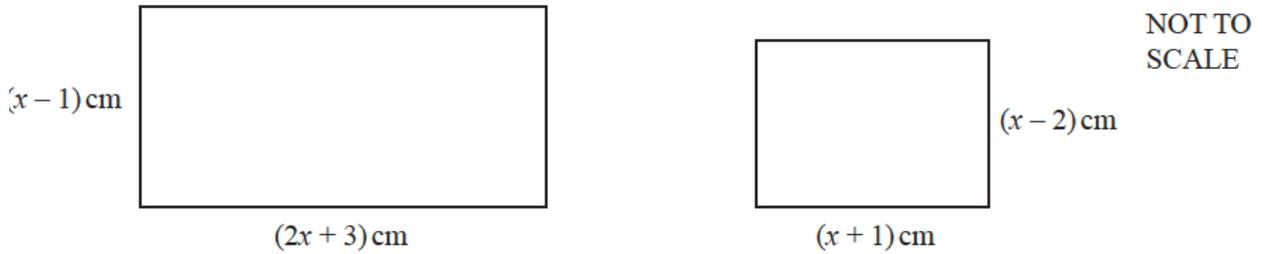
The difference between the areas of the two rectangles is $62\,\mathrm{cm}^2$.

(i) Show that $x^2 + 2x - 63 = 0$.

[3]

(ii) Factorise $x^2 + 2x - 63$.

.... [2]

(iii) Solve the equation $x^2 + 2x - 63 = 0$ to find the difference between the perimeters of the two rectangles.

.... cm [2]

Question 66

Solve.

$$\frac{1}{x} - \frac{2}{x+1} = 3$$

Show all your working and give your answers correct to 2 decimal places.

$x = $ .... or $x = $ .... [7]

Question 67

(a) The diagram shows a triangle and a quadrilateral.
All angles are in degrees.
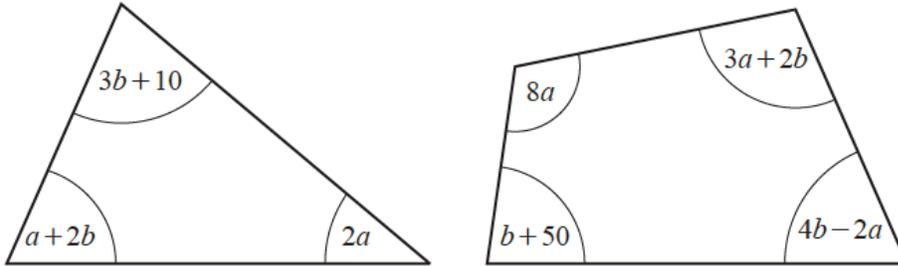
NOT TO SCALE

(i) For the triangle, show that $3a + 5b = 170$.

[1]

(ii) For the quadrilateral, show that $9a + 7b = 310$.

[1]

(iii) Solve these simultaneous equations.
Show all your working.

$a =$ ....

$b =$ .... [3]

(iv) Find the size of the smallest angle in the triangle.

.... [1]

(b) Solve the equation $6x - 3 = -12$.

$x =$ .... [2]

Question 68
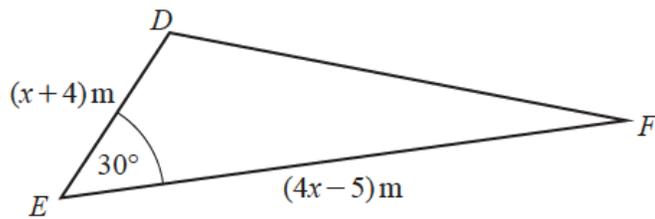
NOT TO SCALE

The area of triangle DEF is $70 \, \text{m}^2$.

(i) Show that $4x^2 + 11x - 300 = 0$.

[4]

(ii) Use the quadratic formula to solve $4x^2 + 11x - 300 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x = $ .... or $x = $ .... [4]

(iii) Find the length of DE.

