1 The diagram shows an isosceles triangle.

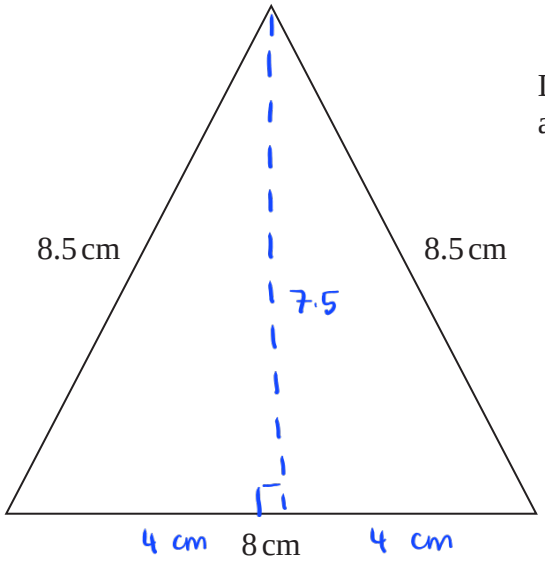


Diagram **NOT** accurately drawn

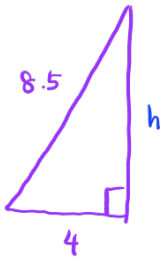
Work out the area of the triangle.

By using Pythagoras' theorem :

$h = \sqrt{8.5^2 - 4^2}$

$= \sqrt{56.25}$ (1)

$= 7.5$ cm (1)



Area of triangle : $\frac{1}{2}$ x base x height

$= \frac{1}{2} \times 8 \text{ cm} \times 7.5 \text{ cm}$ (1)

$= 30 \text{ cm}^2$ (1)

30 ..... cm^2

(Total for Question 1 is 4 marks)

2 The diagram shows a triangle.

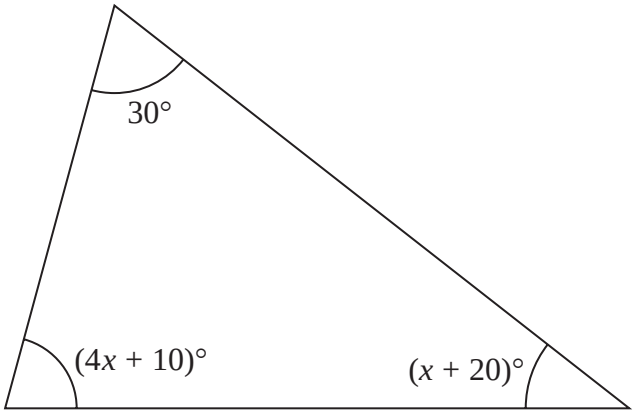


Diagram **NOT** accurately drawn

Work out the value of x. (Angles in a triangle sums up to 180°)

$30^\circ + (4x+10)^\circ + (x+20)^\circ = 180^\circ$

$5x + 30 + 30 = 180$

$5x + 60 = 180$ (1) $\rightarrow -60$

$5x = 180 - 60$ (1)

$5x = 120$ (1) $\rightarrow \div 5$

$x = \frac{120}{5}$

$= 24$ (1)

$x =$ 24

(Total for Question 2 is 4 marks)

3 The diagram shows two circles such that the region **R**, shown shaded in the diagram, is the region common to both circles.

Area of sector:

$\frac{\theta}{360^\circ} \times \pi r^2$

Area of triangle:

$\frac{1}{2} ab \sin C$

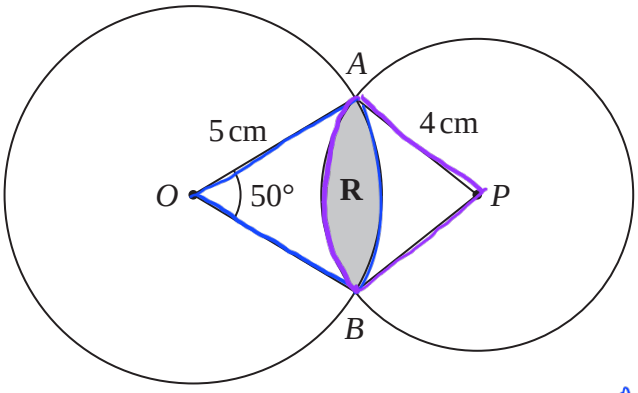
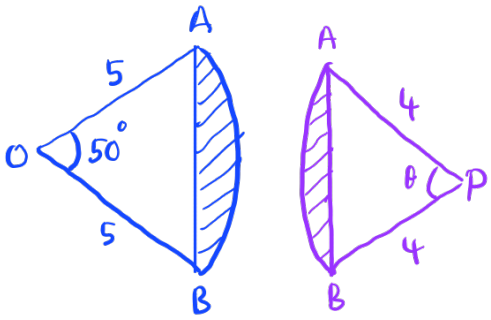


Diagram **NOT** accurately drawn

One of the circles has centre O and radius 5 cm.
The other circle has centre P and radius 4 cm.
Angle $AOB = 50°$

Calculate the area of region **R**.
Give your answer correct to 3 significant figures.



Finding length of AB (using cosine rule):

$AB^2 = 5^2 + 5^2 - 2(5)(5)\cos 50^\circ$

$AB^2 = 17.86...$

$AB = 4.226...$ (1)

Finding angle APB using known length of AB:

$4.226...^2 = 4^2 + 4^2 - 2(4)(4)\cos\theta$

$\cos\theta = \frac{4.226^2 - 4^2 - 4^2}{-2(4)(4)}$

$\cos\theta = 0.4418...$

$\theta = \cos^{-1} 0.4418...$

$= 63.78^\circ...$ (1)

Segment Area = Sector Area - Triangle Area

Large circle :

Segment Area : $\frac{50^\circ}{360^\circ} \times \pi \times 5^2 - \frac{1}{2}(5)(5)\sin 50^\circ$

$= 10.908\ldots$ (1) $- 9.576\ldots$

$= 1.332\ldots$

Small circle :

Segment Area $= \frac{63.78^\circ}{360^\circ} \times \pi \times 4^2 - \frac{1}{2}(4)(4)\sin 63.78^\circ$

$= 8.905\ldots$ (1) $- 7.1768\ldots$

$= 1.728\ldots$

Total segment area : $1.332\ldots + 1.728\ldots$ (1)

$= 3.06$ (1)

3.06 ..... cm^2

(Total for Question 3 is 6 marks)

4 Here is isosceles triangle *ABC*.

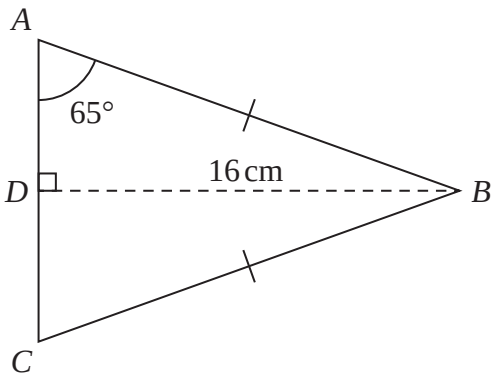


Diagram **NOT** accurately drawn

D is the midpoint of *AC* and *DB* = 16 cm.

Angle *DAB* = 65°

Work out the perimeter of triangle *ABC*.
Give your answer correct to one decimal place.

$AD = \dfrac{16}{\tan 65^\circ}$ (1)

$= 7.4609\ldots$ cm

$AB = \dfrac{16}{\sin 65^\circ}$

$= 17.654\ldots$ cm (1)

Perimeter $= 2(17.654\ldots) + 2(7.4609\ldots)$ (1)

$= 50.2$ cm (1dp) (1)

50.2 cm

(Total for Question 4 is 4 marks)

5 *A*, *B* and *C* are points on a circle with centre *O*.

