

GCSE AQA Geometry I – All Difficult Questions (2021-2023)

Q1.

x and y are acute angles.

$$\sin x = \frac{\sqrt{3}}{2} \quad \tan y = 1$$
$$w = 3x - 2y$$

Work out the value of $\cos w$

You **must** show your working.

Answer _____

(Total 3 marks)

Q2.

Work out the value of $(\cos 30^\circ \times \sin 45^\circ \times \tan 60^\circ)^2$

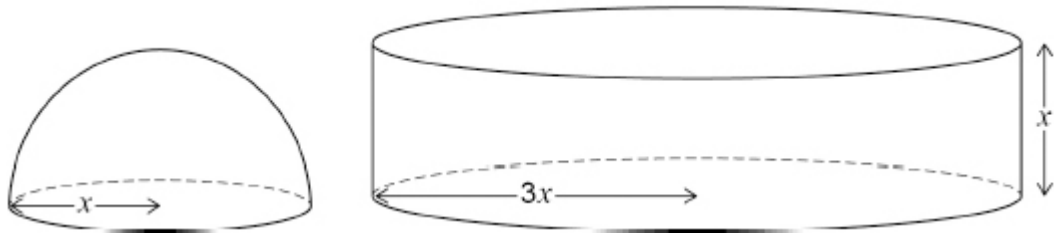
Answer _____

(Total 4 marks)

Q3.

A solid hemisphere has radius x .

A solid cylinder has radius $3x$ and height x .



Surface area of a sphere = $4\pi r^2$
where r is the radius

Work out the ratio

total surface area of the hemisphere : total surface area of the cylinder

Give your answer in its simplest form.

You **must** show your working.

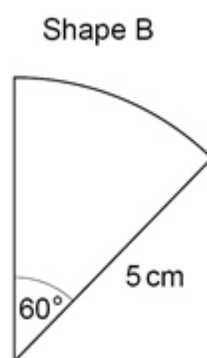
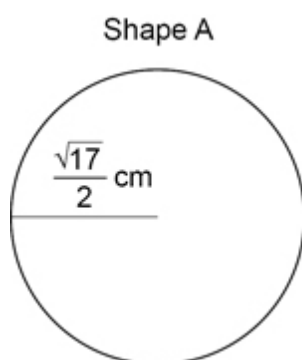
Answer _____ : _____

(Total 3 marks)

Q4.

Shape A is a circle with radius $\frac{\sqrt{17}}{2}$ cm

Shape B is a sector of a circle with radius 5 cm



Not drawn
accurately

Which shape has the greater area, A or B?

You **must** show your working.

Answer _____

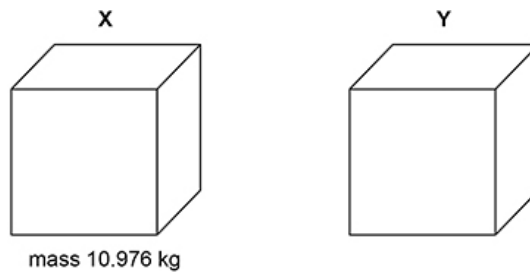
(Total 5 marks)

Q5.

Here are two solid cubes, X and Y.

The mass of X is 10.976 kg

The area of **each face** of X is 784 cm²



- (a) Zayan wants to know the density of Y.

He assumes that Y is identical to X.

What density should he get for Y?

Give your answer in **grams per cubic centimetre**.

Answer _____ g/cm³

(4)

- (b) In fact,

the mass of Y is less than the mass of X

the area of each face of Y is greater than the area of each face of X.

What does this mean about the actual density of Y?

Tick **one** box.

☐

It is less than the answer to part (a)

☐

It is equal to the answer to part (a)

☐

It is greater than the answer to part (a)

☐

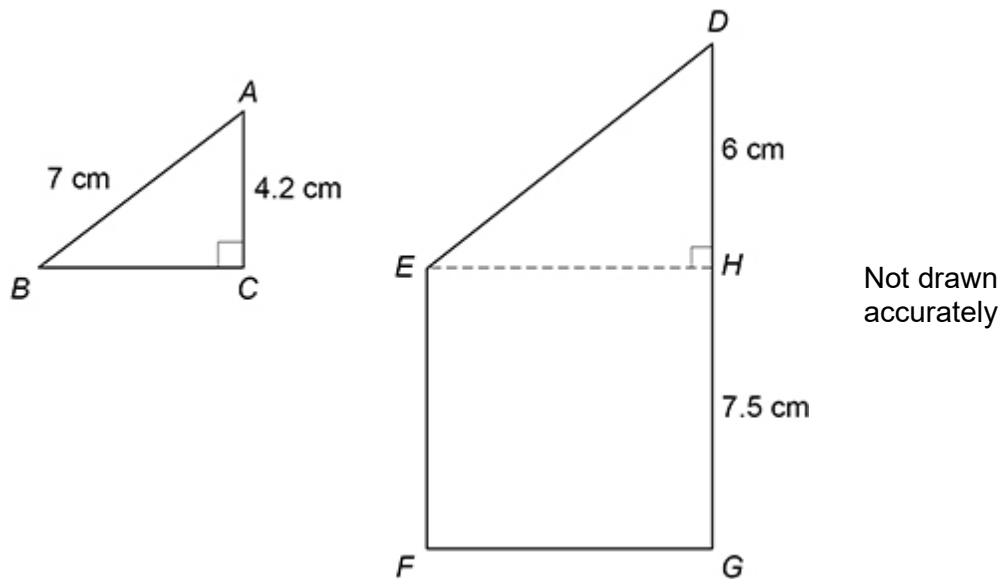
It is not possible to tell

(1)

(Total 5 marks)

Q6.