$DE = $ .... m [1]

Question 69

(a) Oranges cost 21 cents each.
Alex buys x oranges and Bobbie buys $(x+2)$ oranges.
The total cost of these oranges is $4.20 .

Find the value of x.

$x =$ .... [3]

(b) The cost of one ruler is r cents.
The cost of one protractor is p cents.

The total cost of 5 rulers and 1 protractor is 245 cents.
The total cost of 2 rulers and 3 protractors is 215 cents.

Write down two equations in terms of r and p and solve these equations to find the cost of one protractor.

.... cents [5]

(c) Carol walks 12 km at x km/h and then a further 6 km at $(x-1)$ km/h.
The total time taken is 5 hours.

(i) Write an equation, in terms of x, and show that it simplifies to $5x^2 - 23x + 12 = 0$.

[3]

(ii) Factorise $5x^2 - 23x + 12$.

.... [2]

(iii) Solve the equation $5x^2 - 23x + 12 = 0$.

$x =$ .... or $x =$ .... [1]

(iv) Write down Carol's walking speed during the final 6 km.

.... km/h [1]

Question 70

Expand and simplify.
$$(y+3)(y-4)(2y-1)$$

.... [3]

Question 71

All the lengths in this question are in centimetres.
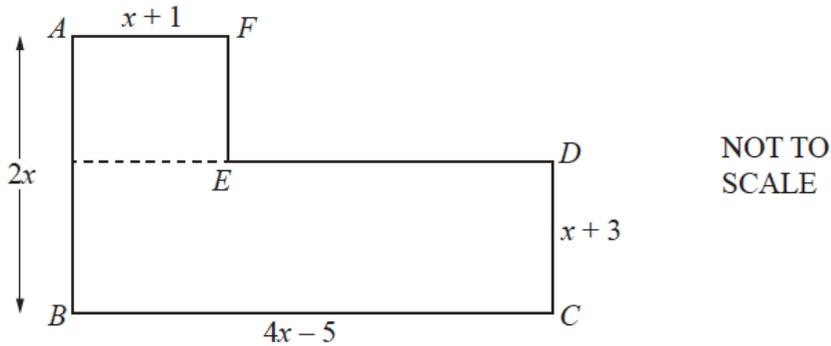
The diagram shows a shape $ABCDEF$ made from two rectangles.
The total area of the shape is $342\,\text{cm}^2$.

(a) Show that $x^2 + x - 72 = 0$.

[5]

(b) Solve by factorisation.
$$x^2 + x - 72 = 0$$

$x =$ .... or $x =$ .... [3]

(c) Work out the perimeter of the shape $ABCDEF$.

.... cm [2]

(d) Calculate angle DBC.

Angle $DBC =$ .... [2]

Question 72

Solve the equation.
$$\frac{2x+5}{3-x} = \frac{14}{15}$$

$x =$ .... [3]

Question 73

Solve the simultaneous equations.
You must show all your working.

$$y = 4-x$$
$$x^2 + 2y^2 = 67$$

$x =$ .... , $y =$ ....

$x =$ .... , $y =$ .... [6]

Question 74

(a) (i) Write $x^2 + 8x - 9$ in the form $(x+k)^2 + h$.

.... [2]

(ii) Use your answer to **part (a)(i)** to solve the equation $x^2 + 8x - 9 = 0$.

$x =$ .... or $x =$ .... [2]

(b) The solutions of the equation $x^2 + bx + c = 0$ are $\dfrac{-7+\sqrt{61}}{2}$ and $\dfrac{-7-\sqrt{61}}{2}$.

Find the value of b and the value of c.

$b =$ ....

$c =$ .... [3]

Question 75

Simplify.

(i) $3a-5b-a+2b$

.... [2]

(ii) $\dfrac{5}{3x}\times\dfrac{9x}{20}$

.... [2]

Question 76

Solve.

