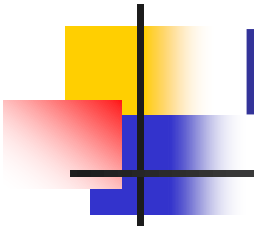


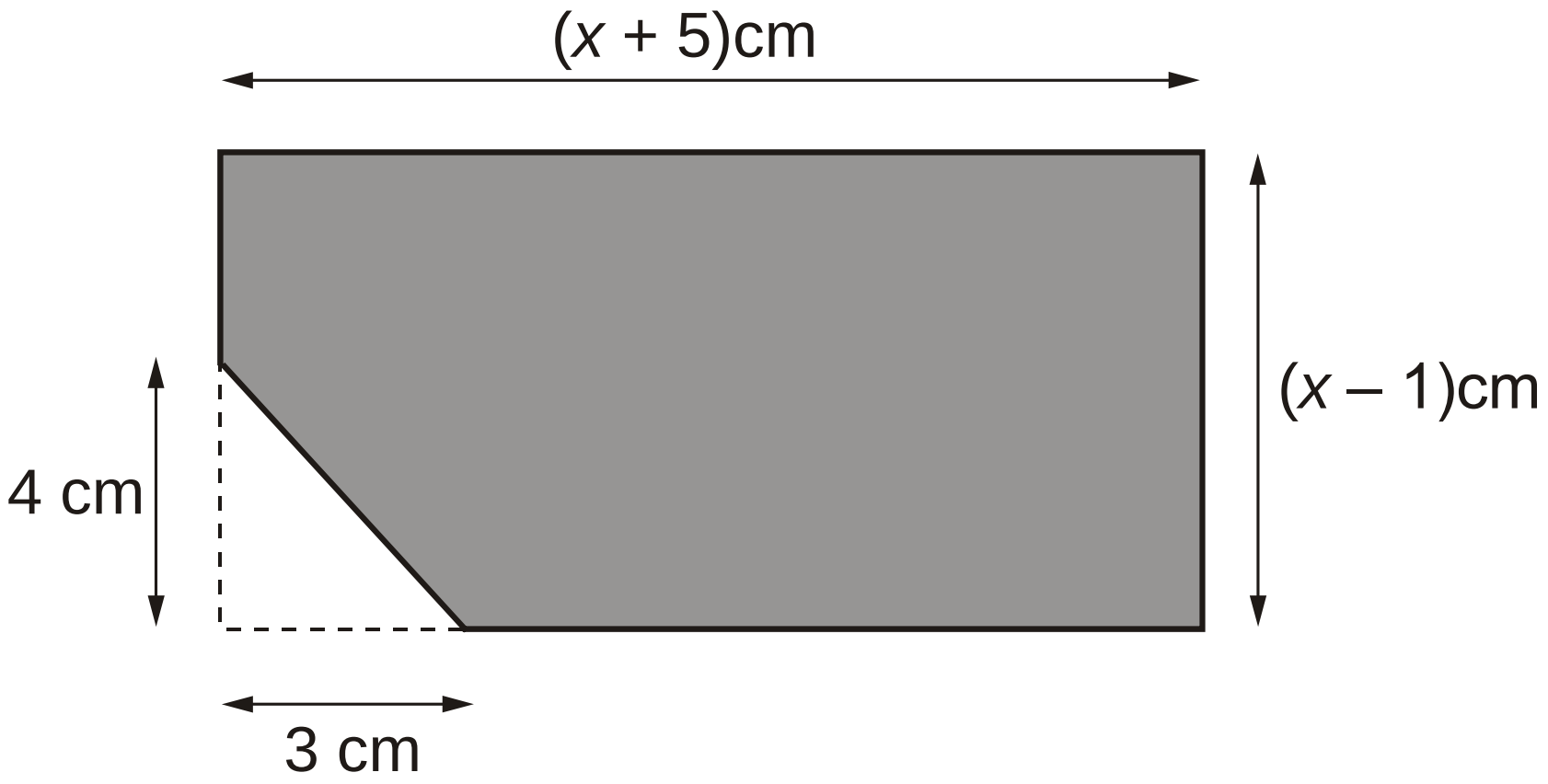
My question using problem 2

Higher Tier Problems

You will be presented with a series of diagrams taken from an exam paper.

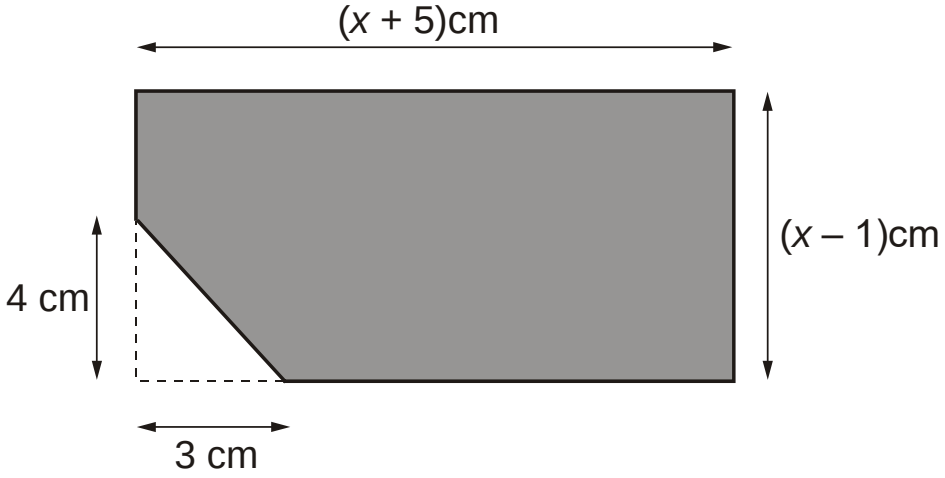
Your task is to make up a possible question using the diagram and then answer it.

Problem 1



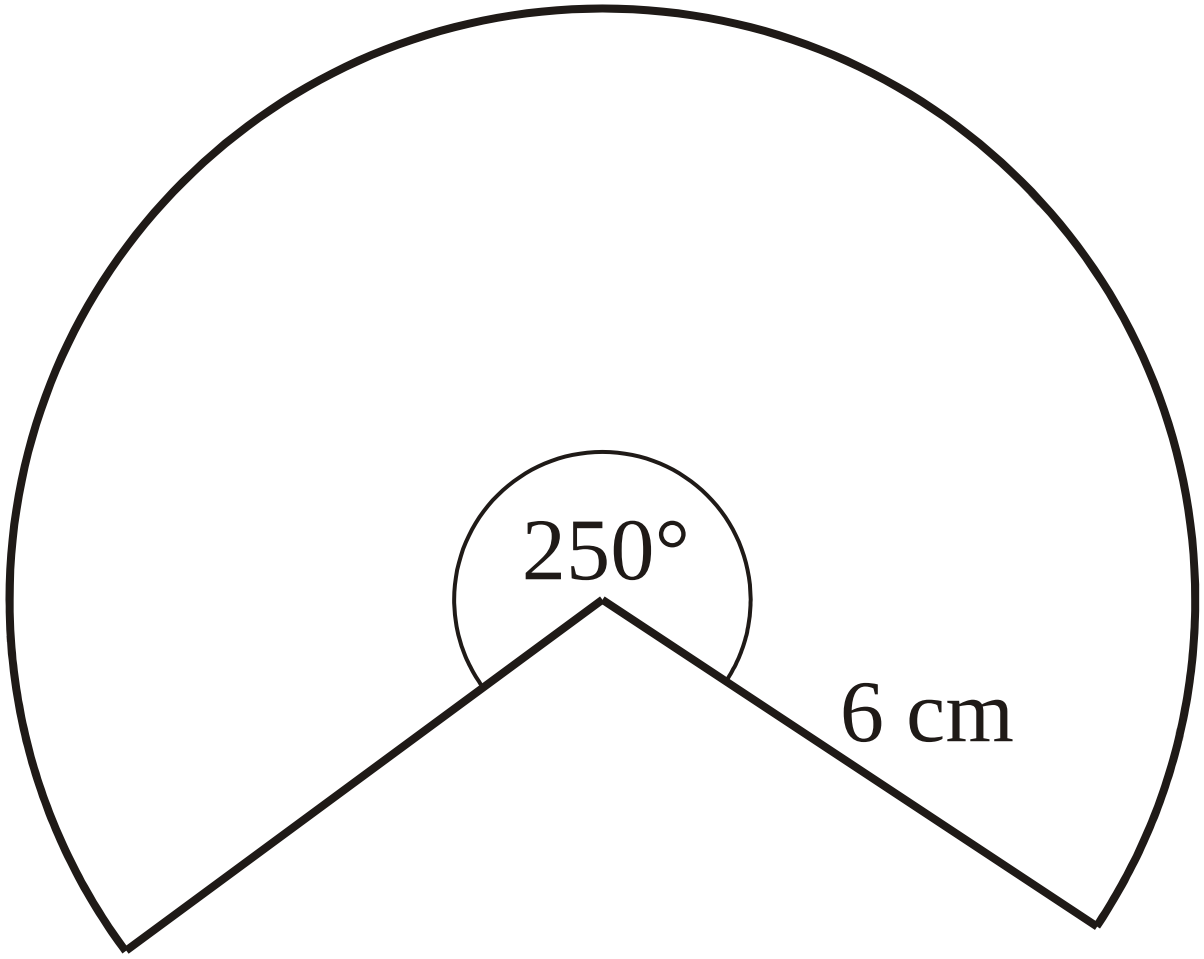
Question 1

A rectangle has length $(x + 5)$ cm and width $(x - 1)$ cm.
A corner is removed from the rectangle as shown.



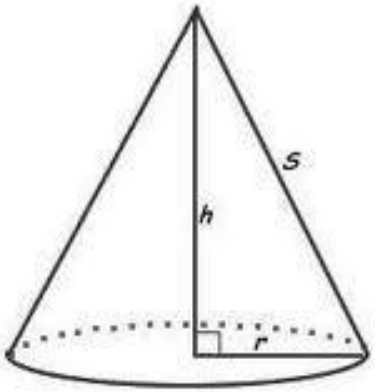
(a) Show that the shaded area is given by $x^2 + 4x - 11$.
(b) The shaded area is 59 cm^2.
(i) Show that $x^2 + 4x - 70 = 0$.
(ii) Calculate the value of x.

Problem 2

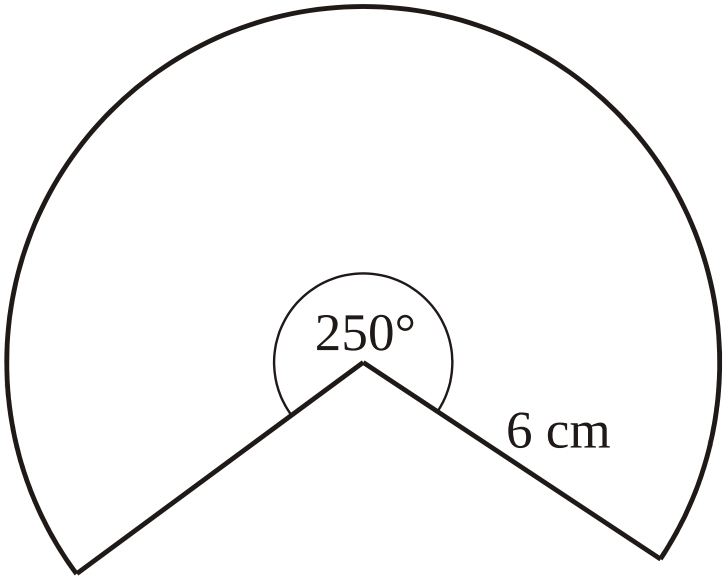


Question 2

The diagram shows the net of the curved surface of a cone.



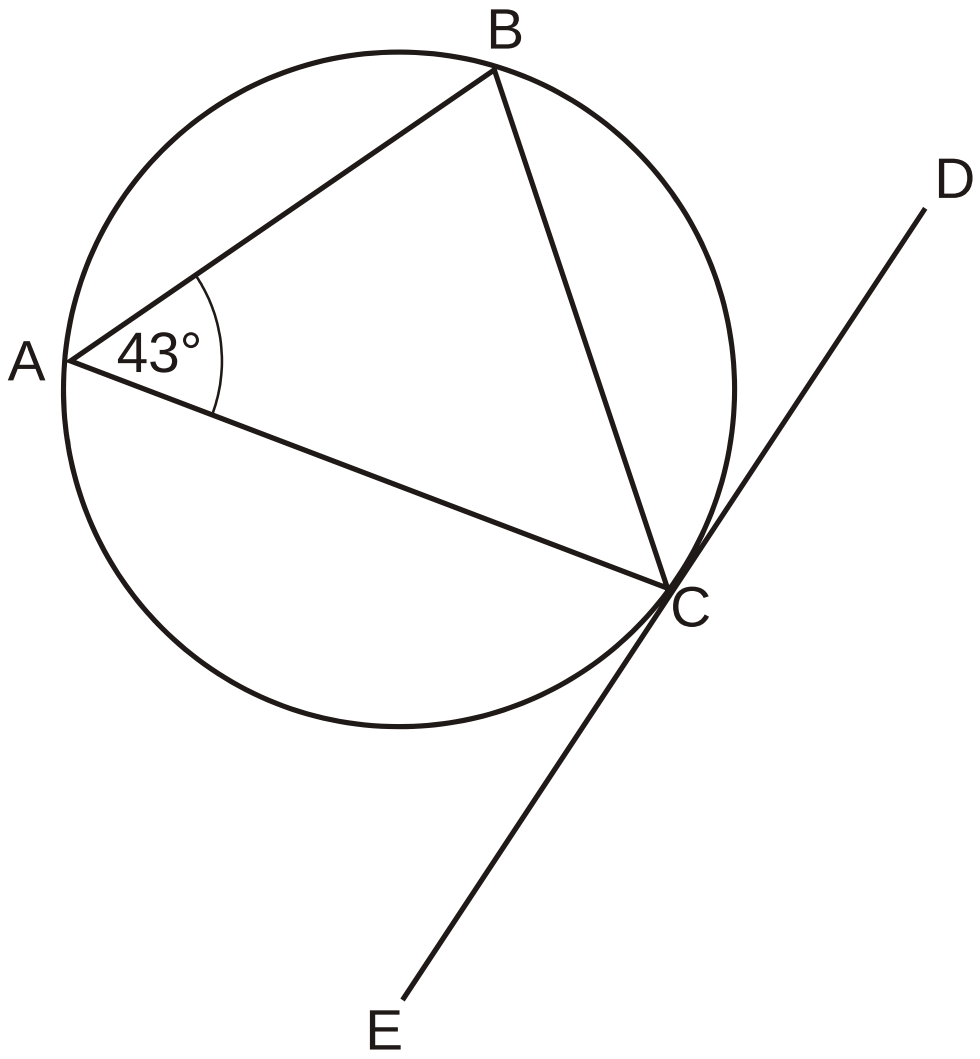
Volume of cone = $\frac{1}{3}\pi r^2 h$



Not to scale

Work out the volume of the cone.

