

# A / A\* questions

## 2014



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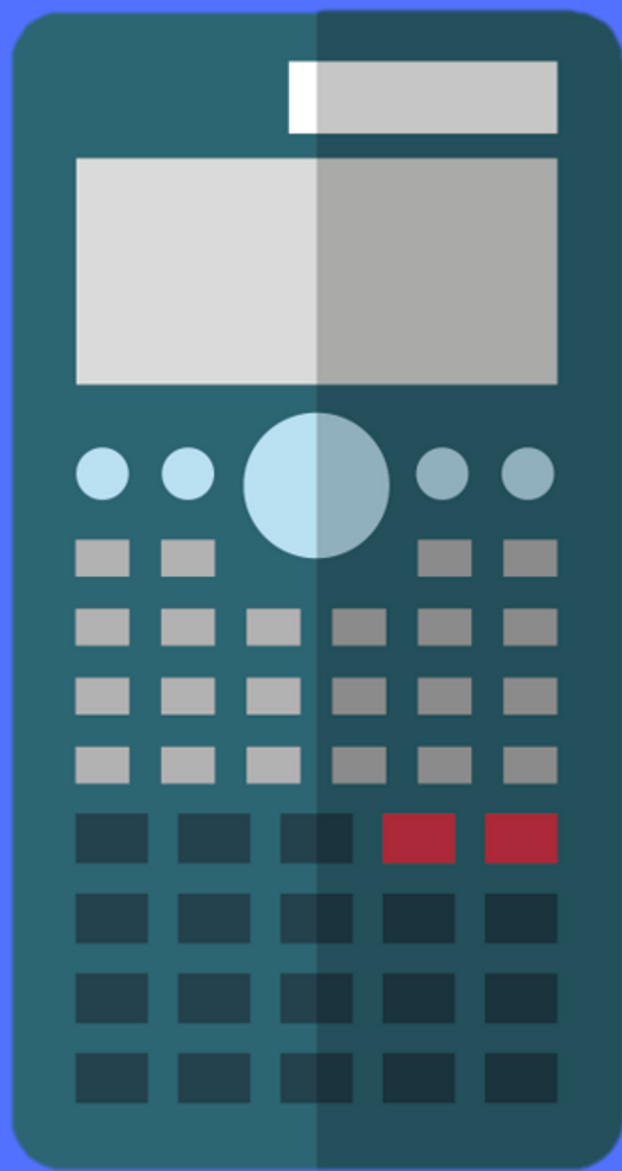
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12  $p = 4 \times 10^5$   $q = 5 \times 10^4$

Find, giving your answer in standard form,

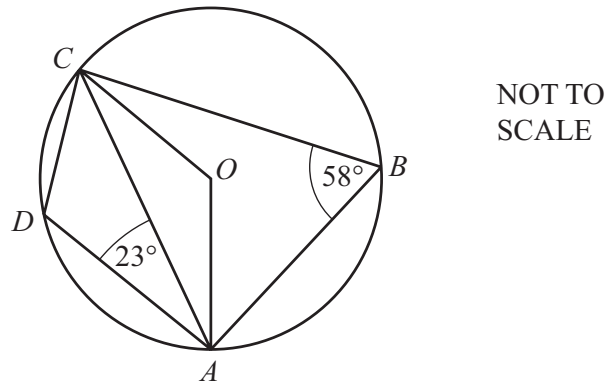
(a)  $pq$ ,

Answer(a) ..... [2]

(b)  $\frac{q}{p}$ .

Answer(b) ..... [2]

13



$A, B, C$  and  $D$  lie on a circle centre  $O$ .  
Angle  $ABC = 58^\circ$  and angle  $CAD = 23^\circ$ .

Calculate

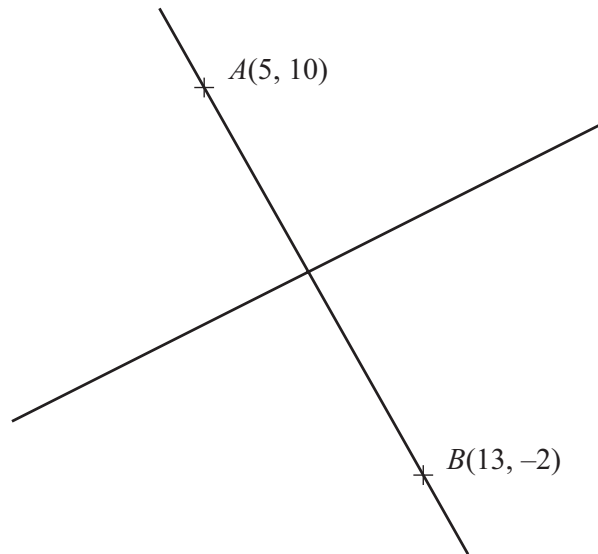
(a) angle  $OCA$ ,

Answer(a) Angle  $OCA =$  ..... [2]

(b) angle  $DCA$ .

Answer(b) Angle  $DCA =$  ..... [2]

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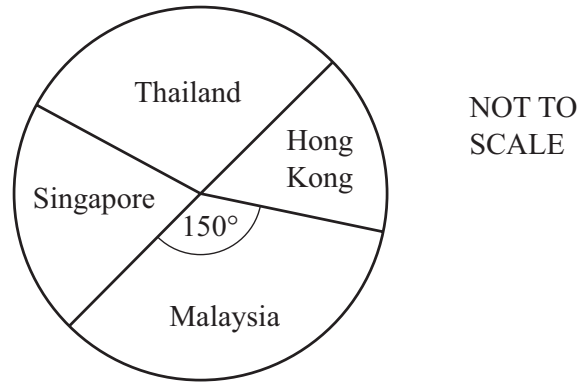
NOT TO  
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$A(5, 10)$  and  $B(13, -2)$  are two points on the line  $AB$ .  
The perpendicular bisector of the line  $AB$  has gradient  $\frac{2}{3}$ .

Find the equation of the perpendicular bisector of  $AB$ .

*Answer* ..... [4]

---



A travel brochure has 72 holidays in four different countries. The pie chart shows this information.

- (a) There are 24 holidays in Thailand.

Show that the sector angle for Thailand is  $120^\circ$ .

*Answer(a)*

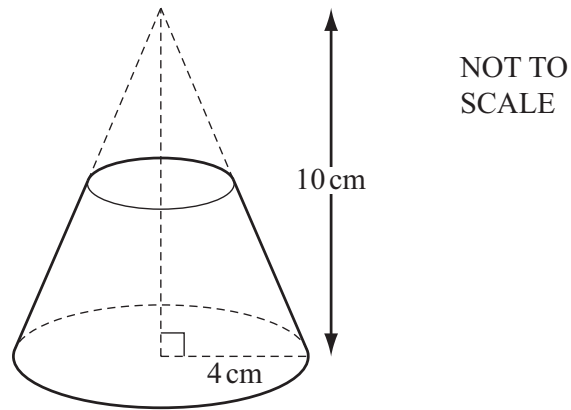
[2]

- (b) The sector angle for Malaysia is  $150^\circ$ .  
The sector angle for Singapore is twice the sector angle for Hong Kong.

Calculate the number of holidays in Hong Kong.

*Answer(b)* ..... [3]

18



A **solid** cone has base radius 4 cm and height 10 cm.

A mathematically similar cone is removed from the top as shown in the diagram.

The volume of the cone that is removed is  $\frac{1}{8}$  of the volume of the original cone.

- (a) Explain why the cone that is removed has radius 2 cm and height 5 cm.

*Answer(a)*

[2]

- (b) Calculate the volume of the remaining solid.

[The volume,  $V$ , of a cone with radius  $r$  and height  $h$  is  $V = \frac{1}{3}\pi r^2 h$ .]

*Answer(b)* .....  $\text{cm}^3$  [4]

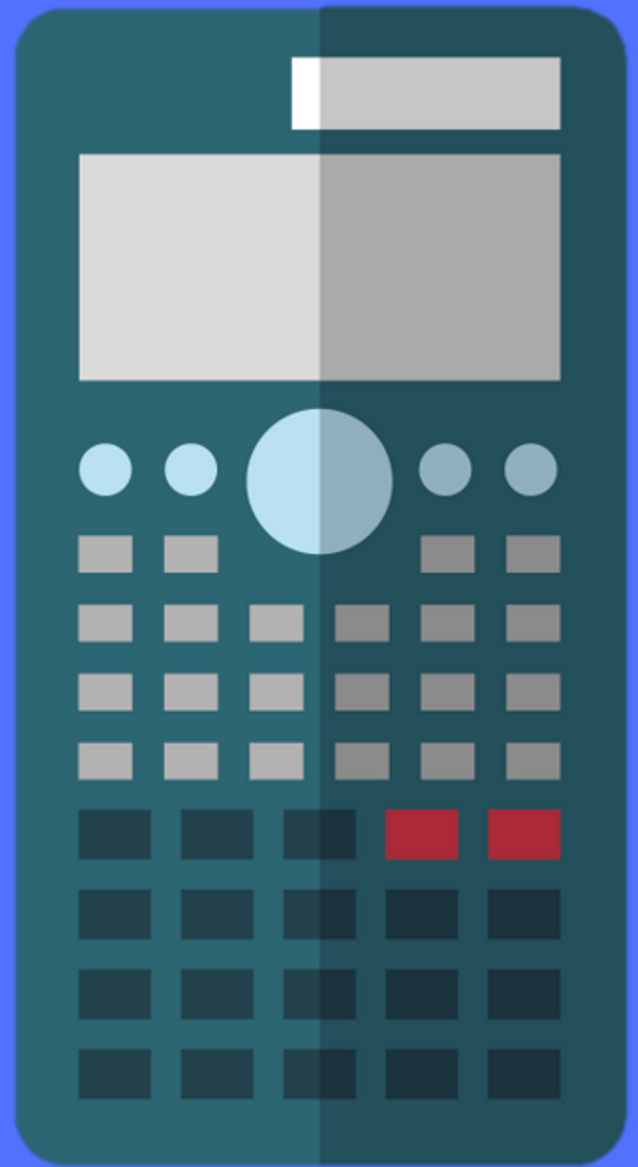
**Question 19 is printed on the next page.**

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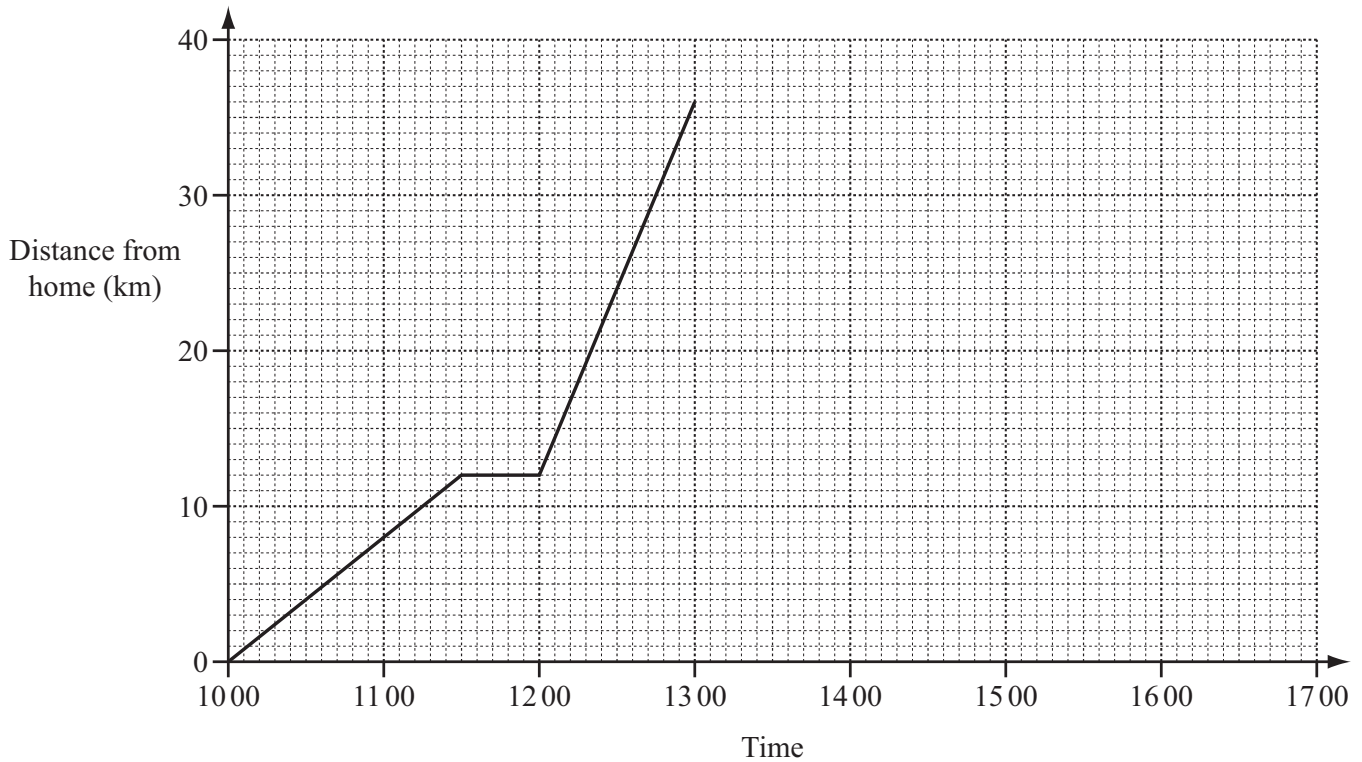
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- 2 Ali leaves home at 1000 to cycle to his grandmother’s house. He arrives at 1300. The distance-time graph represents his journey.



