

Extended Mathematics
Topic : Trigonometry
Year : May 2013 - May 2023

Paper -2

Answers

Question 1

10.5 www

2

M1 for $42 = \frac{1}{2} \times BC \times 8$ or better

Question 2

24.8 or 24.77 to 24.78

4

M1 for recognition of angle CEA

M1 for $\sqrt{12^2 + 5^2}$

M1 for $\tan = \frac{6}{\text{their } AE}$ oe

Question 3

160

3

M1 for $\sin 15 = \frac{[]}{628}$ oe or better

Question 4

(a) 37.2 or 37.17 to 37.19

3

M2 for $\sin[] = \frac{4 \times \sin 65}{6}$

or M1 for $\frac{4}{\sin[]} = \frac{6}{\sin 65}$ oe

(b) 11.7 or 11.72 to 11.74

3

M1 for $[B =] 160 - 65 - \text{their (a)}$

M1 for $\frac{1}{2} \times 4 \times 6 \times \sin \text{their } 77.8$

Question 5

(a) 73.7 or 73.73 to 73.74

3

M1 for $\frac{20}{3+2} \times 2$ or B1 for $BX = 8$

M1 for $\tan [] = \frac{6}{\text{their } 8}$ or better

(b) 120

2

M1 for $\frac{1}{2} \times 20 \times 12$ oe

Question 6

65.4 or 65.37 to 65.4

4

M3 for $\cos = \frac{5}{12}$ or $\frac{\sqrt{3^2 + 4^2}}{12}$ oe

or **M1** for $\sqrt{3^2 + 4^2}$

and **M1** for clearly identifying angle *GAC*

Question 7

8.23 or 8.234 to 8.235

3

M2 for $[PR =] \frac{12.5 \times \sin 37}{\sin 66}$

or **M1** for $\frac{PR}{\sin 37} = \frac{12.5}{\sin 66}$ oe

Question 8

(a) 4.47 or 4.472[...]

3

M2 for $\sqrt{6^2 - 4^2}$

or **M1** for $[PM]^2 + 4^2 = 6^2$ or $6^2 - 4^2$

(b) 48.2 or 48.18 to 48.19

3

M2 for $\cos[\text{correct angle}] = \frac{4}{6}$ oe

or **M1** for recognising a correct angle

Question 9

7.06 or 7.063 to 7.064

2

M1 for $\frac{\perp}{8} = \cos 28$ or better

Question 10

1.38 or 1.39 or 1.384 to 1.389

7

M3 $[\text{Area } \Delta =] \frac{1}{2} \times 8 \cos 60 \times 8 \sin 60$

or **M1** for $[AE =] 8 \cos 60$ and **M1** for $[ED] = 8 \sin 60$
and

M1 for Area sector $\frac{30}{360} \times \pi \times 8^2$

and

M1 for Area rectangle = $8 \times 8 \cos 60$ or 8×4

M1 for *their* 32 – (*their* 13.86 + *their* 16.76) or better

Question 11

113.9 to 114.0

4	<p>M2 for $[\cos =] \frac{8^2 + 2^2 - 9^2}{2 \times 8 \times 2}$ or M1 for $9^2 = 8^2 + 2^2 - 2 \times 8 \times 2 \times \cos x$ A1 for -0.406 or -0.4063 to -0.4062 or $-\frac{13}{32}$ If 0 scored SC2 for $54.3[1\dots]$ or 11.7 or 11.71 to 11.72 SC1 for $[\cos =] \frac{9^2 + 2^2 - 8^2}{2 \times 9 \times 2}$ or $[\cos =] \frac{9^2 + 8^2 - 2^2}{2 \times 9 \times 8}$</p>
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Question 12

(a)	2.47 or 2.474 to 2.4744	2	M1 for $\frac{56}{360} \times \pi \times 2.25^2$ oe
(b)	0.742 or 0.7422 to 0.74232	1FT	FT <i>their</i> (a) $\times 0.3[0]$ correctly evaluated.