Trapezium $DEFG$ is formed by joining
triangle DEH
to
rectangle $EFGH$.



ABC is similar to DEH .

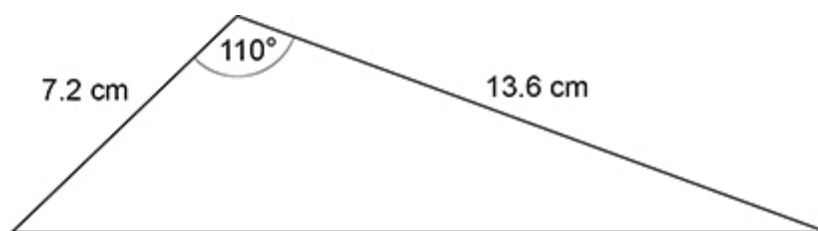
Work out the area of $DEFG$.

Answer _____ cm^2
(Total 5 marks)

Q7.

Two sides of a triangle are measured to 1 decimal place.

The angle between the sides is measured to the nearest degree.



Not drawn
accurately

Work out the upper bound for the area of the triangle.

You **must** show your working.

Answer _____ cm²

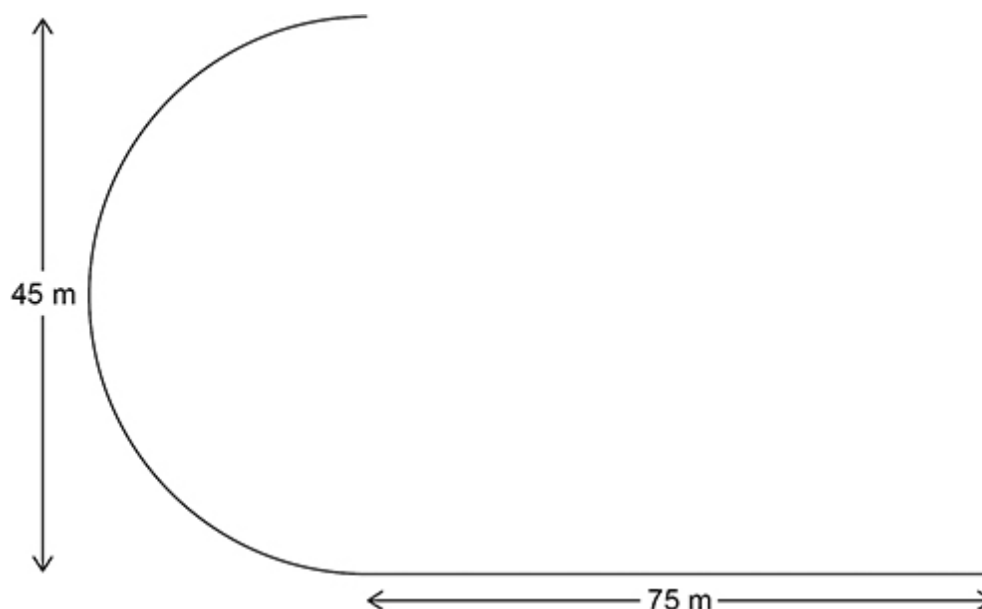
(Total 4 marks)

Q8.

Part of a running track is the arc of a semicircle joined to a straight line.

The semicircle has diameter 45 metres.

The straight line has length 75 metres.



Not drawn
accurately

Abby runs once along this part of the track in 18 seconds.

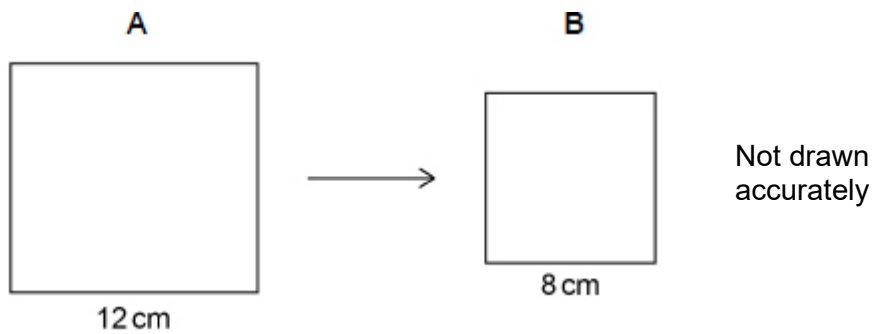
Work out her average speed.

Give your answer to 2 significant figures.

Answer _____ m/s
(Total 4 marks)

Q9.

Square A is enlarged to square B.



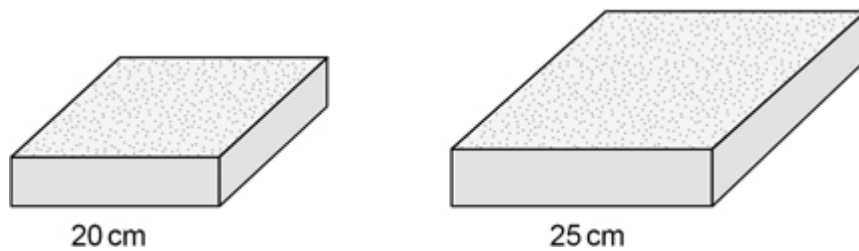
Write down the scale factor of the enlargement as a fraction.

Answer _____
(Total 1 mark)

Q10.

Here are two square-based paving stones.

The stones are similar solids.



The price per cm^3 is the same for both stones.

The price of the **larger** stone is £17.50

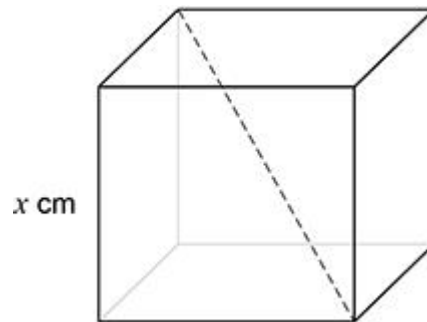
Work out the price of the smaller stone.

