Extended Mathematics
Topic : Trigonometry
Year :May 2013 -May 2024
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 – *their* **(a)** **M1** for $\frac{1}{2} \times 4 \times 6 \times \sin$ *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 [ ] = $\frac{6}{\textit{their } 8}$ 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[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 $\frac{[\ ]}{8} = \cos 28$ or better

Question 10

1.38 or 1.39 or 1.384 to 1.389	**7**	**M3** [Area Δ =] $\frac{1}{2}\times 8\cos 60\times 8\sin 60$ or **M1** for [*AE* =] 8cos 60 and **M1** for [*ED*] = 8sin 60 and **M1** for Area sector $\frac{30}{360}\times\pi\times 8^2$ and **M1** for Area rectangle = 8 × 8cos60 or 8 × 4 **M1** for *their* 32 – (*their* 13.86 + *their* 16.76) or better

Question 11

113.9 to 114.0	**4**	**M2** for [cos =] $\frac{8^2+2^2-9^2}{2\times8\times2}$ 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…] or 11.7 or 11.71 to 11.72 **SC1** for [cos =] $\frac{9^2+2^2-8^2}{2\times9\times2}$ or [cos =] $\frac{9^2+8^2-2^2}{2\times9\times8}$

Question 12

(a)	2.47 or 2.474 to 2.4744	**2**	**M1** for $\frac{56}{360}\times\pi\times2.25^2$ oe
(b)	0.742 or 0.7422 to 0.74232	**1FT**	FT *their* **(a)** × 0.3[0] correctly evaluated.

Question 13

13.5 or 13.45[..]	**3**	**M2** for $\sqrt{\frac{2\times85}{\sin110}}$ or **M1** for ½ × a^2 × sin 110 = 85 or $\frac{2\times85}{\sin110}$ oe [180.9..]

Question 14

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

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 $\sqrt{(9^2 + 10^2 - 2\times 9\times 10 \times \cos(\textit{their } P))}$ or **M2** for $9^2 + 10^2 - 2\times 9\times 10 \times \cos(\textit{their } P)$ or **M1** for a correct implicit expression e.g. $\cos(\textit{their } P) = \frac{9^2 + 10^2 - RQ^2}{2\times 9\times 10}$ 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 $\cos[\ldots =] \frac{2}{5}$ 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 2×15 + 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 $\frac{38}{360}\times2\times\pi\times25$ and **B1** for rounding their more accurate answer correctly to 4sf

Question 26

130 or 130.0 to 130.1	**2**	**M1** for ½ × 22.3 × 27.6 × sin25

Question 27

75.1 or 75.09 to 75.10	**2**	**M1** for cos […=] $\frac{0.9}{3.5}$

Question 28

(a)	20.1 or 20.07 to 20.08	**2**	**M1** for $\frac{1}{2}\times7\times10\times\sin35$ oe
(b)	5.86 or 5.858…..	**4**	**M2** for $7^2+10^2-2\times7\times10\times\cos35$ **A1** for 34.3 .. or **M1** for $\cos35=\frac{7^2+10^2-AC^2}{2\times7\times10}$

Question 29

27	**3**	**M2** for $\frac{6\pi}{\pi\times2\times9}\times\pi\times9^2$ oe or **M1** for $\frac{6\pi}{\pi\times2\times9}$ oe

Question 30

(a)	14.4 or 14.42 to 14.43	**2**	**M1** for $\frac{1}{2}$ × 6.2 × 4.7 × sin 82 oe
(b)	30.7 or 30.72…	**2**	**M1** for sin = $\frac{2050}{\frac{1}{2}\times107\times75}$

Question 31

1024 cao	**5**	**B4** for 1023 to 1024.0… or 1020 or **M3** for $\frac{125}{360}\times\pi\times48^2-\frac{125}{360}\times\pi\times40^2+32\times8$ or **M1** for $\frac{125}{360}\times\pi\times48^2$ or $\frac{125}{360}\times\pi\times40^2$ **and M1** for $32\times8+k\pi$ 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 =] $\frac{300}{\tan52}$ 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 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 = $\frac{8}{\textit{their}\ \textbf{(a)}}$ or cos = $\frac{\sqrt{8^2+8^2}}{\textit{their}\ \textbf{(a)}}$ or tan = $\frac{8}{\sqrt{8^2+8^2}}$ oe