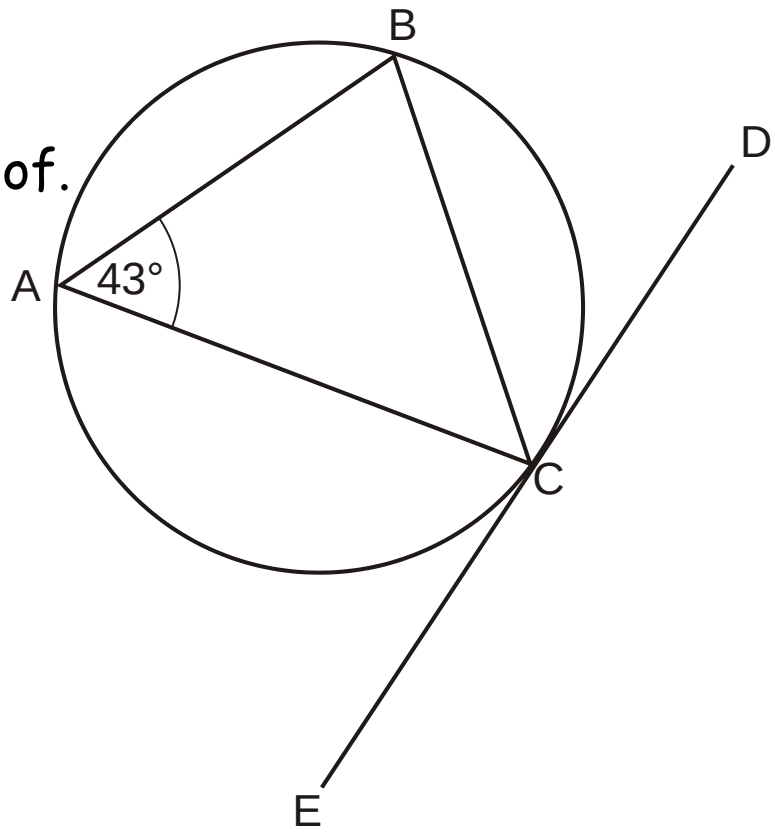
Problem 3



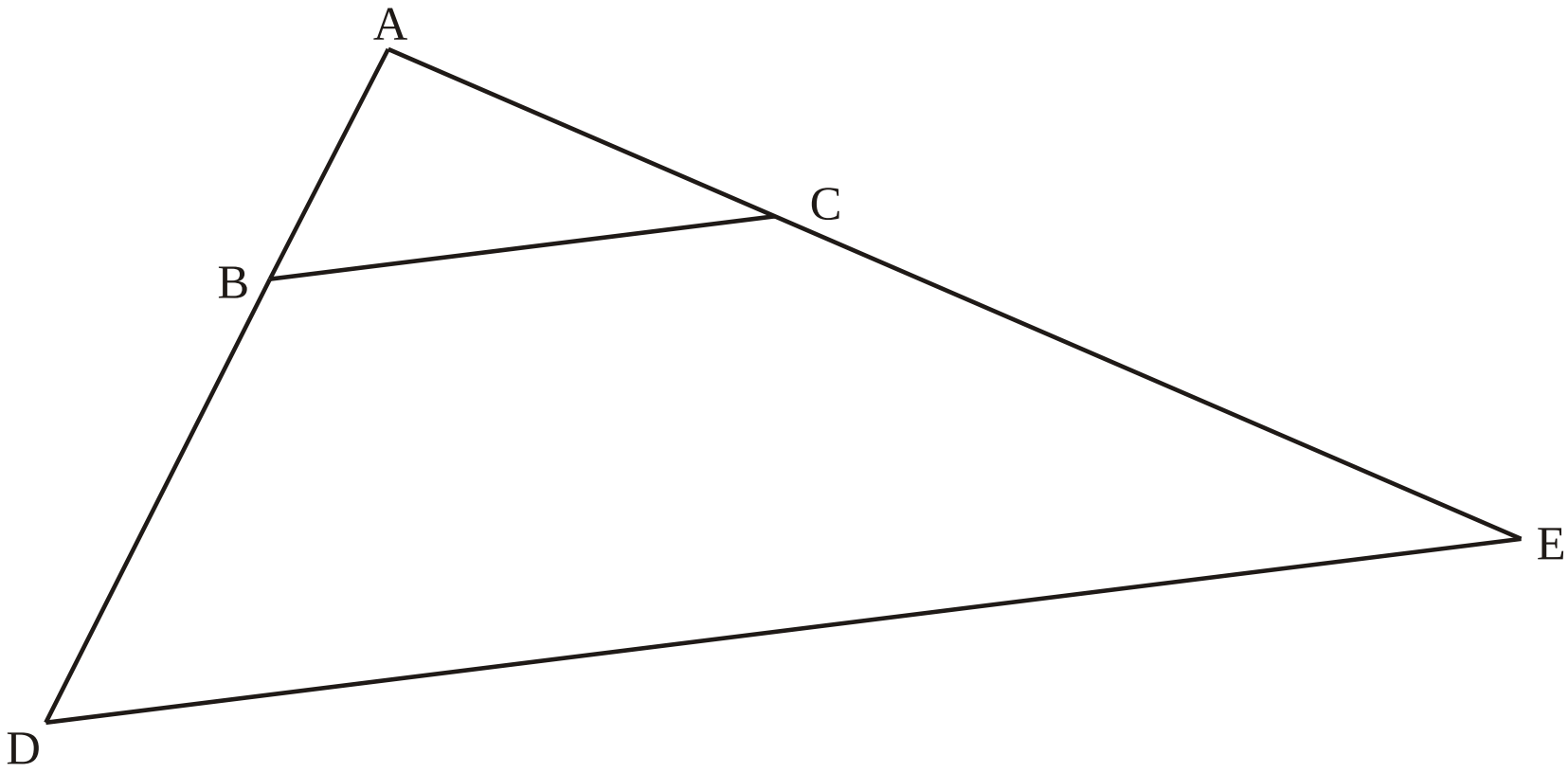
Question 3

A, *B* and *C* are points on the circle.
ECD is the tangent at *C*.
Angle BAC = 43°.

Prove that angle *BCE* = 137°.
Give a reason for each step of your proof.



Problem 4

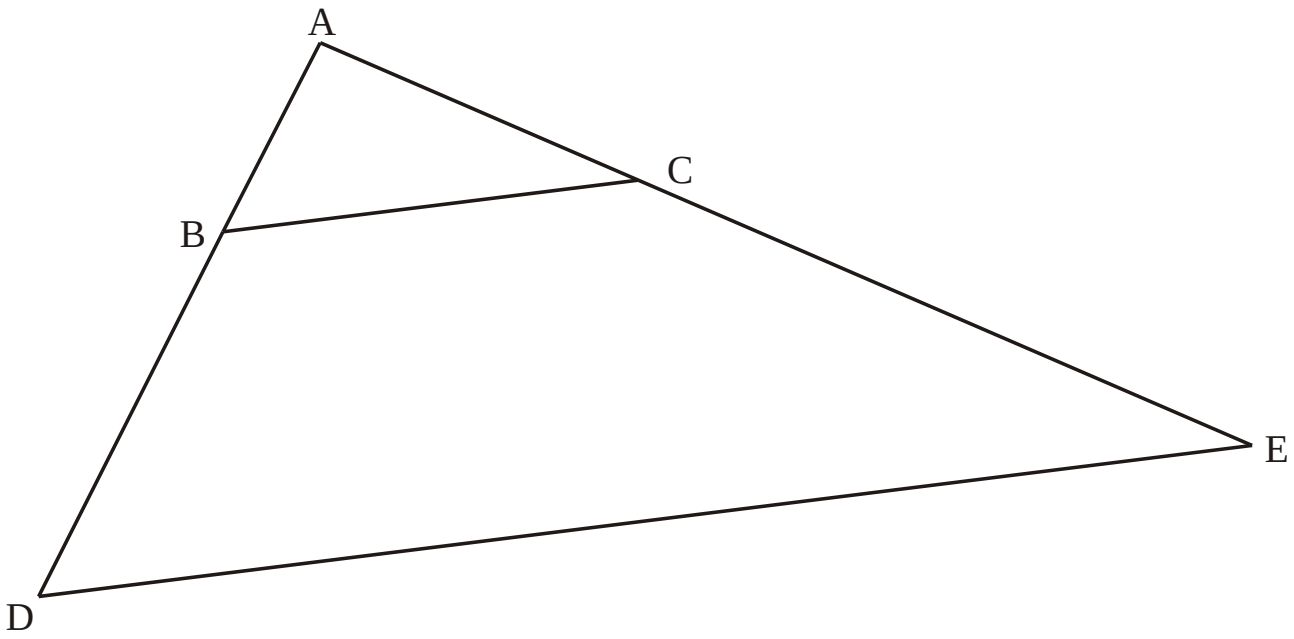


Question 4

ABC and ADE are similar triangles.

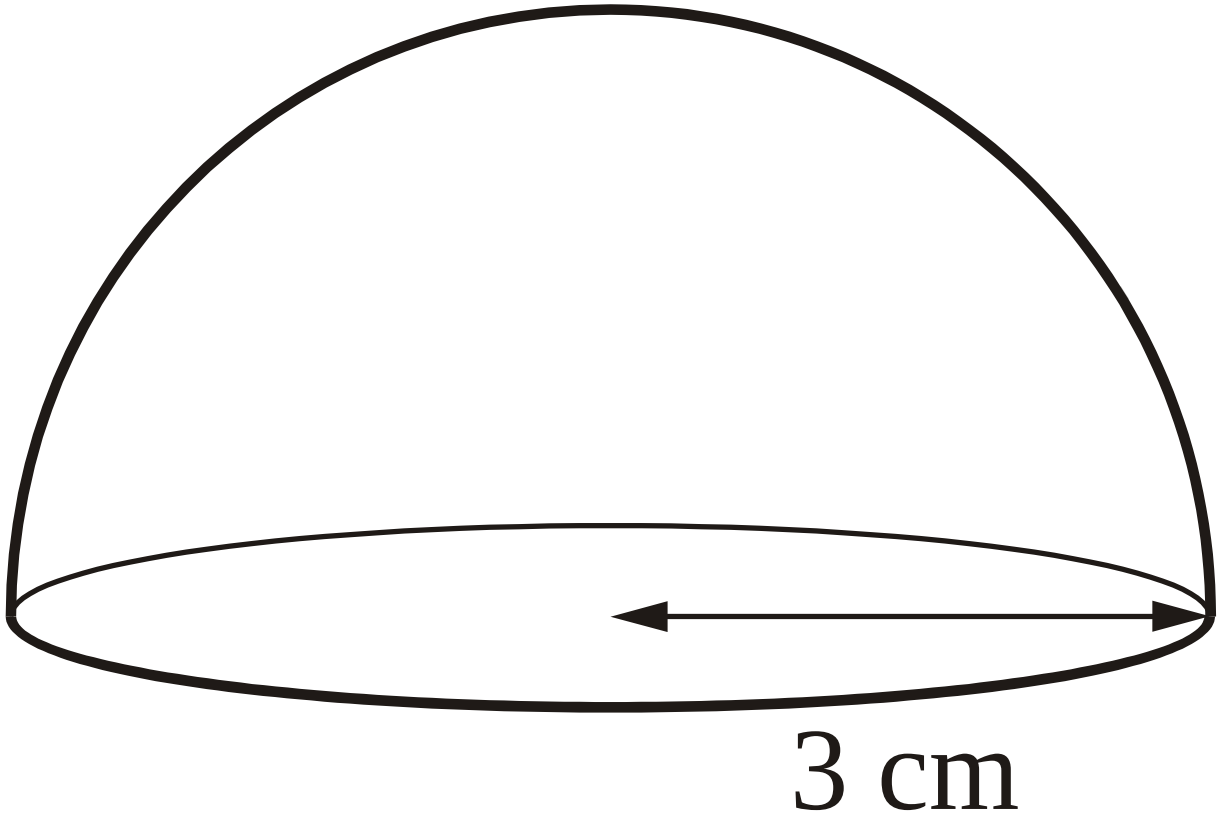
BC is parallel to DE.

BC = 3 cm. DE = 12 cm. AB = 2.1 cm. AE = 10 cm.



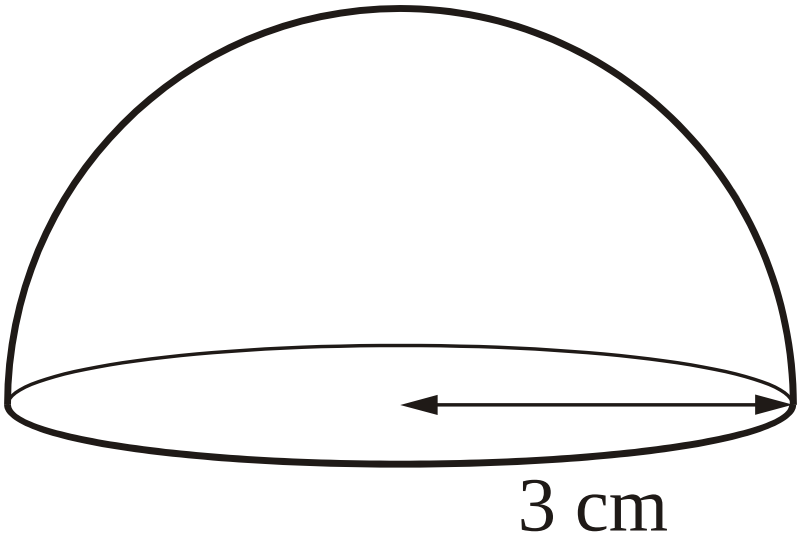
Work out the lengths AD and CE.

