1

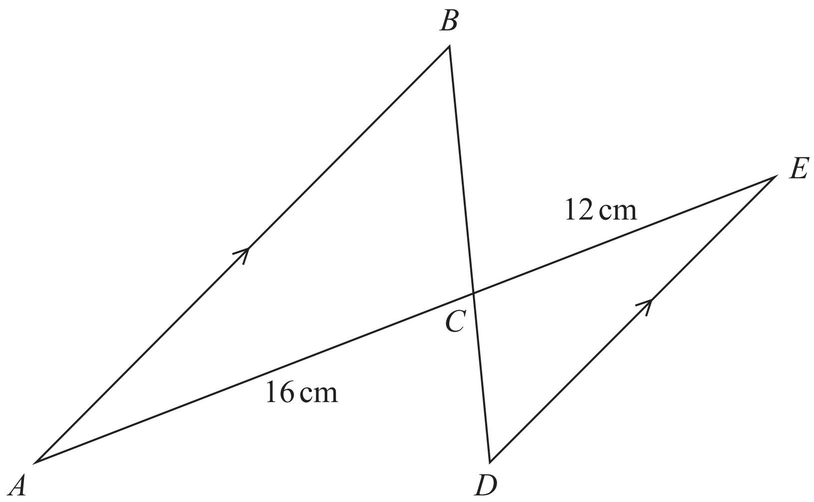


Diagram **NOT** accurately drawn

The diagram shows triangle *ABC* and triangle *EDC*.

AB is parallel to *DE*.

$AC = 16$ cm and $CE = 12$ cm.

Given that the area of triangle *ABC* is 31.5 cm^2 greater than the area of triangle *EDC*,

work out the area of triangle *EDC*.

.... cm^2

(Total for Question 1 is 4 marks)

2 Express $\left(\dfrac{3}{2x-4} - \dfrac{4}{x+2}\right) \div \dfrac{66-15x}{6x^2-4x-16}$ as a single fraction in its simplest form.

Show clear algebraic working.

....

(Total for Question 2 is 4 marks)

3 Simplify $(x-3)^2 \div \left(\frac{x^2-5x+6}{2}\right) - \left(\frac{x+2}{x^2-4}\right)$

Show your working clearly.

....

(Total for Question 3 is 5 marks)

4

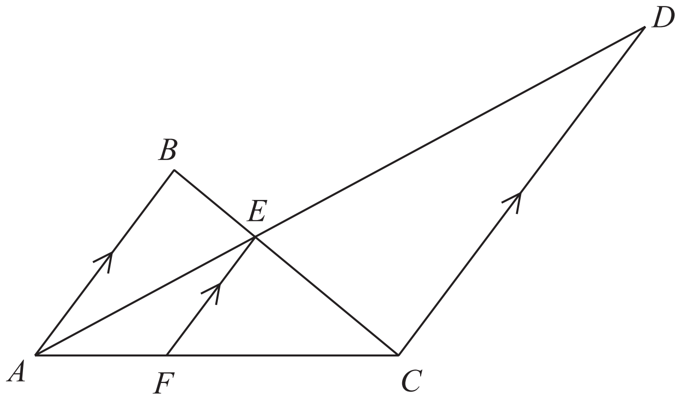


Diagram **NOT** accurately drawn

The diagram shows triangle *ABC* and triangle *ADC*.

E is the point on *BC* and *AD*.
F is the point on *AC* such that *AB*, *FE* and *CD* are parallel.