Question 13

13.5 or 13.45[.]	3	<p>M2 for $\sqrt{\frac{2 \times 85}{\sin 110}}$ or M1 for $\frac{1}{2} \times a^2 \times \sin 110 = 85$ or $\frac{2 \times 85}{\sin 110}$ oe [180.9..]</p>
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Question 14

14.4 or 14.36...	4	<p>M3 for $\tan = \frac{6}{\text{their} \sqrt{15^2 + 18^2}}$ oe or better or M1 for $AC = \sqrt{15^2 + 18^2}$ and M1 for identifying required angle</p>
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Question 15

9.37 or 9.370 to 9.371

6

M2 for $\sin[P] = \frac{38.5}{0.5 \times 9 \times 10}$

or **M1** for $0.5 \times 10 \times 9 \times \sin = 38.5$

M3 for $\sqrt{9^2 + 10^2 - 2 \times 9 \times 10 \times \cos(\text{their } P)}$
 or **M2** for $9^2 + 10^2 - 2 \times 9 \times 10 \times \cos(\text{their } P)$
 or **M1** for a correct implicit expression

e.g. $\cos(\text{their } P) = \frac{9^2 + 10^2 - RQ^2}{2 \times 9 \times 10}$

Note: 87.8, 87.81[...] or 87.7[55...] score 4 marks

Question 16

12.2 or 12.18 to 12.19

3

M2 for $\frac{24 \sin 30}{\sin 100}$

or **M1** for correct implicit equation

e.g. $\frac{\sin 100}{24} = \frac{\sin 30}{BC}$

Question 17

66.4[2...]

2

M1 for $\cos[...]=] \frac{2}{5}$ oe

Question 18

2.9[0] or 2.898 to 2.901

5

M4 for $\frac{30}{360} \times \pi \times 8^2 - 0.5 \times 8 \cos 30 \times 8 \sin 30$

or

M1 for $\frac{30}{360} \times \pi \times 8^2$

and

M2 for [area of triangle =] $0.5 \times 8 \cos 30 \times 8 \sin 30$ oe

or **M1** for $\frac{OC}{8} = \cos 30$ oe or $\frac{BC}{8} = \sin 30$ oe

Question 19

23.6 or 23.57 to 23.58

2

M1 for $\sin[...]=] \frac{2}{5}$ oe

Question 20

36.8 or 36.80 to 36.81

3 **M1** for $\frac{26}{360} \times 2 \times \pi \times 15$
M1 for $2 \times 15 +$ a term involving π

Question 21

8.12 or 8.118...

3 **M2** for $\frac{12.4}{\sin 74} \times \sin 39$
or **M1** for implicit version $\frac{\sin 39}{y} = \frac{\sin 74}{12.4}$ oe

Question 22

281 or 280.8 to 280.9...

5 **M2** for $\frac{25}{360} \times 2 \times \pi \times 15 \times 5$ oe
or
M1 for $\frac{25}{360} \times 2 \times \pi \times 15$ oe
and
M1 for $[2] \times \frac{25}{360} \times \pi \times 15^2$ oe
and
B1 for $15 \times 5 [\times 2]$

Question 23

(a) 90

1

(b) 8.29 or 8.289... to 8.29

2

M1 for $\frac{OP}{11} = \tan 37^\circ$ oe

Question 24

111.2 or 111.1 to 111.2

4

M2 for $[\cos =] \frac{2.8^2 + 3.6^2 - 5.3^2}{2 \times 2.8 \times 3.6}$

or **M1** for implicit form

A1 for $[\cos =] -0.362$ to -0.361

Question 25

16.58 cao

3

B2 for 16.6 or 16.580 to 16.583 final answer
or 16.58 not as final answer
or

M1 for $\frac{38}{360} \times 2 \times \pi \times 25$

and **B1** for rounding their more accurate answer
correctly to 4sf

Question 26

130 or 130.0 to 130.1

2

M1 for $\frac{1}{2} \times 22.3 \times 27.6 \times \sin 25$

Question 27

75.1 or 75.09 to 75.10

2

M1 for $\cos [\dots =] \frac{0.9}{3.5}$

Question 28

(a)

20.1 or 20.07 to 20.08

2

M1 for $\frac{1}{2} \times 7 \times 10 \times \sin 35$ oe

(b)

5.86 or 5.858.....

4

M2 for $7^2 + 10^2 - 2 \times 7 \times 10 \times \cos 35$
A1 for 34.3 ..

or

M1 for $\cos 35 = \frac{7^2 + 10^2 - AC^2}{2 \times 7 \times 10}$

Question 29

27

3

M2 for $\frac{6\pi}{\pi \times 2 \times 9} \times \pi \times 9^2$ oe

or **M1** for $\frac{6\pi}{\pi \times 2 \times 9}$ oe

Question 30

(a)

14.4 or 14.42 to 14.43

2

M1 for $\frac{1}{2} \times 6.2 \times 4.7 \times \sin 82$ oe

(b)

30.7 or 30.72...