Problem 5



Question 5

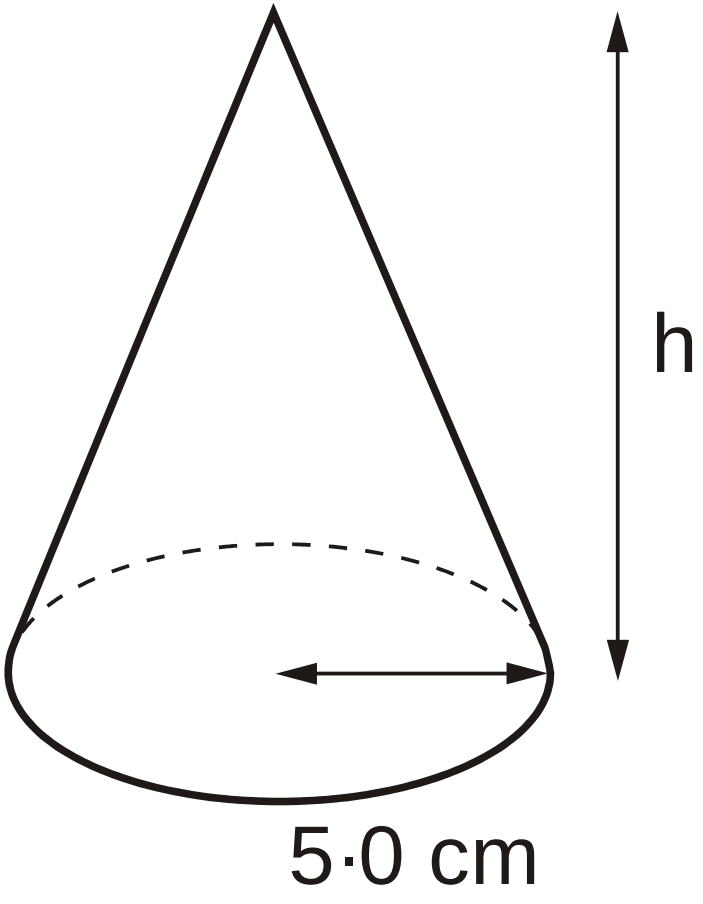
A paperweight is made in the shape of a solid hemisphere.
The paperweight has radius 3 cm.

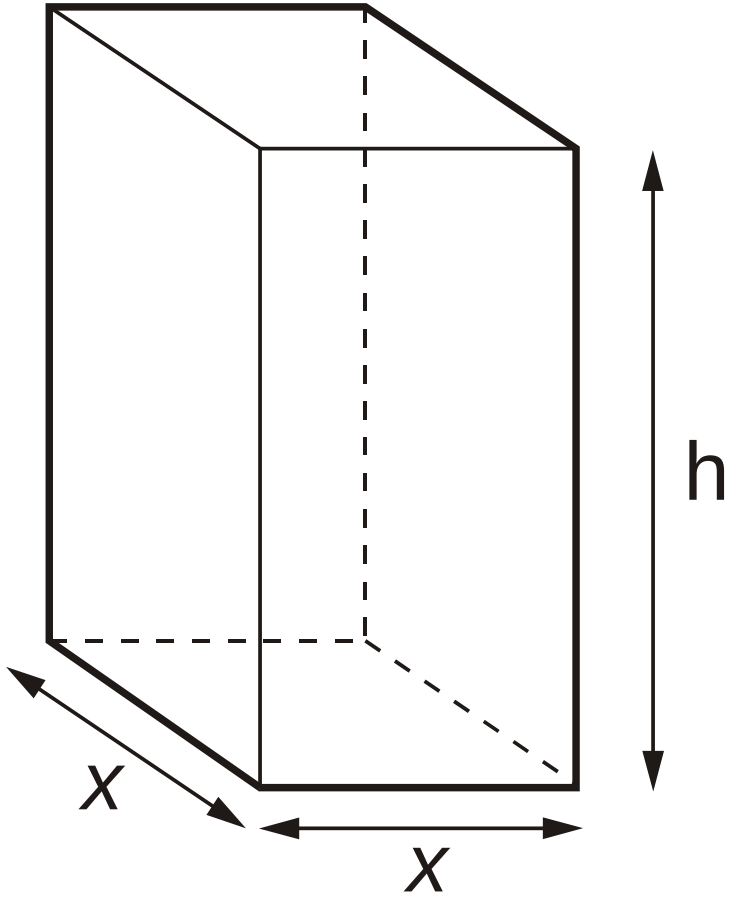


(a) Show that the total surface area of the paperweight is 27π cm^2.

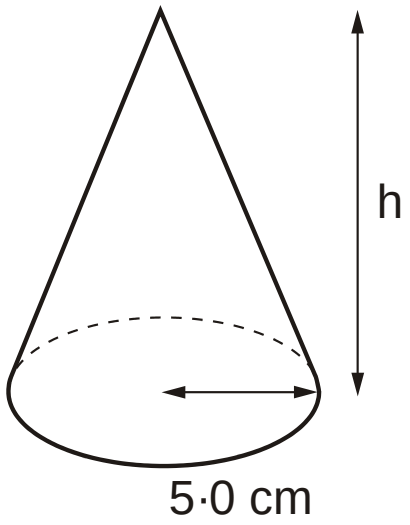
(b) A mathematically similar paperweight has total surface area 12π cm^2.
Work out the radius of this paperweight.

Problem 6

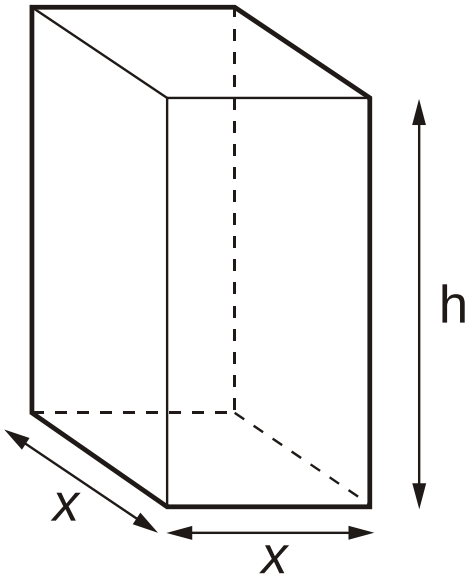




Question 6

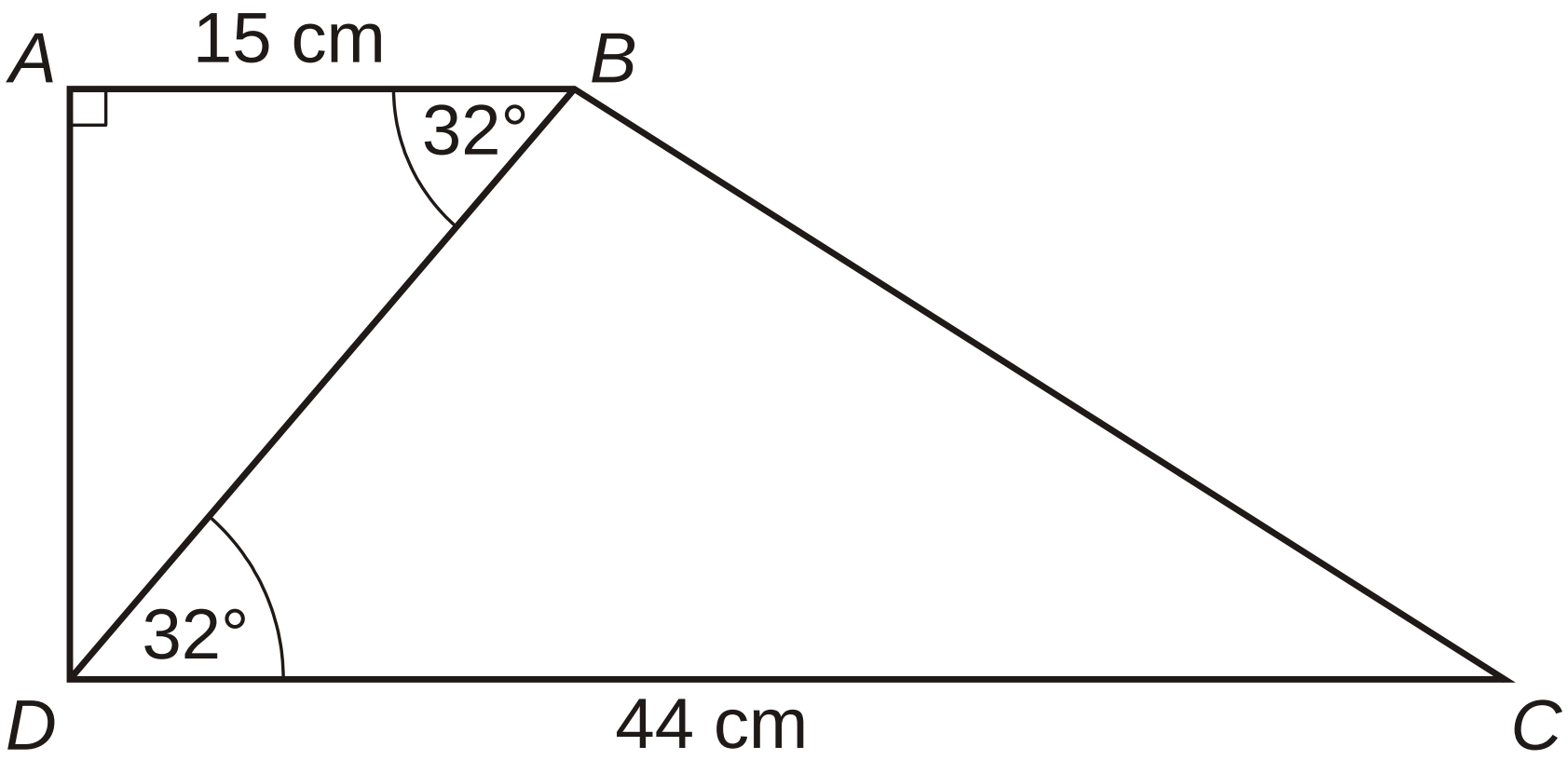


The curved surface area of a cone is 204.2 cm^2.
The radius of the cone is 5.0 cm.
(a) Find the height, h cm, of the cone.

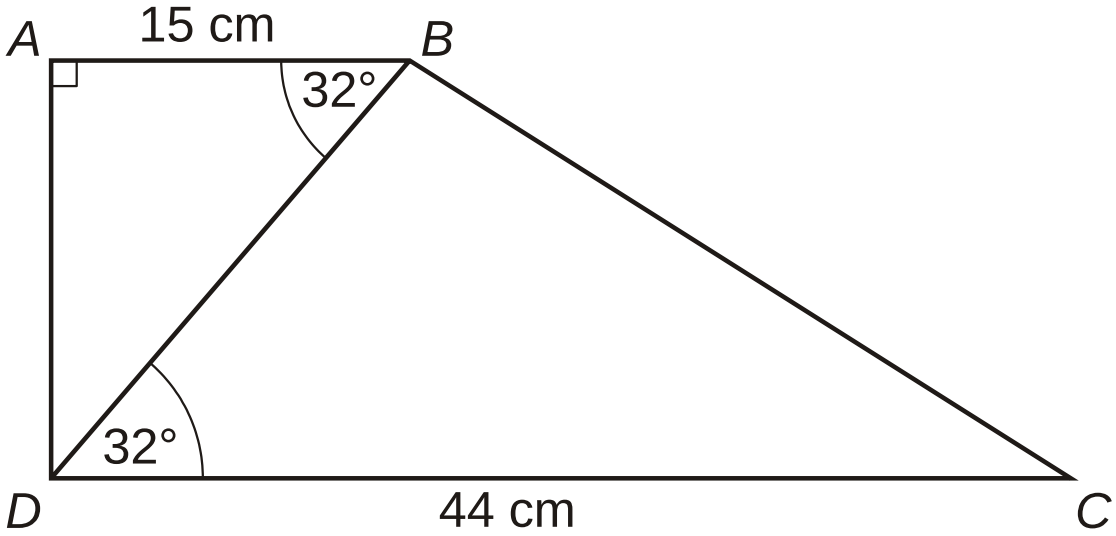


(b) A cuboid has the same height as the cone and a square base with side length *x*.
The volume of the cuboid is twice the volume of the cone. Find *x*.