Given that $AB = 3$ cm and that $CD = 7$ cm,

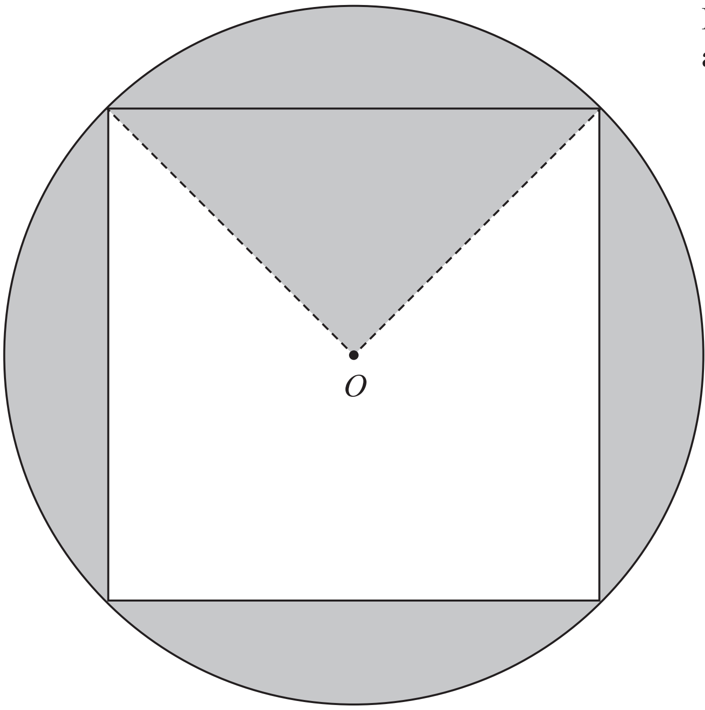
calculate the length of *FE*.

.... cm

(Total for Question 4 is 5 marks)

5

Diagram **NOT** accurately drawn



The diagram shows a circle and a square. The circle has centre O and diameter k cm and each vertex of the square lies on the circle.

The total area of the regions shown shaded in the diagram is A cm^2

(a) Show that $8A = 2\pi k^2 - 3k^2$

....

(3)

(b) Hence find an expression for k in terms of A and π.

$k =$ ....

(2)

(Total for Question 6 is 5 marks)

7 In a triangle ABC

$$AC = 6.5\,\text{cm} \qquad BC = 12\,\text{cm} \qquad \angle ABC = 30^\circ$$

Calculate, in cm^2 to 3 significant figures, the smaller of the areas of the two possible triangles ABC

.... cm^2

(Total for Question 7 is 6 marks)

8

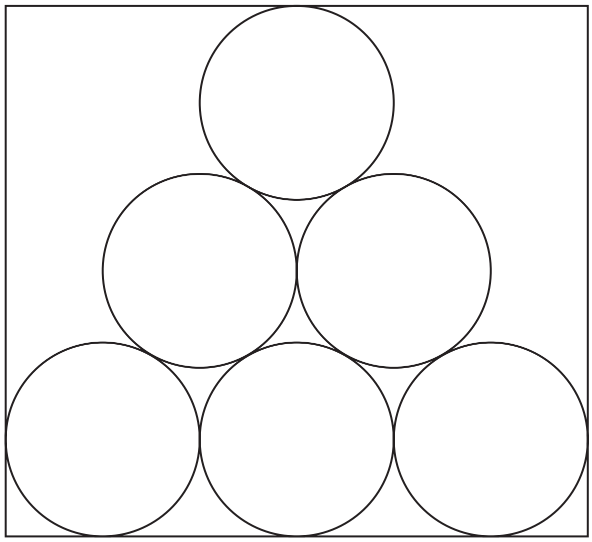


Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows six identical circles inside a rectangle.
The radius of each circle is 12 cm.

The radius of the circles is the greatest possible radius so that the circles fit inside the rectangle.

The six circles form the pattern shown in Figure 4 so that

- each circle touches at least two other circles
- the circle in the top row of the pattern and the circles in the bottom row of the pattern touch at least one side of the rectangle
- the centres of the circles all lie on the perimeter of a single triangle

Show that the total area of the six circles is almost 57.5% of the area of the rectangle.

(Total for Question 8 is 6 marks)

9 There are 25 sweets in a bag.

n of the sweets are orange.
The rest of the sweets are yellow.

