M1.

$4^2 + 4^2$ or $16 + 16$ or 32
or $2^2 + 2^2$ or $4 + 4$ or 8

oe

M1

$\sqrt{32}$ or $4\sqrt{2}$ or $\sqrt{8}$ or $2\sqrt{2}$

Allow use of decimals to 2 dp or better

M1

$\cos x = \dfrac{\sqrt{8}}{6}$ or $0.47\ldots$

oe

$$\cos x = \dfrac{6^2 + 32 - 6^2}{2 \times 6 \times \sqrt{32}}$$

M1

[61.8, 61.9] or 62

A1

[4]

M2.

tan 20 = 38.3 ÷ *BD* or
tan 70 = *BD* ÷ 38.3

M1

(*BD* =) 38.3 ÷ tan 20 or
38.3 ✕ tan 70 or [105.2, 105.3]

This mark implies the first M1

M1

tan 12 = 38.3 ÷ *AD* or
tan 78 = *AD* ÷ 38.3

M1

(*AD* =) 38.3 ÷ tan 12 or
38.3 ✕ tan 78   or   [180.1, 180.2]

This mark implies the third M1

M1

[74.9, 74.96]

Only accept 75(.0) on the answer line if [74.9, 74.96] seen in

working

A1

Alternative method 1

sin 20 = 38.3 ÷ *BC* or
cos 70 = 38.3 ÷ *BC*

oe

M1

(*BC* =) 38.3 ÷ sin 20 or
38.3 ÷ cos 70 or [111.9, 112]

oe
This mark implies the first M1

M1

$$\frac{d}{\sin 8} = \frac{\text{their } 112}{\sin 12}$$

oe

M1

$$\frac{\text{their } 112}{\sin 12} \times \sin 8$$

dep on third M1
This mark implies the third M1

M1dep

[74.9, 74.96]

Only accept 75(.0) on the answer line if [74.9, 74.96] seen in working

A1

Alternative method 2

sin 12 = 38.3 ÷ *AC* or
cos 78 = 38.3 ÷ *AC*

oe

M1

(*AC* =) 38.3 ÷ sin 12 or
38.3 ÷ cos 78 or [184.2, 184.213]

oe
This mark implies the first M1

M1

$$\frac{d}{\sin 8} = \frac{\text{their } [184.2, 184.213]}{\sin 160}$$

oe

M1

$$\frac{\text{their } [184.2, 184.213]}{\sin 160} \times \sin 8$$

dep on third M1
This mark implies the third M1

M1dep

[74.9, 74.96]

Only accept 75(.0) on the answer line if [74.9, 74.96] seen in working

A1

Alternative method 3
sin 20 = 38.3 ÷ *BC* or
cos 70 = 38.3 ÷ *BC*

oe
sin 12 = 38.3 ÷ AC or
cos 78 = 38.3 ÷ AC

M1

(*BC* =) 38.3 ÷ sin 20 or
38.3 ÷ cos 70 or [111.9, 112]

oe
(AC =) 38.3 ÷ sin 12 or
38.3 ÷ cos 78 or [184.2, 184.213]

M1

their *BC*² + their *AC*² −
2 × their *BC* × their *AC* × cos 8 or
[5618.8, 5619]

M1

$$\sqrt{\text{their } [5618.8, 5619]}$$

dep on third M1

M1dep

[74.9, 74.96]

Only accept 75(.0) on the answer line if [74.9, 74.96] seen in working

A1

[5]

M3.
Alternative method 1
$$\sqrt{14^2 + 8^2} \quad \text{or} \quad \sqrt{260}$$

or $2\sqrt{65}$ or   [16.1, 16.125]

         AC

                                               M1

$$\tan(x) = \frac{7}{\text{their } AC}$$

         oe

                                               M1dep

[23.4667, 23.5]

                                               A1

Alternative method 2

$\sqrt{14^2 + 8^2 + 7^2}$ or $\sqrt{309}$

or   [17.578, 17.6]

         EC

         May be seen in stages

         e.g. Work out AC with correct method then work out their

         $AC^2 + 7^2$ then square roots

         Condone use of $2\sqrt{65}^2$ *for AC^2*

                                               M1

$\sin(x) = \dfrac{7}{\text{their } EC}$ (✖ sin 90)

or

$\cos(x) = \dfrac{\sqrt{8^2 + 14^2}}{\text{their } EC}$

$$\cos(x) = \frac{8^2 + 14^2 + \text{their } EC^2 - 7^2}{2 \times \text{their } \sqrt{8^2 + 14^2} \times \text{their } EC}$$

         Condone use of $2\sqrt{65}^2$ *for AC^2*

                                               M1dep

[23.4667, 23.5]

                                               A1

                                                 [3]

M4.