Problem 7

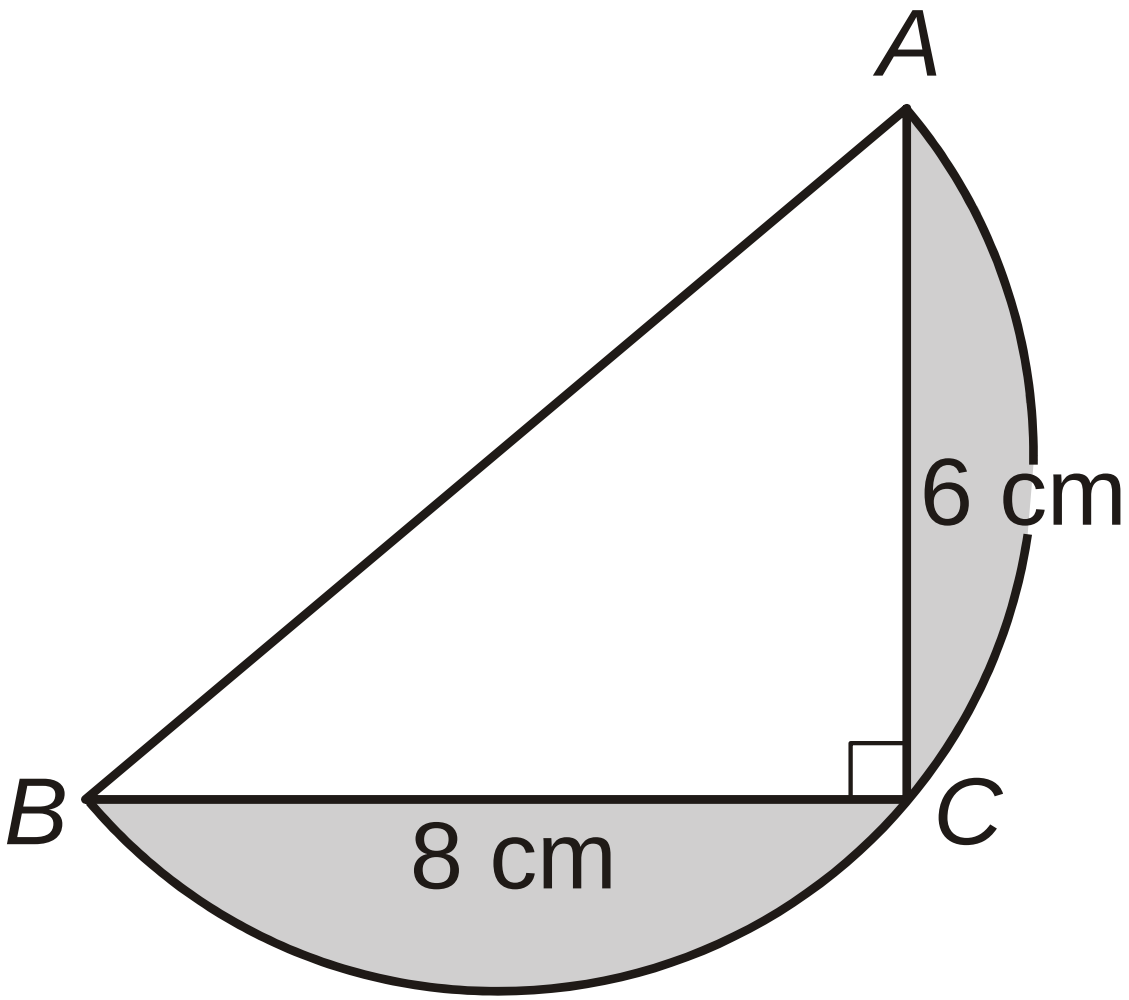


Question 7

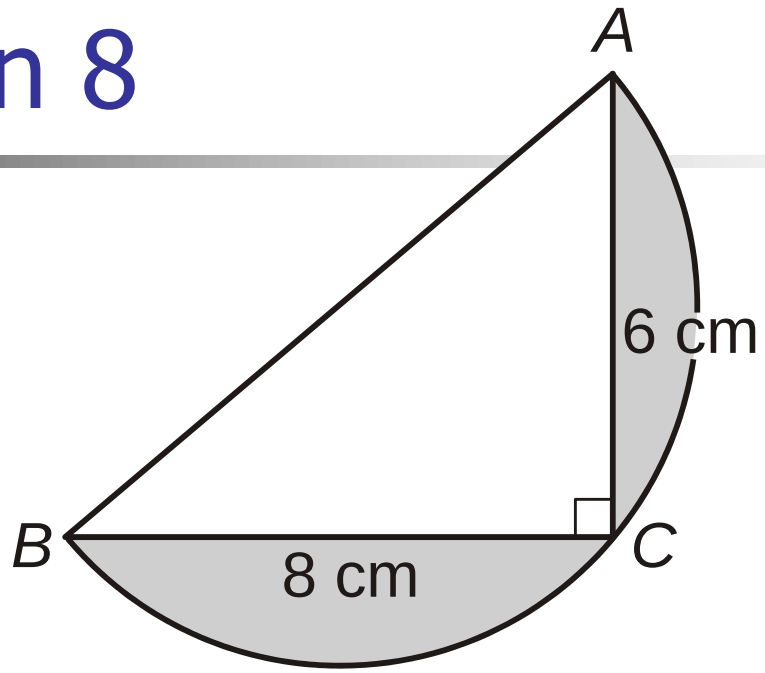


ABCD is a trapezium.
Angle *BAD* = 90°.
Angle *BDC* = angle *ABD* = 32°
AB= 15cm and *DC*= 44cm.
Calculate the length of *BC*
Give your answer to a suitable degree of accuracy.

Problem 8



Question 8

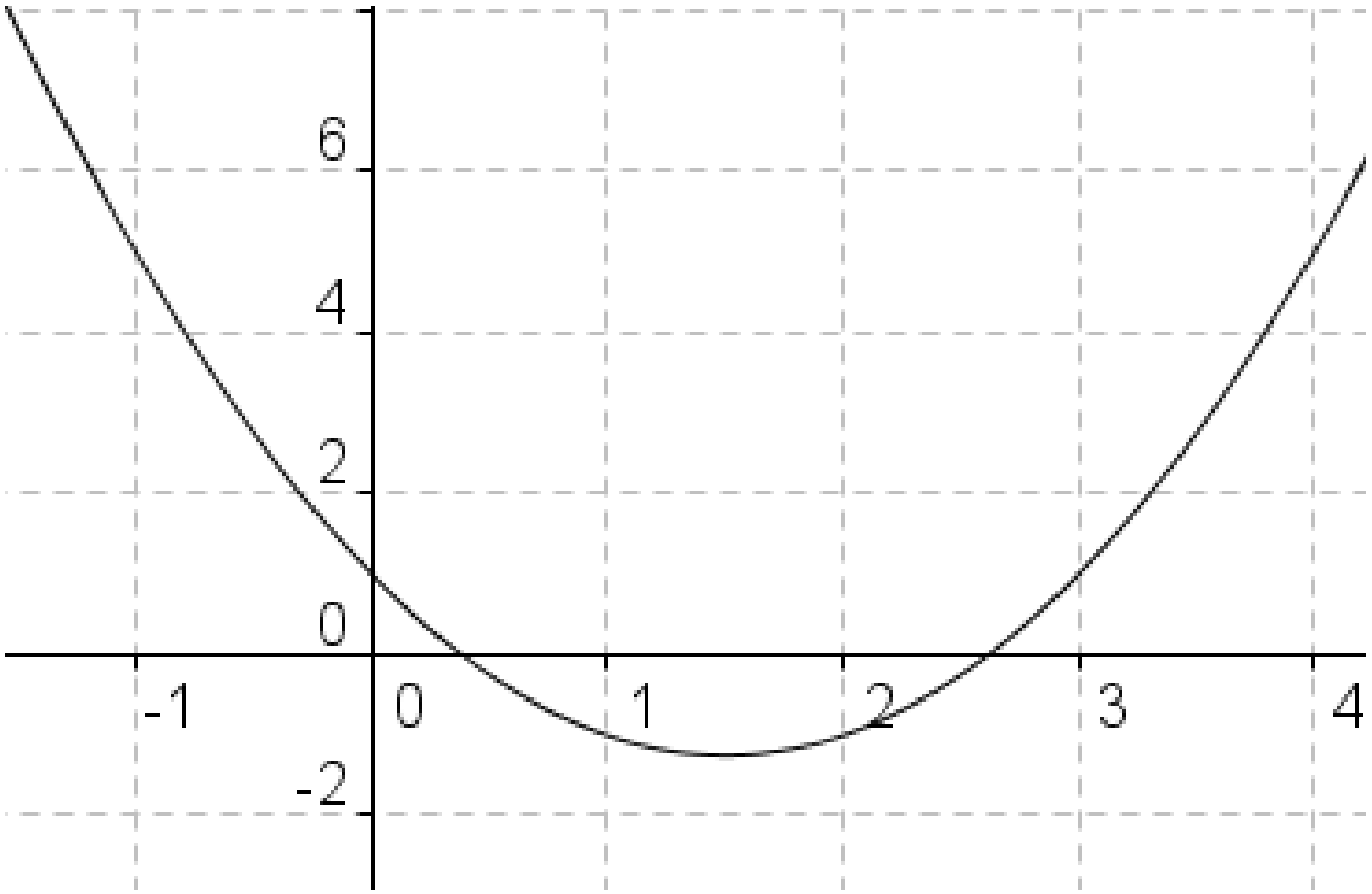


The diagram shows part of a circle, radius 5cm, with points *A*, B and C on the edge. *AC* = 6 cm, *BC* = 8 cm and angle *C* = 90°.

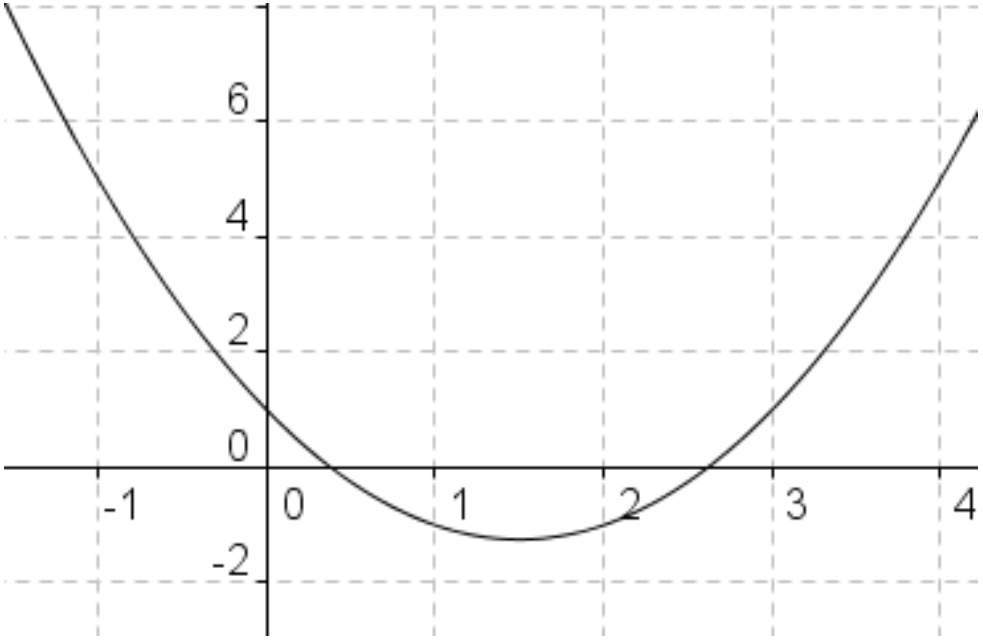
(a) Explain how you can tell that *AB* is the diameter of the circle.

(b) Calculate the total shaded area.
Give the units of your answer.

Problem 9



Question 9

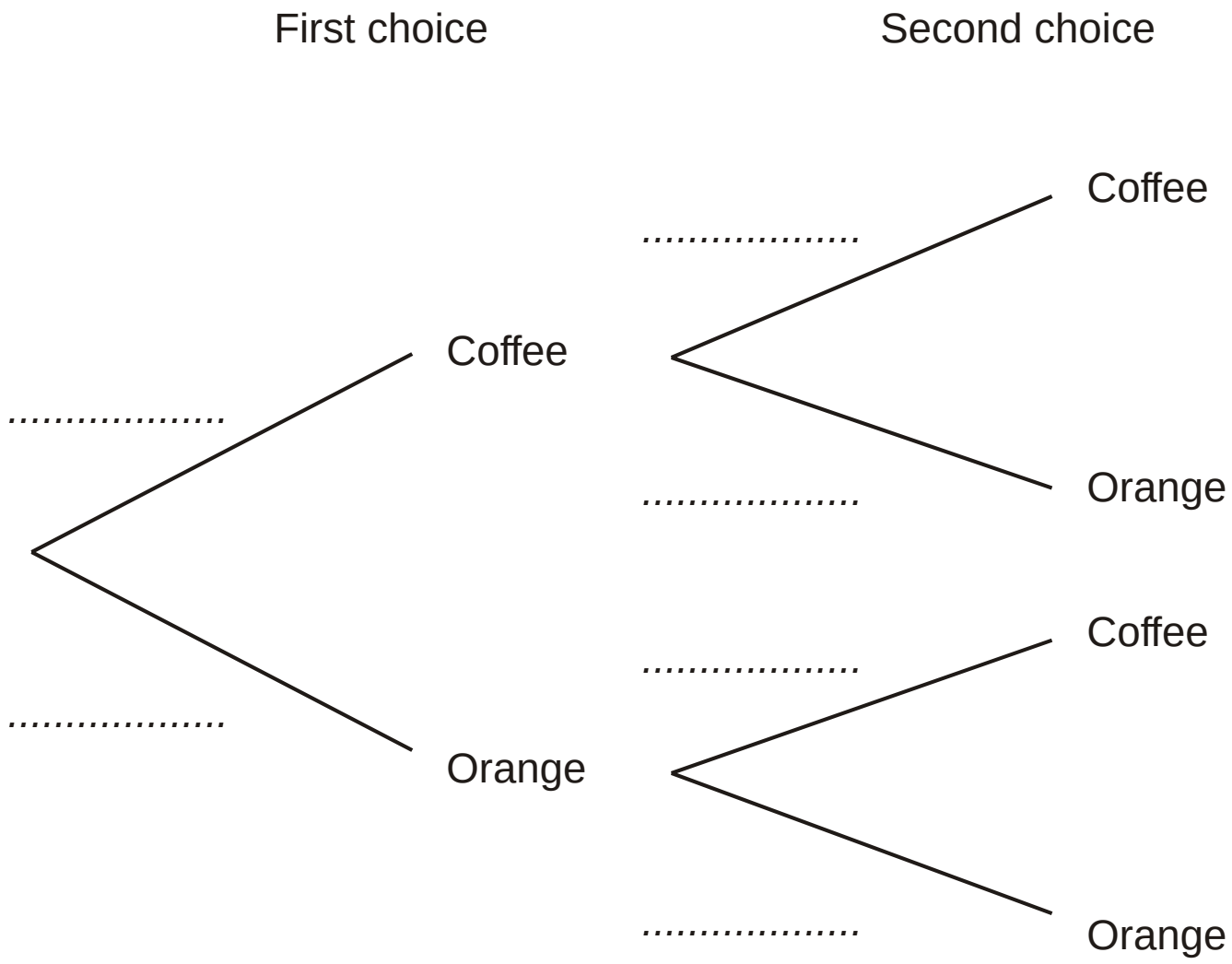


The diagram shows the graph of $y = x^2 - 3x + 1$.