Chana takes a sweet at random from the bag.
She eats the sweet.

Chana takes at random another sweet from the bag.
She eats the sweet.

The probability that Chana eats one orange sweet and one yellow sweet is $\frac{1}{3}$

(a) Write down the probability that both sweets taken by Chana are the same colour.

....
(1)

(b) Find the possible values of n
Show clear algebraic working.

(6)

(Total for Question 9 is 7 marks)

10

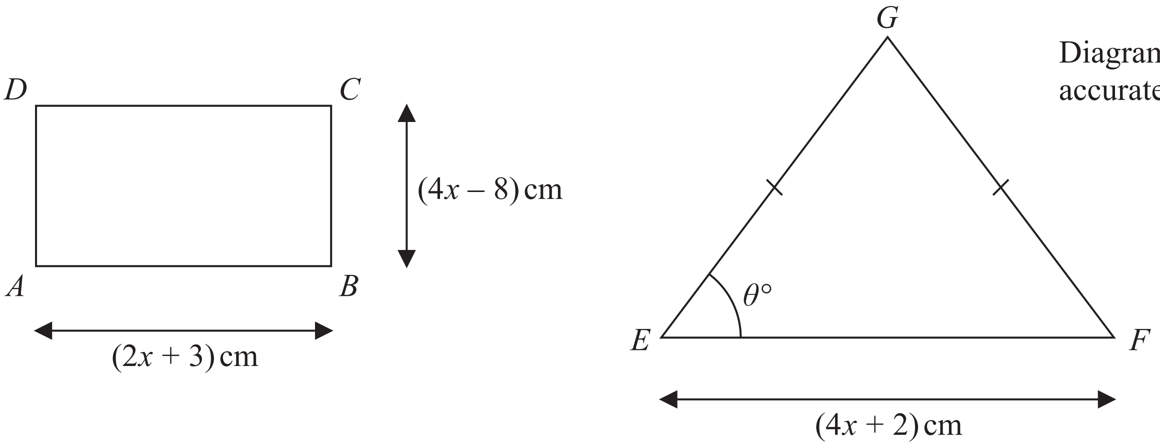


Diagram **NOT** accurately drawn

Figure 4

Figure 4 shows a rectangle $ABCD$ and an isosceles triangle EFG with $EG = FG$

$AB = (2x + 3)$ cm $\quad$ $BC = (4x - 8)$ cm $\quad$ $EF = (4x + 2)$ cm

$\angle FEG = \theta°$ where $\tan\theta° = \dfrac{1}{2}$

The perimeter of the rectangle is P cm and the area of the triangle is T cm^2

Given that $P \geqslant T$

find the range of possible values of x
Show your working clearly.

(Total for Question 10 is 8 marks)

11

Given that $\dfrac{27^{3x}}{9^{y}} = 3^{2x} \times 3^{x+1}$

find an expression for y in terms of x.
Give your answer in its simplest form.

$y =$ ....

(Total for Question 11 is 4 marks)