(i) $\dfrac{15}{x}=-3$

$x=$ .... [1]

(ii) $4(5-3x)=23$

$x=$ .... [3]

Question 77

Expand and simplify.
$$(3x-5y)(2x+y)$$

.... [2]

Question 78

Factorise completely.

(i) $6y^2-15xy$

.... [2]

(ii) y^2-9x^2

.... [2]

Question 79

Ahmed sells different types of cake in his shop.
The cost of each cake depends on its type and its size.

Every small cake costs $x and every large cake costs $(2x + 1).

(a) The total cost of 3 small lemon cakes and 2 large lemon cakes is $12.36 .

Find the cost of a small lemon cake.

$ .... [3]

(b) The cost of 18 small chocolate cakes is the same as the cost of 7 large chocolate cakes.

Find the cost of a small chocolate cake.

$ .... [3]

(c) The number of small cherry cakes that can be bought for $4 is the same as the number of large cherry cakes that can be bought for $13.

Find the cost of a small cherry cake.

$ .... [3]

(d) Petra spends $20 on small coffee cakes and $10 on large coffee cakes.
The total number of cakes is 45.

Write an equation in terms of x.
Solve this equation to find the cost of a small coffee cake.
Show all your working.

$ .... [7]

Question 80

Factorise completely.

$$3a^2b - ab^2$$

.... [2]

Question 81

Expand and simplify.

$$(x-2)(x+5)(2x-1)$$

.... [3]

Question 82

Alan invests $200 at a rate of $r\%$ per year compound interest.
After 2 years the value of his investment is $206.46 .

(i) Show that $r^2 + 200r - 323 = 0$.

[3]

(ii) Solve the equation $r^2 + 200r - 323 = 0$ to find the rate of interest.
Show all your working and give your answer correct to 2 decimal places.

$r =$ .... [3]

Question 83

Gaya spends $48 to buy books that cost $x each.

(a) Write down an expression, in terms of x, for the number of books Gaya buys.

.... [1]

(b) Myra spends $60 to buy books that cost $$(x+2)$ each.
Gaya buys 4 more books than Myra.

Show that $x^2 + 5x - 24 = 0$.

[4]

(c) Solve by factorisation.
$$x^2 + 5x - 24 = 0$$

$x =$ .... or $x =$ .... [3]

(d) Find the number of books Myra buys.

.... [1]

43

Question 84

(a) Factorise.

    (i) $5am + 10ap - bm - 2bp$

.... [2]

    (ii) $15(k+g)^2 - 20(k+g)$

.... [2]

    (iii) $4x^2 - y^4$

.... [2]

(b) Expand and simplify.
$$(x-3)(x+1)(3x-4)$$

.... [3]

(c) $(x+a)^2 = x^2 + 22x + b$

    Find the value of a and the value of b.

$a = $ ....

$b = $ .... [2]

Question 71

Solve the simultaneous equations.

(a) $x + 2y = 13$
          $x + 5y = 22$

$x = $ ....

$y = $ .... [2]

(b) $y = 2 - x$
          $y = x^2 + 2x + 2$

$x = $ .... $y = $ ....

$x = $ .... $y = $ .... [4]

Question 72

(a) $y = px^2 + t$

   (i)   Find the value of y when $p = 3$, $x = 2$ and $t = -13$.

$y =$ .... [2]

   (ii)   Rearrange the formula to write x in terms of p, t and y.

$x =$ .... [3]

(b) (i)   Factorise.

$$15x^2 - 2x - 8$$

.... [2]

   (ii)   Solve the equation.

$$15x^2 - 2x - 8 = 0$$

$x =$ .... or $x =$ .... [1]

(c) Factorise completely.

$$x^3 - 16xy^2$$

.... [3]

(d) Simplify.

$$\frac{2x - 1 - 4ax + 2a}{2x^2 - x}$$

.... [4]

Question 73

Simplify.

$$\frac{x^2 - 25}{x^2 - x - 20}$$

.... [3]

Question 74

(a) Solve the simultaneous equations.
You must show all your working.

$$2p - q = 7$$
$$3p + 2q = 7$$

$p =$ ....