Question 34

(a)	11.4 or 11.40 to 11.41	**2**	**M1** for $\frac{1}{2}\times2.8\times8.3\times\sin79$ 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 ÷ *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 × 8 × 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 $2 \times \{(\frac{40}{360} \times \pi \times 10^2) - (\frac{1}{2} \times 10^2 \times \sin 40)\}$ or **M2** for $\left[\frac{1}{2}\times\right] 10^2 \times \sin 40$ and $[2\times]\frac{40}{360} \times \pi \times 10^2$ or **M1** for $\left[\frac{1}{2}\times\right] 10^2 \times \sin 40$ 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 $\frac{30}{360}\times\pi\times6^2$ **M1** for $\frac{1}{2}\times6\times6\times\sin30$

Question 45

32	**2**	**M1** for $\frac{1}{2}\times33\times h = 528$ oe

Question 46

46.7 or 46.68 to 46.69	**4**	**M3** for $\tan[\ldots=]\ \dfrac{9}{\frac{1}{2}\sqrt{12^2+12^2}}$ 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 $0.5\times1.6\times2.8$
(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 $[\cos x=]\dfrac{11^2+5^2-13^2}{2\times11\times5}$ or **M1** for $13^2=11^2+5^2-2\times11\times5\cos x$ **A1** for $-0.209\ldots$ or $-\dfrac{23}{110}$

Question 49

320	**2**	**M1** for 180 + 140 oe

Question 50

46.2 or 46.17 to 46.18	**4**	**M2** for $[\cos=]\dfrac{16^2+19^2-14^2}{2\times16\times19}$ or **M1** for $14^2=19^2+16^2-2\times19\times16\cos M$ **A1** for $0.692\ldots$ or $\dfrac{421}{608}$

Question 51

19.3 or 19.26 to 19.27 nfww	**3**	**M2** for $[\sin=]5.9\times\dfrac{\sin84.6}{17.8}$ or **M1** for $\dfrac{5.9}{\sin B}=\dfrac{17.8}{\sin84.6}$ 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 $\tan = \dfrac{4}{\sqrt{12^2 + 6^2}}$ 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 $[q =] \dfrac{12}{5}$ oe	**3**	**B1** for $[p =]$ 12 and **B2** for $[q =] \dfrac{12}{5}$ or **M1** for $\dfrac{72}{360}[\times\pi]\times 2\times 6$ oe

Question 55

25.1 or 25.06…	**4**	**M3** for $\tan = \dfrac{8}{\sqrt{16.2^2 + 5.5^2}}$ 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 $\dfrac{1}{2}\times 10\times 10\times \sin 60 - \dfrac{60}{360}\times\pi\times\left(\dfrac{10}{2}\right)^2$ or **M1** for $\dfrac{k}{360}\times\pi\times\left(\dfrac{10}{2}\right)^2$ oe and **M1** for $\dfrac{1}{2}\times 10\times 10\times \sin c$ 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 $\tan = \dfrac{10}{\frac{1}{2}\sqrt{8^2+8^2}}$ 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 $\sin 35\ [=]\ \dfrac{x}{12}$ 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 $\dfrac{45}{360}\times\pi\times5^2$ oe **and** $\dfrac{45}{360}\times\pi\times3^2$ oe or **M1** for $\dfrac{45}{360}\times\pi\times5^2$ oe or $\dfrac{45}{360}\times\pi\times3^2$ oe or $\pi\times5^2-\pi\times3^2$ oe

Question 69

109.3 or 109.26 to 109.27	**3**	**M2** for $\dfrac{12\sin 39}{8}$ or **M1** for $\dfrac{8}{\sin 39}=\dfrac{12}{\sin(...)}$ oe

Question 70

45[.0] or 44.99 to 45.00	**2**	**M1** for $\dfrac{1}{2}\times13\times11\times\sin 39$ 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 $\cos = \dfrac{\frac{1}{2}\sqrt{11^2+11^2}}{18.6}$ 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 $\dfrac{19.02}{2+\pi}$ 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 $\frac{42}{360}\times\pi\times6.5^2$ or **M1** for $\frac{42}{360}\times\pi\times65^2$

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 $[\cos =]\dfrac{100+72-100}{2\times10\times\sqrt{72}}$ OR **M1** for $8^2 + 6^2$ **M1** for $6^2 + 6^2$ **M2** for $\dfrac{(theirAF)^2+(theirAH)^2-(theirHF)^2}{2\times(theirAF)\times(theirAH)}$ or **M1** for $(theirHF)^2 = (theirAF)^2 + (their\ AH)^2 - 2\times(theirAF)\times(their\ AH)\cos(HAF)$ *AF*, *AH* etc from correct method