12

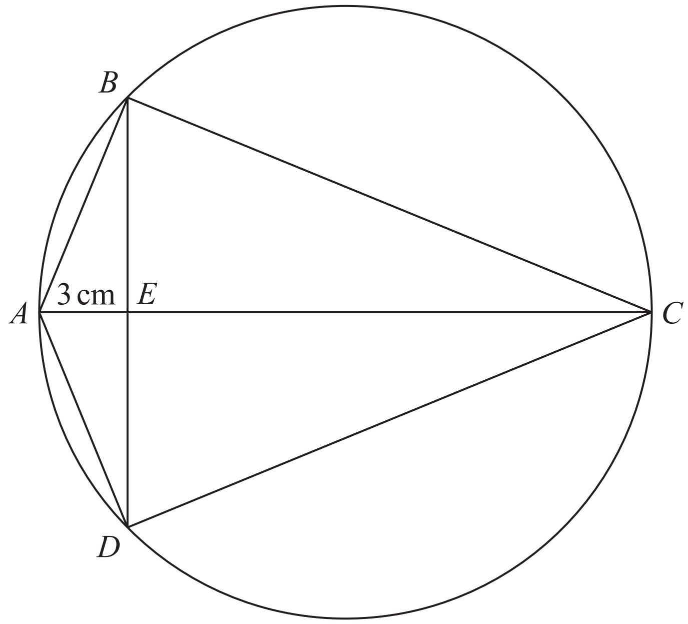


Diagram **NOT** accurately drawn

ABCD is a kite so that the points *A*, *B*, *C* and *D* lie on a circle with radius 7.5 cm.
The diagonals, *AC* and *BD*, of the kite intersect at point *E*, so that *AE* = 3 cm.
The line *AEC* is a diameter of the circle.

Find the area of the kite *ABCD*

....

(Total for Question 12 is 5 marks)

13 $(2x + 1)$, $(10x - 10)$ and $(35x - 5)$ are the first three terms of a geometric sequence.

The first term of the sequence is $(2x + 1)$ where $(2x + 1) \neq 0$

Given that x is an integer,

find the value of the common ratio.

$d = $ ....

(Total for Question 13 is 5 marks)

14

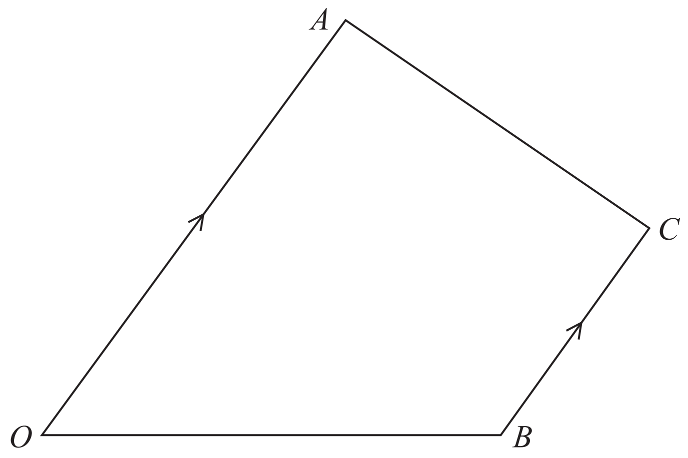


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows a trapezium $OACB$ in which OA is parallel to BC and $OA : BC = 2 : 1$

The point P lies on AC such that $AP : PC = 3 : 1$

The point D is such that $\overrightarrow{OD} = \lambda \overrightarrow{OP}$ where $\lambda > 1$ and such that BCD is a straight line.

Given that $\overrightarrow{OA} = 6\mathbf{a}$ and that $\overrightarrow{OB} = 8\mathbf{b}$

use a vector method to find and simplify an expression, in terms of $\mathbf{a}$ and $\mathbf{b}$ only, for $\overrightarrow{AD}$
Show your working clearly.

(Total for Question 14 is 6 marks)

