

Mark schemes

Q1.

(a) $\frac{1}{2}$

B1

(b) $(b^2 =) 5^2 + 8^2 - 2 \times 5 \times 8 \times \cos 60$

M1

$(b^2 =) 25 + 64 - 40$

M1dep

$b^2 = 49$ so $b = 7$

A1

[4]

Q2.

$6^2 + 9^2 - 2 \times 6 \times 9 \times \cos 120$
or $36 + 81 - 108 \cos 120$
or $36 + 81 + 54$
or 171

oe

M1

$\sqrt{6^2 + 9^2 - 2 \times 6 \times 9 \times \cos 120}$

or $\sqrt{36 + 81 - 108 \cos 120}$

or $\sqrt{36 + 81 + 54}$

oe

M1dep

[13, 13.1]

or $\sqrt{171}$ or $3\sqrt{19}$

A1

Additional Guidance

$6^2 + 9^2 = 36 + 81$

$= 117$

Answer $\sqrt{117}$

M0

[3]

Q3.

$\frac{\sin x}{6} = \frac{\sin 125}{14}$ or $\frac{6}{\sin x} = \frac{14}{\sin 125}$

$$\text{oe eg } \frac{\sin x}{6} = 0.058 (\dots) \text{ or } 0.059 \text{ or } 0.06$$

$$\text{or } \frac{6}{\sin x} = 17.(0\dots) \text{ or } 17.1$$

M1

$$(\sin x =) \frac{\sin 125}{14} \times 6 \text{ or } 0.35(1\dots)$$

$$\text{oe eg } \sin^{-1} \left(\frac{\sin 125}{14} \times 6 \right)$$

M1dep

[20.5, 20.6] or 21

A1

Additional Guidance

Condone incorrect notation if recovered

$$\text{eg } x = \frac{\sin 125}{14} \times 6$$

Answer 20.6

M2 A1

$$\frac{\sin}{6} = \frac{\sin 125}{14} \text{ not recovered}$$

Zero

Answer [20.5, 20.6] from scale drawing

M1M1A1

Answer 21 from scale drawing

Zero

Answer only [20.5, 20.6] or 21

M1M1A1

[3]

Q4.

$$15^2 + 26^2 - 2 \times 15 \times 26 \times \cos 38 \text{ or } [286, 286.4] \text{ or } [16.9, 17]$$

May be seen in a square root

May be seen on diagram

M1

$$\frac{108}{360} \text{ or } 0.3 \text{ or } \frac{360}{108} \text{ or } 3.33(\dots)$$

oe e.g. 108 ÷ 360 or 30%

May be seen in two steps

e.g. × 108 ÷ 360

M1

$$\text{Their } \frac{108}{360} \times \pi \times [286, 286.4]$$

$$\text{or } \pi \times \text{their } [286, 286.4] \div \text{their } \frac{360}{108}$$

or [269, 272.4114]

Dep on 1st and 2nd M1

oe eg $\frac{108}{360} \times \pi \times (\text{their } [16.9, 17])^2$

M1dep

$$(2 \times) \frac{1}{2} \times 15 \times 26 \times \sin 38$$

or [120, 120.1] or [240, 240.2]

oe

M1

[509, 512.6114] and 510

Must see a value in range [509, 512.6114] and 510

A1

Additional Guidance

$15 \times 26 \times \sin 38$ scores 4th M1 unless subsequently doubled

If (sector) 270 and (2 triangles) 240 followed by $270 + 240 = 510$

M4A1

Working back from 510. Apply scheme but maximum mark is M4A0

Assuming angle $AEB = 72$ and then using sine rule to work out BE does lead to area = 510 to 2sf but can score a maximum of M0M1M0M1depA0

$$BE = \frac{26}{\sin 72} \times \sin 38 = 16.8 \text{ (or 17)}$$

M0

$$\frac{108}{360} \times \pi \times 16.8^2 = 266 \quad 2 \times \frac{1}{2} \times 15 \times 26 \times \sin 38 = 240.2$$

M1M0depM1

506.2 \rightarrow 510

A0

$BE = [16.9, 17]$ seen with no working scores first M1 (and possibly all other marks)

$BE = 35 \div 2 = 17.5 \rightarrow 17$ does not score first M1

[5]

Q5.

$$55^2 = 32^2 + 40^2 - (2 \times 32 \times 40 \times \cos x)$$

oe

M1

$$\frac{32^2 + 40^2 - 55^2}{2 \times 32 \times 40}$$

or -0.156...

or -0.16

M1dep

99.(...)

A1

[3]

Q6.

$$\frac{y}{\sin 73} = \frac{23}{\sin 40}$$

oe

$$\frac{y}{0.956\dots} = \frac{23}{0.642\dots}$$

M1

$$\frac{23 \sin 73}{\sin 40}$$

oe

$$\frac{23 \times 0.956}{0.642\dots}$$

M1dep

34.(2...)