$q =$ .... [3]

(b) Solve the equation.

$$\frac{x}{4} + \frac{2x}{3} = 1$$

$x =$ .... [2]

(c) $-8 < 3x - 2 \leqslant 7$

(i) Solve the inequality.

.... [3]

(ii) Find the integer values of x that satisfy the inequality.

.... [1]

(d) Factorise completely.

$$16a - 4a^2$$

.... [2]

(e) Write each of the following as a single fraction, in its simplest form.

(i) $\dfrac{1}{2a} \div \dfrac{3}{4b}$

.... [2]

(ii) $2 - \dfrac{x}{x-1}$

.... [2]

Question 75

(a) Expand and simplify.
$$(x+1)(x-2)(x+3)$$

.... [3]

(b) Make g the subject of the formula.
$$M = \frac{2fg}{g-c}$$

$g =$ .... [4]

(c) Simplify.
$$\frac{4x^2 - 16x}{x^2 - 16}$$

.... [3]

Question 76

(a) Simplify.
$$a - 2b - 3a + 7b$$

.... [2]

(b) Expand and simplify.
$$4(x-5) - (3-2x)$$

.... [2]

(c) Write as a single fraction in its simplest form.
$$\frac{3}{x-5} - \frac{7}{2x}$$

.... [3]

(d) Solve.
$$\frac{13-4x}{3} = 6 - x$$

$x =$ .... [3]

(e) Make x the subject of the formula.
$$y = \frac{5(p-2x)}{x}$$

$x =$ .... [4]

Question 77

(a) Solve.
$$10 - 3p = 3 + 11p$$

$p =$ .... [2]

(b) Make m the subject of the formula.
$$mc^2 - 2k = mg$$

$m =$ .... [3]

(c) Solve.
$$\frac{1}{x-3} + \frac{4}{2x+3} = 1$$

$x =$ .... or $x =$ .... [5]

(d) Solve the simultaneous equations.
You must show all your working.
$$x + 2y = 12$$
$$5x + y^2 = 39$$

$x =$ .... $y =$ ....

$x =$ .... $y =$ .... [5]

(e) Expand and simplify.
$$(2x - 3)(x + 6)(x - 4)$$

.... [3]

Question 78

Solve.

$$\frac{3x - 22}{4} = 23$$

$x =$ .... [3]

Question 79

Use the quadratic formula to solve $3x^2 + 8x - 20 = 0$.
Show all your working and give your answers correct to 2 decimal places.

$x =$ .... , $x =$ .... [4]

Question 80

(a) $P = 5k^2 - 7$

    (i)   Find the value of P when $k = 3$.

$P =$ .... [2]

    (ii) Rearrange the formula to make k the subject.

$k =$ .... [3]

(b) (i) Solve.
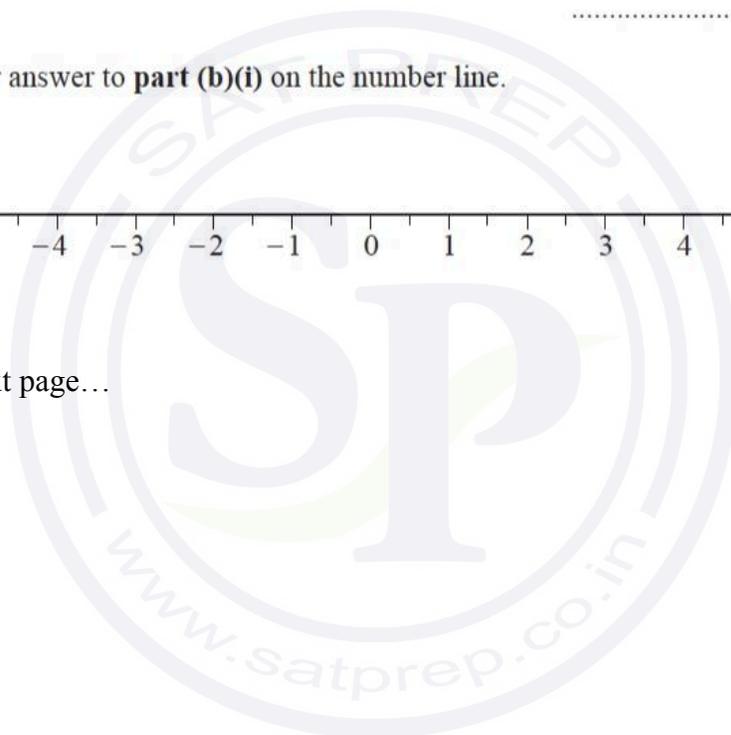$$x - 3 \leqslant 5x + 7$$