15

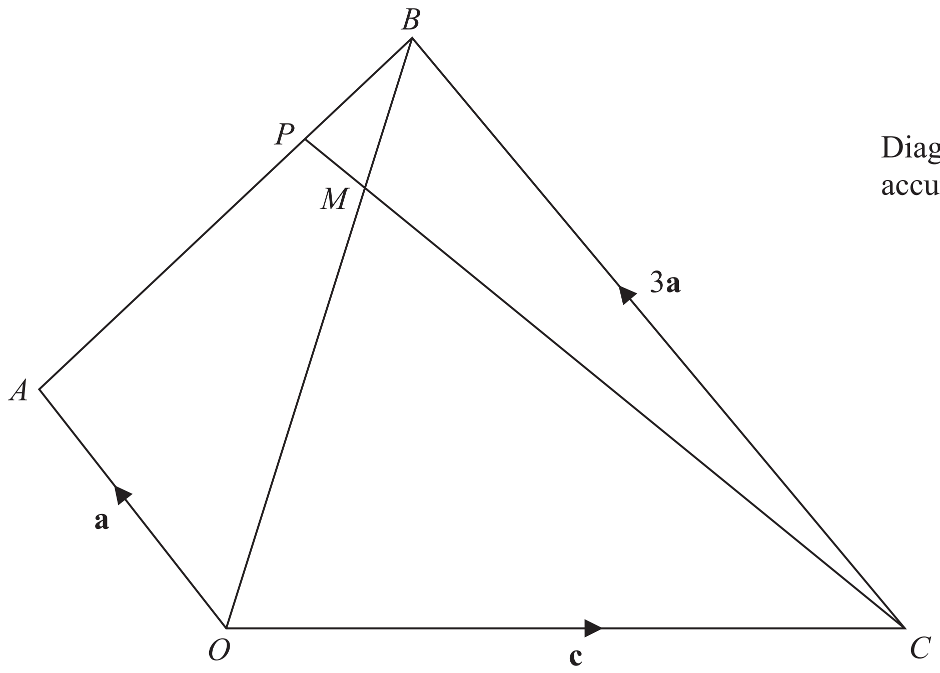


Diagram **NOT** accurately drawn

The diagram shows a quadrilateral *OABC* in which

$$\overrightarrow{OA} = \mathbf{a} \qquad \overrightarrow{OC} = \mathbf{c} \qquad \overrightarrow{CB} = 3\mathbf{a}$$

The point *M* lies on *OB* such that $OM : MB = 7 : 3$
The point *P* lies on *AB* such that *CMP* is a straight line.

(a) Find, in terms of **a** and **c**, simplifying your answer, the vector $\overrightarrow{CM}$

$\overrightarrow{CM}$ = ...

(3)

(b) Using a vector method, and showing your working clearly, find $AP:PB$ in the form $x:y$ where x and y are integers.
Show your working clearly.

$AP:PB =$ ....

(4)

(Total for Question 15 is 7 marks)

16

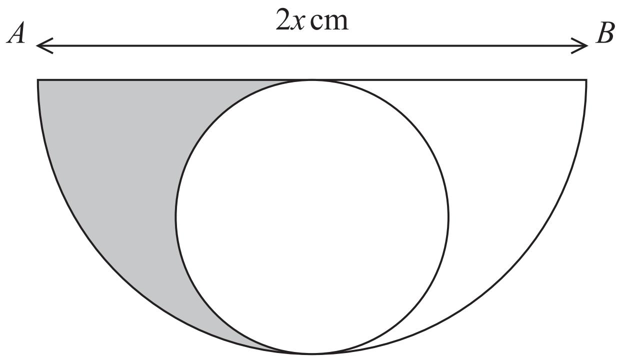


Diagram **NOT** accurately drawn

The diagram shows a semicircle, with diameter AB, where $AB = 2x$ cm.

The diagram also shows a circle, which is the circle with the greatest possible radius that can be drawn inside the semicircle.

The perimeter of the shaded region is P cm and the area of the shaded region is A cm^2.

Given that $P = A$, find an expression for x in terms of π.

$x =$ ....