Answer £ _____
(Total 4 marks)

Q11.

Here is a cube with edge length x cm

One diagonal is shown.



- (a) Circle the length, in centimetres, of the diagonal.

$\sqrt{3}x$

$\sqrt[3]{3x^2}$

$\sqrt{x^3}$

$\sqrt[3]{3}x$

(1)

- (b) The total length, in centimetres, of the edges of the cube is a multiple of 18

Circle the correct statement.

x is a
whole number

x is not a
whole number

x might be a
whole number

(1)

(Total 2 marks)

Q12.

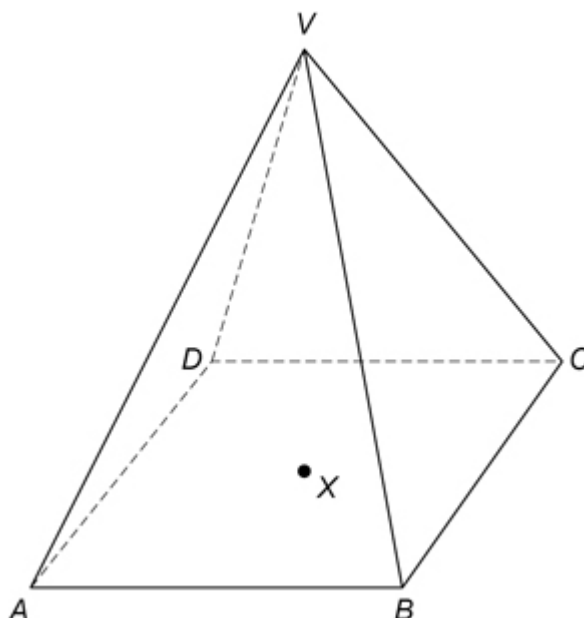
$VABCD$ is a pyramid with a horizontal square base.

X is the centre of the base.

V is vertically above X .

$$BD = 18 \text{ cm}$$

$$\text{Angle } VBX = 72^\circ$$



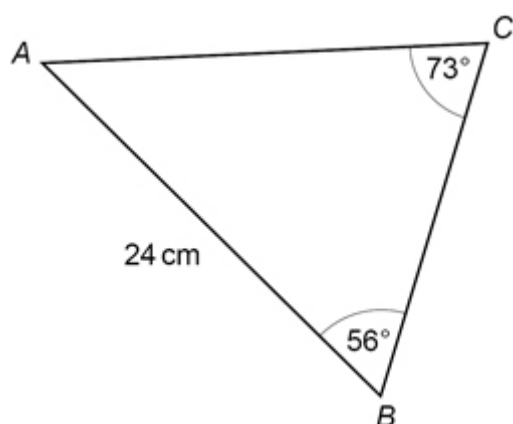
Work out the length of VB .

Answer _____ cm

(Total 3 marks)

Q13.

Work out the area of triangle ABC .



Not drawn
accurately

Answer _____ cm^2
(Total 4 marks)

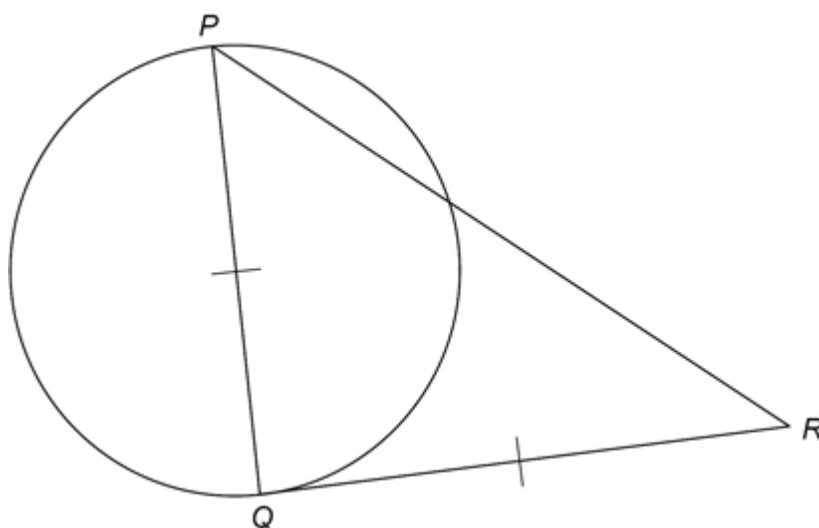
Q14.

PQ is a diameter of a circle.

QR is a tangent to the circle.

$$PQ = QR$$

$$PR = 10 \text{ cm}$$



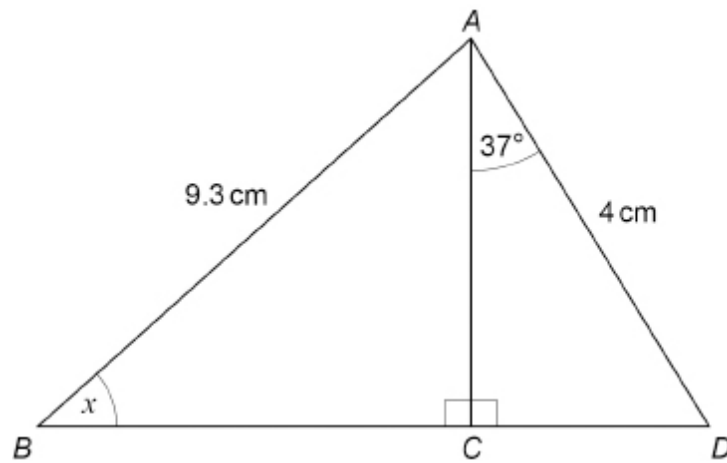
Not drawn
accurately

Work out the **radius** of the circle.