2

M1 for $\sin = \frac{2050}{\frac{1}{2} \times 107 \times 75}$

Question 31

1024 cao

5

B4 for 1023 to 1024.0... or 1020

or

M3 for $\frac{125}{360} \times \pi \times 48^2 - \frac{125}{360} \times \pi \times 40^2 + 32 \times 8$

or

M1 for $\frac{125}{360} \times \pi \times 48^2$ or $\frac{125}{360} \times \pi \times 40^2$

and M1 for $32 \times 8 + k\pi$

If B0 scored **B1** for *their* more accurate decimal answer rounded correctly to an integer

Question 32

234 or 234.3 to 234.4

3

M2 for [dist =] $\frac{300}{\tan 52}$ oe

or **M1** for correct implicit trig statement allow **M1** if they use *their* 52 or *their* 38 provided it is marked on the diagram

or **B1** for 52 or 38 correctly placed

or **B1** for 52 or 38 correctly placed

If zero scored, **SC1** for final answer 384

Question 33

(a)

13.9 or 13.85 to 13.86

3

M2 for $\sqrt{8^2 + 8^2 + 8^2}$ oe

or **M1** for $8^2 + 8^2$ or better for one face

(b)

35.1 to 35.5[4...]

2

M1 for $\sin = \frac{8}{\text{their (a)}}$ or $\cos = \frac{\sqrt{8^2 + 8^2}}{\text{their (a)}}$

or $\tan = \frac{8}{\sqrt{8^2 + 8^2}}$ oe

Question 34

(a)

11.4 or 11.40 to 11.41

2

M1 for $\frac{1}{2} \times 2.8 \times 8.3 \times \sin 79$ oe

(b)

231 or 230.8 to 231.1

2FT

FT *their (a)* $\times 4.5^2$

M1 for 4.5^2 or 20.25 seen

Question 35

18.1 or 18.10....

3

M2 for $\sqrt{20^2 - \left(\frac{1}{2}(17)\right)^2}$ oe
 or **M1** for $h^2 + \left(\frac{1}{2}(17)\right)^2 = 20^2$

Question 36

35.3 or 35.26...

4

M3 for $[\tan =] \frac{26}{\sqrt{26^2 + 26^2}}$ oe
 or
M1 for $[AC^2 =] 26^2 + 26^2$ oe
 and
M1 for $[\tan =] 26 \div \text{their } AC$ oe
 or for angle CAG indicated

Question 37

35.8 or 35.77....

3

M2 for $[\sin =] \frac{24 \times \sin 71.8}{39}$
 or **M1** for $\frac{39}{\sin 71.8} = \frac{24}{\sin x}$ oe

Question 38

37.4 or 37.38...
 and
 142.6 or 142.6...

3

B2 for one correct
 or **M1** for $0.5 \times 8 \times 7 \sin = 17$ oe
 If zero or **M1** only scored, **SC1** for two
 answers with a sum of 180

Question 39

4.34 or 4.336 to 4.337

3

M2 for $\frac{8.15 \sin 30}{\sin 110}$
 or **M1** for $\frac{\sin 110}{8.15} = \frac{\sin 30}{AC}$ oe

Question 40

34.8 or 34.84 to 34.85

2

M1 for $\sin [=] \frac{4}{7}$

Question 41

5.53 or 5.54 or 5.534 to 5.543...

4 **M3** for

$$2 \times \left\{ \left(\frac{40}{360} \times \pi \times 10^2 \right) - \left(\frac{1}{2} \times 10^2 \times \sin 40 \right) \right\}$$

or **M2** for

$$\left[\frac{1}{2} \times \right] 10^2 \times \sin 40 \text{ and } [2 \times] \frac{40}{360} \times \pi \times 10^2$$

or **M1** for

$$\left[\frac{1}{2} \times \right] 10^2 \times \sin 40 \text{ or } [2 \times] \frac{40}{360} \times \pi \times 10^2$$

Question 42

22.6 or 22.61 to 22.62

3 **M2** for $\sin [=] \frac{5}{13}$ oe

or **M1** for identifying angle *AGE*

Question 43

21.8 or 21.80...