(a) Draw a suitable straight line and find, graphically, the solution to $x^2 - 3x + 1 = x - 1$.

(b) What line would you draw to solve $x^2 - x - 1 = 0$?

Problem 10

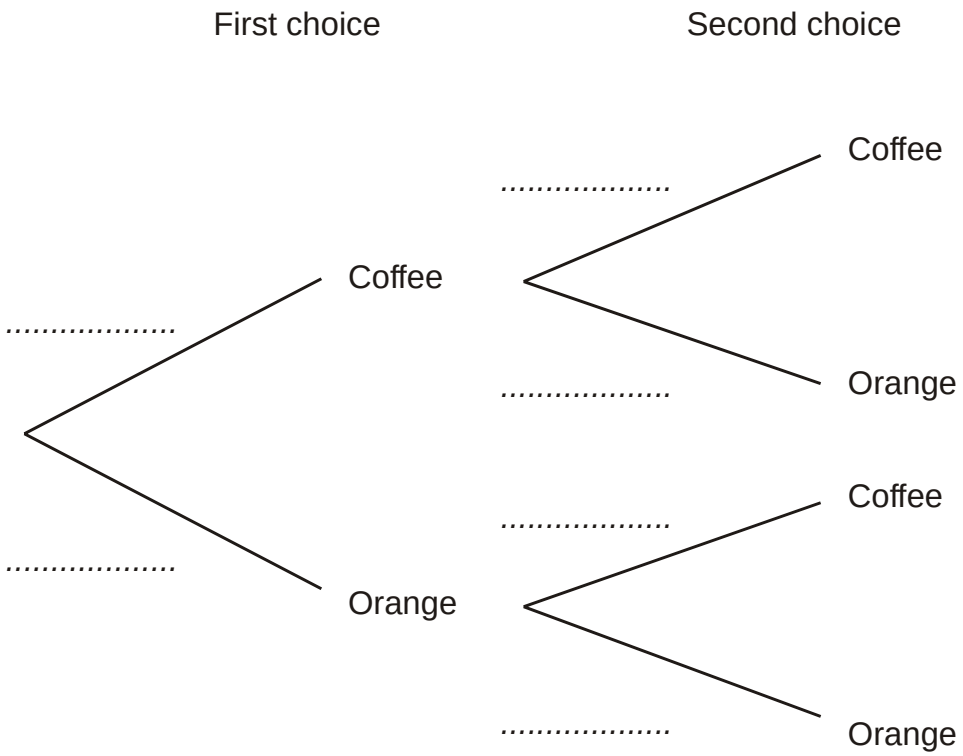

First choice
Second choice
Coffee
Orange
Coffee
Orange
Coffee
Orange

Question 10

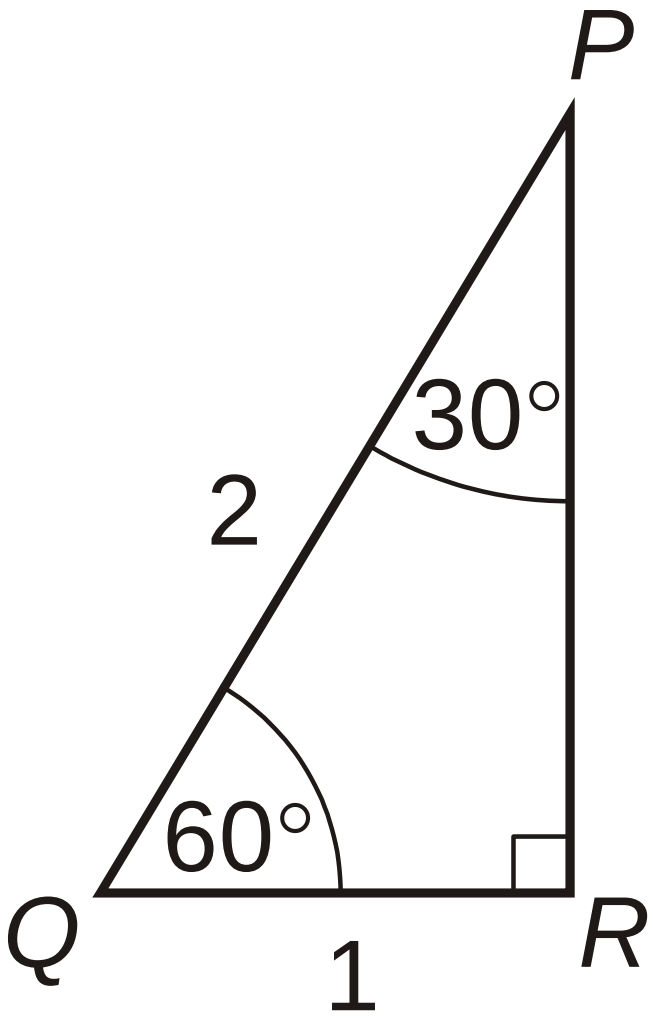
Reuben has 10 bars of chocolate in a tin. They are identical in size and shape. Three of the bars are coffee flavoured, the others are orange flavoured. Reuben chooses one bar at random and eats it. He then chooses a second bar at random.

(a) Complete the tree diagram to show Reuben's choices.

(b) Calculate the probability that exactly one of the bars that Reuben chooses is coffee flavoured.

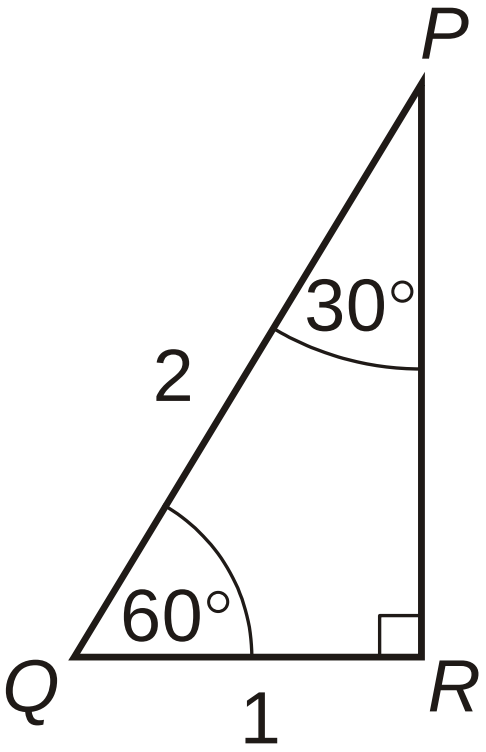


Problem 11



Question 11

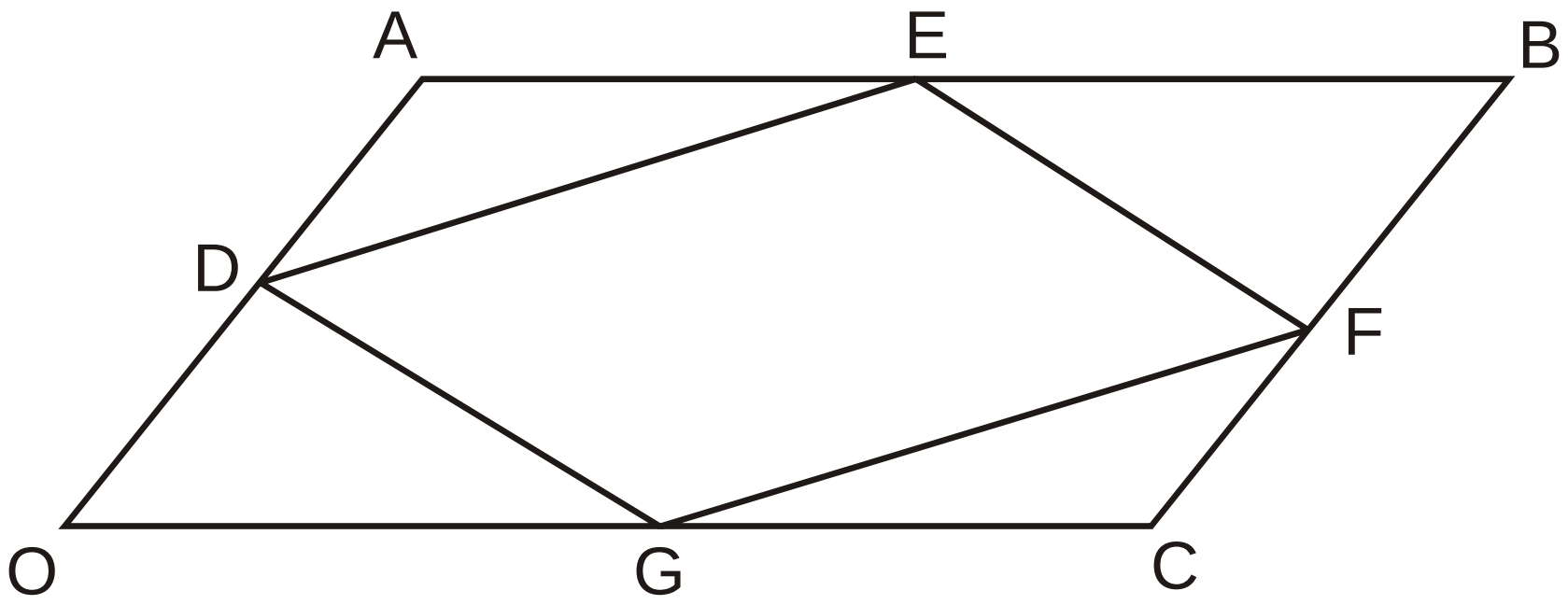
The diagram shows a right-angled triangle *PQR*.
PQ is 2 units long and *QR* is 1 unit long.
Angle *PQR* = 60° and angle *QPR* = 30°.



(a) Find sin 60°.
Give your answer in the form $\frac{\sqrt{a}}{b}$

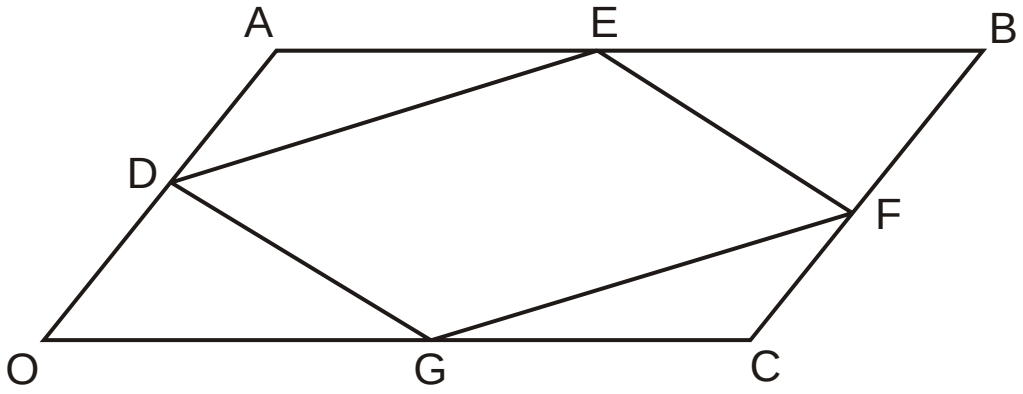
(b) Find tan 30°.
Give your answer in the form $\frac{\sqrt{a}}{b}$

Problem 12



Question 12

OABC is a parallelogram.
D, E, F and G are the midpoints of the sides OA, AB, BC and CO respectively.



$\overrightarrow{OA} = 2\mathbf{a}$
$\overrightarrow{OC} = 2\mathbf{c}$

(a) Find these vectors in terms of **a** and **c**.
(i) DA
(ii) DE
(iii) FC
(iv) FG

(b) Prove that DEFG is a parallelogram.

Problem 13

Temperature ($t\ ^0C$)	$20^0 \leq t < 25^0$	$25^0 \leq t < 30^0$	$30^0 \leq t < 35^0$	$35^0 \leq t < 40^0$	$40^0 \leq t < 45^0$
Frequency	12	24	37	21	6

Question 13

The maximum temperature at a Mediterranean holiday resort was recorded each day for 100 days one summer.
The table below shows the distribution of temperatures.