Question 77

25.6 or 25.59 to 25.60…	**4**	**M3** for $\dfrac{6.4}{2\times\pi\times8}\times\pi\times8^2$ or **M2** for $\dfrac{x}{360}=\dfrac{6.4}{2\times\pi\times8}$ oe or **M1** for $\dfrac{x}{360}\times2\times\pi\times8=6.4$ 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 = $\dfrac{4.5}{\sqrt{20^2+5.5^2}}$ oe or **M1** for recognising angle *GAC* **M1** for $\dfrac{495}{20\times5.5}$ **M1** for $\sqrt{20^2+5.5^2}$ or $\sqrt{20^2+5.5^2+(their4.5)^2}$ **M1** for tan = $\dfrac{their4.5}{\sqrt{20^2+5.5^2}}$ 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 $\frac{1}{2} \times 8 \times \textit{their}\ 6.93 \times \sin 30$ 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 $\frac{1}{2} \times 9 \times 8 \times \sin(180 - 100 - \textit{their}$ **(a)**$)$ oe or **M1** for 180 – 100 – *their* **(a)**

Question 84

29.5 or 29.45 to 29.46	**2**	**M1** for $\frac{60}{360}\times\pi\times7.5^2$ 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 $\cos[\ldots]=\frac{\frac{1}{2}\sqrt{10^2+12^2}}{14}$ 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 $2^2\times3^2$ and $2^2\times3\times7$ or for $2\times2\times3$ final answer or **B1** for 2, 3, 4 or 6 as final answer

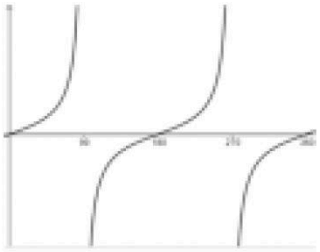
Question 88

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… and 131.4 or 131.4…	**2**	**B1** for each If 0 scored **SC1** for two answers with a sum of 180°

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 $\sin = \frac{4}{\textit{their}\ \textbf{(a)}}$ oe or $\tan = \frac{4}{\textit{their}\ AP}$ or $\cos = \frac{\textit{their}\ AP}{\textit{their}\ \textbf{(a)}}$ or **M1** for recognising angle *CAP*.

Question 93

33.8 or 33.78 to 33.80	**4**	**M2** for $2 \times 12.6 \times \sin 40$ oe or **M1** for $\sin 40 = \frac{(...)}{12.6}$ 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 *their* 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 $\left[AC^2 = \right] 18.6^2 + 9^2$ oe or better or $\left[AG^2 = \right] 18.6^2 + 9^2 + 14.5^2$ or **M1** for recognising the angle *GAC*
(b)	$30 - \sqrt{18.6^2 + 9^2 + 14.5^2}$ $30 - \frac{14.5}{\sin(their\,\mathbf{(a)})}$ or $30 - \frac{\sqrt{18.6^2 + 9^2}}{\cos(their\,\mathbf{(a)})}$	**M2**	**M1** for $AG^2 = 18.6^2 + 9^2 + 14.5^2$ oe or better or $\sin(their\,\mathbf{(a)}) = \frac{14.5}{\text{AG}}$ or $\cos(their\,\mathbf{(a)}) = \frac{\sqrt{18.6^2 + 9^2}}{\text{AG}}$
	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 $4\times11-\frac{their\ acute\ angle}{360}\times\pi\times4^2$ oe or **M1** for $\frac{their\ acute\ angle}{360}\pi\times4^2$ oe **M1** for $\frac{their\ shaded\ area}{4\times11}$ [×100] oe or $\frac{their\ sector\ area}{4\times11}$ ×100 oe

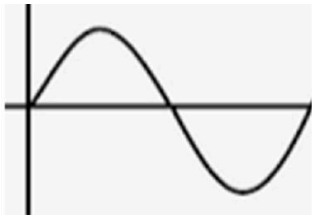
Question 102

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 ÷ (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

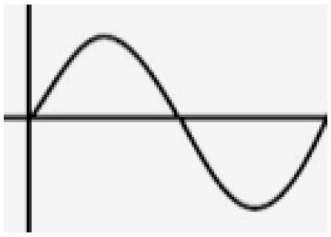
Question 105

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 – *their* 35.5 AND **M1** for *their* angle ABC – (180 – 112) oe

Question 107

 Correct sketch to go through (0, 0), (180, 0) and (360, 0)	**2**	**B**1 for correct sine curve shape through the origin

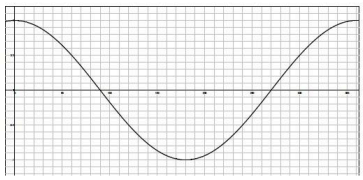
Question 108

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 $\frac{7\sin 115}{\sin(\textit{their}\ \text{angle}\ C)}$ or **M1** for $\frac{\sin 115}{BC}=\frac{\sin(\textit{their}\ \text{angle}\ C)}{7}$ 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 $\frac{\textit{their angle}}{360}\times\pi\times 2\times 9$ 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