- (a) Calculate Ali’s speed between 1000 and 1130. Give your answer in kilometres per hour.

Answer(a) ..... km/h [2]

- (b) Show that Ali’s average speed for the whole journey to his grandmother’s house is 12 km/h.

Answer(b)

[2]

- (c) Change 12 kilometres per hour into metres per minute.

Answer(c) ..... m/min [2]

- (d) Ali stays for 45 minutes at his grandmother’s house and then returns home. He arrives home at 1642.

Complete the distance-time graph.

[2]



- 3 (a) The running costs for a papermill are \$75 246.  
This amount is divided in the ratio labour costs : materials = 5 : 1.

Calculate the labour costs.

Answer(a) \$ ..... [2]

- (b) In 2012 the company made a profit of \$135 890.  
In 2013 the profit was \$150 675.

Calculate the percentage increase in the profit from 2012 to 2013.

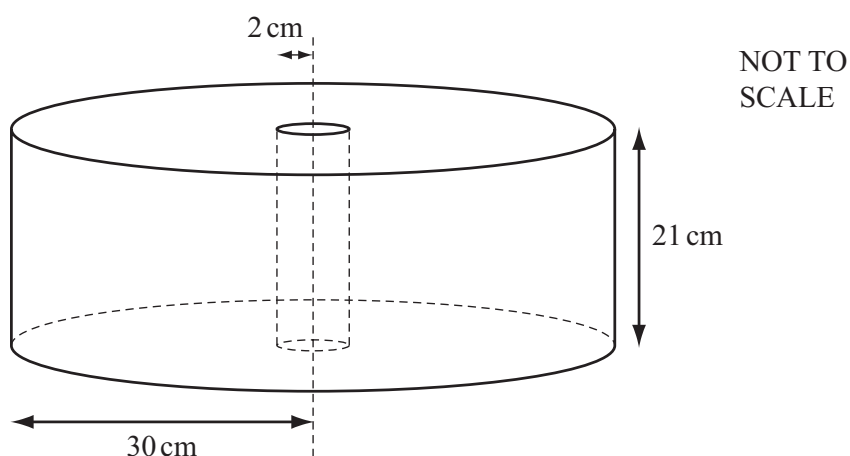
Answer(b) ..... % [3]

- (c) The profit of \$135 890 in 2012 was an increase of 7% on the profit in 2011.

Calculate the profit in 2011.

Answer(c) \$ ..... [3]

- (d)



Paper is sold in cylindrical rolls.

There is a wooden cylinder of radius 2 cm and height 21 cm in the centre of each roll.

The outer radius of a roll of paper is 30 cm.

- (i) Calculate the volume of paper in a roll.

Answer(d)(i) .....  $\text{cm}^3$  [3]

(ii) The paper is cut into sheets which measure 21 cm by 29.7 cm.  
The thickness of each sheet is 0.125 mm.

(a) Change 0.125 millimetres into centimetres.

*Answer(d)(ii)(a)* ..... cm [1]

(b) Work out how many whole sheets of paper can be cut from a roll.

*Answer(d)(ii)(b)* ..... [4]

---

- 6 (a) A square spinner is biased.  
The probabilities of obtaining the scores 1, 2, 3 and 4 when it is spun are given in the table.

Score	1	2	3	4
Probability	0.1	0.2	0.4	0.3

- (i) Work out the probability that on one spin the score is 2 or 3.

*Answer(a)(i)* ..... [2]

- (ii) In 5000 spins, how many times would you expect to score 4 with this spinner?

*Answer(a)(ii)* ..... [1]

- (iii) Work out the probability of scoring 1 on the first spin and 4 on the second spin.

*Answer(a)(iii)* ..... [2]

- (b) In a bag there are 7 red discs and 5 blue discs.  
From the bag a disc is chosen at random and not replaced.  
A second disc is then chosen at random.

Work out the probability that at least one of the discs is red.  
Give your answer as a fraction.

*Answer(b)* ..... [3]

11 (a)  $\vec{PQ} = \begin{pmatrix} -3 \\ 4 \end{pmatrix}$

- (i)  $P$  is the point  $(-2, 3)$ .

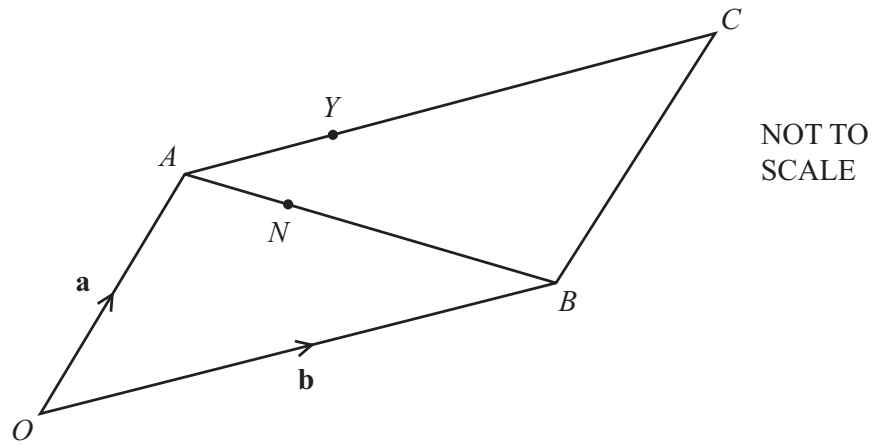
Work out the co-ordinates of  $Q$ .

*Answer(a)(i)* (....., .....) [1]

- (ii) Work out  $|\vec{PQ}|$ , the magnitude of  $\vec{PQ}$ .

*Answer(a)(ii)* ..... [2]

(b)



$OACB$  is a parallelogram.

$\vec{OA} = \mathbf{a}$  and  $\vec{OB} = \mathbf{b}$ .

$AN:NB = 2:3$  and  $AY = \frac{2}{5}AC$ .

(i) Write each of the following in terms of  $\mathbf{a}$  and/or  $\mathbf{b}$ .  
Give your answers in their simplest form.

(a)  $\vec{ON}$

Answer(b)(i)(a)  $\vec{ON} = \dots\dots\dots$  [2]

(b)  $\vec{NY}$

Answer(b)(i)(b)  $\vec{NY} = \dots\dots\dots$  [2]

(ii) Write down two conclusions you can make about the line segments  $NY$  and  $BC$ .

Answer(b)(ii)  $\dots\dots\dots$

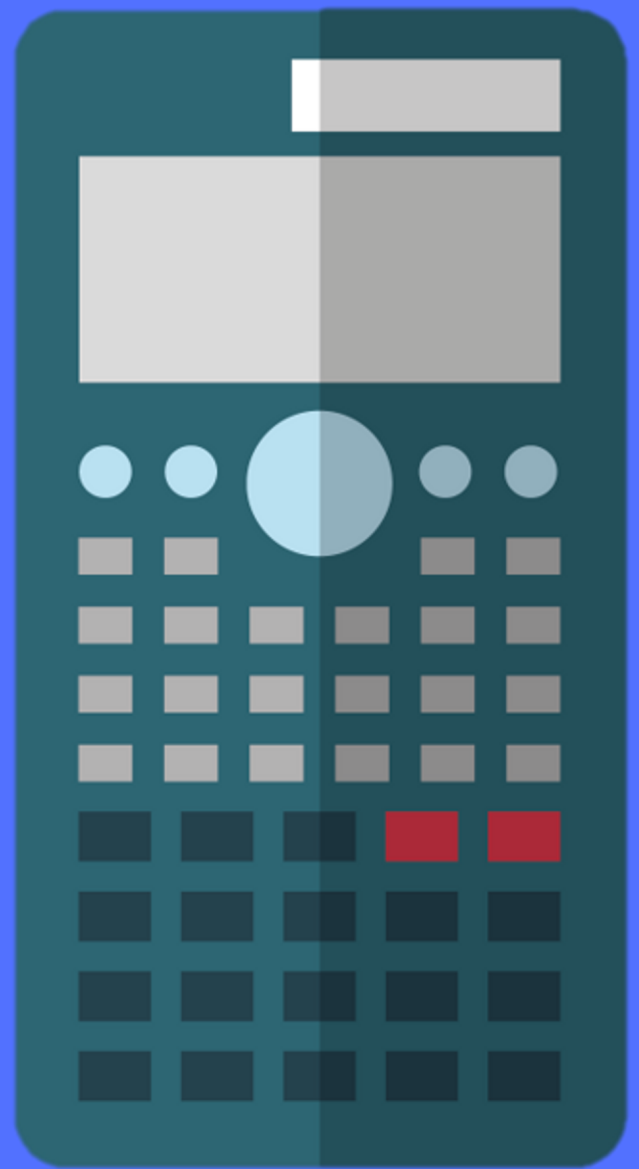
$\dots\dots\dots$  [2]

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- 6 The mass of  $1 \text{ cm}^3$  of copper is 8.5 grams, correct to 1 decimal place.

Complete the statement about the total mass,  $T$  grams, of  $12 \text{ cm}^3$  of copper.

*Answer* .....  $\leq T <$  ..... [2]

---

- 7 Write the following in order, smallest first.

$$\sqrt{0.1} \quad \frac{43}{201} \quad 2\frac{1}{2}\% \quad 0.2$$

*Answer* .....  $<$  .....  $<$  .....  $<$  ..... [2]

---

- 8 Without using your calculator, work out  $\frac{5}{6} - \left(\frac{1}{2} \times 1\frac{1}{2}\right)$ .

Write down all the steps of your working.

*Answer* ..... [3]

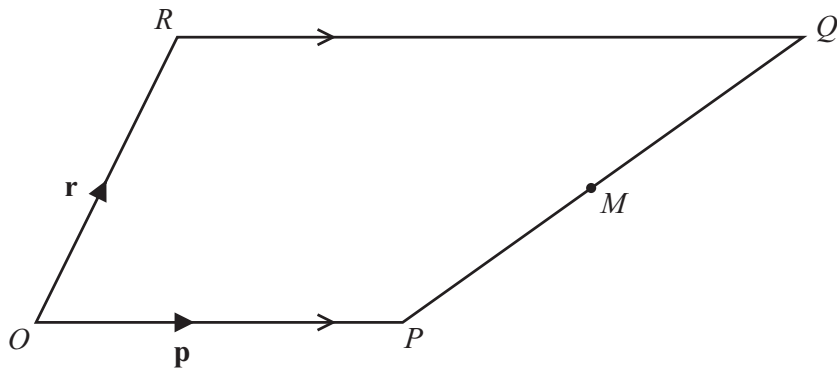
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- 13  $w$  varies inversely as the square root of  $x$ .  
When  $x = 4$ ,  $w = 4$ .

Find  $w$  when  $x = 25$ .

Answer  $w = \dots\dots\dots$  [3]

14



NOT TO SCALE

$OPQR$  is a trapezium with  $RQ$  parallel to  $OP$  and  $RQ = 2OP$ .  
 $O$  is the origin,  $\vec{OP} = \mathbf{p}$  and  $\vec{OR} = \mathbf{r}$ .  
 $M$  is the midpoint of  $PQ$ .

Find, in terms of  $\mathbf{p}$  and  $\mathbf{r}$ , in its simplest form

- (a)  $\vec{PQ}$ ,

Answer(a)  $\vec{PQ} = \dots\dots\dots$  [1]

- (b)  $\vec{OM}$ , the position vector of  $M$ .

Answer(b)  $\vec{OM} = \dots\dots\dots$  [2]



17 (a) Simplify  $(3125t^{125})^{\frac{1}{5}}$ .

Answer(a) ..... [2]

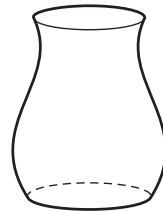
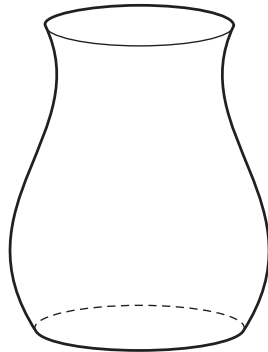
(b) Find the value of  $p$  when  $3^p = \frac{1}{9}$ .