(Total for Question 16 is 6 marks)

17

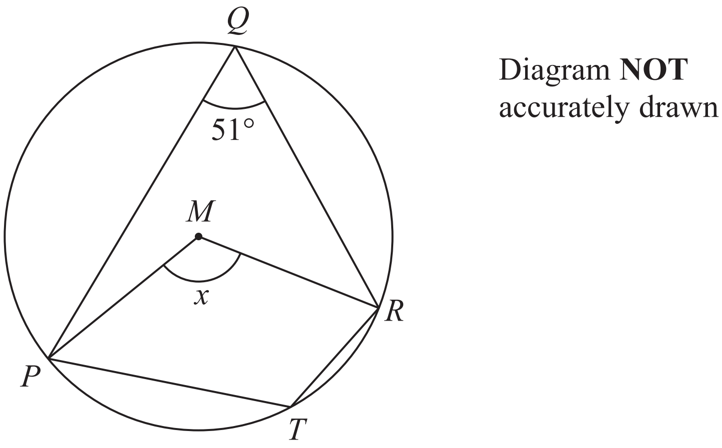


Figure 2

In Figure 2, P, Q, R and T are points on a circle with centre M such that $\angle PQR = 51°$

(a) Find the size, in degrees, of the angle marked x in Figure 2

(1)

(b) Find the size, in degrees, of the obtuse angle PTR.

(1)

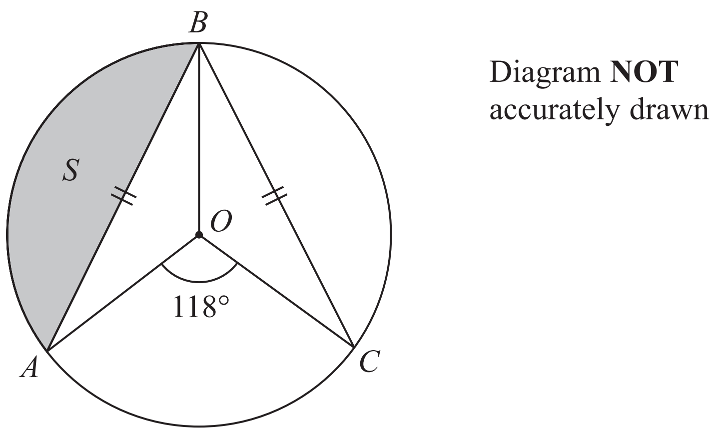


Figure 3

In Figure 3, A, B and C are points on a circle with centre O such that $\angle AOC = 118°$ and $BA = BC$.

The area of the region S, shown shaded in Figure 3, is $70\,\text{cm}^2$

(c) Calculate the total area, in cm^2 to 3 significant figures, of the unshaded region inside the circle.

(5)

(Total for Question 17 is 7 marks)

18

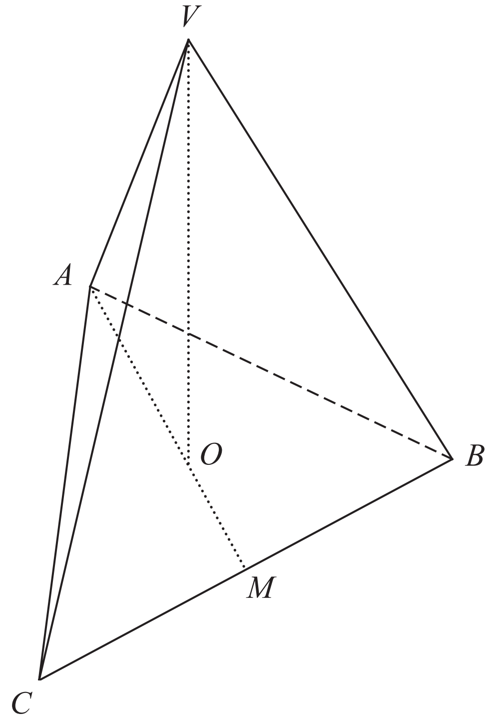


Diagram **NOT** accurately drawn

The diagram shows a solid pyramid with a triangular base ABC, which is an equilateral triangle of side $8\sqrt{3}$ cm.

The base of the pyramid is on a horizontal surface and the vertex V of the pyramid is vertically above the point O of the base.

The edges AV, BV and CV of the pyramid are the same length and O lies on AM, where M is the midpoint of CB and $AO : OM = 2 : 1$

Given that the total surface area of the pyramid is $150\sqrt{3}$ cm^2,

find the length, in cm, of VO.