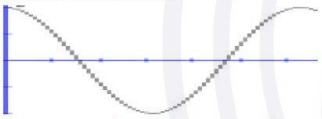
Question 115

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 $\frac{27.3}{\sin UWV}=\frac{62.4}{\sin 125}$ **M1** for $180+(125-90)+$ *their* 21 oe or $180+(90-$ *their* $34)$ oe If 0 scored **SC1** for the correct bearing marked at W

Question 119

(a)	11.7 or 11.74 to 11.75	**3**	**M2** for $\left(\frac{14}{2}\right)^2+5^2+8^2$ oe or **M1** for $\left(\frac{14}{2}\right)^2+5^2$, 5^2+8^2 or $\left(\frac{14}{2}\right)^2+8^2$
(b)	42.9 to 43.14	**3**	**M2** for $\sin[\ldots.]=\frac{8}{\textit{their}\ \textbf{(a)}}$ oe or **M1** for recognising angle MBX where X is the midpoint of DC

Question 120

116.9 or 116.85…	**4**	**M3** for $180-\sin^{-1}\left(\frac{18\sin 42}{13.5}\right)$ or **B3** for 63.1 or 63.14 to 63.15 or **M2** for $[\sin PRQ=]\ \frac{18\sin 42}{13.5}$ or **M1** for $\frac{18}{\sin PRQ}=\frac{13.5}{\sin 42}$ oe

Question 121

231	**2**	**B1** for any of these angles in correct place on diagram 51 or 129 or 141 between east line drawn from P and QP or 39 between west line drawn from P and QP or indicating the correct bearing of Q from P on the diagram or **M1** for $180 + (90 - 39)$ oe or $360 - (90 + 39)$ oe

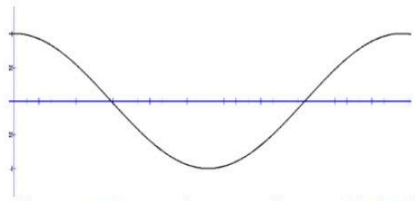
Question 122

110 or 110.3…	**4**	**M3** for $[2\times]\ (2(\frac{1}{2} \times 13.6^2 \times \sin 41) - (\frac{41}{360} \times \pi \times 13.6^2))$ oe OR **M1** for $\left[\frac{1}{2}\times\right] 13.6^2 \times \sin 41$ oe **M1** for $[2\times]\ \frac{41}{360} \times \pi \times 13.6^2$ oe

Question 123

55.9 or 55.85…	**4**	**M3** for $\tan[\ldots] = \frac{15.1}{\sqrt{4.5^2 + 9.2^2}}$ oe or **M2** for $[AH^2 =]\ 4.5^2 + 9.2^2$ or $[BH^2 =]\ 4.5^2 + 9.2^2 + 15.1^2$ or **M1** for recognising angle BHA if 0 scored **SC1** for [angle BHD =] 59.7[1…] or 59.72

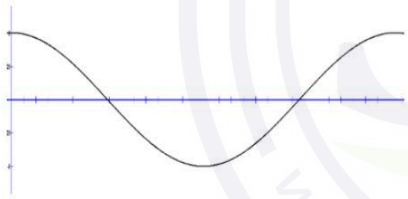
Question 124

(a)	 Correct sketch to go through (0, 1), close to (360, 1) and reasonably close to (180, –1)	**2**	**B1** for correct cosine curve shape through (0,1)
(b)	282.1 or 282.12…	**2**	**B1** implied by 77.9 or 77.87 to 77.88 or 282.13 or **M1** for 360 – *their* acute angle

Question 125

29.7 or 29.66[...]	**3**	**M2** for $[\sin y =] \dfrac{8.3\sin 105}{16.2}$ or **M1** for $\dfrac{16.2}{\sin 105} = \dfrac{8.3}{\sin y}$ oe

Question 126

(a)	 Correct sketch to go through (0, 1), close to (360, 1) and reasonably close to (180, –1)	**2**	**M1** for correct cosine curve shape through (0, 1)
(b)	72.9 and 287.1	**2**	**B1** for one correct If 0 scored, **SC1** for two angles with a sum of 360

Question 127

5.36 or 5.360 to 5.361	**2**	**M1** for $\frac{1}{2} \times 5.6 \times 4.9 \times \sin 23$ oe

Question 128

287	**2**	**M1** for 360 – (180 – 107) oe or indicates correct angle on a diagram