A1

Additional Guidance

For the method marks accept rounded or truncated values

[3]

Q7.

$$\frac{w}{\sin 65} = \frac{18}{\sin 40}$$

$$\text{or } \frac{w}{\sin 65} = 28$$

M1

$$\frac{18}{\sin 40} \times \sin 65$$

or $28 \sin 65$

M1

25.37(...) or 25.4 or 25.38 or 25

A1

[3]

Q8.

$$(a) \quad \frac{\sin 130}{95} = \frac{\sin x}{50}$$

$$\text{or } 0.008(\dots) = \frac{\sin x}{50}$$

$$\frac{95}{\sin 130} = \frac{50}{\sin x}$$

$$\text{or } 124. (\dots) = \frac{50}{\sin x}$$

M1

$$\frac{50 \sin 130}{95}$$

or 0.4(...)

$$50 \div \frac{95}{\sin 130}$$

M1dep

[23.7, 23.8] or 24

A1

(b) $30^2 + 72^2 - 2 \times 30 \times 72 \cos 40$

M1

2774.(688...) or 2775

A1

[52.6, 52.7] or 53

SC1 for [36.7, 36.8] or 37

A1

[6]

Q9.

(cos Q =)

$$(15^2 + 13^2 - 19^2) \div (2 \times 13 \times 15)$$

$$19^2 = 13^2 + 15^2 - 2 \times 13 \times 15 \times \cos Q$$

$$361 = 394 - 390 \cos Q$$

$$361 = 4 \cos Q$$

M1

0.0846...

A1

[85, 85.2]

85 with no working is M0

A1

[3]

Q10.

(a) tan chosen

$$\tan (y) = \frac{12}{7}$$

M1

$$\tan x = \frac{7}{12}$$

oe

$$\sin x = \frac{7}{\sqrt{193}}$$

$$\cos x = \frac{12}{\sqrt{193}}$$

(y =) 59.7... or 60

M1

[30, 30.3]

A1

(b) $\frac{BC}{\sin 40} = \frac{18}{\sin 110}$ (= 19.15...)

oe

Perpendicular height = 6.1563...

M1

$$\sin 40 \times \frac{18}{\sin 110}$$

oe

6.1563... ÷ sin 30

M1

12.3(...)

SC2 9.57... or 9.6

A1

[6]

Q11.

(a) $(\cos B =) \frac{(3\sqrt{2})^2 + (\sqrt{2})^2 - (\sqrt{14})^2}{2 \times 3\sqrt{2} \times \sqrt{2}}$

$$(\sqrt{14})^2 = (3\sqrt{2})^2 + (\sqrt{2})^2 - 2 \times 3\sqrt{2} \times \sqrt{2} \times \cos B$$

M1

$$\frac{18 + 2 - 14}{2 \times 3 \times 2}$$

$$14 = 18 + 2 - 12 \times \cos B$$

allow one error

oe

M1dep

$$\cos B = \frac{6}{12} = \frac{1}{2} \text{ and } B = 60^\circ$$

$$\text{or } (B =) \cos^{-1}(\frac{1}{2}) = 60^\circ$$

A1

(b) $\sin 60 = \frac{\sqrt{3}}{2}$ seen

M1

$$\frac{1}{2} \times 3\sqrt{2} \times \sqrt{2} \times \sin 60$$

oe

B1

$$\frac{3\sqrt{3}}{2}$$

oe

A1

[6]

Q12.

(a) $\cos x = \frac{8^2 + 9^2 - 15^2}{2 \times 8 \times 9}$

B1

(b) $\cos x = \frac{15^2 - 8^2 - 9^2}{2 \times 8 \times 9}$ implies

$$x = 56.2\dots \text{ or } 56.3$$

$$\cos x = \frac{8^2 + 9^2 - 15^2}{15 \times 8 \times 9} \text{ implies}$$

$$x = 94.2\dots$$

$$\cos x = \frac{8^2 + 9^2 - 15^2}{2 \times 8 \times 9} \text{ implies}$$

$$x = 123.7\dots$$

$$\cos x = \frac{15^2 - 8^2 + 9^2}{15 \times 8 \times 9} \text{ implies}$$

$$x = 77\dots$$

ft their answer in part (a)

Accept rounding or truncation of their answers

B1ft

[2]

Q13.

(a) $\frac{11^2 + 12^2 - 15^2}{2 \times 11 \times 12}$

$$15^2 = 11^2 + 12^2 - 2 \times 11 \times 12 \cos x$$

oe

M1

$$\frac{40}{264} \text{ or } \frac{5}{33} \text{ or } 0.15\dots$$

oe

A1

81 or 81.28(...) or 81.29 or 81.3

SC1 for 52.25(...) or 52 or 52.3 or 52.26
or 46.45(...) or 46 or 46.5 or 46.46

A1

(b) $\frac{BC}{\sin 35} = \frac{8}{\sin 74}$

oe

M1

$$\frac{8 \sin 35}{\sin 74}$$

M1dep

4.77(...) or 4.8

Accept 5 with some correct working shown

A1

[6]

Q14.

(a) $\frac{x}{\sin 19} = \frac{8}{\sin 123}$

oe

$$\frac{x}{0.325...} = \frac{8}{0.838...}$$

M1

$$\frac{8 \sin 19}{\sin 123}$$

$$\frac{8 \times 0.325...}{0.838...}$$

M1dep

3.1...

Accept 3 with working shown

A1

Additional Guidance

For the method marks accept rounded or truncated values

(b) $\sin 123^\circ = \sin 57^\circ$

and

$$\cos 123^\circ = -\cos 57^\circ$$

B1 for 2 correct and 1 incorrect
or for 1 correct and 1 incorrect

or for 1 correct and 0 incorrect

B2

(c) 3.1...

ft their answer to part (a)

B1ft

[6]