 $(x^2 =)\ 6^2 + 8^2 - 2 \times 6 \times 8 \times \cos 72$

               4 × cos 72

                                                 M1

70.33…

1.236 or 1.24 is A0

A1

[8.385, 8.4]…

A1

Alternative 1
XB = 7.608… **and** AX = 2.472… **and** XC = 3.5278
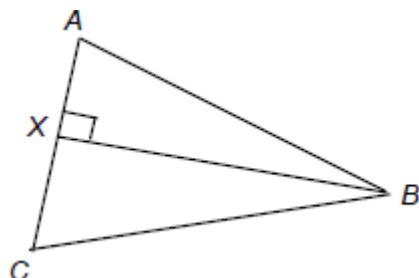
M1

$\sqrt{(7.608^2 + 3.5278^2)}$

M1

[8.385, 8.4]

A1

Alternative 2
CX = 5.706… **and** AX = 1.854… **and** XB = 6.145
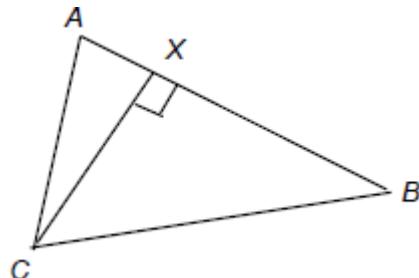
M1

$\sqrt{(5.706^2 + 6.145^2)}$

M1

[8.385, 8.4]

A1

[3]

M5.

(a) $(AC =) \sqrt{10^2 + 6^2}$ $(= \sqrt{136})$

[11.66, 11.7]

M1

$(AX =)$ their $AC \div 2$

$(= [5.8, 5.85])$

$(AX =) \sqrt{5^2 + 3^2}$ $(= \sqrt{34})$ is M2

*Do **not** allow their AC to be 10*

M1

$\tan(VAX) = \dfrac{5}{\text{their } AX}$

Dep on at least one M mark gained

$(AV =) \sqrt{5^2 + \text{their } AX^2}$ $(= \sqrt{59})$ **and**

$\sin(VAX) = \dfrac{5}{\text{their } AV}(\times \sin 90)$ **or**

$\cos(VAX) = \dfrac{\text{their } AX}{\text{their } AV}$ **or**

correct use of cosine rule in triangle VAX
*Do **not** allow their AX to be their AC*

M1dep

[40.5, 40.8]

Allow 41 if correct method seen
SC3 Answer [0.707, 0.7115]
SC3 Answer [45.02, 45.293]

A1

(b) $\tan VMY = \dfrac{2}{5}$

oe
(M is midpoint of RQ, Y is the centre of PQRS))

M1

[21.8, 21.80141]

Allow 22 if correct method seen
SC1 Angle VMY clearly marked on a diagram
SC1 Answer [0.38, 0.381]
SC1 Answer [24.2, 24.224]

A1

[6]

M6.
$60^2 + 80^2 \; (= 10\,000)$
or
$80^2 + 120^2 \; (= 20\,800)$
or
$60^2 + 120^2 \; (= 18\,000)$

100 (may be seen on diagram)

or

[144.2, 144.2221]

or

[134.1, 134.2]

M1

$\sqrt{60^2 + 80^2 + 120^2}$

$(= \sqrt{3600 + 6400 + 14\,400})$

oe eg 1 $\sqrt{100^2 + 120^2}$

eg 2 $\sqrt{10\,000 + 120^2}$

eg 3 $\sqrt{24\,400}$ $\;20\sqrt{61}$

This mark implies M1 M1

M1dep

[156, 156.205]

A1

[3]

M7.(a) $35^2 + 30^2$

M1

$\sqrt{35^2 + 30^2}$

M1dep

46(.097 …) or $5\sqrt{85}$ or $\sqrt{2125}$

A1

(b) $35^2 + 30^2 + 87^2$ or   their $46^2 + 87^2$

or $2125 + 87^2$

M1

$$\sqrt{35^2 + 30^2 + 87^2}$$

or $\sqrt{\text{their } 46^2 + 87^2}$

or $\sqrt{2125 + 87^2}$

or $\sqrt{9694}$

M1 dep

98.(…) and No

A1

[6]