.... cm

(Total for Question 18 is 7 marks)

19 The function f is defined as

$$\mathrm{f}: x \mapsto \frac{3x+1}{x-1}$$

(a) Find f(3)

(2)

(b) State the value of x that must be excluded from any domain of the function f

(1)

(c) Find the inverse of the function f
Give your answer in its simplest form.

(4)

The function g is such that

$$\mathrm{fg}(x) = \frac{x-1}{3x+1}$$

(d) Find the value of a such that $\mathrm{gf}(a) = \mathrm{fg}(a)$

(7)

(Total for Question 19 is 14 marks)

20 There are 12 marbles in bag *A* and 15 marbles in bag *B*.

In bag *A*, there are 7 yellow marbles and 5 red marbles.
In bag *B*, there are 10 yellow marbles and 5 red marbles.

Eugene takes at random **one** marble from bag *A* and without looking at the marble puts the marble into bag *B*.

Eugene then takes at random **one** marble from bag *A* and takes at random **two** marbles from bag *B*. He places the **three** marbles on a table.

Calculate the probability that the **three** marbles on the table all have the same colour.

(Total for Question 20 is 7 marks)

21

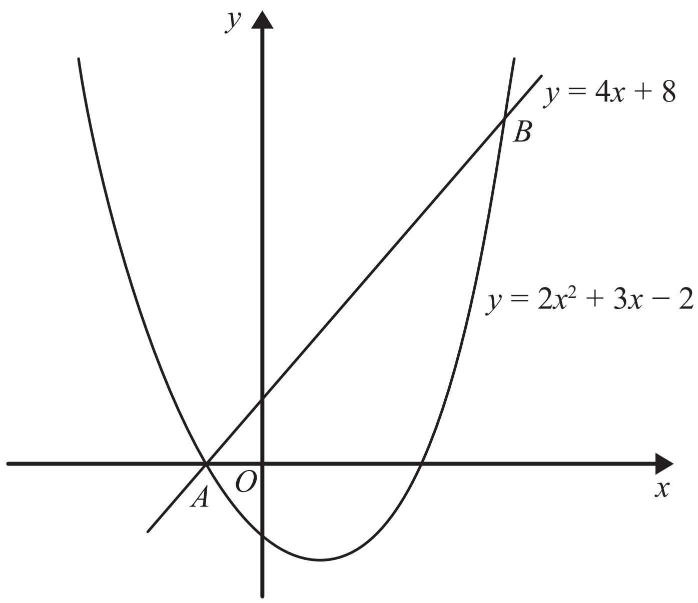


Diagram **NOT** accurately drawn

The diagram shows a sketch of part of the curve with equation $y = 2x^2 + 3x - 2$ and part of the straight line with equation $y = 4x + 8$

The points of intersection of the line with the curve are A and B.

(a) Find the length of AB, giving your answer in the form $k\sqrt{17}$, where k is a rational number to be determined.
Show your working clearly.

....
(6)

The point C has coordinates $(-5, 0)$

(b) Calculate the size, to the nearest degree, of $\angle CAB$.

.... °
(2)

(Total for Question 21 is 8 marks)