.... [2]

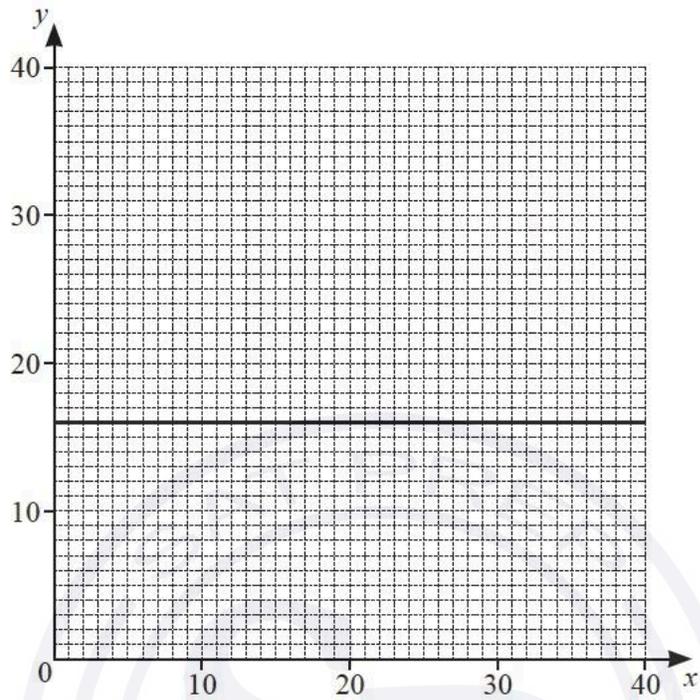   (ii) Show your answer to **part (b)(i)** on the number line.

[1]

Continue on the next page…

(c) The line $y = 16$ is drawn on the grid.

The region R satisfies the following inequalities.

$$y \geqslant 16 \qquad x > 2 \qquad 2x + 3y \geqslant 72 \qquad y \leqslant 32 - x$$

(i) By drawing three more lines and shading the region **not required**, find and label region R.

[6]

(ii) Find the integer coordinates (x, y) in the region R that give the maximum value of $2x + y$.

(....................... , ...) [2]

Question 81

(a) Solve.
$$4x + 15 = 9$$

$x = $ .... [2]

(b) Factorise.
$$a^2 - 9$$

.... [1]

(c) Write as a single fraction in its simplest form.
$$\frac{4a}{5} \div \frac{3ad}{10c}$$

.... [3]

(d) $$5^n + 5^n + 5^n + 5^n + 5^n = 5^m$$

Find an expression for m in terms of n.

$m = $ .... [2]

(e) Solve by factorisation.
$$4x^2 + 8x - 5 = 0$$

$x = $ .... or $x = $ .... [3]

(f) **(i)** y is directly proportional to $(x+3)^3$.
When $x = 2$, $y = 13.5$.

Find x when $y = 108$.