Give your answer as a decimal.

Answer _____ cm
(Total 3 marks)

Q15.



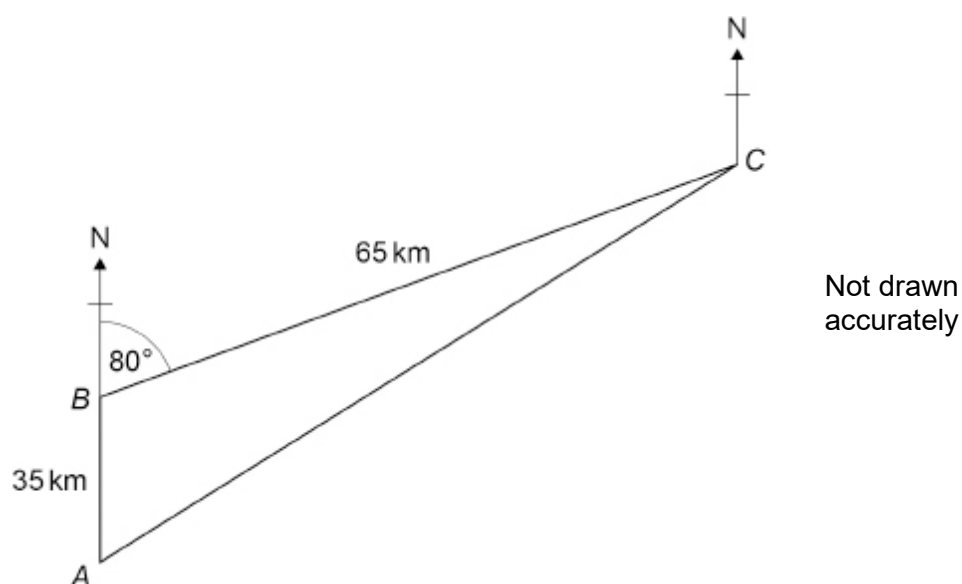
Not drawn accurately

Work out the size of angle x .

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

$x =$ _____^o
(Total 4 marks)

Q16.



A boat sails 35 km North from A to B .

From B the boat sails to C and then back to A .

- (a) Show that the distance the boat sails from C to A is 79 km to the nearest km
You **must** show your working.

(2)

- (b) Work out the bearing of A from C .

Answer _____°

(4)

(Total 6 marks)

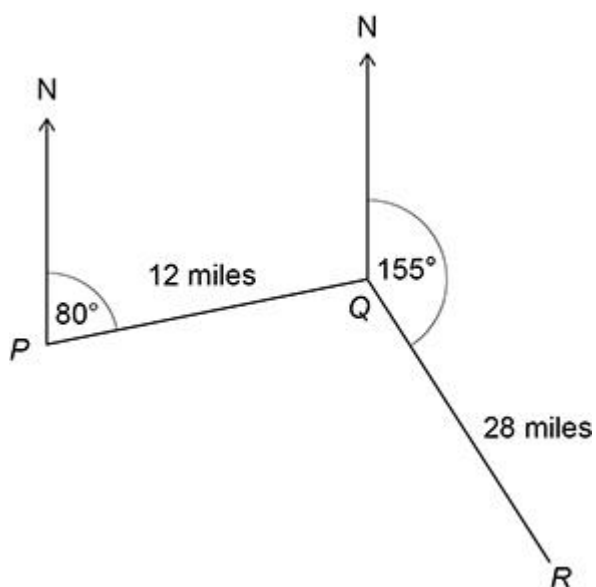
Q17.

A ship sails from P to Q and then from Q to R .

Q is 12 miles from P , on a bearing of 080°

R is 28 miles from Q , on a bearing of 155°

Not drawn accurately



Work out the direct distance from P to R .

Answer _____ miles
(Total 4 marks)

Mark schemes

Q1.

$$(x =) 60 \text{ or } (3x =) 180$$

or

$$(y =) 45 \text{ or } (2y =) 90$$

implied by sin 60 or tan 45

must be selected and not just in a table

M1

$$3 \times 60 - 2 \times 45$$

$$\text{or } 180 - 90$$

$$\text{or } (w =) 90 \text{ or } \cos 90$$

M1dep

0 with M2 awarded

A1

Additional Guidance

0 with no working

M0M0A0

Condone degrees sign on answer with correct working

M1M1A1

[3]

Q2.

$$(\cos 30 =) \frac{\sqrt{3}}{2}$$

$$\text{or } (\sin 45 =) \frac{\sqrt{2}}{2} \text{ or } \frac{1}{\sqrt{2}}$$

$$\text{or } (\tan 60 =) \sqrt{3}$$

oe correct trig function may be implied by position in multiplication string

may be seen in a table

M1

$$\left(\frac{\sqrt{3}}{2} \times \frac{\sqrt{2}}{2} \times \sqrt{3} \right)^2$$

or

$$\left(\frac{\sqrt{3}}{2} \right)^2 \times \left(\frac{\sqrt{2}}{2} \right)^2 \times (\sqrt{3})^2$$

oe with all values correct

M1dep

or

$$\frac{3\sqrt{2}}{4} \text{ or } \frac{3}{2\sqrt{2}} \text{ or } \frac{\sqrt{18}}{4}$$

oe single term squared

$$\left(\frac{3\sqrt{2}}{4}\right)^2 \text{ or } \left(\frac{3}{2\sqrt{2}}\right)^2 \text{ or } \left(\frac{\sqrt{18}}{4}\right)^2$$

oe with all values correct

oe single term squared

or

$$\frac{3}{4} \times \frac{1}{2} \times 3$$

oe multiplication string without surds

or

$$\frac{\sqrt{324}}{16}$$

oe single fraction with one surd

M1dep

$$\frac{9}{8} \text{ or } 1\frac{1}{8} \text{ or } 1.125$$

oe fraction, mixed number or decimal

A1

Additional Guidance

Ignore an incorrect attempt to simplify or convert a correct answer

$$\text{eg } \frac{9}{8} = 1.8$$

M1M1M1A1

[4]

Q3.