Answer(b)  $p =$  ..... [1]

(c) Find the value of  $w$  when  $x^{72} \div x^w = x^8$ .

Answer(c)  $w =$  ..... [1]

18



NOT TO  
SCALE

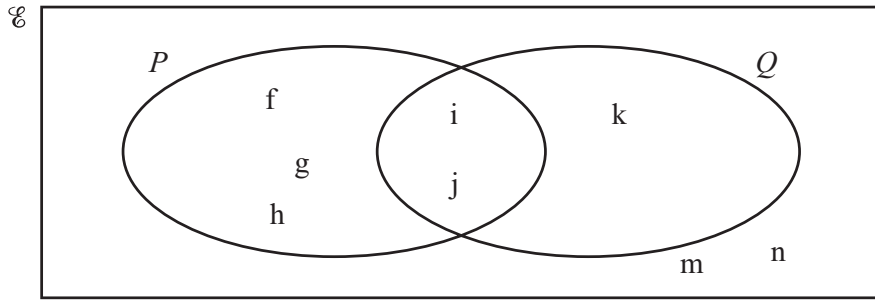
The two containers are mathematically similar in shape.

The larger container has a volume of  $3456 \text{ cm}^3$  and a surface area of  $1024 \text{ cm}^2$ .

The smaller container has a volume of  $1458 \text{ cm}^3$ .

Calculate the surface area of the smaller container.

Answer .....  $\text{cm}^2$  [4]



(a) Use the information in the Venn diagram to complete the following.

(i)  $P \cap Q = \{ \dots \}$  [1]

(ii)  $P' \cup Q = \{ \dots \}$  [1]

(iii)  $n(P \cup Q)' = \dots$  [1]

(b) A letter is chosen at random from the set  $Q$ .

Find the probability that it is also in the set  $P$ .

Answer(b) ..... [1]

(c) On the Venn diagram shade the region  $P' \cap Q$ . [1]

(d) Use a set notation symbol to complete the statement.

$\{f, g, h\}$  .....  $P$  [1]

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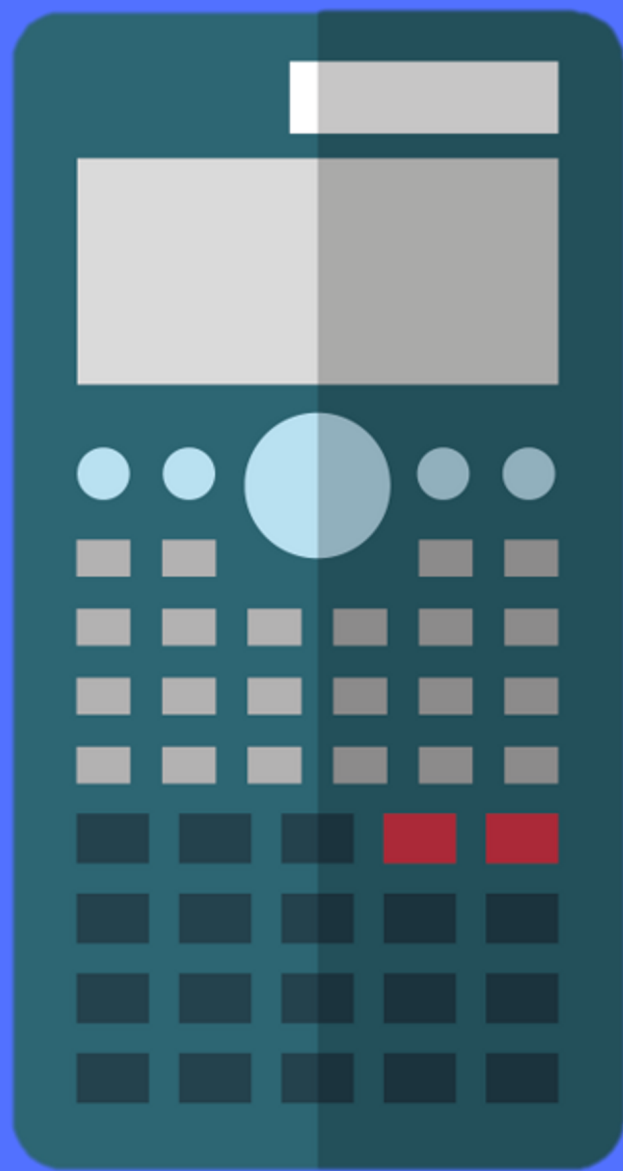
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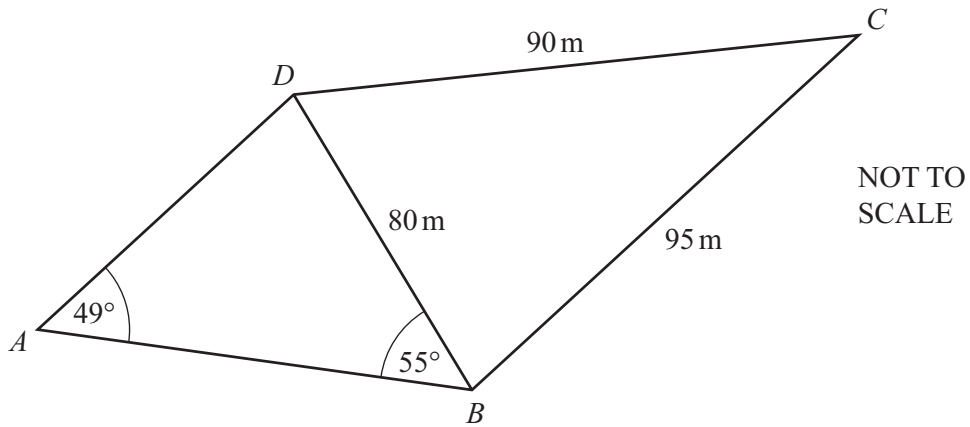
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3



The diagram shows a quadrilateral  $ABCD$ .  
 Angle  $BAD = 49^\circ$  and angle  $ABD = 55^\circ$ .  
 $BD = 80$  m,  $BC = 95$  m and  $CD = 90$  m.

(a) Use the sine rule to calculate the length of  $AD$ .

Answer(a)  $AD = \dots\dots\dots$  m [3]

(b) Use the cosine rule to calculate angle  $BCD$ .

Answer(b) Angle  $BCD = \dots\dots\dots$  [4]

(c) Calculate the area of the quadrilateral  $ABCD$ .

*Answer(c)* .....  $\text{m}^2$  [3]

(d) The quadrilateral represents a field.

Corn seeds are sown across the whole field at a cost of \$3250 per hectare.

Calculate the cost of the corn seeds used.

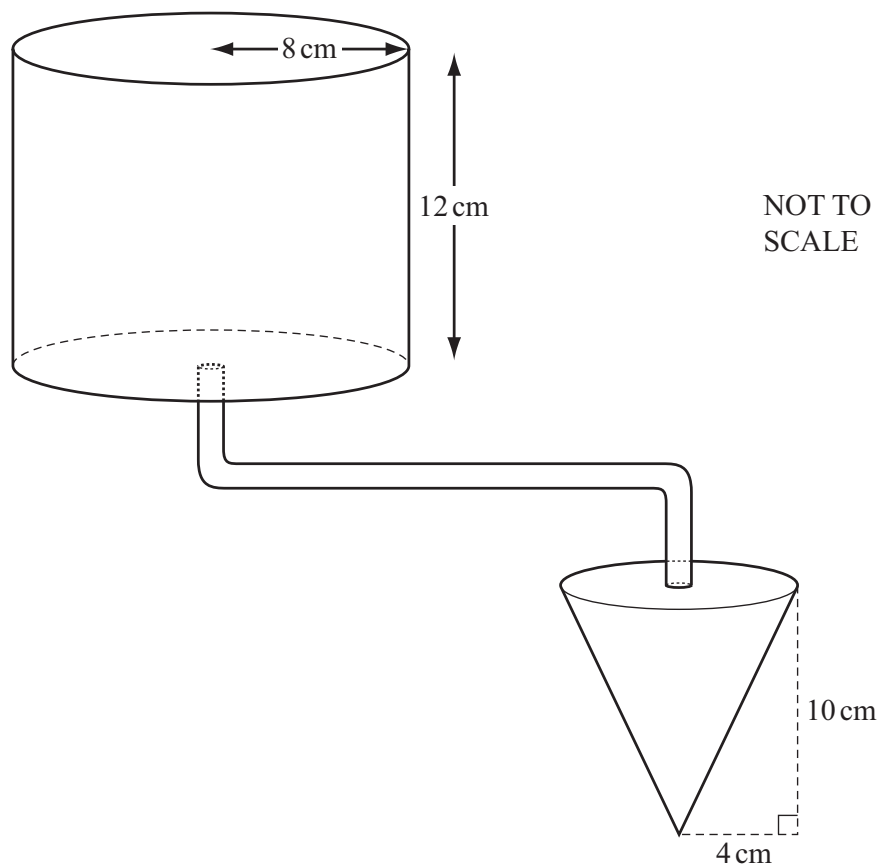
1 hectare =  $10\,000\text{m}^2$

*Answer(d)* \$ ..... [3]

---

5

8



The diagram shows a cylinder with radius 8 cm and height 12 cm which is full of water. A pipe connects the cylinder to a cone. The cone has radius 4 cm and height 10 cm.

- (a) (i) Calculate the volume of water in the cylinder.  
Show that it rounds to  $2410 \text{ cm}^3$  correct to 3 significant figures.

*Answer(a)(i)*

[2]

- (ii) Change  $2410 \text{ cm}^3$  into litres.

*Answer(a)(ii)* ..... litres [1]

- (b) Water flows from the cylinder along the pipe into the cone at a rate of  $2 \text{ cm}^3$  per second.

Calculate the time taken to fill the empty cone.

Give your answer in minutes and seconds correct to the nearest second.

[The volume,  $V$ , of a cone with radius  $r$  and height  $h$  is  $V = \frac{1}{3}\pi r^2 h$ .]

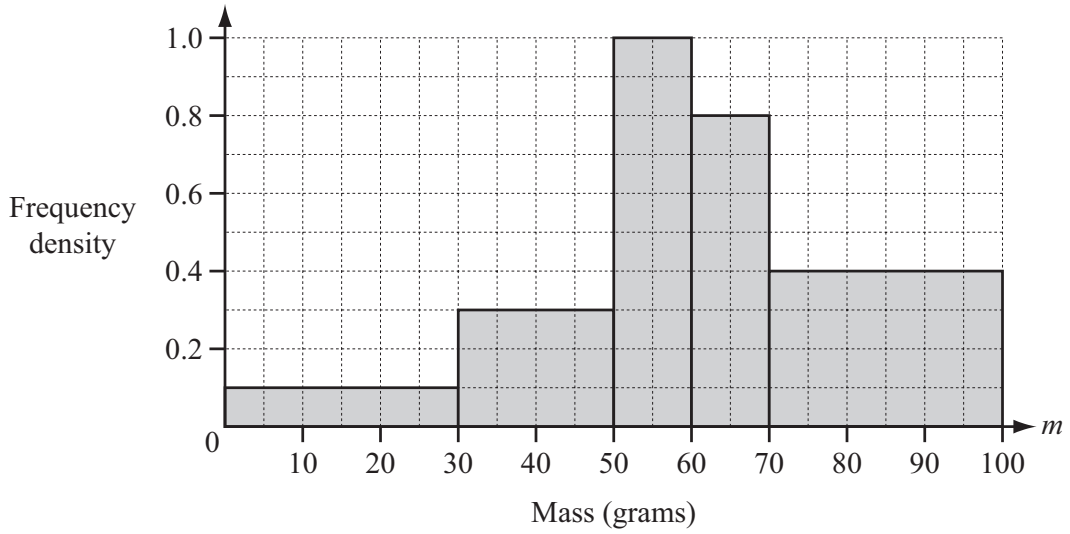
*Answer(b)* ..... min ..... s [4]

- (c) Find the number of empty cones which can be filled completely from the full cylinder.

*Answer(c)* ..... [3]

---

7 (a)



The histogram shows some information about the masses ( $m$  grams) of 39 apples.

(i) Show that there are 12 apples in the interval  $70 < m \leq 100$ .

*Answer(a)(i)*

[1]

(ii) Calculate an estimate of the mean mass of the 39 apples.

*Answer(a)(ii)* ..... g [5]

(b) The mean mass of 20 oranges is 70 g.  
 One orange is eaten.  
 The mean mass of the remaining oranges is 70.5 g.

Find the mass of the orange that was eaten.