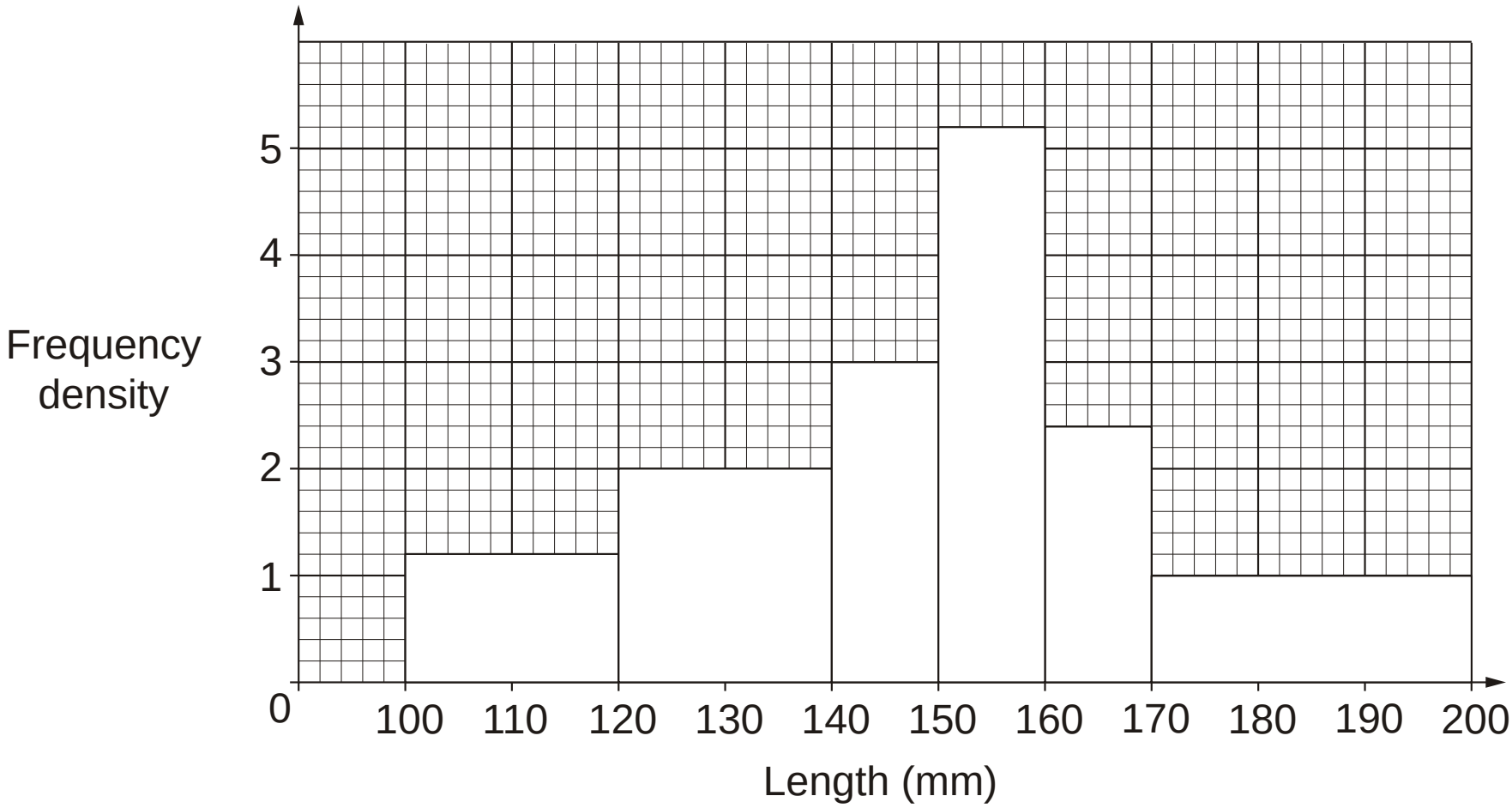
Temperature (t ^0C)	$20^0 \leq t < 25^0$	$25^0 \leq t < 30^0$	$30^0 \leq t < 35^0$	$35^0 \leq t < 40^0$	$40^0 \leq t < 45^0$
Frequency	12	24	37	21	6

(a) Complete the cumulative frequency table.

Temperature (t ^0C)	$t < 25^0$	$t < 30^0$	$t < 35^0$	$t < 40^0$	$t < 45^0$
Cumulative frequency	12	24	37	21	6

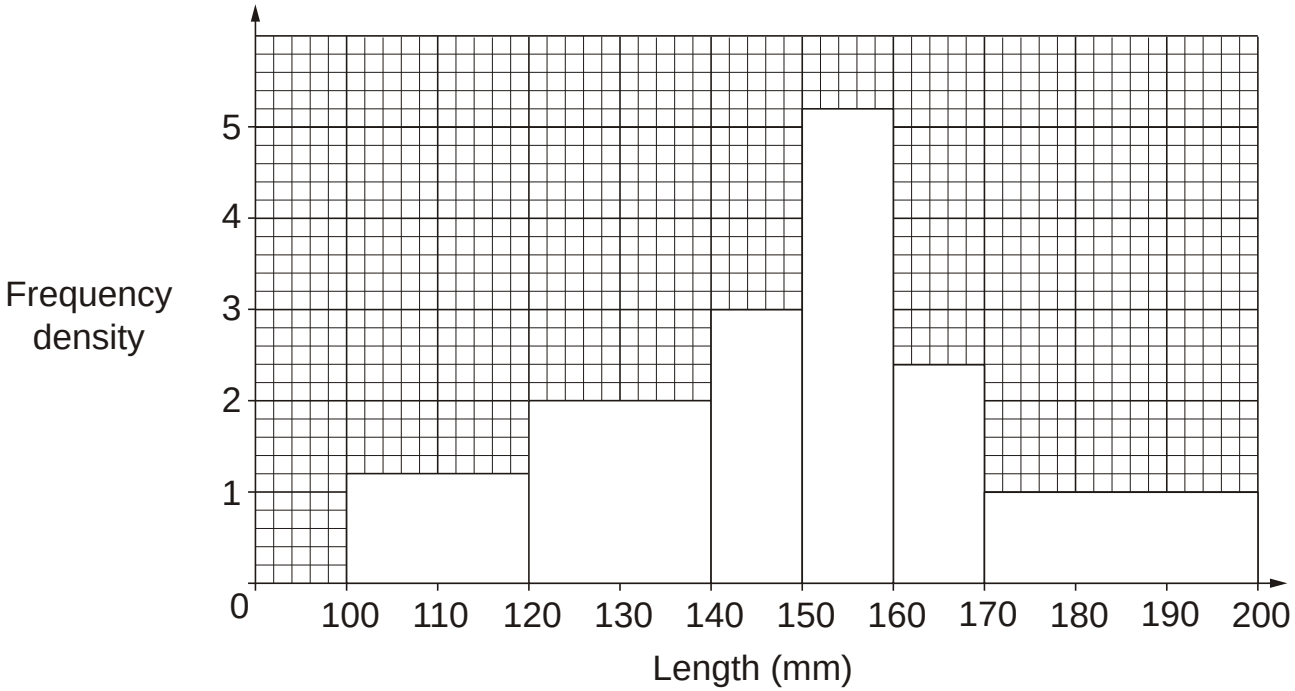
(b) Draw a cumulative frequency diagram.
(c) Use your graph to find the median temperature.
(d) Use your graph to estimate the number of days with a maximum temperature of 38°C or less.

Problem 14


Frequency density
0
1
2
3
4
5
100
110
120
130
140
150
160
170
180
190
200
Length (mm)

Question 14

The histogram shows the distribution of the lengths of a sample of 200 zips.



Estimate the number of zips from this sample that are between 140 mm and 165mm.

Problem 15

	Number of boys	Number of girls	Number of students
Year 7	78	82	160
Year 8	67	93	160
Year 9	85	75	160

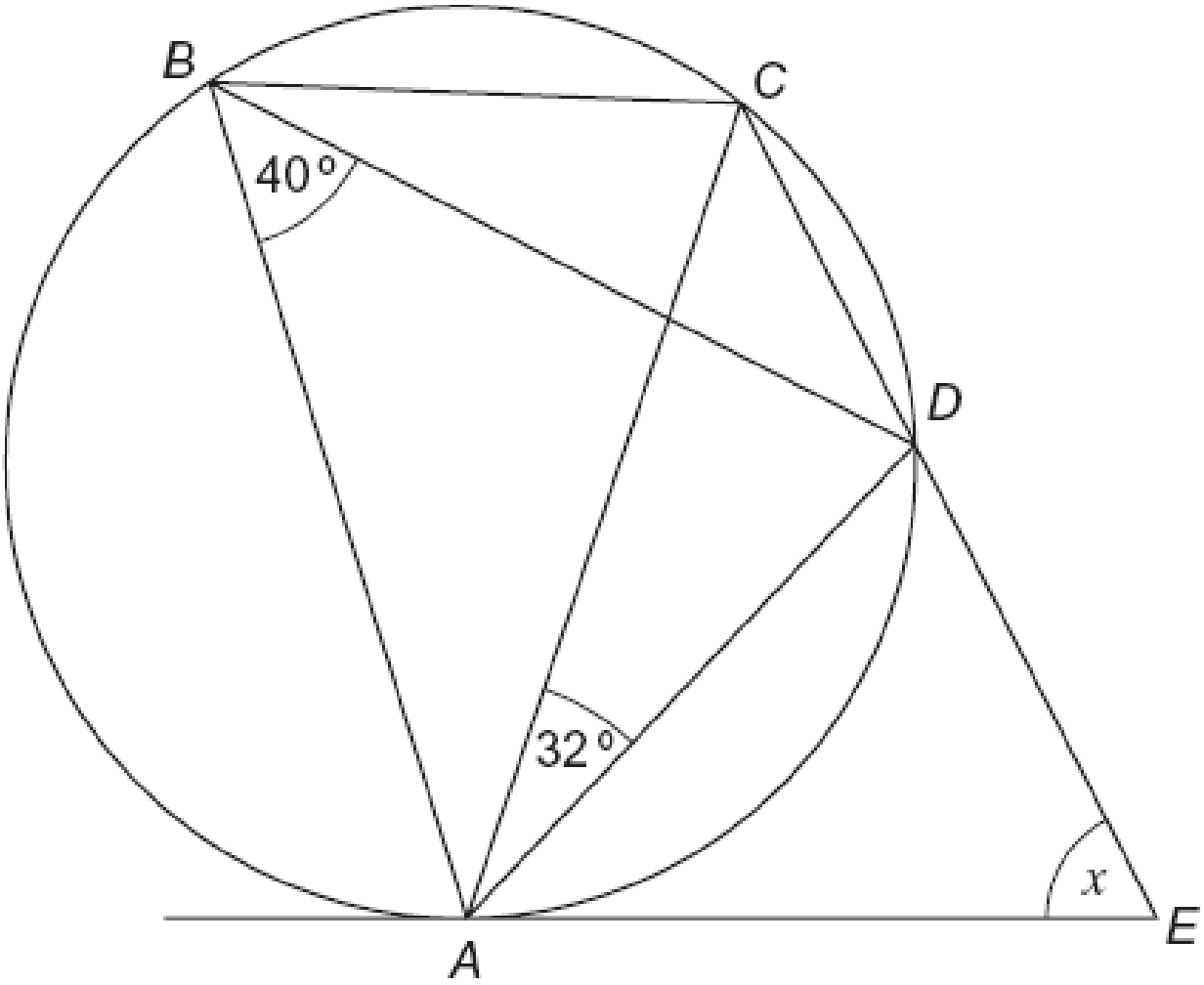
Question 15

	Number of boys	Number of girls	Number of students
Year 7	78	82	160
Year 8	67	93	160
Year 9	85	75	160

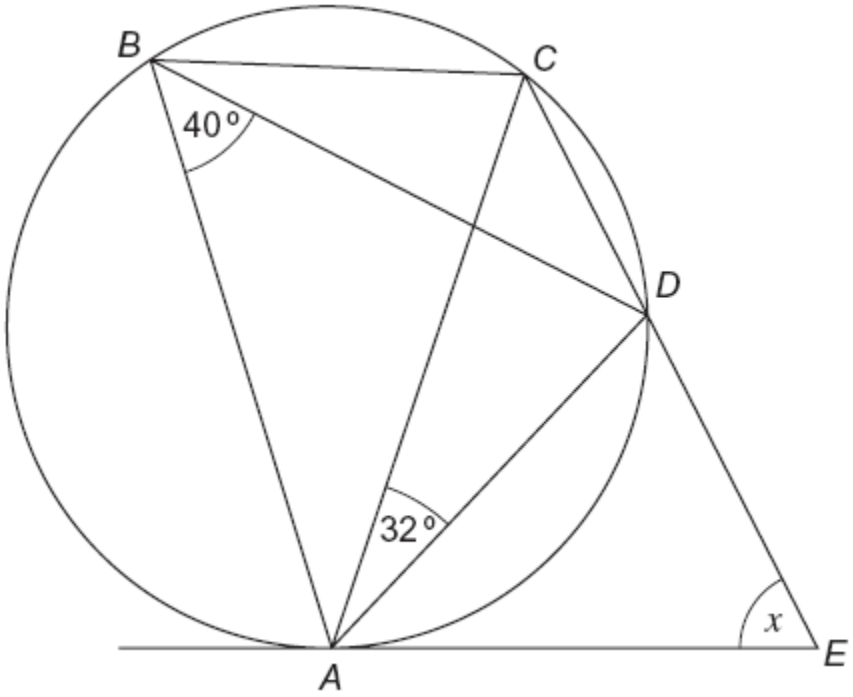
The table gives the numbers of students in each of years 7, 8 and 9.
Peter wanted to interview 150 students in total from the three years.

He chose a stratified sample of boys and girls.
How many boys and how many girls should he choose from **year 8**?

Question 16



Question 16

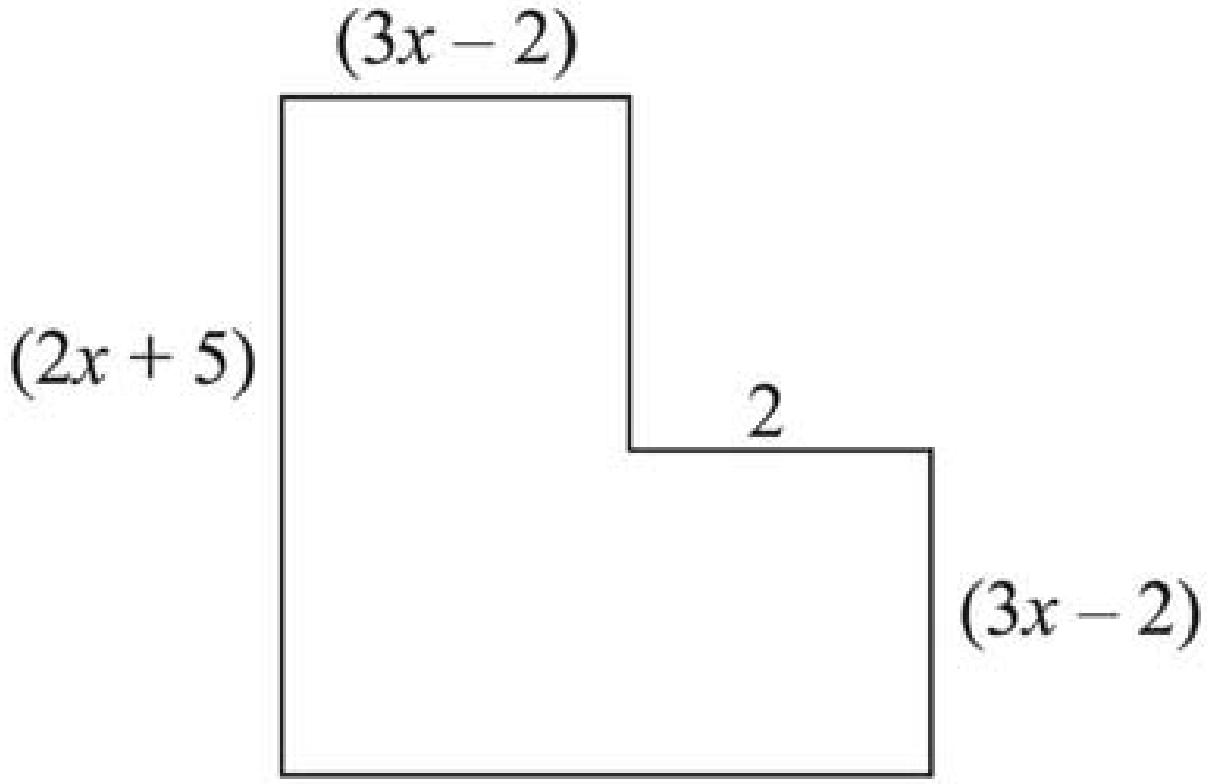


ABCD is a cyclic quadrilateral.
AE is a tangent at *A*.
CDE is a straight line.
Angle *CAD* = 32°
Angle *ABD* = 40°

Work out the size of angle *AED*, marked *x*, on the diagram.