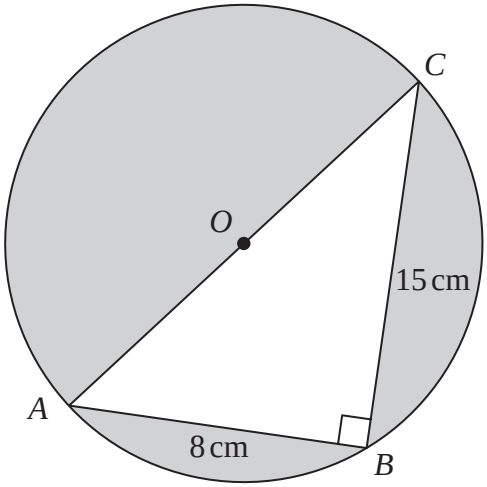


Diagram **NOT** accurately drawn

AOC is a diameter of the circle.

AB = 8 cm *BC* = 15 cm

Angle *ABC* = 90°

Work out the total area of the regions shown shaded in the diagram.
Give your answer correct to 3 significant figures.

Area of triangle $= \frac{1}{2}ab\sin C$

Area of triangle $= \frac{1}{2} \times 8 \times 15 \times \sin 90°$

$= 60$

$AC = \sqrt{8^2 + 15^2}$ (1)

$= 17$ (1)

radius of circle $= 17 \div 2 = 8.5$ cm

Area of circle $= \pi r^2$

$= \pi (8.5)^2$

$= 226.98$ (1)

Area of shaded region $= 226.98 - 60$ (1)

$= 166.98$

$= 167$ (3sf) (1)

167 ..... cm^2

(Total for Question 5 is 5 marks)

6

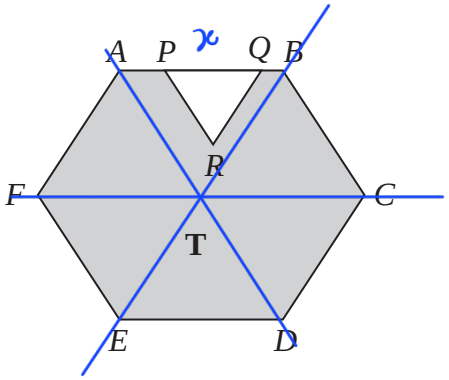


Diagram **NOT** accurately drawn

The diagram shows a shaded region **T** formed by removing an equilateral triangle *PQR* from a regular hexagon *ABCDEF*.

The points *P* and *Q* lie on *AB* such that $AB = 1.5 \times PQ$

Given that the area of region **T** is $72\sqrt{3}$ cm^2

work out the length of *PQ*.

$AB = x$

Area of one triangle in hexagon $= \frac{1}{2} ab \sin C$

$= \frac{1}{2} x^2 \sin 60°$

$= \frac{\sqrt{3}}{4} x^2$ (1)

Area of hexagon $= 6 \times \frac{\sqrt{3} x^2}{4}$

$= \frac{3\sqrt{3}}{2} x^2$ (1)

Area of PQR $= \frac{1}{2} ab \sin C$

$= \frac{1}{2} \left(\frac{2}{3}x\right)^2 \sin 60°$

$= \frac{\sqrt{3}}{9} x^2$

Area of shaded region $= \left(\frac{3\sqrt{3}}{2} - \frac{\sqrt{3}}{9}\right) x^2$

$72\sqrt{3} = \frac{25\sqrt{3}}{18} x^2$ (1)

$x^2 = \frac{18 \times 72\sqrt{3}}{25\sqrt{3}}$

$= \frac{1296}{25}$

$x = \sqrt{\frac{1296}{25}}$

$x = \frac{36}{5}$

$PQ = \frac{2}{3} AB$

$= \frac{2}{3} \times \frac{36}{5}$

$= \frac{24}{5}$

$= 4.8$ (1)

4.8 ..... cm

(Total for Question 6 is 4 marks)