$x = $ .... [3]

(ii) g is inversely proportional to the square of d.
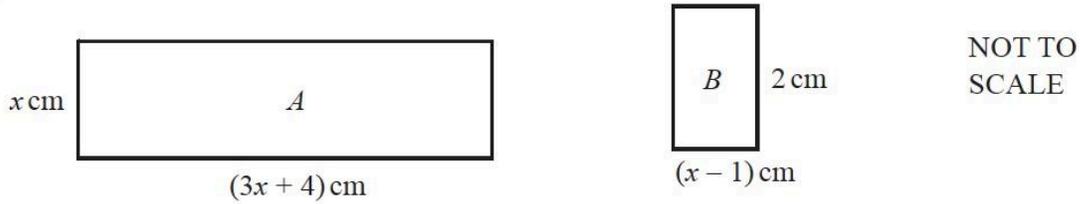When d is halved, the value of g is multiplied by a factor n.

Find n.

(g) Expand and simplify.
$$(2x+3)(x-1)(x+3)$$

.... [3]

Question 82

(a)

x cm

A

(3x + 4) cm

B   2 cm

(x − 1) cm

NOT TO
SCALE

The total of the areas of rectangles A and B is $20\,\text{cm}^2$.

(i) Show that $3x^2 + 6x - 22 = 0$.

[2]

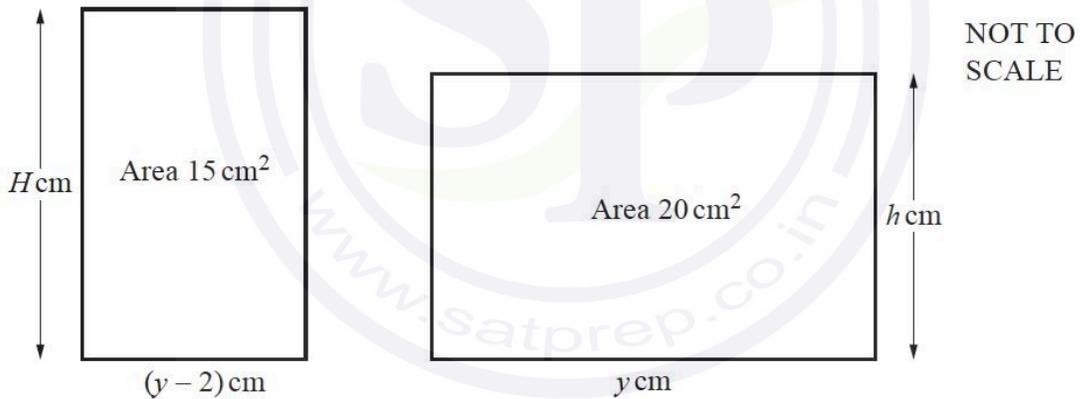**(ii)** Solve the equation $3x^2 + 6x - 22 = 0$, giving your answers correct to 4 significant figures.
You must show all your working.

$x =$ .... or $x =$ .... [4]

(iii) Find the perimeter of rectangle B.

.... cm [1]

(b)

H cm

Area 15 cm²

(y − 2) cm

Area 20 cm²

h cm

y cm

NOT TO
SCALE
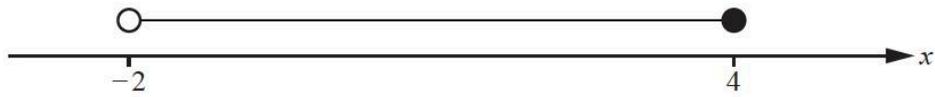
The diagram shows two rectangles where $H - h = 1$.

By forming a quadratic equation and factorising, find the value of y.

$y =$ .... [7]

52

Question 83

(a)

Write down the inequality shown by the number line.

.... [1]

(b) $-3 \leqslant 2x+3 < 9$

    (i) Solve the inequality.

.... [3]

    (ii) Write down all the integer values of x that satisfy the inequality.

.... [2]

(c) Solve the equations.

    (i) $3(3-x) - \dfrac{2(x+2)}{5} = 1$

$x = $ .... [4]

    (ii) $\dfrac{5}{x+3} = \dfrac{3}{x+5}$

$x = $ .... [3]

Question 84

(a)

NOT TO
SCALE

9 cm

12 cm

Calculate the area of the triangle.