4 **M3** for $\tan = \frac{2}{\sqrt{3^2 + 4^2}}$ oe

or

M1 for $\sqrt{3^2 + 4^2}$ or $\sqrt{3^2 + 4^2 + 2^2}$

and **M1** for recognising angle *QAC*

Question 44

[*k* =] 3

[*c* =] 9

3 **M1** for $\frac{30}{360} \times \pi \times 6^2$

M1 for $\frac{1}{2} \times 6 \times 6 \times \sin 30$

Question 45

32

2 **M1** for $\frac{1}{2} \times 33 \times h = 528$ oe

Question 46

46.7 or 46.68 to 46.69

4

M3 for $\tan [\dots] = \frac{9}{\frac{1}{2}\sqrt{12^2 + 12^2}}$ oe

or

M1 for $\left[\frac{1}{2} \times\right] \sqrt{12^2 + 12^2}$ oe e.g. $\sqrt{\frac{12^2}{2}}$

and **M1** for identifying angle *MCE*

Question 47

(a) 2.24

2 **M1** for $0.5 \times 1.6 \times 2.8$

(b) 3.22 or 3.224 to 3.225

2 **M1** for $[AC^2 =] 1.6^2 + 2.8^2$

Question 48

102.1 or 102.06 to 102.07

4

M2 for $[\cos x =] \frac{11^2 + 5^2 - 13^2}{2 \times 11 \times 5}$

or **M1** for $13^2 = 11^2 + 5^2 - 2 \times 11 \times 5 \cos x$

A1 for $-0.209\dots$ or $-\frac{23}{110}$

Question 49

320

2 **M1** for $180 + 140$ oe

Question 50

46.2 or 46.17 to 46.18

4

M2 for $[\cos =] \frac{16^2 + 19^2 - 14^2}{2 \times 16 \times 19}$

or **M1** for

$14^2 = 19^2 + 16^2 - 2 \times 19 \times 16 \cos M$

A1 for $0.692\dots$ or $\frac{421}{608}$

Question 51

19.3 or 19.26 to 19.27 nfw

3

M2 for $[\sin =] 5.9 \times \frac{\sin 84.6}{17.8}$

or **M1** for $\frac{5.9}{\sin B} = \frac{17.8}{\sin 84.6}$ oe

Question 52

4.8[0] or 4.802...

2

M1 for $[AC^2 =] 2.5^2 + 4.1^2$

Question 53

16.6 or 16.60...

4

M3 for $\tan = \frac{4}{\sqrt{12^2 + 6^2}}$ oe

or **M2** for $\sqrt{12^2 + 6^2}$

or **M1** for $12^2 + 6^2$ oe

or **B1** for recognising angle PAC is required

Question 54

$[p =] 12$

$[q =] \frac{12}{5}$ oe

3

B1 for $[p =] 12$
and

B2 for $[q =] \frac{12}{5}$

or **M1** for $\frac{72}{360} [\times \pi] \times 2 \times 6$ oe

Question 55

25.1 or 25.06...

4

M3 for $\tan = \frac{8}{\sqrt{16.2^2 + 5.5^2}}$ oe

or **M2** for $\sqrt{16.2^2 + 5.5^2}$

or **M1** for $16.2^2 + 5.5^2$

or **B1** for identifying correct angle

Question 56

30.2 or 30.20 to 30.21...

4

M3 for $\frac{1}{2} \times 10 \times 10 \times \sin 60 - \frac{60}{360} \times \pi \times \left(\frac{10}{2}\right)^2$

or **M1** for $\frac{k}{360} \times \pi \times \left(\frac{10}{2}\right)^2$ oe

and **M1** for $\frac{1}{2} \times 10 \times 10 \times \sin c$ oe

Question 57

154.5 or 154.5...

2

B1 for 25.5 or 25.46 to 25.47
or **M1** for $180 - \sin^{-1}(0.43)$ oe

Question 58

[0]47

2 | **B1** for 133 or 47 seen
or **M1** for 227 – 180 oe

Question 59

(a) | 5.95 or 5.954...

3 | **M2** for $\frac{7.4}{\sin 97} \times \sin 53$
or **M1** for $\frac{\sin 97}{7.4} = \frac{\sin 53}{SR}$ oe

(b) | 3.73 or 3.733 to 3.734

4 | **M2** for $8.5^2 + 7.4^2 - 2 \times 8.5 \times 7.4 \times \cos 26$
or **M1** for implicit form
A1 for 13.9[4...]

Question 60

308

2 | **M1** for 180 + 128 oe or 52 seen

Question 61

72.8 or 72.79 to 72.80...

2 | **M1** for $\frac{217}{360} \times \pi \times 6.2^2$

Question 62

31.9 or 31.85...

4 | **M3** for $\tan = \frac{12}{\sqrt{18^2 + 7^2}}$ oe
or **M2** for $\sqrt{18^2 + 7^2}$
or **M1** for $18^2 + 7^2$
or **B1** for identifying correct angle *CAG*

Question 63

14.7

2 | **M1** for $\frac{1}{2} \times 8.4 \times 3.5$ oe

Question 64

60.5 or 60.50...