Alternative method 1 – expressions in x

$$4\pi x^2 \div 2 \text{ or } 2\pi x^2$$

$$\text{or } \pi x^2$$

$$\text{or } \pi(3x)^2 \text{ or } 9\pi x^2$$

$$\text{or } 2 \times \pi(3x)^2 \text{ or } 18\pi x^2$$

or $2\pi x(3x)$ or $6\pi x^2$

oe area of curved face of hemisphere

oe area of flat face of hemisphere

oe area of one flat face of cylinder

oe area of both flat faces of cylinder

oe area of curved face of cylinder

M1

$4\pi x^2 \div 2 + \pi x^2$ or $3\pi x^2$

or

$\pi(3x)^2 + \pi(3x)^2 + 2\pi x(3x)$

or $9\pi x^2 + 9\pi x^2 + 6\pi x^2$

or $24\pi x^2$

oe total surface area of the hemisphere

oe total surface area of the cylinder

M1dep

$3\pi x^2$ and $24\pi x^2$ and $1 : 8$

either order

A1

Alternative method 2 – substituting a value for x

Substitutes a value for x and works out the area of at least one of

area of curved face of hemisphere

area of flat face of hemisphere

area of one flat face of cylinder

area of both flat faces of cylinder

area of curved face of cylinder

eg using $x = 5$, at least one of

50π

25π

225π

450π

150π

M1

Substitutes a value for x and works out an expression for the total surface area of the hemisphere or the cylinder

eg using $x = 5$

total surface area of hemisphere =

$25\pi + 50\pi$ or 75π

or
total surface area of cylinder =
 $225\pi + 225\pi + 150\pi$ or 600π

M1dep

Both correct total surface areas for their value of x and 1 : 8
either order

A1

Additional Guidance

1 : 8 or 8 : 1 without correct working or values

M0M0A0

Condone π missing consistently for all marks

Allow 'correct' and consistent values of π throughout (eg 3, 3.14, $\frac{22}{7}$)

Condone use of r for x throughout

Do not allow $3\pi x^2$ from $3x \times \pi \times x$ oe

[3]

Q4.

$$(\pi \times) \left(\frac{\sqrt{17}}{2} \right)^2$$

oe
condone missing brackets

M1

$$\frac{17}{4}(\pi) \text{ or } 4\frac{1}{4}(\pi) \text{ or } 4.25(\pi)$$

oe fraction, mixed number or decimal

A1

$$(\pi \times) 5^2 \text{ or } (\pi \times) 25$$

or

$$\frac{60}{360} \text{ used}$$

oe

M1

$$\frac{25}{6}(\pi) \text{ or } 4\frac{1}{6}(\pi)$$

$$\text{or } 4.1(6\dots)(\pi) \text{ or } 4.17(\pi)$$

oe fraction, mixed number or decimal

A1

A with values in comparable form

or

A by $\frac{1}{12}(\pi)$ or A by $0.08(3\dots)(\pi)$

eg values

$$\frac{51}{12}(\pi) \text{ and } \frac{50}{12}(\pi)$$

$$4\frac{1}{4}(\pi) \text{ and } 4\frac{1}{6}(\pi)$$

$$4.2(5)(\pi) \text{ and } 4.1(6\dots)(\pi)$$

$$4.2(5)(\pi) \text{ and } 4.17(\pi)$$

accept 'circle' for A

allow comparison of fraction or decimal parts only if integer parts shown as equal

A1

Additional Guidance

For the final mark, presence or absence of π must be the same for both values

Accept consistent use of a numerical value of π throughout.

The value can be 3 or 3.1 or 3.14 or 3.142 or better

[5]

Q5.

(a) $\sqrt{784}$ or 28

M1

(their 28)³ or 21 952

21 952 implies M1M1

M1dep

$10.976 \div \text{their } 21\,952$ or $0.000\,5$

or

digits $10\,976 \div \text{their } 21\,952$

oe eg 5×10^{-4}

eg $1097.6 \div \text{their } 21\,952$

M1dep

0.5

oe

A1

Additional Guidance

784×6 or $784 \div 6$ or $784 \div 2$

M0M0M0A0

(b) It is less than the answer to part (a)

B1

[5]

Q6.

Alternative method 1 Works out BC using Pythagoras then works out EH

$$7^2 \text{ or } 49$$

and

$$4.2^2 \text{ or } 17.64$$

oe

M1

$$\sqrt{7^2 - 4.2^2} \text{ or } \sqrt{49 - 17.64}$$

$$\text{or } \sqrt{31.36} \text{ or } 5.6$$

oe

*implied by 11.76 as the area of the smaller triangle
may be on diagram*

M1dep

$$6 \div 4.2 \times \text{their } 5.6 \text{ or } 8$$

oe

full method to work out EH

may be on diagram as EH or FG

*implied by 24 as the area of the larger triangle or 60 as the
area of the rectangle*