*Answer(b)* ..... g [3]



8 The distance a train travels on a journey is 600 km.

(a) Write down an expression, in terms of  $x$ , for the average speed of the train when

(i) the journey takes  $x$  hours,

*Answer(a)(i)* ..... km/h [1]

(ii) the journey takes  $(x + 1)$  hours.

*Answer(a)(ii)* ..... km/h [1]

(b) The difference between the average speeds in **part(a)(i)** and **part(a)(ii)** is 20 km/h.

(i) Show that  $x^2 + x - 30 = 0$ .

*Answer(b)(i)*

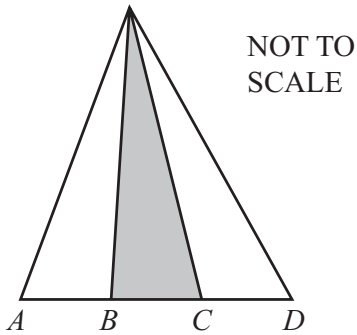
[3]

(ii) Find the average speed of the train for the journey in **part(a)(ii)**.  
Show all your working.

*Answer(b)(ii)* ..... km/h [4]

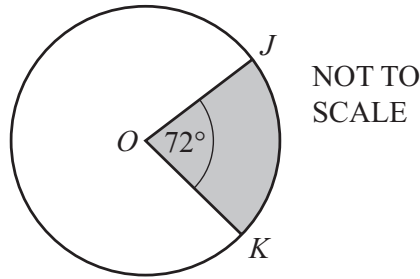
- 11 The total area of each of the following shapes is  $X$ .  
The area of the shaded part of each shape is  $kX$ .

For each shape, find the value of  $k$  and write your answer below each diagram.



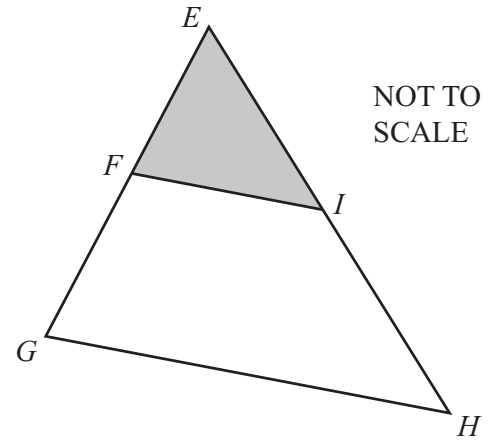
$AB = BC = CD$

$k = \dots\dots\dots$



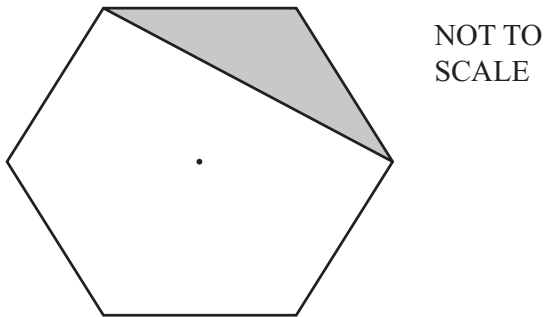
Angle  $JOK = 72^\circ$

$k = \dots\dots\dots$



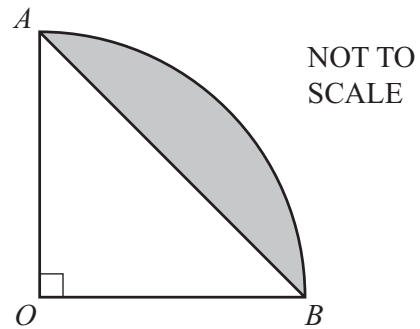
$EF = FG$  and  $EI = IH$

$k = \dots\dots\dots$



The shape is a regular hexagon.

$k = \dots\dots\dots$



The diagram shows a sector of a circle centre  $O$ .  
Angle  $AOB = 90^\circ$

$k = \dots\dots\dots$

[10]

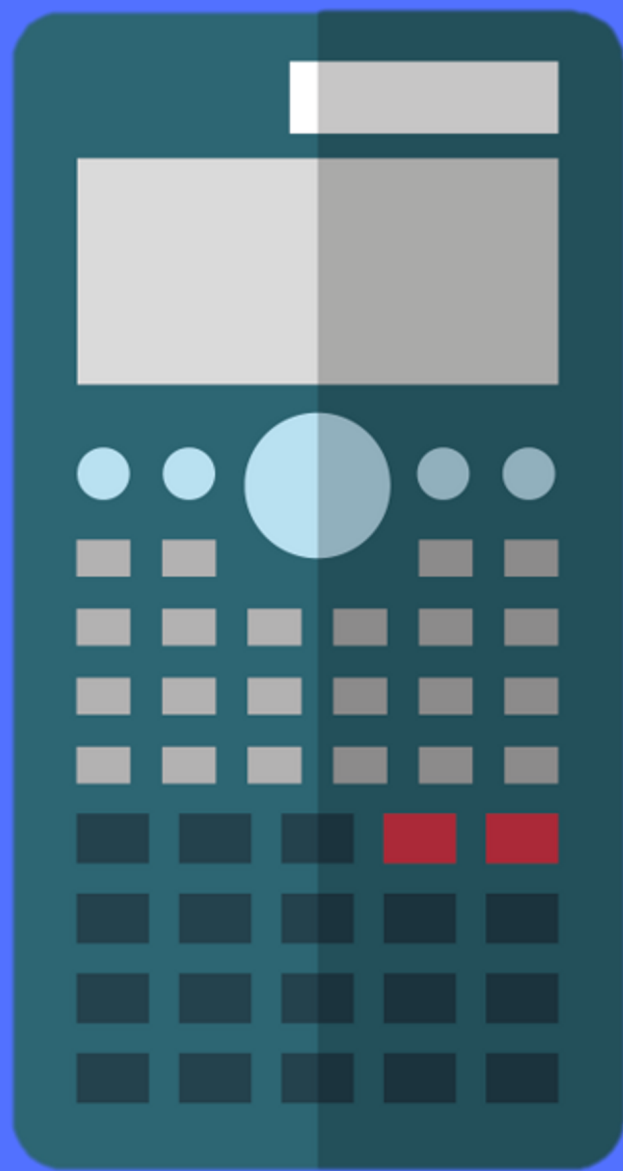
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- 8 Hans draws a plan of a field using a scale of 1 centimetre to represent 15 metres.  
The actual area of the field is  $10\,800\text{ m}^2$ .

Calculate the area of the field on the plan.

*Answer* .....  $\text{cm}^2$  [2]

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- 9 Solve the inequality.

$$5t + 23 < 17 - 2t$$

*Answer* ..... [2]

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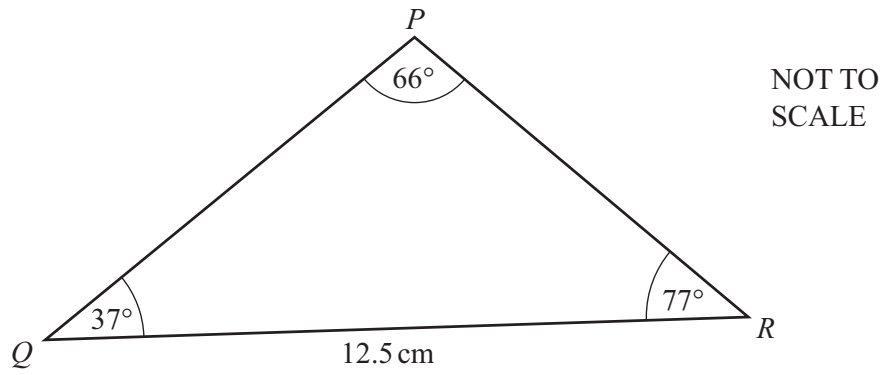
- 10 Without using a calculator, work out  $1\frac{1}{4} - \frac{7}{9}$ .

Write down all the steps in your working.

*Answer* ..... [3]

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14



Calculate  $PR$ .

*Answer*  $PR = \dots\dots\dots \text{ cm}$  [3]

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15 A rectangle has length  $127.3 \text{ cm}$  and width  $86.5 \text{ cm}$ , both correct to 1 decimal place.

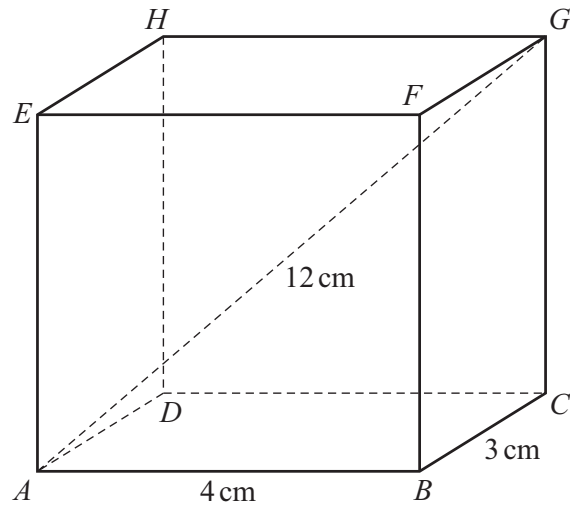
Calculate the upper bound and the lower bound for the perimeter of the rectangle.

*Answer* Upper bound =  $\dots\dots\dots \text{ cm}$

Lower bound =  $\dots\dots\dots \text{ cm}$  [3]

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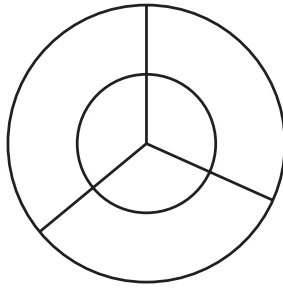
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$ABCDEFGH$  is a cuboid.  
 $AB = 4$  cm,  $BC = 3$  cm and  $AG = 12$  cm.

Calculate the angle that  $AG$  makes with the base  $ABCD$ .

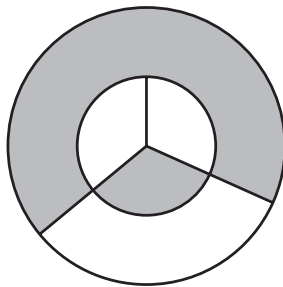
Answer ..... [4]

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NOT TO  
SCALE

The diagram shows two concentric circles and three radii.  
The diagram has rotational symmetry of order 3.

A club uses the diagram for its badge with some sections shaded.  
The radius of the large circle is 6 cm and the radius of the small circle is 4 cm.

NOT TO  
SCALE

Calculate the total perimeter of the shaded area.

*Answer* ..... cm [5]

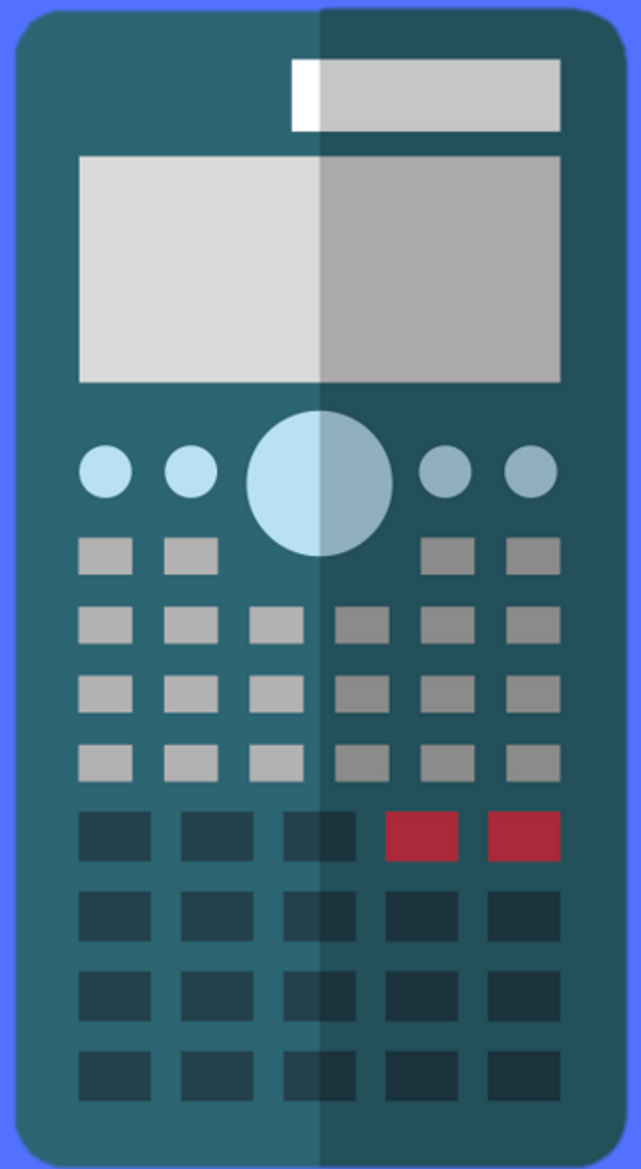
**Question 22 is printed on the next page.**

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1 In July, a supermarket sold 45 981 bottles of fruit juice.