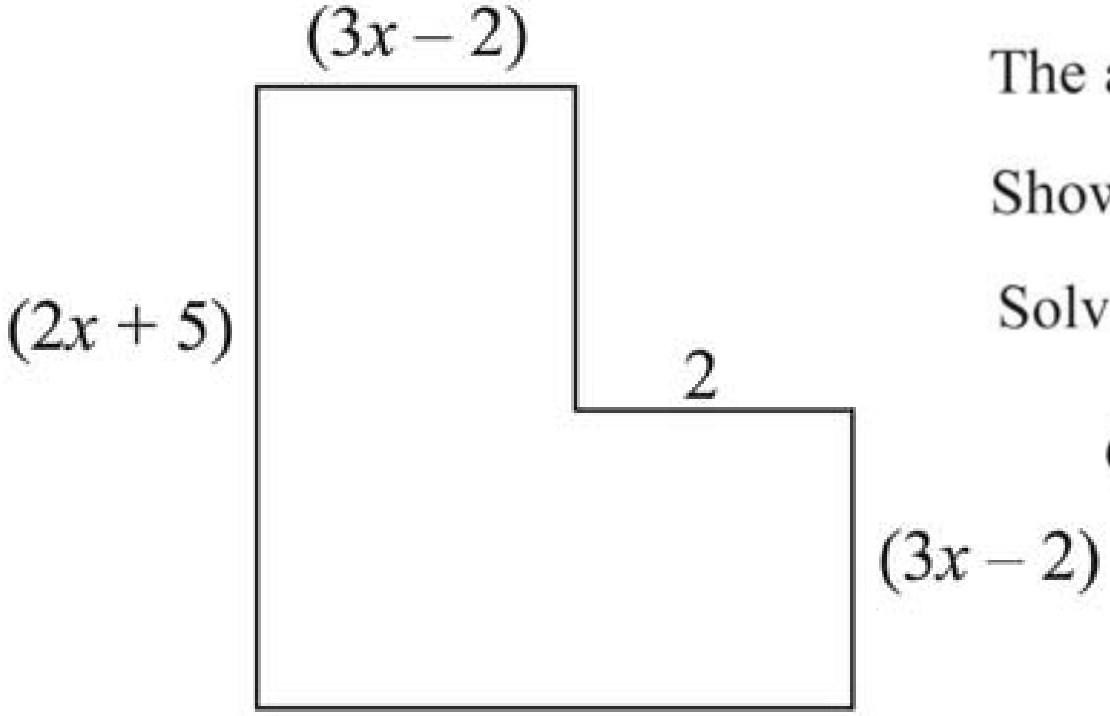
You **must** show your working.
Give reasons for any angles you work out.

Question 17



Question 17

The diagram below shows a 6-sided shape.
All the corners are right angles.
All measurements are given in centimetres.



The area of the shape is 25 cm^2.

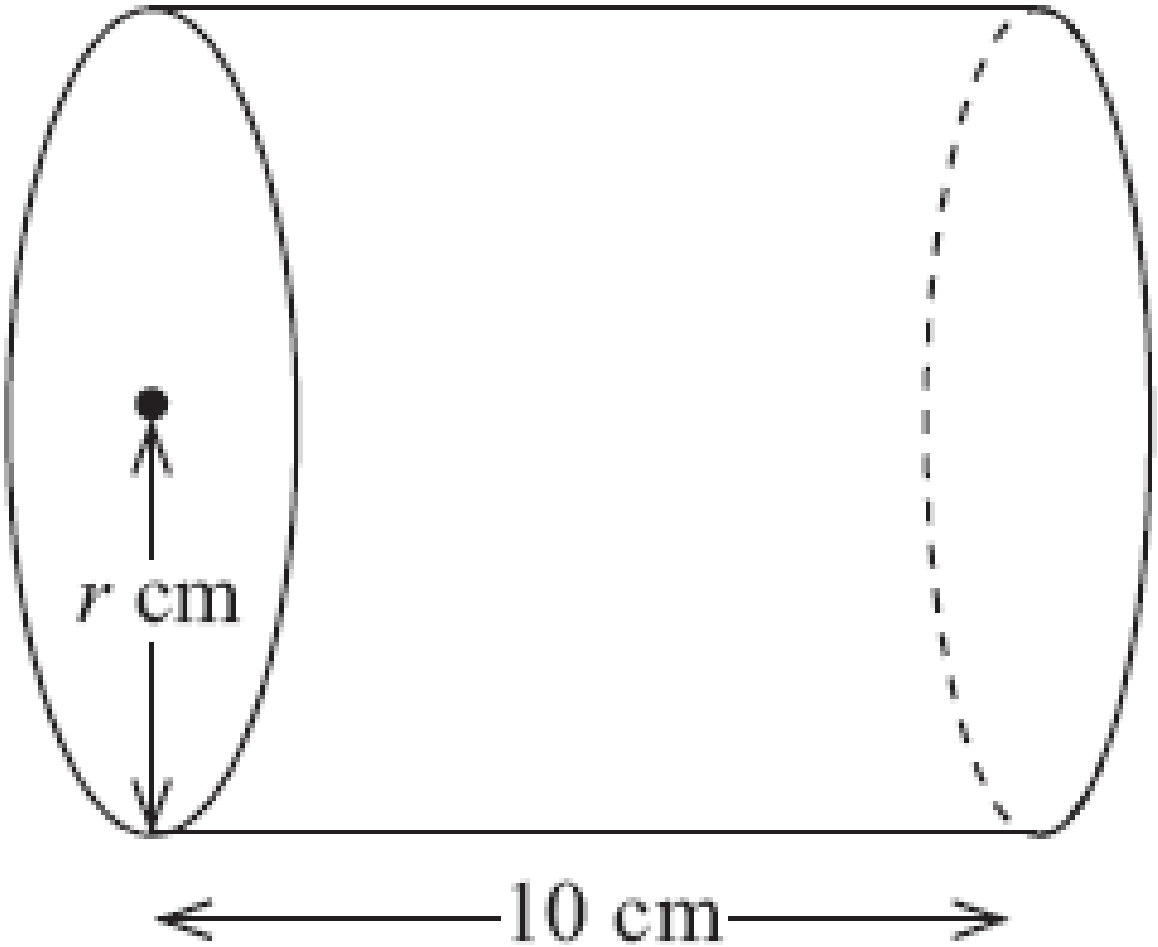
Show that $6x^2 + 17x - 39 = 0$

Solve the equation

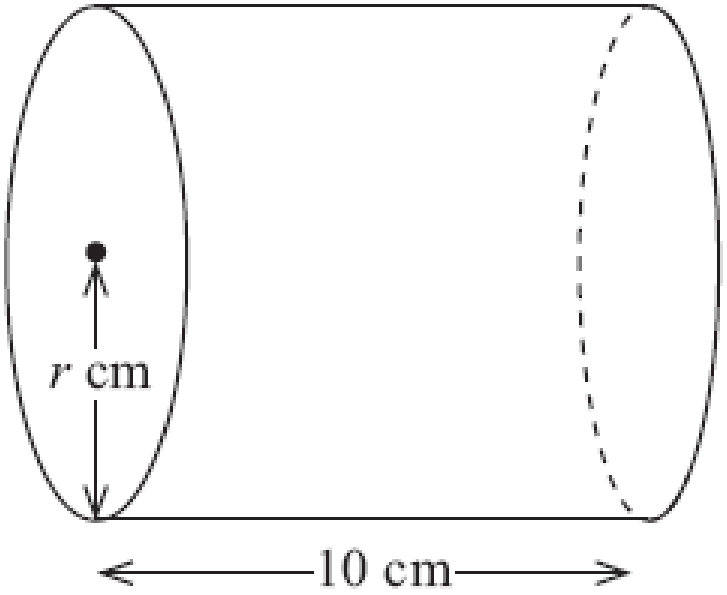
$$6x^2 + 17x - 39 = 0$$

Hence work out the length of the longest side of the shape.

Question 18



Question 18



The diagram shows a cylinder.
The radius of the cylinder is r cm.
The length of the cylinder is 10 cm.

The volume of the cylinder is 140 cm^3.

Work out the value of r.
Give your answer correct to 3 significant figures.

Question 19

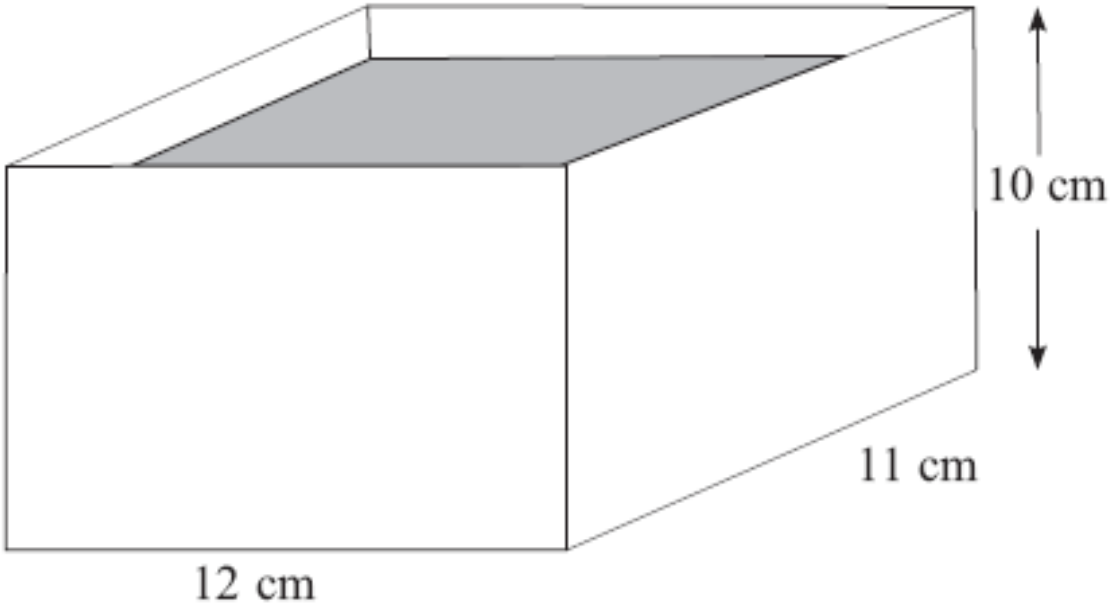
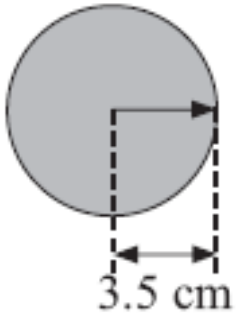


Diagram **NOT** accurately drawn



Question 19

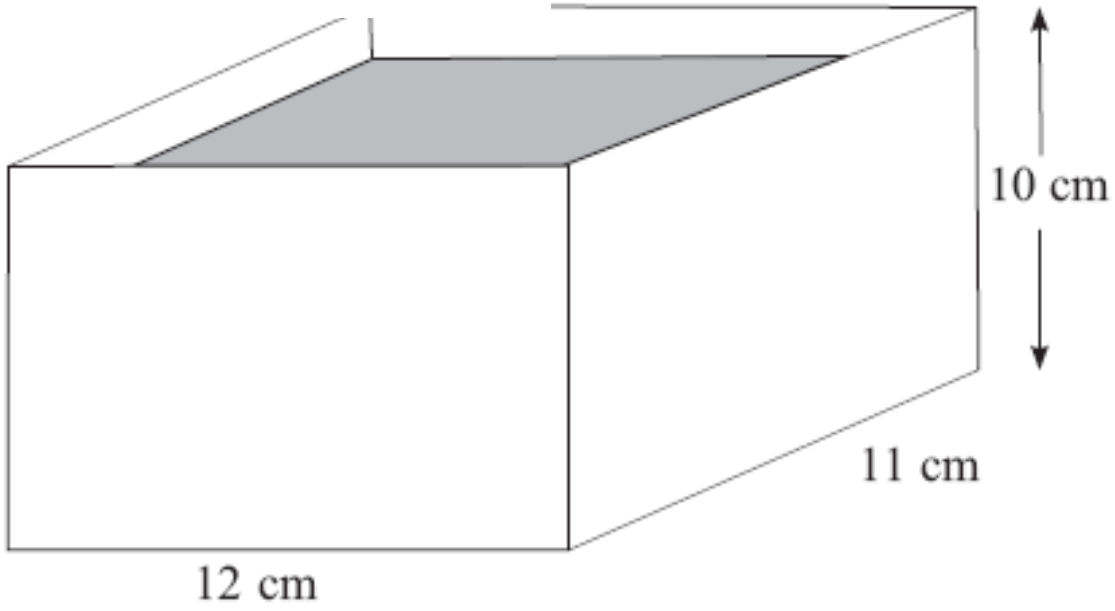
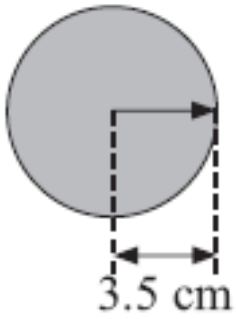