.... cm² [2]

(b)

NOT TO
SCALE

C

h

A   B

AB = (2x+3)cm and h = (x+5)cm.

The area of triangle ABC = 50 cm² .

Find the value of x, giving your answer correct to 2 decimal places.

You must show all your working.

x = ... [6]

Question 85

(a) Expand and simplify.
$$(2p^2 - 3)(3p^2 - 2)$$

.... [2]

(b) $s = \frac{1}{2}(u+v)t$

    (i) Find the value of s when $u = 20$, $v = 30$ and $t = 7$.

$$s = \text{.....................................} \quad [2]$$

    (ii) Rearrange the formula to write v in terms of s, u and t.

$$v = \text{.....................................} \quad [3]$$

(c) Factorise completely.

    (i) $2qt - 3t - 6 + 4q$

.... [2]

    (ii) $x^3 - 25x$

.... [3]

Question 86

(a) A shop sells shirts for $\$x$ and jackets for $\$(x + 27)$.
The shop sells 4 shirts and 3 jackets for a total of $\$194.75$.

Write down and solve an equation to find the cost of one shirt.

$\$ \text{.....................................}$ [3]

(b) Solve the simultaneous equations.
You must show all your working.

$$x^2 + 4y = 37$$
$$5x + y = -8$$

$x = \text{....................} \, , y = \text{....................}$

$x = \text{....................} \, , y = \text{....................}$ [5]

(c) A solid cylinder has radius x and height $6x$.
A sphere of radius r has the same surface area as the total surface area of the cylinder.

Show that $r^2 = \frac{7}{2}x^2$.

[The surface area, A, of a sphere with radius r is $A = 4\pi r^2$.]

[4]

Question 87

Solve the simultaneous equations.
You must show all your working and give your answers correct to 2 decimal places.

$$2x + y = 7$$
$$y = 5x^2 + 2x - 13$$

$x = $ .... , $y = $ ....

$x = $ .... , $y = $ .... [6]

Question 88

(a) Factorise fully.

(i) $27y^2 - 3$

.... [3]

(ii) $2m - pk + 2k - pm$

.... [2]

(b) Solve $\dfrac{x-1}{x+1} - \dfrac{6}{x-1} = 1$.

$x = $ .... [5]

(c) Solve $4x^2 - 3x - 2 = 0$.
You must show all your working and give your answers correct to 2 decimal places.

$x = $ .... or $x = $ .... [4]

(d) Make k the subject of the formula.

$$\frac{k}{m} = 4 + kp$$

$k = $ .... [4]

56

Question 89

(a) Expand and simplify.

$$4(2x-1)-6(3-x)$$

.... [2]

(b) Factorise completely.

(i) $6x^2y+9xy$

.... [2]

(ii) $4x^2-y^2+8x+4y$

.... [3]

(c) Antonio travels 100 km at an average speed of x km/h.
He then travels a further 150 km at an average speed of $(x+10)$ km/h.
The time taken for the whole journey is 4 hours 20 minutes.

(i) Show that $13x^2-620x-3000=0$.

[4]

(ii) Solve $13x^2-620x-3000=0$ to find the speed Antonio travels for the first 100 km of the journey.
You must show all your working and give your answer correct to 1 decimal place.

.... km/h [3]

Question 90

(a) In a shop the cost of a fiction book is $x and the cost of a reference book is $(x+2).
The cost of 11 fiction books is the same as the cost of 10 reference books.

Find the value of x.

$x =$ .... [2]

(b) In another shop, the cost of a fiction book is $y and the cost of a reference book is $(y+2).
Maria spends $95 on fiction books and $147 on reference books.
She buys a total of 12 books.

(i) Show that $6y^2 - 109y - 95 = 0$.

[4]

(ii) Factorise $6y^2 - 109y - 95$.

(iii) Find the value of y.

$y =$ .... [1]

Question 91

(a) $s = \dfrac{1}{2}at^2$

Find the value of s when $a = 9.8$ and $t = 20$.