- (a) The cost of a bottle of fruit juice was \$1.35 .

Calculate the amount received from the sale of the 45 981 bottles.  
Give your answer correct to the nearest hundred dollars.

*Answer(a)* \$ ..... [2]

- (b) The number of bottles sold in July was 17% more than the number sold in January.

Calculate the number of bottles sold in January.

*Answer(b)* ..... [3]

- (c) There were 3 different flavours of fruit juice.

The number of bottles sold in each flavour was in the ratio apple : orange : cherry = 3 : 4 : 2.  
The total number of bottles sold was 45 981.

Calculate the number of bottles of orange juice sold.

*Answer(c)* ..... [2]

- (d) One bottle contains 1.5 litres of fruit juice.

Calculate the number of 330 ml glasses that can be filled completely from one bottle.

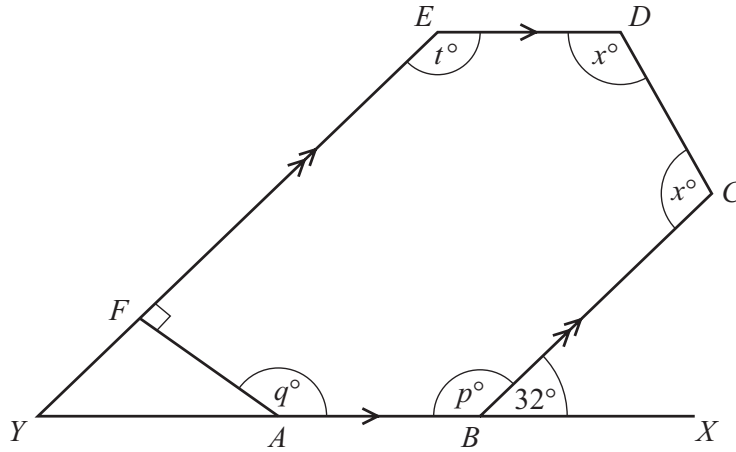
*Answer(d)* ..... [3]

- (e)  $\frac{5}{9}$  of the 45 981 bottles are recycled.

Calculate the number of bottles that are recycled.

*Answer(e)* ..... [2]

7 (a)



NOT TO SCALE

*ABCDEF* is a hexagon.  
*AB* is parallel to *ED* and *BC* is parallel to *FE*.  
*YFE* and *YABX* are straight lines.  
 Angle  $CBX = 32^\circ$  and angle  $EFA = 90^\circ$ .

Calculate the value of

(i)  $p$ ,

Answer(a)(i)  $p = \dots\dots\dots$  [1]

(ii)  $q$ ,

Answer(a)(ii)  $q = \dots\dots\dots$  [2]

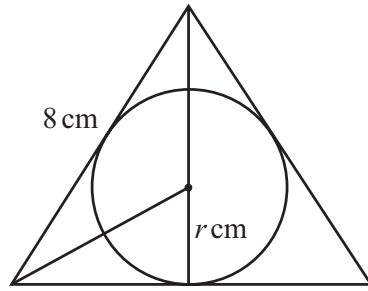
(iii)  $t$ ,

Answer(a)(iii)  $t = \dots\dots\dots$  [1]

(iv)  $x$ .

Answer(a)(iv)  $x = \dots\dots\dots$  [3]

10 (a)



NOT TO SCALE

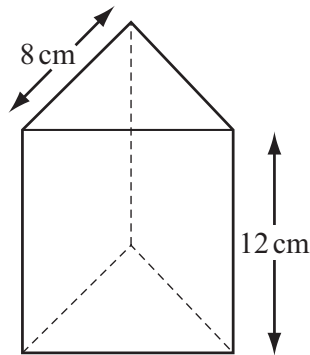
The three sides of an equilateral triangle are tangents to a circle of radius  $r$  cm. The sides of the triangle are 8 cm long.

Calculate the value of  $r$ .  
Show that it rounds to 2.3, correct to 1 decimal place.

*Answer(a)*

[3]

(b)



NOT TO SCALE

The diagram shows a box in the shape of a triangular prism of height 12 cm. The cross section is an equilateral triangle of side 8 cm.

Calculate the volume of the box.

*Answer(b)* ..... cm<sup>3</sup> [4]

- (c) The box contains biscuits.  
Each biscuit is a cylinder of radius 2.3 centimetres and height 4 millimetres.

Calculate

- (i) the largest number of biscuits that can be placed in the box,

*Answer(c)(i)* ..... [3]

- (ii) the volume of one biscuit in cubic centimetres,

*Answer(c)(ii)* .....  $\text{cm}^3$  [2]

- (iii) the percentage of the volume of the box **not** filled with biscuits.

*Answer(c)(iii)* ..... % [3]

---

**Question 11 is printed on the next page.**

11

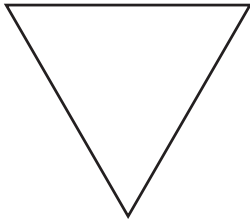


Diagram 1

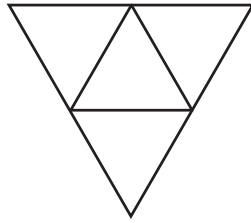


Diagram 2

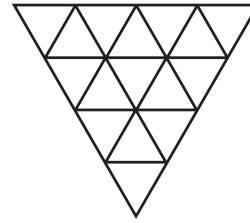


Diagram 3

The first three diagrams in a sequence are shown above.  
Diagram 1 shows an equilateral triangle with sides of length 1 unit.

In Diagram 2, there are 4 triangles with sides of length  $\frac{1}{2}$  unit.

In Diagram 3, there are 16 triangles with sides of length  $\frac{1}{4}$  unit.

(a) Complete this table for Diagrams 4, 5, 6 and  $n$ .

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6	Diagram $n$
Length of side	1	$\frac{1}{2}$	$\frac{1}{4}$				
Length of side as a power of 2	$2^0$	$2^{-1}$	$2^{-2}$				

[6]

(b) (i) Complete this table for the number of the smallest triangles in Diagrams 4, 5 and 6.

	Diagram 1	Diagram 2	Diagram 3	Diagram 4	Diagram 5	Diagram 6
Number of smallest triangles	1	4	16			
Number of smallest triangles as a power of 2	$2^0$	$2^2$	$2^4$			

[2]

(ii) Find the number of the smallest triangles in Diagram  $n$ , giving your answer as a power of 2.

*Answer(b)(ii)* ..... [1]

(c) Calculate the number of the smallest triangles in the diagram where the smallest triangles have sides of length  $\frac{1}{128}$  unit.

*Answer(c)* ..... [2]

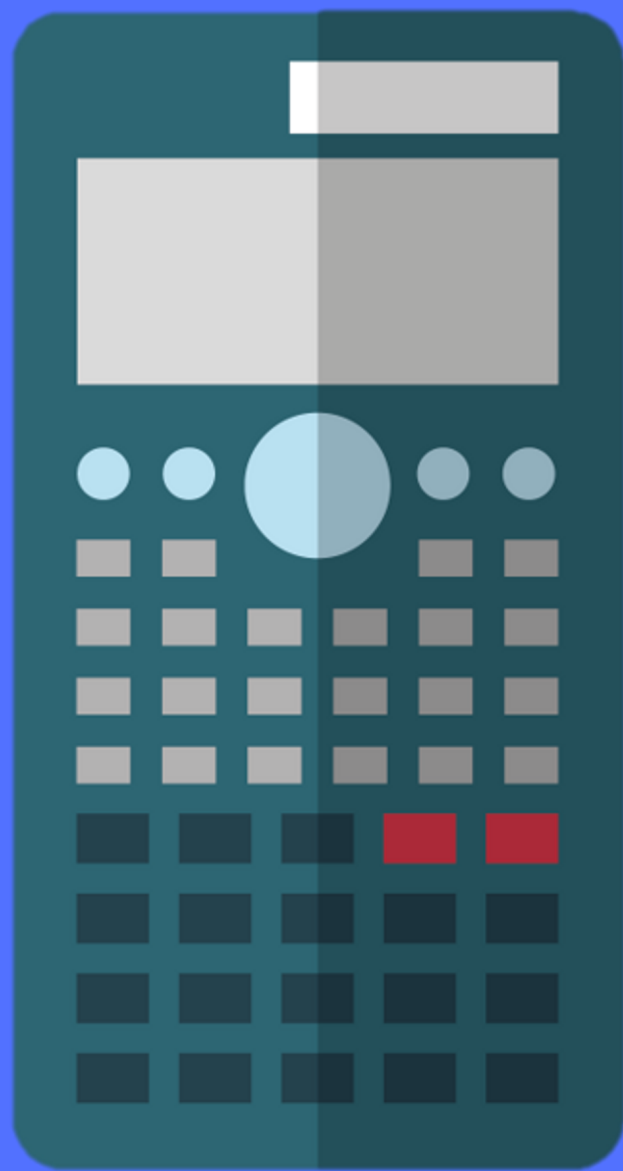
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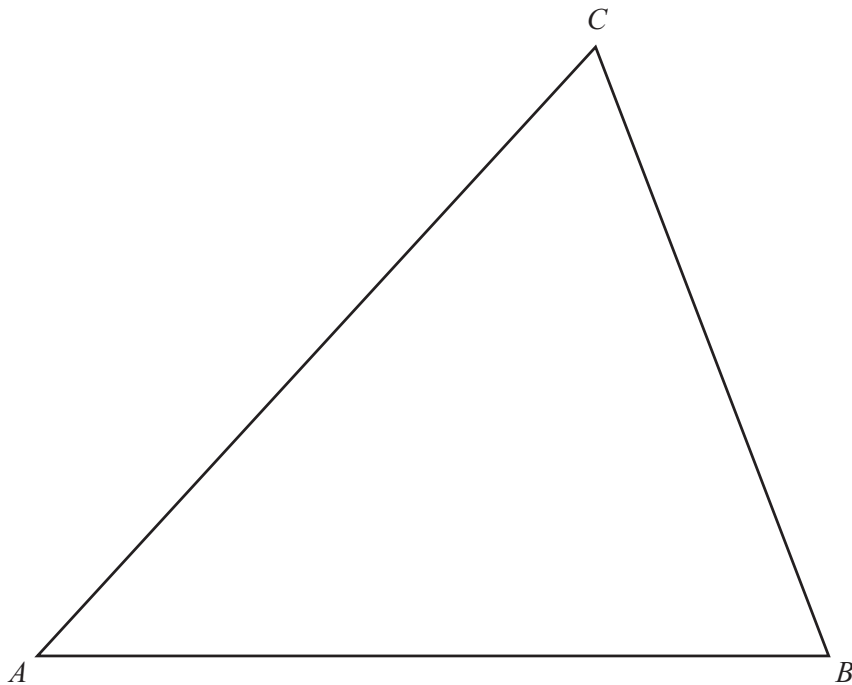
$$\mathbf{A} = \begin{pmatrix} 2 & 8 \\ 1 & 4 \end{pmatrix}$$

Work out  $\mathbf{A}^2 - 4\mathbf{A}$ .

Answer  $\left( \begin{array}{cc} & \\ & \end{array} \right)$  [3]

---

15



(a) Using compasses and straight edge only, construct

(i) the perpendicular bisector of  $AC$ , [2]

(ii) the bisector of angle  $ACB$ . [2]

(b) Shade the region inside the triangle which is

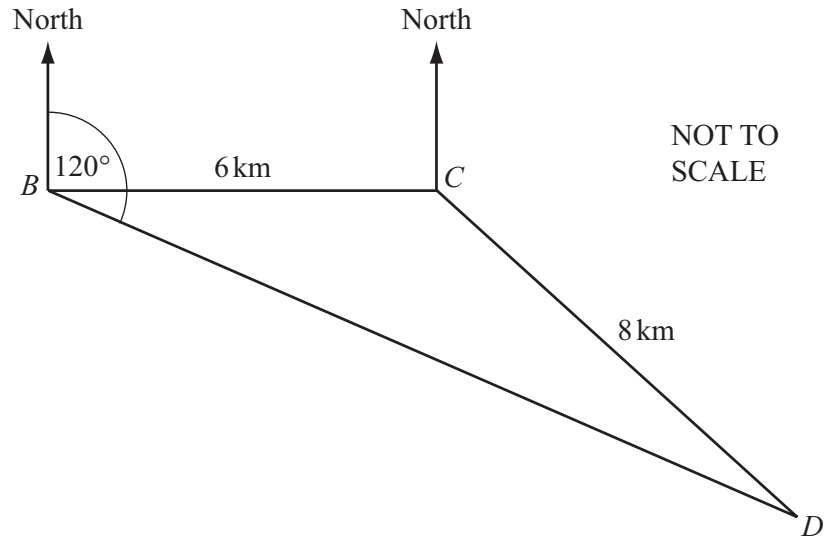
• nearer to  $A$  than to  $C$

and

• nearer to  $AC$  than to  $BC$ . [1]

---

- 16 A helicopter flies from its base  $B$  to deliver supplies to two oil rigs at  $C$  and  $D$ .  
 $C$  is 6 km due east of  $B$  and the distance from  $C$  to  $D$  is 8 km.  
 $D$  is on a bearing of  $120^\circ$  from  $B$ .