4

M3 for $\tan = \frac{10}{\frac{1}{2}\sqrt{8^2+8^2}}$ oe

or **M2** for $[\frac{1}{2} \times] \sqrt{8^2+8^2}$

or **M1** for 8^2+8^2 or 4^2+4^2

or **B1** for recognising the angle required

Question 65

6.88 or 6.882 to 6.883

2

M1 for $\sin 35 [=] \frac{x}{12}$ oe or better

Question 66

(a) 21.1 or 21.10...

1

(b) 158.9 or 158.8 to 158.9

1

FT 180 – *their (a)* providing answer is an obtuse angle

Question 67

282

2

M1 for $180 + 102$ or $360 - (180 - 102)$

Question 68

6.28 or 6.283 to 6.284

3

M2 for $\frac{45}{360} \times \pi \times 5^2$ oe and $\frac{45}{360} \times \pi \times 3^2$ oe

or **M1** for $\frac{45}{360} \times \pi \times 5^2$ oe

or $\frac{45}{360} \times \pi \times 3^2$ oe

or $\pi \times 5^2 - \pi \times 3^2$ oe

Question 69

109.3 or 109.26 to 109.27

3

M2 for $\frac{12 \sin 39}{8}$

or **M1** for $\frac{8}{\sin 39} = \frac{12}{\sin(\dots)}$ oe

Question 70

45[.0] or 44.99 to 45.00

2

M1 for $\frac{1}{2} \times 13 \times 11 \times \sin 39$ oe

Question 71

(a)	45.9	2	M1 for $0.5 \times 8.5 \times 10.8$ oe
(b)	33[.0] or 33.04...	3	M2 for $8.5 + 10.8 + \sqrt{8.5^2 + 10.8^2}$ oe or M1 for $8.5^2 + 10.8^2$ oe

Question 72

65.3 or 65.28..

4

M3 for $\cos = \frac{\frac{1}{2}\sqrt{11^2 + 11^2}}{18.6}$ or better

or **M2** for $AM = \frac{1}{2}\sqrt{11^2 + 11^2}$ oe

or **M1** for $AC^2 = 11^2 + 11^2$

If 0 scored, **SC1** for identifying angle VAM

Question 73

3.7[0] or 3.689 to 3.699...

3

M2 for $\frac{19.02}{2 + \pi}$

or **M1** for $2r + \pi r$ [=19.02] oe

Question 74

15.5 or 15.48 to 15.49

3

B2 for 1550 or 1548 to 1549

or **M2** for $\frac{42}{360} \times \pi \times 6.5^2$

or **M1** for $\frac{42}{360} \times \pi \times 65^2$

Question 75

[0]94

2

M1 for 86 or $274 - 180$ or for sketch with 274 marked correctly

Question 76

64.9 or 64.89 to 64.90

6 **B5** for $[\cos =] \frac{100 + 72 - 100}{2 \times 10 \times \sqrt{72}}$

OR

M1 for $8^2 + 6^2$

M1 for $6^2 + 6^2$

M2 for $\frac{(theirAF)^2 + (theirAH)^2 - (theirHF)^2}{2 \times (theirAF) \times (theirAH)}$

or **M1** for $(theirHF)^2 = (theirAF)^2 + (theirAH)^2 - 2 \times (theirAF) \times (theirAH) \cos(HAF)$
AF, AH etc from correct method

Question 77

25.6 or 25.59 to 25.60...

4 **M3** for $\frac{6.4}{2 \times \pi \times 8} \times \pi \times 8^2$

or **M2** for $\frac{x}{360} = \frac{6.4}{2 \times \pi \times 8}$ oe

or **M1** for $\frac{x}{360} \times 2 \times \pi \times 8 = 6.4$ oe

Question 78

285

2 **M1** for 180 + 105 or 75 or 105 seen in correct position at *B*

Question 79

12.2 or 12.24...