Diagram **NOT** accurately drawn

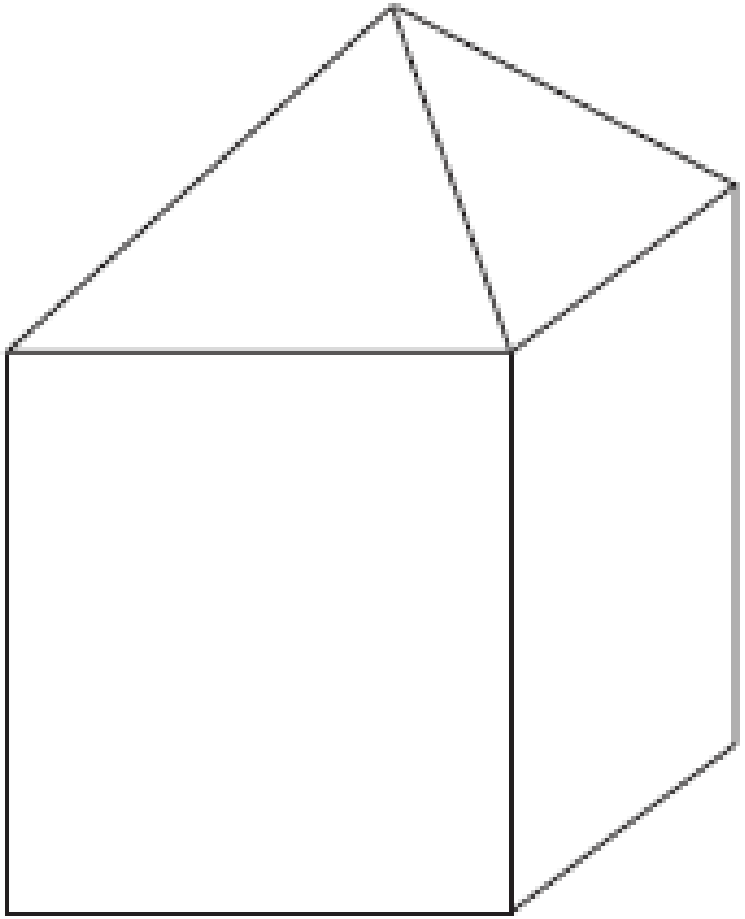


A rectangular container is 12 cm long, 11 cm wide and 10 cm high.
The container is filled with water to a depth of 8 cm.

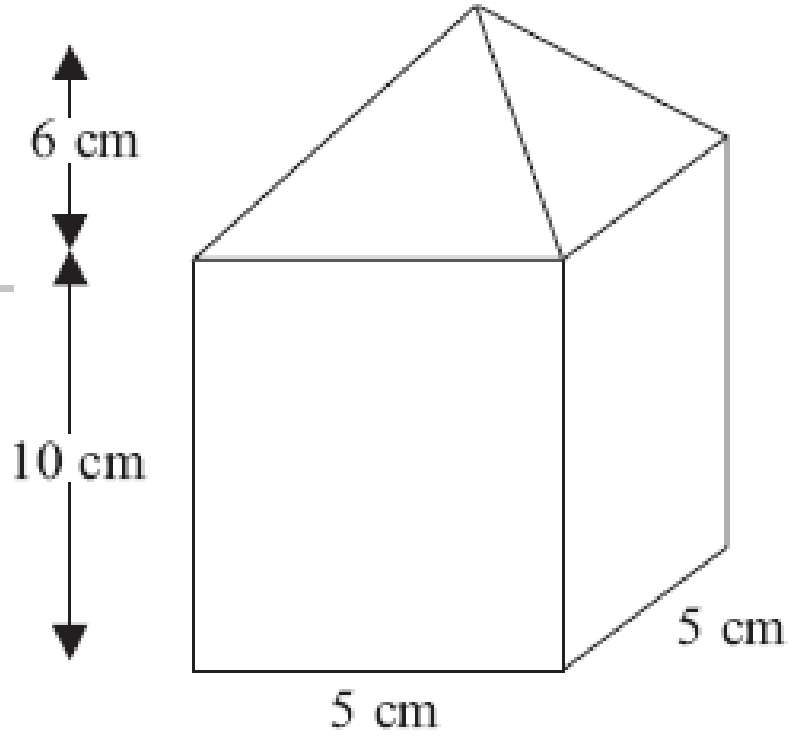
A metal sphere of radius 3.5 cm is placed in the water.
It sinks to the bottom.

Calculate the rise in the water level.
Give your answer correct to 3 significant figures.

Question 20



Question 20



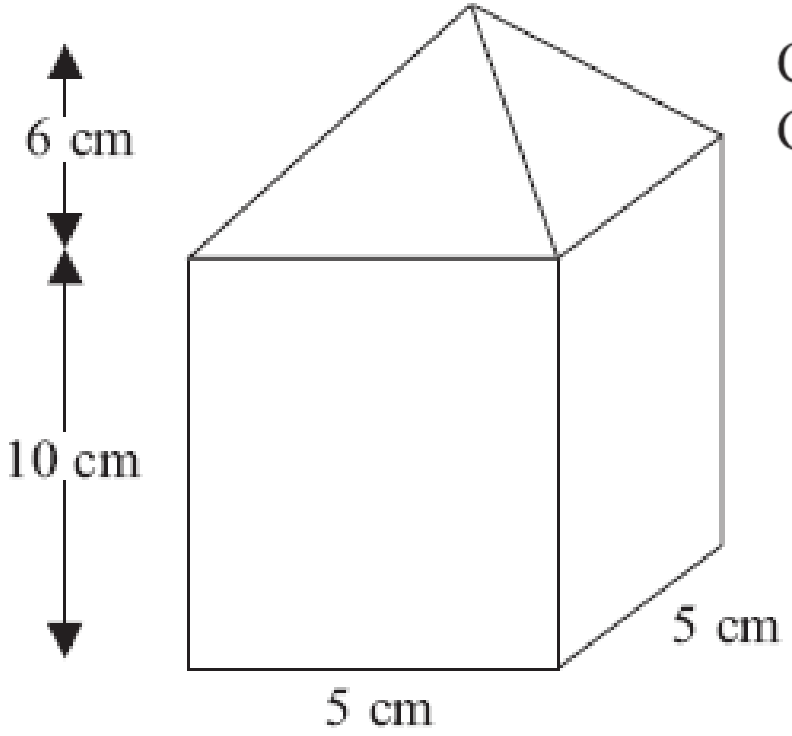
The diagram shows a model.
The model is a cuboid with a pyramid on top.
The base of the model is a square with sides of length 5 cm.
The height of the cuboid in the model is 10 cm.
The height of the pyramid in the model is 6 cm.

Calculate the volume of the model.

Question 20

The diagram shows a model.
The model is a cuboid with a pyramid on top.

The model represents a concrete post.
The model is built to a scale of 1:30
The surface area of the model is 290 cm^2.



Calculate the surface area of the post.
Give your answer in square metres.

Question 21

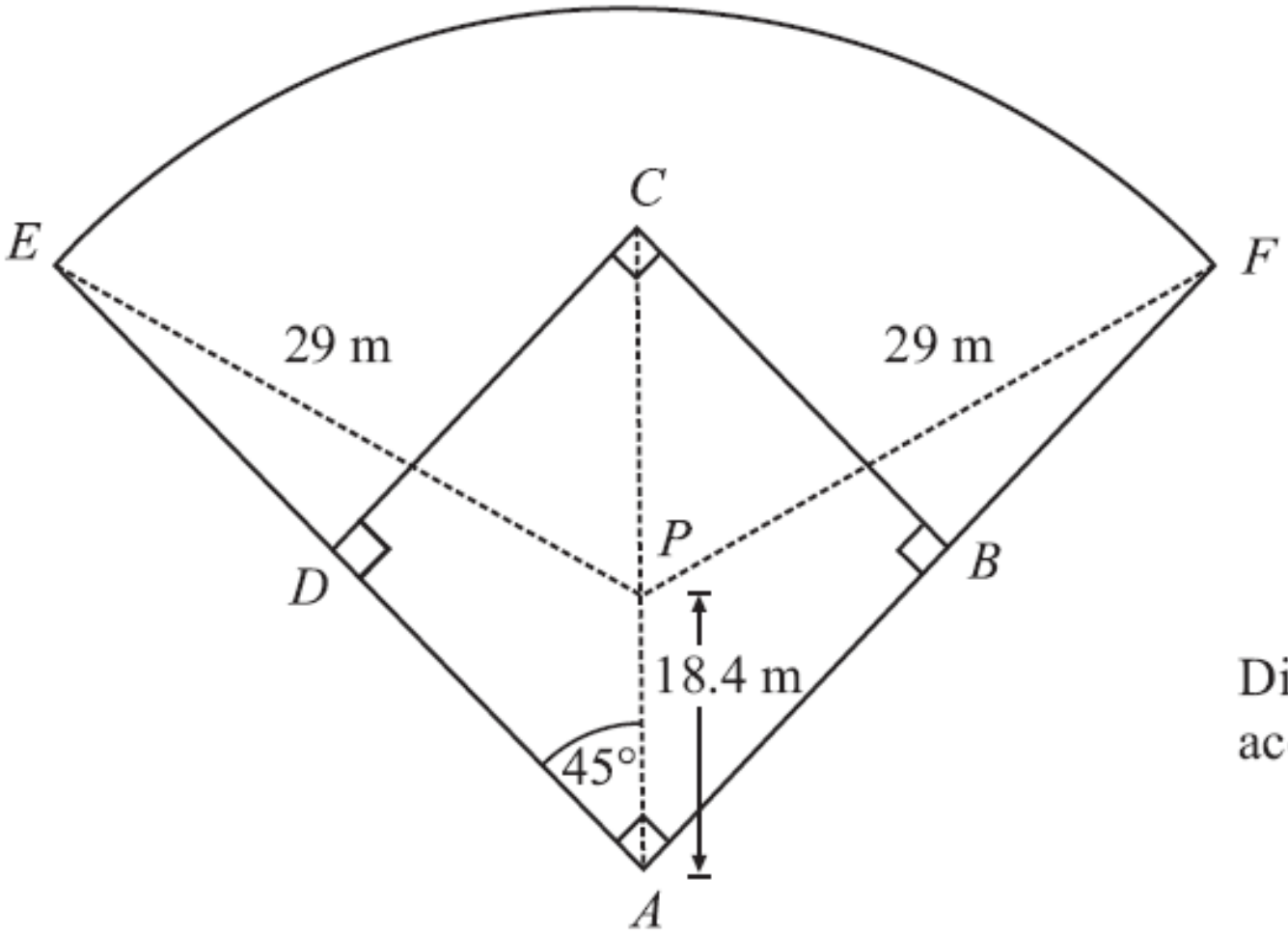


Diagram **NOT** accurately drawn

Question 21

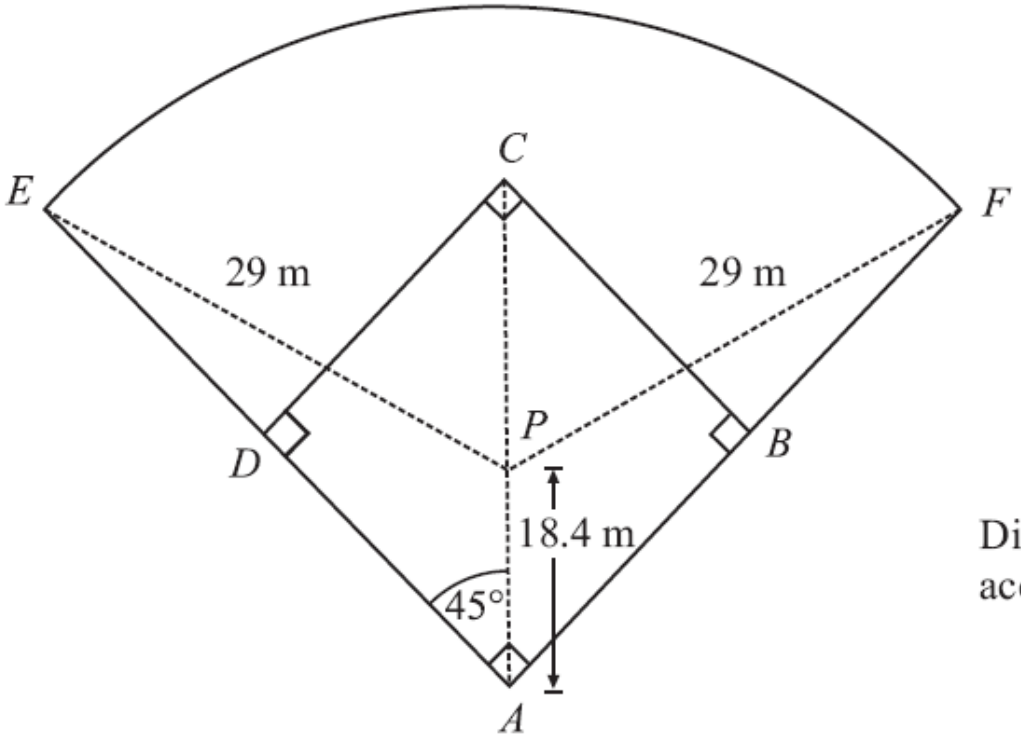


Diagram **NOT** accurately drawn

ABCD is a square.
AC is a diagonal of *ABCD*.
P is a point on *AC*.
ADE and *ABF* are straight lines.

$AP = 18.4$ m
Angle $PAE = 45°$

EF is an arc of the circle, centre *P* and radius 29 m.

By considering triangle *PAE*, calculate the size of angle *AEP*.
Give your answer correct to 3 significant figures.