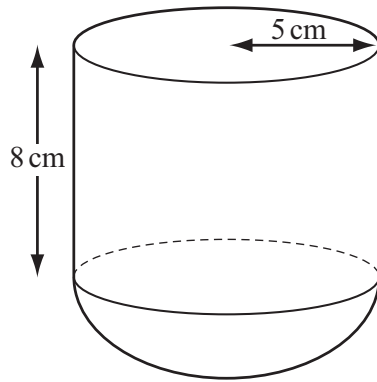


Find the bearing of  $D$  from  $C$ .

Answer ..... [5]



17 The diagram shows a child's toy.



NOT TO  
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The shape of the toy is a cylinder of radius 5 cm and height 8 cm on top of a hemisphere of radius 5 cm.

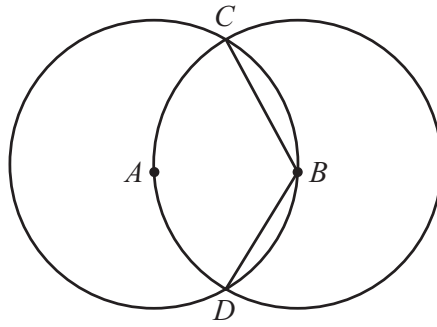
Calculate the volume of the toy.

[The volume,  $V$ , of a sphere with radius  $r$  is  $V = \frac{4}{3}\pi r^3$ .]

Answer ..... cm<sup>3</sup> [5]

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NOT TO SCALE

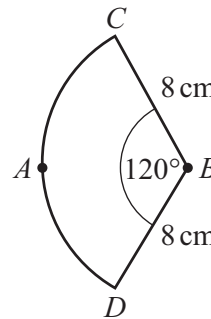
Two circles, centres  $A$  and  $B$ , are each of radius 8 cm and intersect at  $C$  and  $D$ . Each circle passes through the centre of the other circle.

(a) Explain why angle  $CBD$  is  $120^\circ$ .

*Answer(a)*

[1]

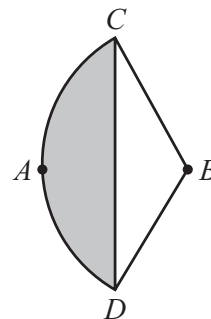
(b) For the circle, centre  $B$ , find the area of the sector  $BCD$ .



NOT TO SCALE

*Answer(b)* .....  $\text{cm}^2$  [2]

(c) (i) Find the area of the shaded segment  $CAD$ .



NOT TO SCALE

*Answer(c)(i)* .....  $\text{cm}^2$  [3]

(ii) Find the area of overlap of the two circles.

*Answer(c)(ii)* .....  $\text{cm}^2$  [1]

Question 20 is printed on the next page.

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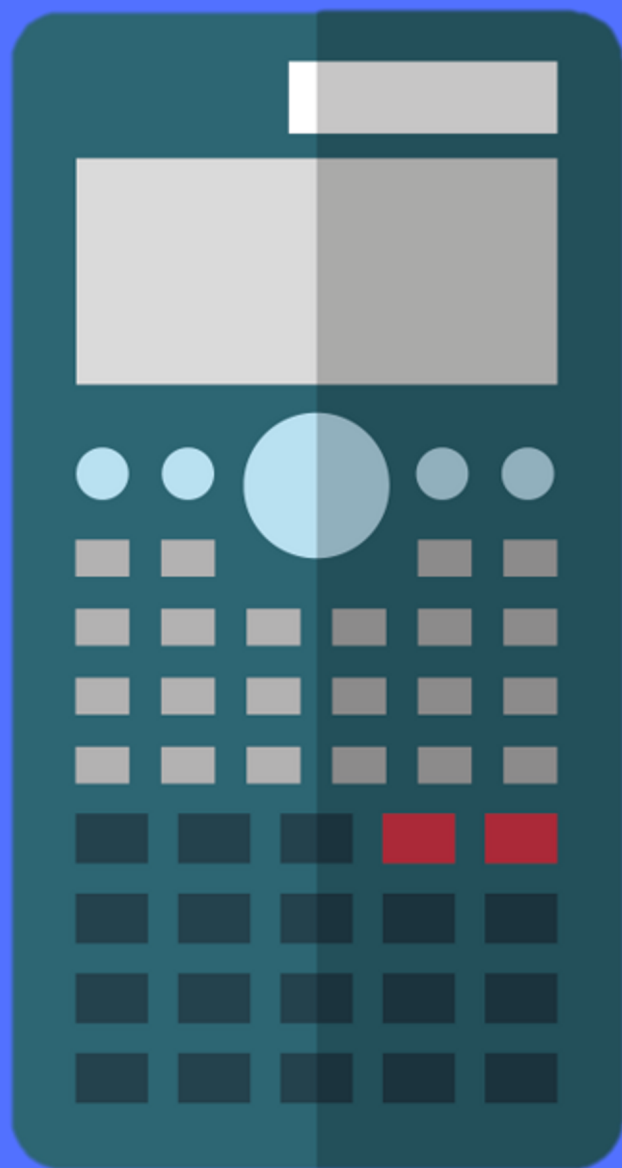
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- 1 (a) A company makes compost by mixing loam, sand and coir in the following ratio.

$$\text{loam} : \text{sand} : \text{coir} = 7 : 2 : 3$$

- (i) How much loam is there in a 72 litre bag of the compost?

*Answer(a)(i)* ..... litres [2]

- (ii) In a small bag of the compost there are 13.5 litres of coir.

How much compost is in a small bag?

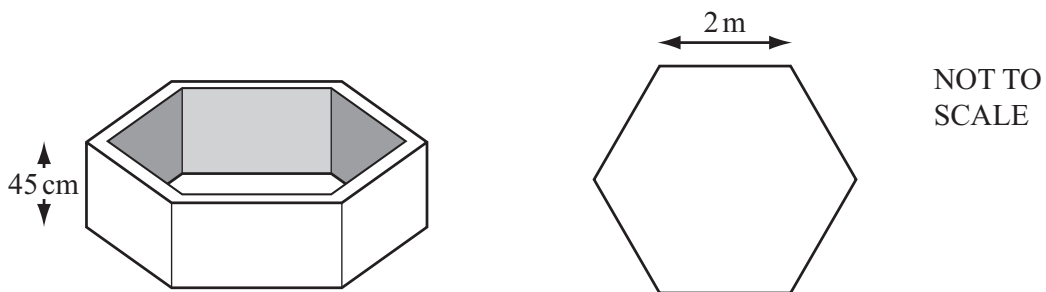
*Answer(a)(ii)* ..... litres [2]

- (iii) The price of a large bag of compost is \$8.40 .  
This is an increase of 12% on the price last year.

Calculate the price last year.

*Answer(a)(iii)* \$ ..... [3]

- (b) Teresa builds a raised garden bed in the shape of a hexagonal prism.



The garden bed has a height of 45 cm.

The cross section of the inside of the garden bed is a regular hexagon of side 2 m.

- (i) Show that the area of the cross section of the inside of the garden bed is  $10.4\text{m}^2$ , correct to 3 significant figures.

*Answer(b)(i)*

[3]

- (ii) Calculate the volume of soil needed to fill the garden bed.

*Answer(b)(ii)* .....  $\text{m}^3$  [2]

- (iii) Teresa wants to fill the garden bed with organic top soil.  
She sees this advertisement in the local garden centre.

ORGANIC TOP SOIL	Number of tonnes purchased		
	1 to 5	6 to 10	Over 10
<b>Cost per tonne</b>	\$47.00	\$45.50	\$44.00

Organic top soil is sold in one tonne bags.  
 $1\text{m}^3$  of organic top soil has a mass of 1250 kg.

Calculate the cost of the organic top soil needed to fill the garden bed completely.  
[1 tonne = 1000 kg]

*Answer(b)(iii)* \$ ..... [4]

- 2 (a) Rearrange the formula  $v^2 = u^2 - 2as$  to make  $u$  the subject.

*Answer(a)*  $u = \dots\dots\dots$  [2]

- (b) Chuck cycles along Skyline Drive.  
 He cycles 60 km at an average speed of  $x$  km/h.  
 He then cycles a further 45 km at an average speed of  $(x + 4)$  km/h.  
 His total journey time is 6 hours.

- (i) Write down an equation in  $x$  and show that it simplifies to  $2x^2 - 27x - 80 = 0$ .

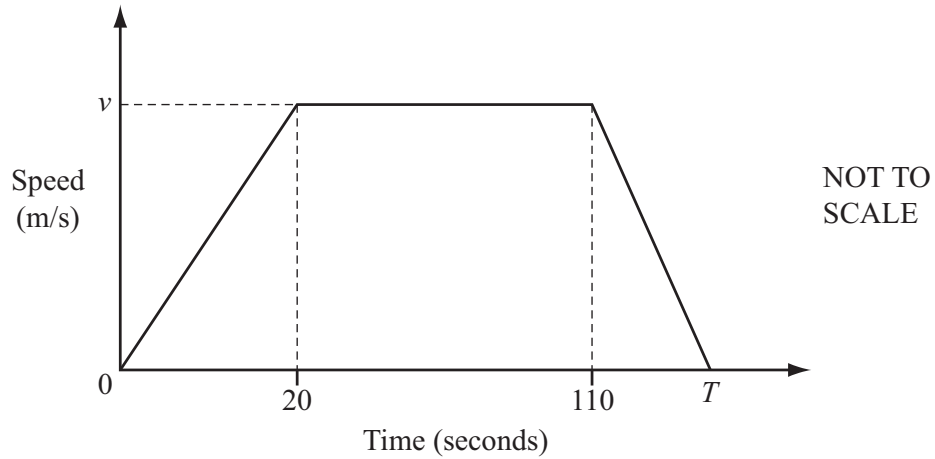
*Answer(b)(i)*

[4]

- (ii) Solve  $2x^2 - 27x - 80 = 0$  to find the value of  $x$ .

*Answer(b)(ii)*  $x = \dots\dots\dots$  [3]

- (c) The diagram shows the speed-time graph for a car travelling along a road for  $T$  seconds.



To begin with the car accelerated at  $0.75 \text{ m/s}^2$  for 20 seconds to reach a speed of  $v \text{ m/s}$ .

- (i) Show that the speed,  $v$ , of the car is  $15 \text{ m/s}$ .

*Answer(c)(i)*

[1]

- (ii) The total distance travelled is **1.8 kilometres**.

Calculate the total time,  $T$ , of the journey.

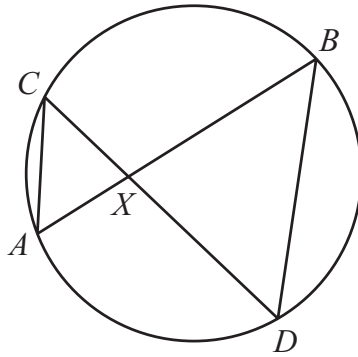
*Answer(c)(ii)* ..... seconds [4]

- (d) Asma runs 22 kilometres, correct to the nearest kilometre.  
She takes  $2\frac{1}{2}$  hours, correct to the nearest half hour.

Calculate the upper bound of Asma's speed.

*Answer(d)* ..... km/h [3]

- 7 (a) The diagram shows a circle with two chords,  $AB$  and  $CD$ , intersecting at  $X$ .



NOT TO  
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- (i) Show that triangles  $ACX$  and  $DBX$  are similar.

*Answer(a)(i)*

[2]

- (ii)  $AX = 3.2$  cm,  $BX = 12.5$  cm,  $CX = 4$  cm and angle  $AXC = 110^\circ$ .

- (a) Find  $DX$ .

*Answer(a)(ii)(a)*  $DX = \dots\dots\dots$  cm [2]

- (b) Use the cosine rule to find  $AC$ .