5 **M4** for $\tan = \frac{4.5}{\sqrt{20^2 + 5.5^2}}$ oe

or

M1 for recognising angle *GAC*

M1 for $\frac{495}{20 \times 5.5}$

M1 for $\sqrt{20^2 + 5.5^2}$

or $\sqrt{20^2 + 5.5^2 + (their4.5)^2}$

M1 for $\tan = \frac{their4.5}{\sqrt{20^2 + 5.5^2}}$ oe

Question 80

126.9 or 126.86 to 126.87 and 306.9 or 306.86 to 306.87

3 **B2** for one correct
 or **M1** for $\tan x = -\frac{4}{3}$
 if 0 scored then **SC1** for two answers with a difference of 180°

Question 81

(a) 1.07 or 1.071 to 1.072

3 **M2** for $[8 -] 8 \cos 30$ oe
 or **M1** for $\frac{OP}{8} = \cos 30$ oe

(b) 2.9[0] or 2.895 to 2.901

3 **M1** for $\frac{30}{360} \times \pi \times 8^2$ oe
M1 for $\frac{1}{2} \times 8 \times \text{their } 6.93 \times \sin 30$ oe
 or $\frac{1}{2} \times 8 \cos 30 \times 4$ oe

Question 82

63.4 or 63.43...
 243.4 or 243.4...

2 **B1** for each
 If 0 scored **SC1** for two answers with a difference of 180

Question 83

(a) 61.1 or 61.08 to 61.09...

3 **M2** for $[\sin x =] \frac{8 \sin 100}{9}$ oe or better
 or **M1** for $\frac{9}{\sin 100} = \frac{8}{\sin x}$ oe

(b) 11.7 or 11.66 to 11.67

3 **M2** for
 $\frac{1}{2} \times 9 \times 8 \times \sin(180 - 100 - \text{their (a)})$ oe
 or **M1** for $180 - 100 - \text{their (a)}$

Question 84

29.5 or 29.45 to 29.46

2 | **M1** for $\frac{60}{360} \times \pi \times 7.5^2$ oe

Question 85

11.7 or 11.73...

3 | **M2** for $\sin 43 = \frac{PT}{17.2}$ oe
or **M1** for identifying angle *PVT*

Question 86

56.1 or 56.09...

4 | **M3** for $\cos[\dots] = \frac{\frac{1}{2}\sqrt{10^2 + 12^2}}{14}$ oe

or **M2** for $[MC =] \frac{1}{2}\sqrt{10^2 + 12^2}$ oe

or **M1** for $[AC^2 =] 10^2 + 12^2$ oe

or **B1** for indicating required angle

Question 87

12

2 | **M1** for $2^2 \times 3^2$ and $2^2 \times 3 \times 7$
or for $2 \times 2 \times 3$ final answer

or **B1** for 2, 3, 4 or 6 as final answer

Question 88

14.1 or 14.12...

3 | **M2** for $\sin 65 = \frac{12.8}{BC}$ oe or better
or **M1** for recognition that the line from *B*
is perpendicular to *AC*

Question 89

48.6 or 48.59...

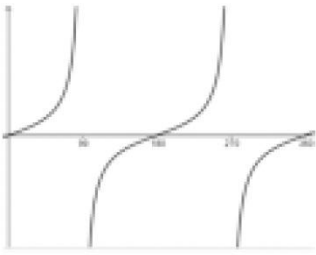
2 | **B1** for each

and

If 0 scored **SC1** for two answers with a
sum of 180°

131.4 or 131.4...

Question 90

(a)	Correct sketch 	2	1 for one correct branch or correct sketch but with branches joined
(b)	11.3 or 11.30 to 11.31 and 191.3 or 191.30 to 191.31	2	B1 for each If 0 scored SC1 for two answers with a difference of 180°

Question 91

60
and
240

2 **B1** for 60 or 240

If 0 scored **SC1** for two answers with a difference of 180°

Question 92

(a)	13.6 or 13.60...	3	M2 for $12^2 + 5^2 + 4^2$ or M1 for $5^2 + 4^2$ or $12^2 + 4^2$ or $12^2 + 5^2$
(b)	17.1 or 17.08 to 17.10...	3	M2 for $\sin = \frac{4}{\text{their (a)}}$ oe or $\tan = \frac{4}{\text{their AP}}$ or $\cos = \frac{\text{their AP}}{\text{their (a)}}$ or M1 for recognising angle <i>CAP</i> .

Question 93

33.8 or 33.78 to 33.80

4 **M2** for $2 \times 12.6 \times \sin 40$ oe
or **M1** for $\sin 40 = \frac{(\dots)}{12.6}$ oe

M1 for $\frac{80}{360} \times 2 \times \pi \times 12.6$ oe

Question 94

196.6 or 196.60...
and
343.4 or 343.39...

