

M1.

$$\frac{\sin y}{16} = \frac{\sin 34}{10}$$

oe

M1

$$\frac{\sin 34}{10} \times 16 \text{ or } [63.47, 63.5]$$

M1

[116.5, 116.53]

A1

[3]**M2.**

$$180 - 112 - 46 \text{ or } 22$$

May be seen on the diagram

M1

$$\frac{15}{\sin 112} = \frac{x}{\sin \text{their } 22}$$

oe

M1

$$\frac{15 \sin \text{their } 22}{\sin 112}$$

M1

6.06... or 6.1 or 6

A1

[4]

M3.

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

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

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

$$\text{or } 28 \sin 65$$

$$25.37(\dots) \text{ or } 25.4 \text{ or } 25.38 \text{ or } 25$$

M1

M1

A1

[3]**M4.**

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

B1

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

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

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

$$x = 94.2\dots$$

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

$$x = 123.7\dots$$

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

$$x = 77\dots$$

ft their answer in part (a)
Accept rounding or truncation of their answers

B1ft

[2]

M5.

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

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

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

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

M1

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

or 0.4(...)

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

M1dep

[23.7, 23.8] or 24

A1

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

M1

2774.(688...) or 2775

A1

[52.6, 52.7] or 53

SC1 for [36.7, 36.8] or 37

A1

[6]

$$\mathbf{M6.(a)} \quad \frac{11^2 + 12^2 - 15^2}{2 \times 11 \times 12}$$

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

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

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

oe

M1

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

M1dep

4.77(...) or 4.8
 Accept 5 with some correct working shown

A1

[6]

M7.

(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

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

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]

M8. $45^2 + 60^2 - 2 \times 45 \times 60 \times \cos 110$
 [7461, 7472]

M1

$$\sqrt{45^2 + 60^2 - 2 \times 45 \times 60 \times \cos 110}$$

M1dep

[86.3, 86.5] or 86

A1

Additional Guidance

If they extend the base to form a right-angled triangle then the mark scheme still works, i.e.

$$AD = 45 \cos 70 = 15.3909$$

$$DC = 45 \sin 70 = 42.2861$$

$$BD = 15.3909 + 60 = 75.3909$$

$$BC^2 = 75.3909^2 + 42.2861^2 \text{ (first M1 here)}$$

M1

$$BC^2 = 5683.78 + 1788.11 = 7471.89$$

$$BC = \sqrt{7471.89} \text{ (second M1 here)}$$

M1

$$BC = 86.44 \text{ (full marks)}$$

A1

[3]

$$\mathbf{M9.180 - 28 - 74 \text{ or } 78}$$

M1

$$\frac{BC}{\sin 28} = \frac{9}{\sin 78}$$

their 78

M1dep

$$\frac{9 \sin 28}{\sin 78}$$

their 78

M1dep

4.3 ...

Accept 4 if working seen

A1

[4]

M10.

$$\frac{1}{2} \times w \times 2w \times \sin 30 (= 18)$$

oe e.g.1 $2w^2 \sin 30 = 36$

e.g.2 $\sin 30 = \frac{18}{w^2}$

M1

$$w^2 = 36 \text{ or } w = 6 \text{ or } 2w = 12$$

A1

their 6^2 + their 12^2

$$-2 \times \text{their } 6 \times \text{their } 12 \times \cos 30$$

$$(= [55.29, 55.3])$$

their $36 + 4 \times \text{their } 36$

$-4 \times \text{their } 36 \times \cos 30$

(= [55.29, 55.3])

M1

$$\sqrt{\text{their } [55.29, 55.3]}$$

Dep on previous M1

Do not allow if from incorrect working

e.g. $\sqrt{36 \cos 30}$ is M0 Dep

M1dep

$$[7.4, 7.44]$$

ft their w if 2nd and 3rd M1 gained

A1ft

[5]

M11.20 or 30 seen

M1

90 + 35 or 125 seen

20 sin 35 and 20 cos 35

10 sin 35 and 10 cos 35

B1

$$20^2 + 30^2 - (2 \times 20 \times 30 \times \cos 125)$$

$$(30 + 20 \sin 35)^2 + (20 \cos 35)^2$$

$$\text{or } (15 + 10 \sin 35)^2 + (10 \cos 35)^2$$

$$\text{or } 10^2 + 15^2 - (2 \times 10 \times 15 \times \cos 125)$$

M1

1988(.29 ...) or 1990

497(.07 ...) or 500

22.29(5 ...) or 22.3 or 22.5

ft their 90 + 35

A1ft

44.5 ... or 44.6 or 45

A1

[5]