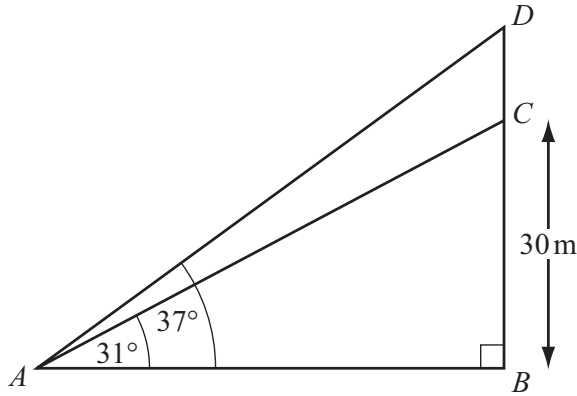
*Answer(a)(ii)(b)*  $AC = \dots\dots\dots$  cm [4]



(c) Find the area of triangle  $BXD$ .

Answer(a)(ii)(c) .....  $\text{cm}^2$  [2]

(b)



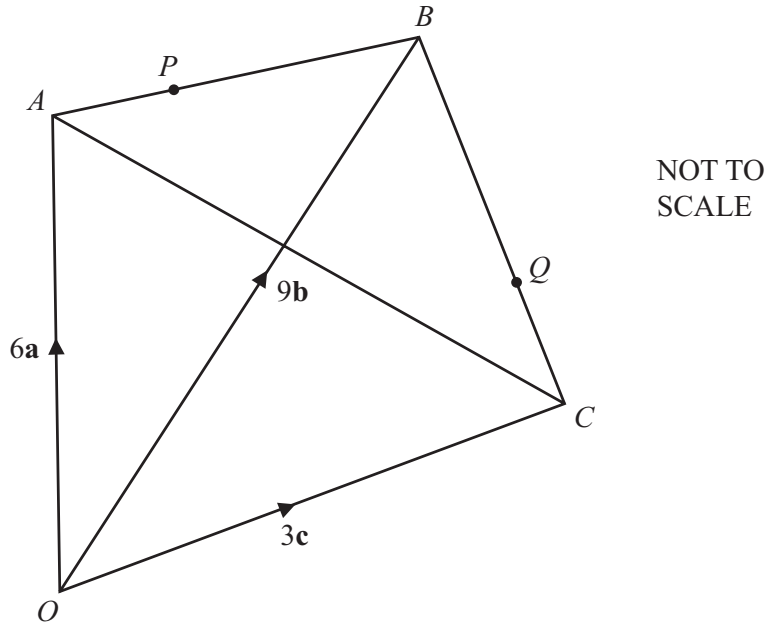
NOT TO  
SCALE

In the diagram,  $BC$  represents a building 30 m tall.  
A flagpole,  $DC$ , stands on top of the building.  
From a point,  $A$ , the angle of elevation of the top of the building is  $31^\circ$ .  
The angle of elevation of the top of the flagpole is  $37^\circ$ .

Calculate the height,  $DC$ , of the flagpole.

Answer(b) ..... m [5]

8



In the diagram,  $O$  is the origin and  $\vec{OA} = 6\mathbf{a}$ ,  $\vec{OB} = 9\mathbf{b}$  and  $\vec{OC} = 3\mathbf{c}$ .

The point  $P$  lies on  $AB$  such that  $\vec{AP} = 3\mathbf{b} - 2\mathbf{a}$ .

The point  $Q$  lies on  $BC$  such that  $\vec{BQ} = 2\mathbf{c} - 6\mathbf{b}$ .

- (a) Find, in terms of  $\mathbf{b}$  and  $\mathbf{c}$ , the position vector of  $Q$ .  
Give your answer in its simplest form.

Answer(a) ..... [2]

(b) Find, in terms of **a** and **c**, in its simplest form

(i)  $\vec{AC}$ ,

*Answer(b)(i)*  $\vec{AC} = \dots\dots\dots$  [1]

(ii)  $\vec{PQ}$ .

*Answer(b)(ii)*  $\vec{PQ} = \dots\dots\dots$  [2]

(c) Explain what your answers in **part (b)** tell you about  $PQ$  and  $AC$ .

*Answer(c)* .....

..... [2]

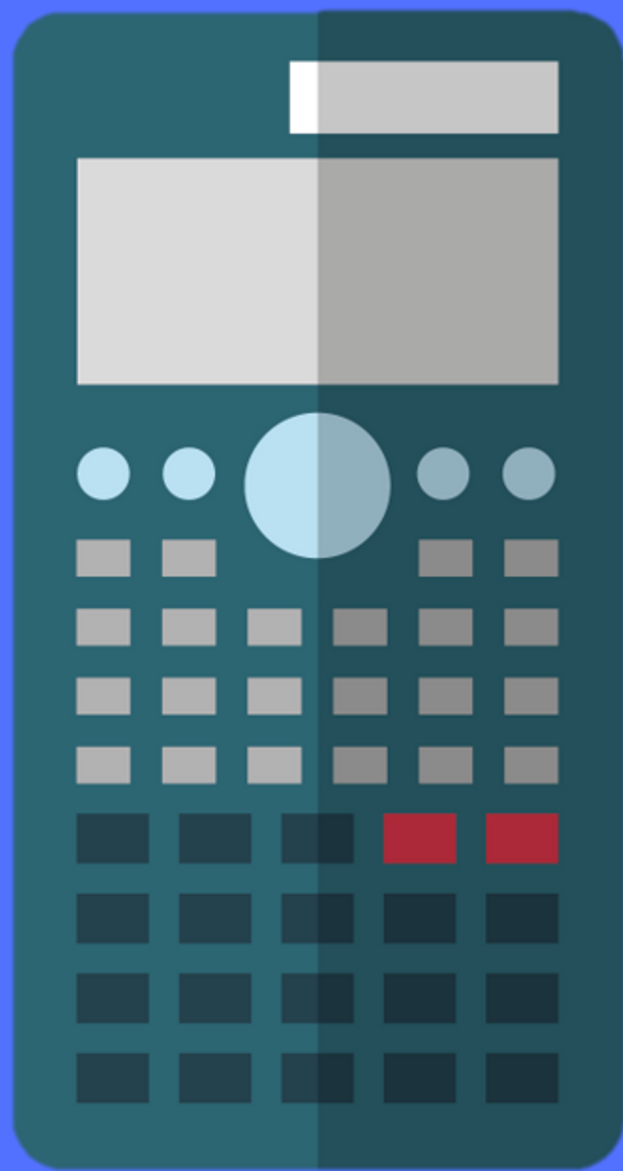
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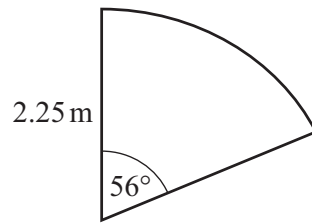
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NOT TO  
SCALE

The diagram shows a sand pit in a child's play area.  
The shape of the sand pit is a sector of a circle of radius 2.25 m and sector angle  $56^\circ$ .

- (a) Calculate the area of the sand pit.

*Answer(a)* .....  $\text{m}^2$  [2]

- (b) The sand pit is filled with sand to a depth of 0.3 m.

Calculate the volume of sand in the sand pit.

*Answer(b)* .....  $\text{m}^3$  [1]

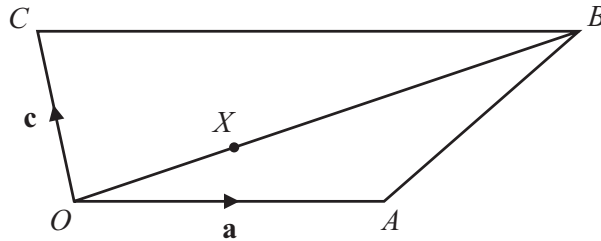
- 15 (a) Write 90 as a product of prime factors.

*Answer(a)* ..... [2]

- (b) Find the lowest common multiple of 90 and 105.

*Answer(b)* ..... [2]

19



NOT TO SCALE

The diagram shows a quadrilateral  $OABC$ .

$\vec{OA} = \mathbf{a}$ ,  $\vec{OC} = \mathbf{c}$  and  $\vec{CB} = 2\mathbf{a}$ .

$X$  is a point on  $OB$  such that  $OX:XB = 1:2$ .

(a) Find, in terms of  $\mathbf{a}$  and  $\mathbf{c}$ , in its simplest form

(i)  $\vec{AC}$ ,

Answer(a)(i)  $\vec{AC} = \dots\dots\dots$  [1]

(ii)  $\vec{AX}$ .

Answer(a)(ii)  $\vec{AX} = \dots\dots\dots$  [3]

(b) Explain why the vectors  $\vec{AC}$  and  $\vec{AX}$  show that  $C$ ,  $X$  and  $A$  lie on a straight line.

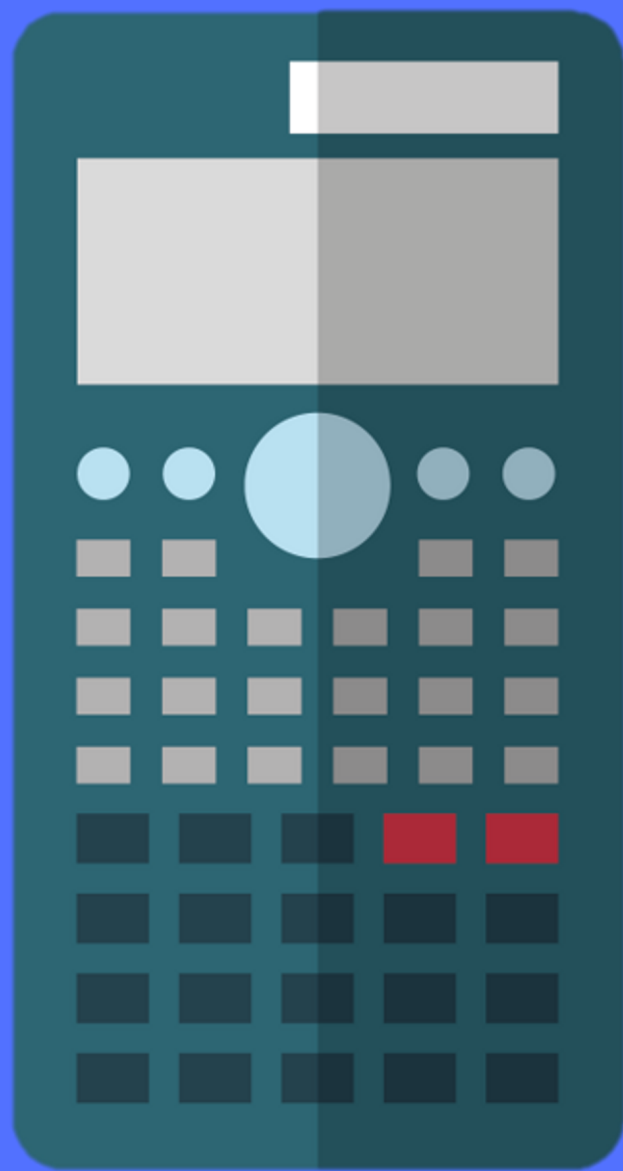
Answer(b)  $\dots\dots\dots$   
 $\dots\dots\dots$  [2]

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- 1 (a) Alfonso has \$75 to spend on the internet.  
He spends some of the money on music, films and books.

- (i) The money he spends on music, films and books is in the ratio

$$\text{music : films : books} = 5 : 3 : 7.$$

He spends \$16.50 on music.

Calculate the **total** amount he spends on music, films and books.

*Answer(a)(i)* \$ ..... [3]

- (ii) Find this total amount as a percentage of the \$75.

*Answer(a)(ii)* ..... % [1]

- (b) The download times for the music, films and books are in the ratio

$$\text{music : films : books} = 2 : 9 : 1.$$

The **total** download time is 3 hours and 33 minutes.

Calculate the download time for the films.

Give your answer in hours, minutes and seconds.

*Answer(b)* ..... hours ..... minutes ..... seconds [3]

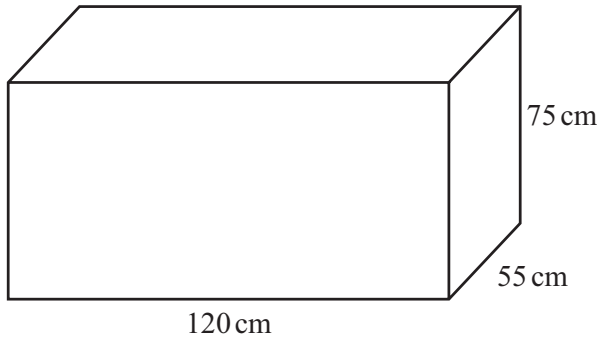
- (c) The cost of \$16.50 for the music was a reduction of 12% on the original cost.

Calculate the original cost of the music.

*Answer(c)* \$ ..... [3]



7



NOT TO SCALE

The diagram shows a water tank in the shape of a cuboid measuring 120 cm by 55 cm by 75 cm. The tank is filled completely with water.

- (a) Show that the capacity of the water tank is 495 litres.