3 | **B2** for one correct angle

or **M1** for $\sin x = -\frac{2}{7}$ or better

If 0 scored **SC1** for two angles that sum to 540°

Question 95

68.6 or 68.55 to 68.56

4 | **M3** for $\tan[.] = \frac{9}{\frac{1}{2}\sqrt{5^2+5^2}}$ oe

or **M2** for $\frac{1}{2}\sqrt{5^2+5^2}$ oe

or **M1** for 5^2+5^2 oe or $2.5^2+2.5^2$ oe
or $x^2+x^2=5^2$ oe

or **B1** for indicating required angle

Question 96

109.4 to 109.5
and 250.5 to 250.6

3 | **B2** for one correct angle

or **M1** for $\cos x = \frac{5}{3} - 2$ or better

If 0 scored **SC1** for two angles that sum to 360

Question 97

1150

3 | **M2** for $\left(\frac{1}{2} \times 800 \times 2300 \times \sin 30\right) \div 400$ oe

or **M1** for $\frac{1}{2} \times 800 \times 2300 \times \sin 30$ oe

Question 98

54.3 or 54.31...

2 | **M1** for $\cos [x] = \frac{7}{12}$ oe

Question 99

(a)	32.8	2	M1 for 8[cm] to 8.4[cm] seen or for <i>their</i> measurement [in cm] multiplied by 4
(b)	065	1	
(c)	X correctly placed 7 cm from P on a bearing of 140°	2	M1 for X on bearing of 140 from P or for X 7 cm from P If 0 scored SC1 for X on bearing of 140 from Q and 7 cm from Q

Question 100

(a)	35.1 or 35.05 to 35.06	4	M3 for $\tan = \frac{14.5}{\sqrt{18.6^2 + 9^2}}$ oe or M2 for $[AC^2 =]18.6^2 + 9^2$ oe or better or $[AG^2 =]18.6^2 + 9^2 + 14.5^2$ or M1 for recognising the angle GAC
(b)	$30 - \sqrt{18.6^2 + 9^2 + 14.5^2}$ $30 - \frac{14.5}{\sin(\text{their}(\mathbf{a}))}$ or $30 - \frac{\sqrt{18.6^2 + 9^2}}{\cos(\text{their}(\mathbf{a}))}$	M2	M1 for $AG^2 = 18.6^2 + 9^2 + 14.5^2$ oe or better or $\sin(\text{their}(\mathbf{a})) = \frac{14.5}{AG}$ or $\cos(\text{their}(\mathbf{a})) = \frac{\sqrt{18.6^2 + 9^2}}{AG}$
	4.75 to 4.78...	A1	

Question 101

77.8 or 77.77 to 77.80

5 **B4** for answer 22.2[%] or 22.20[%] to 22.23[%]

OR

M1 for $\tan^{-1} \frac{11}{4}$ oe or $\tan^{-1} \frac{4}{11}$ oe

M2 for $4 \times 11 - \frac{\text{their acute angle}}{360} \times \pi \times 4^2$ oe

or **M1** for $\frac{\text{their acute angle}}{360} \pi \times 4^2$ oe

M1 for $\frac{\text{their shaded area}}{4 \times 11} [\times 100]$ oe

or $\frac{\text{their sector area}}{4 \times 11} \times 100$ oe

Question 102

221.8 or 221.81...

and

318.2 or 318.18 to 318.19

3 **B2** for one correct

or **M1** for $\sin x = -\frac{2}{3}$ oe

If **0** scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180

Question 103

252

3 **M2** for $180 \div (7 - 2)$ oe

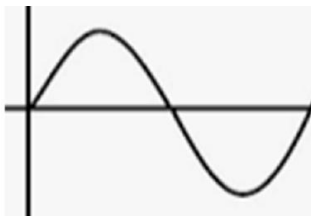
OR

M1 for $180 - x + y = 360$ oe

M1 for correct use of ratio

Question 104

(a)



Correct sketch to go through
(0, 0), (180, 0) and (360, 0)

2

B1 for correct sine curve shape through the origin

(b)

199.5 or 199.47...
and
340.5 or 340.52 to 340.53...