M1dep

$$0.5 \times \text{their } 8 \times 6 \text{ or } 24$$

and

$$\text{their } 8 \times 7.5 \text{ or } 60$$

$$\text{oe eg } 0.5 \times \text{their } 5.6 \times 4.2 \times (6 \div 4.2)^2$$

and

$$\text{their } 8 \times 7.5$$

or

$$0.5 \times \text{their } 8 \times (7.5 + 13.5)$$

M1dep

$$84$$

A1

Alternative method 2 Works out ED using similar triangles then works out EH

$$6 \div 4.2 \times 7 \text{ or } 10$$

oe

may be on diagram

M1

$$(\text{their } 10)^2 \text{ or } 100$$

and

$$6^2 \text{ or } 36$$

oe

M1dep

$$\sqrt{(\text{their } 10)^2 - 6^2} \text{ or } \sqrt{100 - 36}$$

$$\text{or } \sqrt{64} \text{ or } 8$$

oe

full method to work out EH

may be on diagram as EH or FG

implied by 24 as the area of the larger triangle or 60 as the area of the rectangle

M1dep

$$0.5 \times \text{their } 8 \times 6 \text{ or } 24$$

and

$$\text{their } 8 \times 7.5 \text{ or } 60$$

$$\text{oe eg } 0.5 \times \text{their } 5.6 \times 4.2 \times (6 \div 4.2)^2$$

and

$$\text{their } 8 \times 7.5$$

or

$$0.5 \times \text{their } 8 \times (7.5 + 13.5)$$

M1dep

84

A1

Alternative method 3 Uses trigonometry to work out BC then works out EH or uses trigonometry to work out EH

$$(\text{angle } ABC =) \sin^{-1} \left(\frac{4.2}{7} \right)$$

$$\text{or } (\text{angle } ABC =) [36.8, 36.9]$$

or

$$(\text{angle } BAC =) \cos^{-1} \left(\frac{4.2}{7} \right)$$

$$\text{or } (\text{angle } BAC =) [53.1, 53.2]$$

oe

full method to work out ABC or BAC

M1

$$7 \times \cos (\text{their } [36.8, 36.9])$$

$$\text{or } 7 \times \sin (\text{their } [53.1, 53.2])$$

$$\text{or } 5.6$$

or

$$\tan(\text{their } [36.8, 36.9]) = \frac{6}{EH}$$

$$\text{or } \tan(\text{their } [53.1, 53.2]) = \frac{EH}{6}$$

oe

full method to work out BC

or

partial method to work out EH

M1dep

$$6 \div 4.2 \times \text{their } 5.6 \text{ or } 8$$

or

$$6 \div \tan(\text{their } [36.8, 36.9])$$

or

$$6 \times \tan(\text{their } [53.1, 53.2])$$

oe

full method to work out EH

may be on diagram as EH or FG

implied by 24 as the area of the larger triangle or 60 as the area of the rectangle

M1dep

$$0.5 \times \text{their } 8 \times 6 \text{ or } 24$$

and

$$\text{their } 8 \times 7.5 \text{ or } 60$$

oe eg $0.5 \times \text{their } 5.6 \times 4.2 \times (6 \div 4.2)^2$

and

their 8×7.5

or

$0.5 \times \text{their } 8 \times (7.5 + 13.5)$

M1dep

84

A1

Additional Guidance

Up to M3 may be awarded for correct work with no answer, or incorrect answer, even if this is seen amongst multiple attempts

[5]

Q7.

7.15 or 7.25

or

13.55 or 13.65

or

109.5 or 110.5

B1

7.25 and 13.65 and 109.5 chosen

B1

$0.5 \times$ their 7.25 $\times$ their 13.65 $\times$ sin their 109.5

their 7.25 must be [7.2, 7.25]

their 13.65 must be [13.6, 13.65]

their 109.5 must be [109.5, 110] or 110.5

M1

46.6(4...) with correct bounds seen

condone 47 with B1B1 scored

ft their three bounds within M1 ranges which are not 7.2 or 13.6 or 110

A1ft

Additional Guidance

Accept 7.249 for 7.25 or 13.649 for 13.65 or 110.49 for 110.5

7.25 and 13.65 and 110.5 used and answer 46.3...

B1B0M1A1ft

7.25 and 13.65 and 110 used and answer 46.497... or 46.5

B1B0M1A0ft

7.2 and 13.6 and 110 used, with or without answer 46(.0...)

B0B0M1A0ft

46.6(4...) or 47 with no working

B0B0M0A0

[4]

Q8.

$0.5 \times \pi \times 45$

or $0.5 \times [141, 141.4]$

or [70.5, 70.7]

or $0.5 \times \pi \times 45 + 75$

or [145.5, 145.7]

oe eg 22.5π

M1

$(0.5 \times \pi \times 45 + 75) \div 18$

or

their [145.5, 145.7] $\div 18$

oe

their [145.5, 145.7] can be any value

M1

8.08(...) or 8.09(...)

may be implied by 8.1

A1

8.1

ft any answer seen with greater than 2 sf

SC2 3.9

B1ft

Additional Guidance

Up to M2 may be awarded for correct work, with no or incorrect answer, even if this is seen amongst multiple attempts, B1ft may also be awarded

$$\frac{120}{18} = 6.67 \text{ answer } 6.7$$

M0M1A0B1ft

$$\frac{120}{18} = 6.7$$

M0M1A0B0ft

$$0.5 \times \pi \times 45 \text{ and } 70.7 \div 18 = 3.93 \text{ answer } 3.9$$

M1M1A0B1ft

SC2 for an answer of 3.9 without working is when 75 is not used

[4]

Q9.