Question 129

14.2 or 14.19 to 14.20	**4**	**M3** for $\tan = \dfrac{4}{\sqrt{15^2+5^2}}$ oe or **M2** for 15^2+5^2 or $15^2+5^2+4^2$ or **M1** for recognition of angle VAC

Question 130

120, 300	**3**	**B2** for one correct or **M1** for $\tan x = -\sqrt{3}$ oe If 0 or M1 scored **SC1** for answers with difference of 180

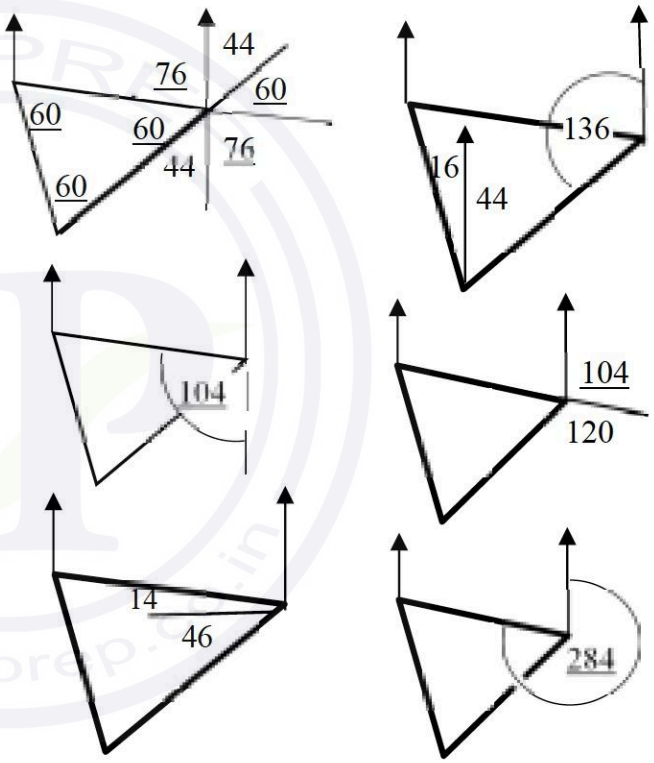
Question 131

6.39 or 6.389...	**2**	**M1** for $\cos 37 = \dfrac{AB}{8}$ oe

Question 132

(i)	correct sine curve sketch through (0, 0), (180, 0) and (360, 0) 	**2**	**M1** for correct sine curve shape through the origin
(ii)	203.6 and 336.4	**3**	**B2** for one correct or **M1** for $\sin x = -0.4$ oe If 0 or M1 scored, **SC1** for two reflex angles with a sum of 540 or two non-reflex angles with a sum of 180

Question 133

224	3	**M2** for a fully correct method e.g. 360 – (180 – 104 + 60) oe or **B2** for 120, 136, 44, 46, 14, or 16 in the correct position or **B1** for 60, 76, 104 or 284 in the correct position or for interior angle of triangle = 60 i.e. these positions for B2 or B1: 

Question 134

52.6 or 52.61 to 52.62	2	**M1** for $\cos[\ldots =]\frac{8.5}{14}$ oe

Question 135

33.2 or 33.18…	**4**	**M3** for $\tan = \dfrac{6.5}{\sqrt{4^2 + 9.1^2}}$ oe or **M2** for $4^2 + 9.1^2$ oe or $4^2 + 9.1^2 + 6.5^2$ oe or **M1** for recognising the angle *ECH*

Question 136

218.7, 321.3	**3**	**B2** for one correct or **M1** for $\sin x = -\dfrac{5}{8}$ oe 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 137

19.5 or 19.52…	**2**	**M1** for $\dfrac{1}{2} \times 6.7 \times 5.9 \times \sin 81$ oe

Question 138

221 or 220.5 to 220.6	**3**	**M2** for $\dfrac{360 - 48}{360} \times \pi \times 9^2$ or **M1** for $\dfrac{k}{360} \times \pi \times 9^2$ where $k < 360$ or **B1** for 312

Question 139

(a)	146 or 146.2 to 146.3	**3**	**M1** for $\dfrac{1}{2} \times 12.8 \times 12.8$ **M1** for $\left[\dfrac{1}{2}\times\right] \pi \times \left(\dfrac{12.8}{2}\right)^2$

(b)	51[.0] or 51.00 to 51.01…	**4**	**M1** for $\frac{1}{2}\times\pi\times12.8$ **M2** for $\sqrt{12.8^2+12.8^2}$ or $\frac{12.8}{\sin 45}$ oe or **M1** for $12.8^2+12.8^2$ oe or $\sin 45=\frac{12.8}{KL}$ oe