3

B2 for one correct

or **M1** for $\sin x = -\frac{1}{3}$ oe

If 0 scored **SC1** for two reflex angles with sum of 540 or two non-reflex angles with sum of 180

Question 105

239

2

M1 for $180 + 59$ or $360 - (180 - 59)$ oe

or indicates correct angle on diagram

Question 106

076 or 076.4 to 076.5

5

B3 for [angle $ABC =$] 144 or 144.4 to 144.5

OR

M2 for [sin $ABC =$] $\frac{17.6 \sin 25}{12.8}$ oe

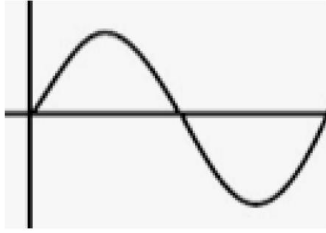
or **M1** for $\frac{17.6}{\sin B} = \frac{12.8}{\sin 25}$ oe

M1 for $180 - \textit{their} 35.5$

AND

M1 for $\textit{their} \text{ angle } ABC - (180 - 112)$ oe

Question 107



Correct sketch to go through (0, 0), (180, 0) and (360, 0)

2 **B1** for correct sine curve shape through the origin

Question 108

187.2
and 352.8

3 **B2** for one correct value, if more than two answers given award **B2** if any of the correct answers found and may be in the working
or **M1** for $\sin x = -\frac{1}{8}$ oe soi
If 0 scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180

Question 109

(a) 9.8[0] or 9.797 to 9.798

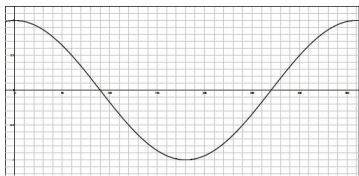
3 **M2** for $14^2 - 10^2$ oe or better
or **M1** for $10^2 + h^2 = 14^2$ oe or better

(b) 33.8 or 33.79 to 33.80

1 **FT** 24 + *their* (a)

Question 110

(a) Correct sketch



Correct sketch to go through (0, 1), (360, 1) and (180, -1)

2 To go through (0, 1) and close to (360, 1) and reasonably close to (180, -1)
B1 for correct cosine curve shape through (0, 1)

(b) 120, 240

2 **B1** for each or for two values with sum of 360

Question 111

12.7 or 12.68 to 12.69

4

M3 for $\frac{7 \sin 115}{\sin(180 - 115 - 35)}$

or **B2** for 8.03... seen

OR

B1 for [angle C =] 30

M2 for $\frac{7 \sin 115}{\sin(\text{their angle } C)}$

or **M1** for $\frac{\sin 115}{BC} = \frac{\sin(\text{their angle } C)}{7}$ oe

Question 112

24.9 or 24.93 to 24.94

4

M3 for $\tan = \frac{4}{\sqrt{5^2 + 7^2}}$ oe

or **M2** for $5^2 + 7^2$ oe or $5^2 + 7^2 + 4^2$ oe

or **M1** for recognition of angle *PCA*.

Question 113

6.12 or 6.116... to 6.118

3

M1 for $\sin = \frac{3}{9}$ oe or $\cos = \frac{9^2 + 9^2 - 6^2}{2 \times 9 \times 9}$ oe

M1 dep for $\frac{\text{their angle}}{360} \times \pi \times 2 \times 9$ dependent
on use of trig for *their angle*

Question 114

216.9 or 216.86 to 216.87
323.1 or 323.13...

3

B2 for one correct angle

or **M1** for $\sin x = -\frac{3}{5}$ or better

If M1 or 0 scored **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180

Question 115

40.7 or 40.73 to 40.74

2 | **M1** for $\frac{1}{2} \times 92.5 \times 71 \sin x = 2143$ oe

Question 116

9.1

3 | **M2** for
 $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2 - \frac{140}{360} \times [\pi] \times 3.2^2$ oe

or **M1** for $\frac{140}{360} \times [\pi] \times 3.2^2$ oe

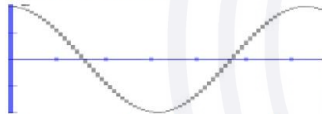
or $\frac{140}{360} \times [\pi] \times (3.2 + 2.6)^2$ oe

or $[\pi] \times (3.2 + 2.6)^2 - [\pi] \times 3.2^2$

Question 117

(a)

correct sketch



Correct sketch to go through (0, 1), (360, 1) and (180, -1)

2 | **B1** for correct cosine curve shape through (0, 1)

(b)

126.9 or 126.86 to 126.87
 233.1 or 233.13 to 233.14

3 | **B2** for 1 correct angle

or **M1** for $\cos x = -\frac{3}{5}$ oe

If M1 or 0 scored SC1 for two angles with a sum of 360

Question 118

236[.0...]

4

M2 for $\frac{27.3 \times \sin 125}{62.4}$

or **M1** for $\frac{27.3}{\sin U W V} = \frac{62.4}{\sin 125}$

M1 for $180 + (125 - 90) + \textit{their 21}$ oe

or $180 + (90 - \textit{their 34})$ oe

If 0 scored **SC1** for the correct bearing marked at *W*