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

oe fraction

B1

Additional Guidance

$$\frac{2}{3} = 0.66\dots$$

B0

[1]

Q10.

$$\frac{25}{20} \text{ or } \frac{5}{4} \text{ or } 1.25$$

or

$$\frac{20}{25} \text{ or } \frac{4}{5} \text{ or } 0.8$$

or

(ratio of lengths is) 20 : 25

oe

M1

$$\left(\frac{25}{20}\right)^3 \text{ or } \left(\frac{5}{4}\right)^3 \text{ or } 1.25^3$$

or

$$\left(\frac{20}{25}\right)^3 \text{ or } \left(\frac{4}{5}\right)^3 \text{ or } 0.8^3$$

(ratio of volumes is) $20^3 : 25^3$

$$\begin{aligned} & \text{oe eg } \frac{125}{64} \text{ or } 1.953125 \\ & \text{or} \\ & \frac{64}{125} \text{ or } 0.512 \\ & \text{oe eg } 4^3 : 5^3 \end{aligned}$$

M1dep

$$17.5(0) \div 1.25^3$$

or

$$17.5(0) \times 0.8^3$$

oe

M1dep

$$8.96$$

$$SC2 \ 34.18$$

A1

Additional Guidance

Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

$$17.5(0) \times 1.25^3 \text{ or } 17.5(0) \div 0.8^3$$

M1M1M0A0

$$1.25^2 \text{ or } 0.8^2$$

M1M0M0A0

[4]

Q11.

(a) $\sqrt{3} \ x$

B1

(b) x might be a whole number

B1

[2]

Q12.

$$\cos 72 = \frac{9}{x}$$

$$\text{oe eg } \frac{x}{\sin 72} = \frac{18}{\sin 36}$$

x can be any letter or VB or VA or VC or VD

M1

$$\frac{9}{\cos 72}$$

$$\text{oe eg } \frac{18 \times \sin 72}{\sin 36}$$

M1dep

29.1(2...)

accept 29 with M1 scored

A1

Additional Guidance

Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

[3]

Q13.

Alternative method 1 – finding length AC

$$\frac{b}{\sin 56} = \frac{24}{\sin 73}$$

*oe
any letter*

M1

$$\frac{24}{\sin 73} \times \sin 56 \text{ or } [20.8, 20.81]$$

oe

M1dep

$0.5 \times 24 \times \text{their } [20.8, 20.81]$

$\times \sin 51$

*oe dep on M2
51 must come from $180 - 56 - 73$*

M1dep

[193.9, 194.1]

A1

Alternative method 2 – finding length BC

$$\frac{a}{\sin 51} = \frac{24}{\sin 73}$$

*oe
any letter*

51 must come from $180 - 56 - 73$

M1

$$\frac{24}{\sin 73} \times \sin 51$$

or [19.5, 19.504]

oe

M1dep

$0.5 \times 24 \times \text{their } [19.5, 19.504]$

$\times \sin 56$

oe dep on M2

M1dep

[193.9, 194.1]

A1

Alternative method 3 – finding lengths AC and BC

$$\frac{b}{\sin 56} = \frac{24}{\sin 73}$$

or

$$\frac{a}{\sin 51} = \frac{24}{\sin 73}$$

oe

any letter

51 must come from $180 - 56 - 73$

M1

$$\frac{24}{\sin 73} \times \sin 56 \text{ or } [20.8, 20.81]$$

or

$$\frac{24}{\sin 73} \times \sin 51 \text{ or } [19.5, 19.504]$$

oe

M1dep

$0.5 \times \text{their } [20.8, 20.81]$

$\times \text{their } [19.5, 19.504] \times \sin 73$

oe dep on M2

must have correct method for both AC and BC

M1dep

[193.9, 194.1]

A1

[4]

Q14.

Alternative method 1

$$d^2 + d^2 = 10^2 \text{ or } 2d^2 = 100$$

$$\text{oe eg } (d =) \sqrt{50}$$

or

$$(2r)^2 + (2r)^2 = 10^2 \text{ or } 8r^2 = 100$$

$$\text{oe must use same letter for PQ and QR}$$

M1

$$(d =) \sqrt{\frac{100}{2}} \text{ or } (d =) 5\sqrt{2}$$

$$\text{or } (d =) 7.07(1\dots) \text{ or } (d =) 7.1$$

or

$$(r^2 =) \frac{100}{8} \text{ or } (r =) \frac{5}{2}\sqrt{2}$$

M1dep

$$3.5(3\dots) \text{ or } 3.54 \text{ or } 3.55$$

A1

Alternative method 2

$$\sin 45 = \frac{d}{10} \text{ or } \cos 45 = \frac{d}{10}$$

$$\text{oe eg } \sin 45 = \frac{2r}{10} \text{ or } \sin 45 = \frac{r}{5}$$

M1

$$(d =) 10 \times \sin 45$$

$$\text{or } (d =) 10 \times \cos 45 \text{ or } (d =) 5\sqrt{2}$$

$$\text{or } (d =) 7.07(1\dots) \text{ or } (d =) 7.1$$

$$\text{oe eg } (2r =) 10 \times \sin 45$$

$$\text{or } (r =) 5 \times \sin 45 \text{ or } (r =) \frac{5\sqrt{2}}{2}$$

M1dep

$$3.5(3\dots) \text{ or } 3.54 \text{ or } 3.55$$

A1

Additional Guidance

Alt method 1

If working with diameter, square root is required for 2nd M1

If working with radius, square root is not required for 2nd M1

Alt method 1 $2r^2 + 2r^2 = 10^2$ is M0M0A0 unless recovered

Use of sine rule follows Alt method 2

[3]