7 In the diagram, *ABC* is a right-angled triangle and *DEF* is a semicircular arc.

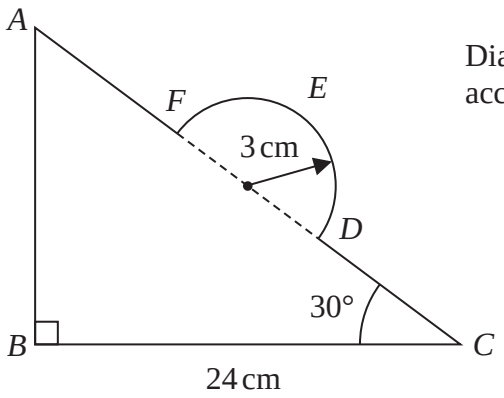


Diagram **NOT** accurately drawn

In triangle *ABC*

BC = 24 cm angle *ABC* = 90° angle *BCA* = 30°

The points *D* and *F* lie on *AC* so that *DF* is the diameter of the semicircular arc *DEF*
The radius of the semicircular arc is 3 cm.

Work out the length of *AFEDC*
Give your answer correct to 2 significant figures.

$\cos 30^\circ = \frac{24}{AC}$ (1)

$AC = \frac{24}{\cos 30^\circ} = 27.712\ldots$ (1)

$FED = \frac{1}{2} \times 2 \times \pi \times 3$ (1)

$= 3\pi = 9.424\ldots$

$AFEDC = 27.712 - 3 - 3 + 9.424$ (1)

$= 31$ (1)

31

..... cm

(Total for Question 7 is 5 marks)

8 The diagram shows quadrilateral *ABCD*

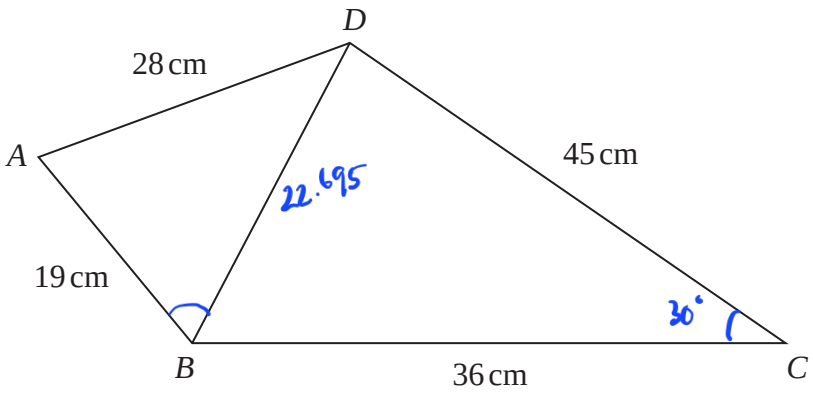


Diagram **NOT** accurately drawn

The angle *BCD* is acute.

Given that the area of triangle *BCD* = 405 cm^2

work out the size of angle *ABD*
Give your answer correct to one decimal place.

$\frac{1}{2} \times 36 \times 45 \times \sin C = 405$ (1)

$\sin C = \frac{405 \times 2}{36 \times 45}$

$C = \sin^{-1} \frac{405 \times 2}{36 \times 45}$

$C = 30^\circ$ (1)

$BD = \sqrt{45^2 + 36^2 - 2 \times 45 \times 36 \times \cos 30^\circ}$ (1)

$= \sqrt{3321 - 3240 \cos 30^\circ}$

$= \sqrt{515.077\ldots}$

$= 22.695$

$28^2 = 19^2 + 22.695^2 - 2(19)(22.695) \cos ABD$

$\cos ABD = -\left(\frac{28^2 - 19^2 - 22.695^2}{2(19)(22.695)}\right)$ (1)

$ABD = 83.9^\circ$ (1)

83.9 °

(Total for Question 8 is 5 marks)