22

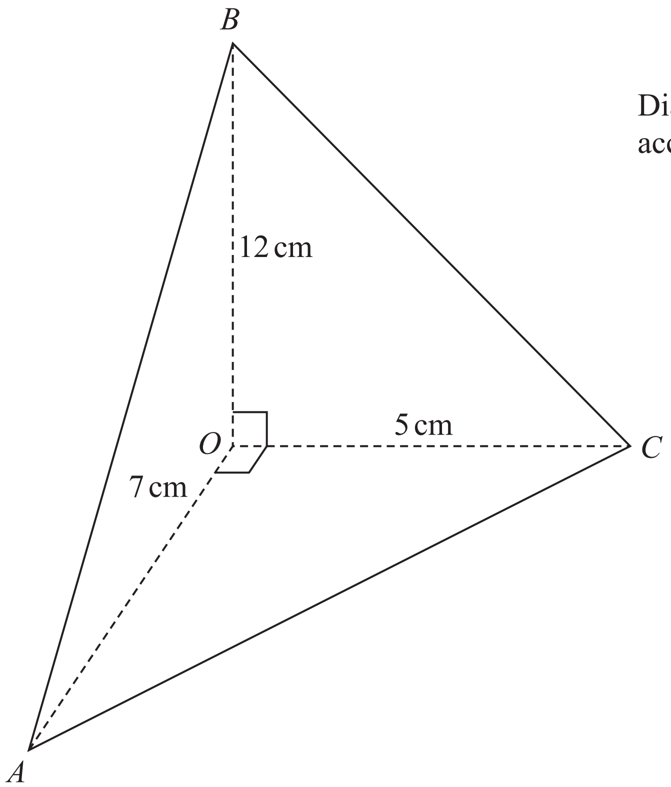


Diagram **NOT** accurately drawn

The diagram shows a pyramid with triangular base *OAC*. The edges *OA*, *OB* and *OC* of the pyramid are perpendicular to each other.

$OA = 7\,\text{cm}$ $OB = 12\,\text{cm}$ $OC = 5\,\text{cm}$

(a) Calculate the volume, in cm^3, of the pyramid.

cm^3

(2)

(b) Calculate the area, in cm^2 to 3 significant figures, of triangle *ABC*.

cm^2

(6)

(Total for Question 22 is 8 marks)

23

Diagram **NOT** accurately drawn

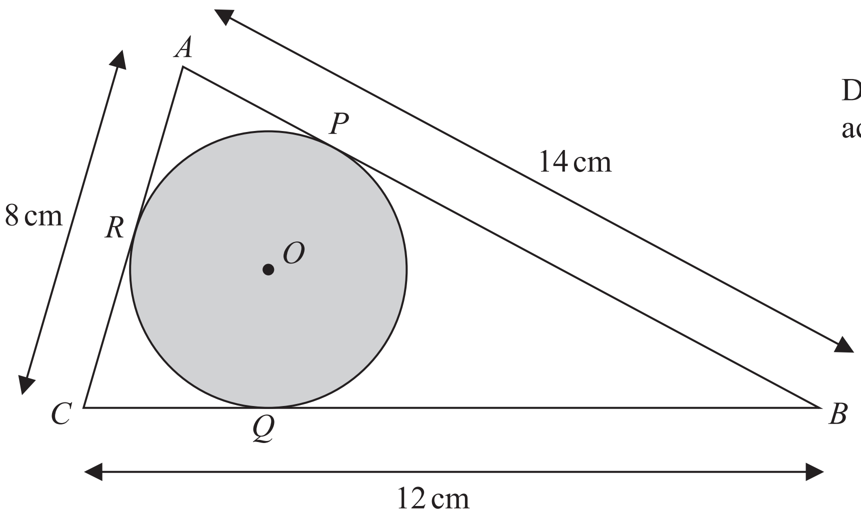


Figure 6

Figure 6 shows a triangle *ABC* and a circle *PQR*, centre *O*. The triangle is such that side *AB* is the tangent to the circle at *P*, side *BC* is the tangent to the circle at *Q* and side *AC* is the tangent to the circle at *R*. The region inside the circle is shaded, as shown in Figure 6.

$AB = 14$ cm, $BC = 12$ cm and $AC = 8$ cm.

Let $BP = x$ cm and by considering the lengths of the tangents to the circle,

(a) obtain an equation in x only and solve it to find the length, in cm, of *BP*.

(4)

(b) Find, to 3 significant figures, the area of the circle as a percentage of the total area of triangle *ABC*.

(7)

(Total for Question 23 is 11 marks)