Q15.**Alternative method 1** Works out AC and uses it in triangle ABC

$$\cos 37 = \frac{AC}{4}$$

$$\text{oe eg } \sin 53 = \frac{AC}{4}$$

allow [0.798, 0.8] for cos 37 or sin 53

M1

$$(AC =) 4 \times \cos 37$$

$$\text{or } (AC =) [3.19, 3.2]$$

$$\text{oe eg } (AC =) 4 \times \sin 53$$

allow [0.798, 0.8] for cos 37 or sin 53

may be seen on diagram

M1dep

$$\sin x = \frac{\text{their } [3.19, 3.2]}{9.3}$$

$$\text{or } (x =) \sin^{-1} [0.34, 0.3441]$$

$$\text{oe eg } \cos x = \frac{\sqrt{9.3^2 - \text{their } [3.19, 3.2]^2}}{9.3}$$

$$\text{or } (x =) 90 - \cos^{-1} [0.34, 0.3441]$$

M1dep

$$[19.87, 20.13]$$

A1

Alternative method 2 Works out angle ADC and uses it in triangle ABD

$$(\text{angle } ADC =) 90 - 37$$

$$\text{or } (\text{angle } ADC =) 53$$

$$\text{oe eg } (\text{angle } ADC =) 180 - 90 - 37$$

may be seen on diagram

M1

$$\frac{\sin x}{4} = \frac{\sin(90 - 37)}{9.3}$$

$$\text{oe eg } \frac{4}{\sin x} = \frac{9.3}{\sin 53}$$

M1dep

$$(\sin x =) \frac{\sin(90 - 37)}{9.3} \times 4$$

$$\text{or } (x =) \sin^{-1} [0.34, 0.3441]$$

oe

M1dep

$$[19.87, 20.13]$$

A1

Additional Guidance

Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts

Allow any unambiguous notation for angles eg allow B for x

Alt 1 Allow any unambiguous notation for AC eg y

(condone x if clearly referring to AC)

Alt 1 1st M1 must be an equation where AC is the only variable

eg $AC^2 + (4 \sin 37)^2 = 4^2$

M1

Alt 1 A calculation that leads to AC scores M1M1

eg $\sqrt{4^2 - (4 \sin 37)^2}$

M1M1

Alt 1 3rd M1 must have $\sin x$ (or $\cos x$) as the subject or be a calculation that leads to x

Alt 2 53 only marked at angle BAC on diagram

M0

[4]

Q16.

(a) $35^2 + 65^2 - 2 \times 35 \times 65 \times \cos 100$

*oe valid trigonometric method used
must be correct*

M1

$$\sqrt{35^2 + 65^2 - 2 \times 35 \times 65 \times \cos 100}$$

$$= 78.9(\dots)$$

or

$$\sqrt{6240.0992\dots} = 78.9(\dots)$$

$$CA = 78.99429858$$

A1

Additional Guidance

Using sine rule with $CA = 79$ to obtain AB or BC

M0A0

(b) **Alternative method 1 – sine rule to find ACB**

$$\frac{\sin ACB}{35} = \frac{\sin 100}{79}$$

oe

79 may be 78.9(...)

M1

$$\sin ACB = 35 \times \frac{\sin 100}{79}$$

$$\text{or } \sin ACB = 35 \times 0.0124\dots$$

$$\text{or } \sin ACB = 0.436\dots$$

oe

M1dep

$$ACB = [25.8, 26]$$

A1

$$234.(\dots)$$

ft 360 – 100 – their ACB with M2 scored

A1ft

Alternative method 2 – cosine rule to find ACB

$$35^2 = 79^2 + 65^2 - 2 \times 79 \times 65 \times \cos ACB$$

oe

79 may be 78.9(...)

M1

$$\cos ACB = \frac{79^2 + 65^2 - 35^2}{2 \times 79 \times 65}$$

$$\text{or } \cos ACB = \frac{9241}{10270}$$

$$\text{or } \cos ACB = 0.899\dots$$

M1dep

$$ACB = [25.8, 26]$$

A1

$$234.(\dots)$$

ft 360 – 100 – their ACB with M2 scored

A1ft

Alternative method 3 – sine rule to find BAC

$$\frac{\sin ACB}{35} = \frac{\sin 100}{79}$$

oe

79 may be 78.9(...)

M1

$$\sin BAC = 65 \times \frac{\sin 100}{79}$$

$$\text{or } \sin BAC = 65 \times 0.0124\dots$$

$$\text{or } \sin BAC = 0.81(0\dots)$$

oe

M1dep

$$BAC = [54.1, 54.3]$$

A1

234.(...)

ft their BAC + 180 with M2 scored

A1ft

Alternative method 4 – cosine rule to find BAC

$$65^2 = 79^2 + 35^2 - 2 \times 79 \times 35 \times \cos BAC$$

*oe**79 may be 78.9(...)*

M1

$$\cos BAC = \frac{79^2 + 65^2 - 35^2}{2 \times 79 \times 65}$$

$$\text{or } \cos BAC = \frac{9241}{10270}$$

$$\text{or } \cos BAC = 0.586...$$

M1dep

$$BAC = [54.1, 54.3]$$

A1

234.(...)

ft their BAC + 180 with M2 scored

A1ft

Additional Guidance

CA = 79 is given in part (a) or 78.9(...) can be used. There is no follow through from part (a).

Accept any notation for the angle eg $\sin x$ or $\sin C$ for angle ACB

Correct work for part (b) seen in part (a) may be awarded method marks in part (b)

[6]**Q17.**

105

may be seen on the diagram

B1

$$12^2 + 28^2 - 2 \times 12 \times 28 \times \cos \text{their } 105$$

or

$$[1101, 1102]$$

oe eg $144 + 784 - 672 \cos \text{their } 105$ *or $928 - 672 \cos \text{their } 105$* *their 105 cannot be 0 or 90**their 105 must be < 180*

M1

$\sqrt{\text{their } [1101, 1102]}$

M1dep

[33.19, 33.2] or 33

ft BOM2

A1ft

Additional Guidance

Follow through answers must be rounded to 2 sf or better

[4]