9 The diagram shows an isosceles triangle *ABC*

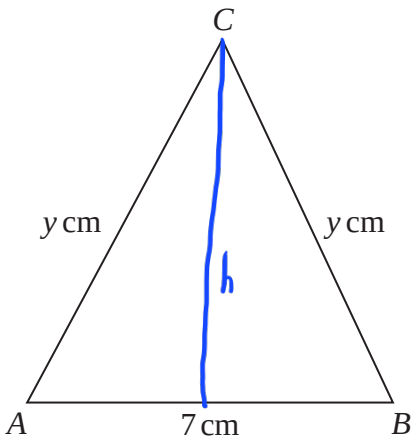


Diagram **NOT** accurately drawn

$AB = 7\,\text{cm}$ $AC = BC = y\,\text{cm}$

The area of the triangle is $42\,\text{cm}^2$

Work out the value of y

Area : $\frac{1}{2} \times 7 \times h = 42$ (1)

$h = 12$

$y^2 = 12^2 + 3.5^2$ (1)

$y = \sqrt{12^2 + 3.5^2}$ (1)

$= 12.5$ (1)

$y =$ 12.5

(Total for Question 9 is 4 marks)

10

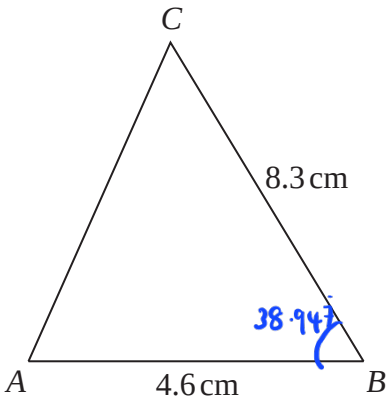


Diagram **NOT** accurately drawn

AB = 4.6 cm *BC* = 8.3 cm angle *ABC* is acute

The area of triangle *ABC* is 12 cm²

Work out the perimeter of triangle *ABC*
Give your answer correct to 3 significant figures.

$12 = \frac{1}{2} \times 8.3 \times 4.6 \times \sin ABC$ (1)

$ABC = \sin^{-1} \frac{12}{\frac{1}{2} \times 8.3 \times 4.6}$ (1)

$= 38.947\ldots$

$AC^2 = 4.6^2 \times 8.3^2 - 2(4.6)(8.3) \cos 38.947$ (1)

$AC^2 = 30.6627\ldots$

$AC = \sqrt{30.6627\ldots}$ (1)

$= 18.4$ (1)

18.4 ..... cm

(Total for Question 10 is 5 marks)

11 The diagram shows the cross section of a circular water pipe.

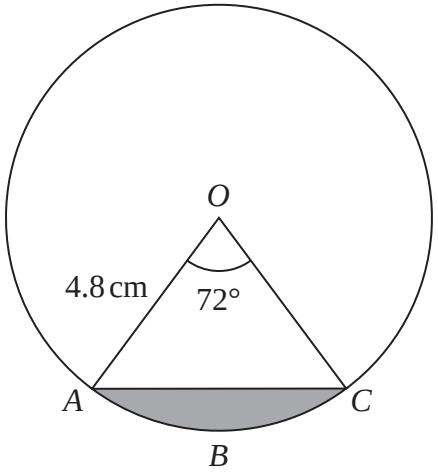


Diagram **NOT** accurately drawn

OABC is a sector of the circle, centre *O*

The shaded region in the diagram represents the water flowing in the pipe.

The water flows at 14 cm/s in the pipe.

Work out the volume of water that has flowed through the pipe in 3 minutes.
Give your answer in cm^3 correct to 3 significant figures.

Area of sector : $\pi \times 4.8^2 \times \frac{72}{360} = 14.476\ldots$ (1)

Area of triangle : $\frac{1}{2} \times 4.8^2 \times \sin 72 = 10.956\ldots$ (1)

Area of shaded : $14.476\ldots - 10.956\ldots$ (1)

$= 3.520\ldots$

Volume : $3.520\ldots \times 14\ cm/s \times (3 \times 60)s$ (1)

$= 3.520\ldots \times 2520$

$= 8870$ (1)

8870 ..... cm^3

(Total for Question 11 is 5 marks)