$s =$ .... [2]

(b) Solve.
$$5(4y-3) = 15$$

$y =$ .... [3]

(c) Expand and simplify.
$$3(5x-8) - 2(3x-7)$$

.... [2]

(d) Rearrange $A = 2b^2 - 3c^3$ to make c the subject.

$c =$ .... [3]

(e) Factorise completely.
$$6pq - 4q - 3p + 2$$

.... [2]

Question 92

(a) (i) Factorise.
$$x^2 - x - 12$$

.... [2]

(ii) Simplify.
$$\frac{x^2 - 16}{x^2 - x - 12}$$

.... [2]

(b) Simplify.
$$(2x - 3)^2 - (x + 1)^2$$

.... [3]

(c) Write as a single fraction in its simplest form.
$$\frac{2x + 4}{x + 1} - \frac{x}{x - 3}$$

.... [4]

(d) Expand and simplify.
$$(x - 3)(x - 5)(2x + 1)$$

.... [3]

(e) Solve the simultaneous equations.
You must show all your working.

$$x - 3y = 13$$
$$2x^2 - 9y = 116$$

$x =$ .... $y =$ ....

$x =$ .... $y =$ .... [6]

Question 93

In this question all the measurements are in centimetres.

NOT TO SCALE

The area of the triangle is equal to the area of the square.

(a) Show that $3r^2 + r - 6 = 0$.

[4]

(b) Solve the equation $3r^2 + r - 6 = 0$.
Give your answer to 2 decimal places.
You must show all your working.

$r = $ .... or $r = $ .... [3]

(c) Find the perimeter of the square.

.... cm [2]

Question 94

(a) Solve $3x - 8 = 6 - 4x$.

$x = $ .... [2]

(b) Factorise fully $10a^2 + 5a$.

.... [2]

(c) Factorise fully $(2x - 3)^2 - 9$.

.... [2]

Question 95

Expand and simplify.
$$(x + 4)(x - 3)(3x - 1)$$

……………………………….. [3]

Question 96

(i) Show that $(3x+5) + \dfrac{7}{x-2} = x$ simplifies to $2x^2 + x - 3 = 0$.

[4]

(ii) Solve by factorisation $2x^2 + x - 3 = 0$.

$x = $ .... or $x = $ .... [3]

Question 97

(a) $C = \dfrac{1}{4}xy^2$

(i) Find C when $x = 5$ and $y = 8$.

$C = $ .... [2]

(ii) Find the positive value of y when $C = 15$ and $x = 2.4$.

$y = $ .... [2]

(b) Write as a single fraction in its simplest form.

$$\frac{4}{x-1} - \frac{3}{2x+5}$$

.... [3]

(c) Expand and simplify.

$$(2x+3)(4-x)^2$$

.... [3]

(d) Simplify.

$$\left(\frac{y^8}{16x^{16}}\right)^{-\frac{3}{4}}$$
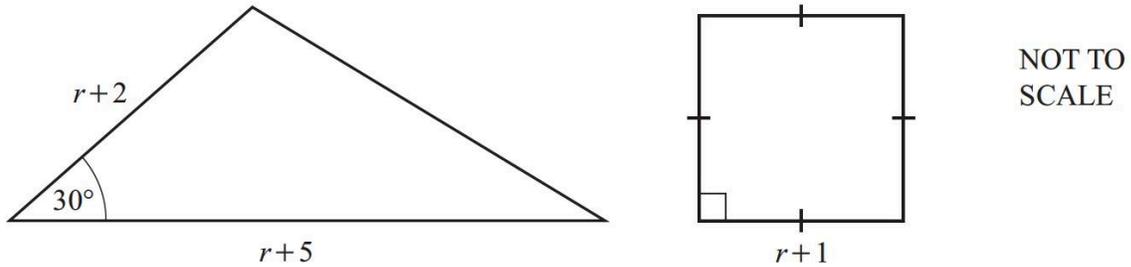
.... [3]