12 The diagram shows a triangle ABC where A, B and C represent the positions of three towns.

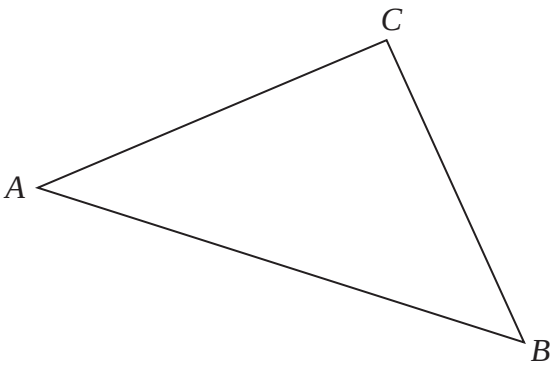


Diagram **NOT** accurately drawn

$$\overrightarrow{AB} = \begin{pmatrix} 7 \\ -2 \end{pmatrix} \qquad \overrightarrow{BC} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$$

Pru travels directly from A to B and then directly from B to C

Yang travels directly from A to C

Given that the values for $\overrightarrow{AB}$ and $\overrightarrow{BC}$ are in kilometres,

work out how much further Pru travels than Yang travels.
Give your answer in km, correct to one decimal place.

$\overrightarrow{AC} = \overrightarrow{AB} + \overrightarrow{BC}$

$= \begin{pmatrix} 7 & -3 \\ -2 & +5 \end{pmatrix}$

$= \begin{pmatrix} 4 \\ 3 \end{pmatrix}$ (1)

distance $\overrightarrow{AB} = \sqrt{7^2 + (-2)^2}$

$= \sqrt{53}$

distance $\overrightarrow{BC} = \sqrt{(-3)^2 + 5^2}$ (1)

$= \sqrt{34}$

distance $\overrightarrow{AC} = \sqrt{4^2 + 3^2}$

$= 5$ (1)

total distance $= \sqrt{53} + \sqrt{34}$

$= 7.28\ldots + 5.83\ldots$

$= 13.11\ldots$ (1)

difference $= 13.11 - 5$

$= 8.11$ (1)

8.1 km

(Total for Question 12 is 5 marks)

13 Here is a triangle *ABC*

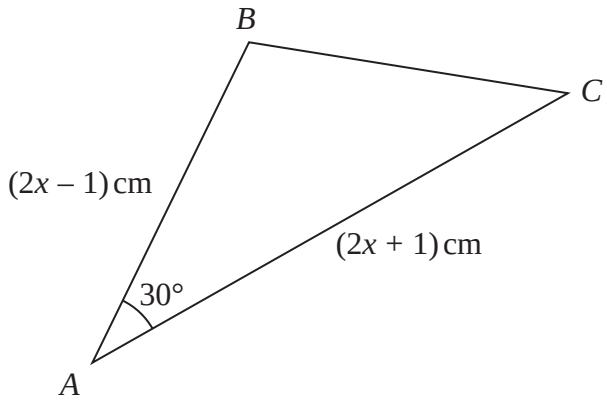


Diagram **NOT** accurately drawn

The area of the triangle is $(x^2 + x - 3.75)\,\text{cm}^2$

Find the size of the largest angle in triangle *ABC*
Give your answer correct to the nearest degree.

$\frac{1}{2}(2x-1)(2x+1)\sin 30^\circ = x^2 + x - 3.75$ (1)

$\frac{1}{4}(4x^2 - 1) = x^2 + x - 3.75$

$x^2 - 0.25 = x^2 + x - 3.75$

$x = -0.25 + 3.75$

$= 3.5$ (1)

$AB = 2(3.5) - 1 = 6$ cm

$AC = 2(3.5) + 1 = 8$ cm

since AC > AB, largest angle is ABC.

$BC^2 = 6^2 + 8^2 - 2(6)(8)\cos 30^\circ$

$= 16.8615\ldots$ (1)

$BC = \sqrt{16.8615\ldots} = 4.10628\ldots$

$$\frac{\sin ABC}{8} = \frac{\sin 30^\circ}{4.10628\ldots}$$ (1)

$$\sin ABC = 0.974\ldots$$

$$ABC = \sin^{-1} 0.974\ldots$$ (1)

$$= 103^\circ$$ (1)

103 °

(Total for Question 13 is 6 marks)