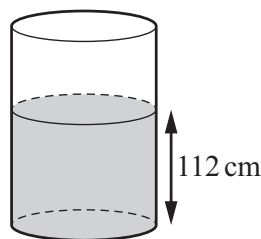
*Answer(a)*

[2]

- (b) (i) The water from the tank flows into an empty cylinder at a uniform rate of 750 millilitres per second. Calculate the length of time, in minutes, for the water to be completely emptied from the tank.

*Answer(b)(i)* ..... min [2]

- (ii) When the tank is completely empty, the height of the water in the cylinder is 112 cm.

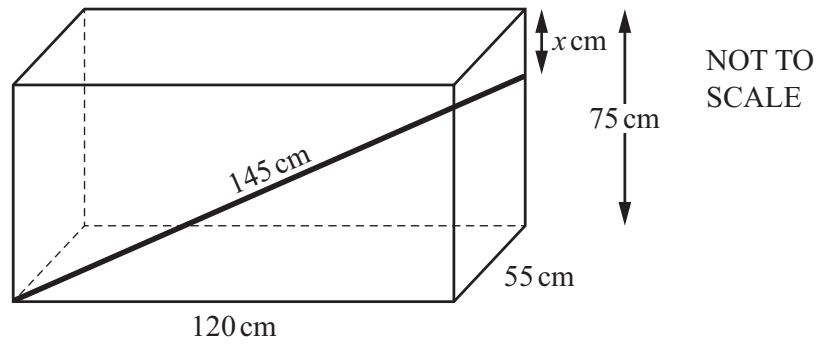


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Calculate the radius of the cylinder.

*Answer(b)(ii)* ..... cm [3]

(c)



A rod of length 145 cm is placed inside the water tank.  
 One end of the rod is in the bottom corner of the tank as shown.  
 The other end of the rod is  $x$  cm below the top corner of the tank as shown.

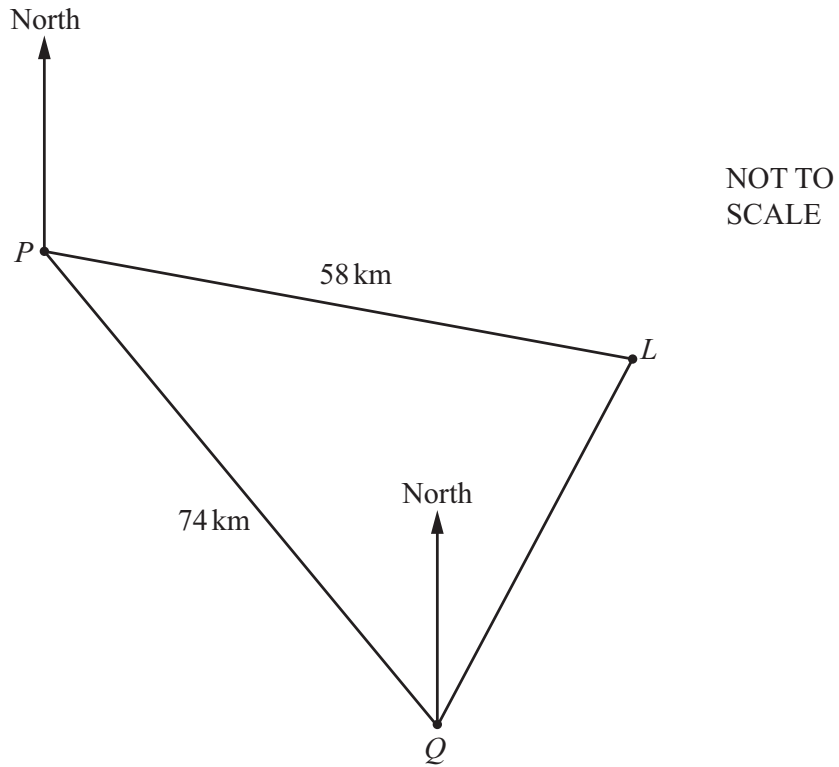
Calculate the value of  $x$ .

*Answer(c)*  $x =$  ..... [4]

(d) Calculate the angle that the rod makes with the base of the tank.

*Answer(d)* ..... [3]

8



A ship sails from port  $P$  to port  $Q$ .  
 $Q$  is 74 km from  $P$  on a bearing of  $142^\circ$ .  
 A lighthouse,  $L$ , is 58 km from  $P$  on a bearing of  $110^\circ$ .

(a) Show that the distance  $LQ$  is 39.5 km correct to 1 decimal place.

*Answer(a)*

[5]

(b) Use the sine rule to calculate angle  $PQL$ .

*Answer(b)* Angle  $PQL = \dots\dots\dots$  [3]

(c) Find the bearing of

(i)  $P$  from  $Q$ ,

*Answer(c)(i)* ..... [2]

(ii)  $L$  from  $Q$ .

*Answer(c)(ii)* ..... [1]

(d) The ship takes 2 hours and 15 minutes to sail the 74 km from  $P$  to  $Q$ .

Calculate the average speed in knots.

[1 knot = 1.85 km/h]

*Answer(d)* ..... knots [3]

(e) Calculate the shortest distance from the lighthouse to the path of the ship.

*Answer(e)* ..... km [3]

---

10 Kenwyn plays a board game.

Two cubes (dice) each have faces numbered 1, 2, 3, 4, 5 and 6.

In the game, a **throw** is rolling the **two** fair 6-sided dice and then adding the numbers on their top faces. This total is the number of spaces to move on the board.

For example, if the numbers are 4 and 3, he moves 7 spaces.

(a) Giving each of your answers as a fraction in its simplest form, find the probability that he moves

(i) two spaces with his next throw,

*Answer(a)(i)* ..... [2]

(ii) ten spaces with his next throw.

*Answer(a)(ii)* ..... [3]

(b) What is the most likely number of spaces that Kenwyn will move with his next throw?

Explain your answer.

*Answer(b)* ..... because .....

..... [2]

(c)

95	96	97	98	99 Go back 3 spaces	100 WIN
----	----	----	----	---------------------------	------------

To win the game he must move **exactly** to the 100th space.

Kenwyn is on the 97th space.

If his next throw takes him to 99, he has to move back to 96.

If his next throw takes him over 100, he stays on 97.

Find the probability that he reaches 100 in either of his next two throws.

*Answer(c)* ..... [5]

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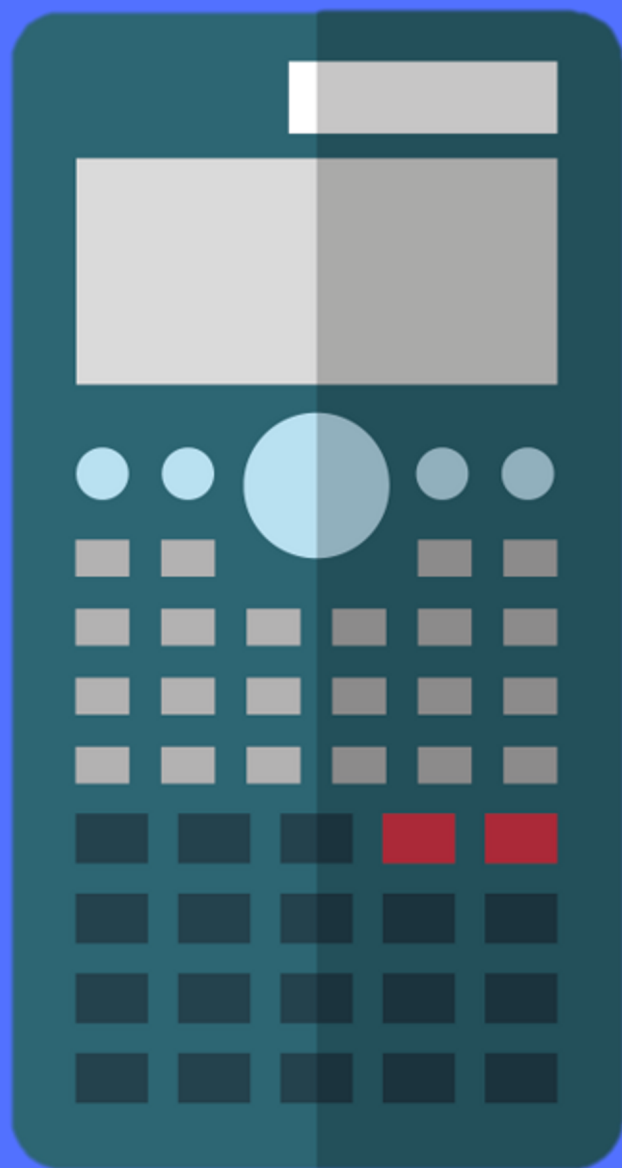
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- 10 Maryah borrows \$12 000 to start a business.  
The loan is for 3 years at a rate of 5% per year compound interest.  
The loan has to be paid back at the end of the 3 years.

Calculate the total amount to be paid back.

Answer \$..... [3]

---

- 11 (a) Here are the first three terms of a sequence.

$$U_1 = 1^3 \qquad U_2 = 1^3 + 2^3 \qquad U_3 = 1^3 + 2^3 + 3^3$$

The  $n$ th term is given by  $U_n = \frac{1}{4}n^2(n+1)^2$ .

Work out the value of  $U_{39}$ .

Answer(a)  $U_{39} =$  ..... [2]

- (b) Here are the first three terms of another sequence.

$$V_1 = 2^3 \qquad V_2 = 2^3 + 4^3 \qquad V_3 = 2^3 + 4^3 + 6^3$$

By comparing this sequence with the sequence in **part (a)**, find a formula for the  $n$ th term,  $V_n$ .

Answer(b)  $V_n =$  ..... [1]

---



- 15 The lights and brakes of 30 bicycles are tested.  
The table shows the results.

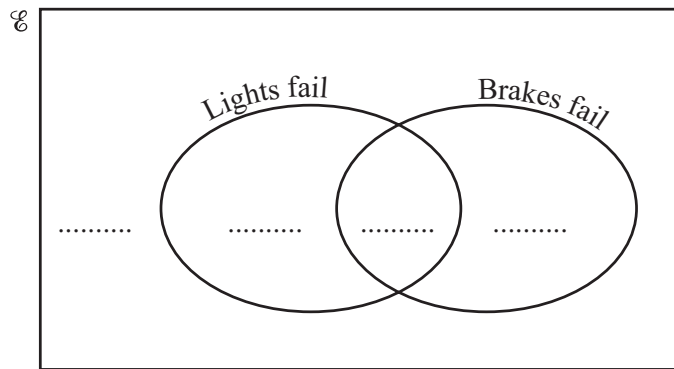
	Lights	Brakes
Fail test	3	9
Pass test	27	21

The lights and brakes both failed on one bicycle only.

$\mathcal{E} = \{30 \text{ bicycles}\}$

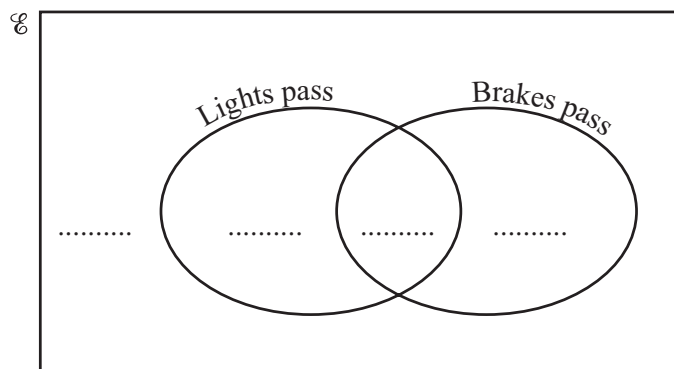
Complete the Venn diagrams.

(a)

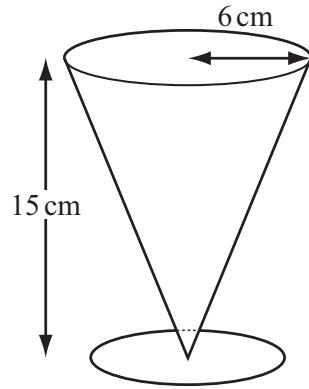


[2]

(b)



[2]



NOT TO SCALE

The diagram shows a glass, in the shape of a cone, for drinking milk.  
 The cone has a radius of 6 cm and height 15 cm.  
 A bottle of milk holds 2 litres.

- (a) How many times can the glass be completely filled from the bottle?  
 [The volume,  $V$ , of a cone with radius  $r$  and height  $h$  is  $V = \frac{1}{3}\pi r^2 h$ .]

Answer(a) ..... [4]

- (b) Calculate the volume of milk left in the bottle.  
 Give your answer in  $\text{cm}^3$ .

Answer(b) .....  $\text{cm}^3$  [3]

Question 19 is printed on the next page.

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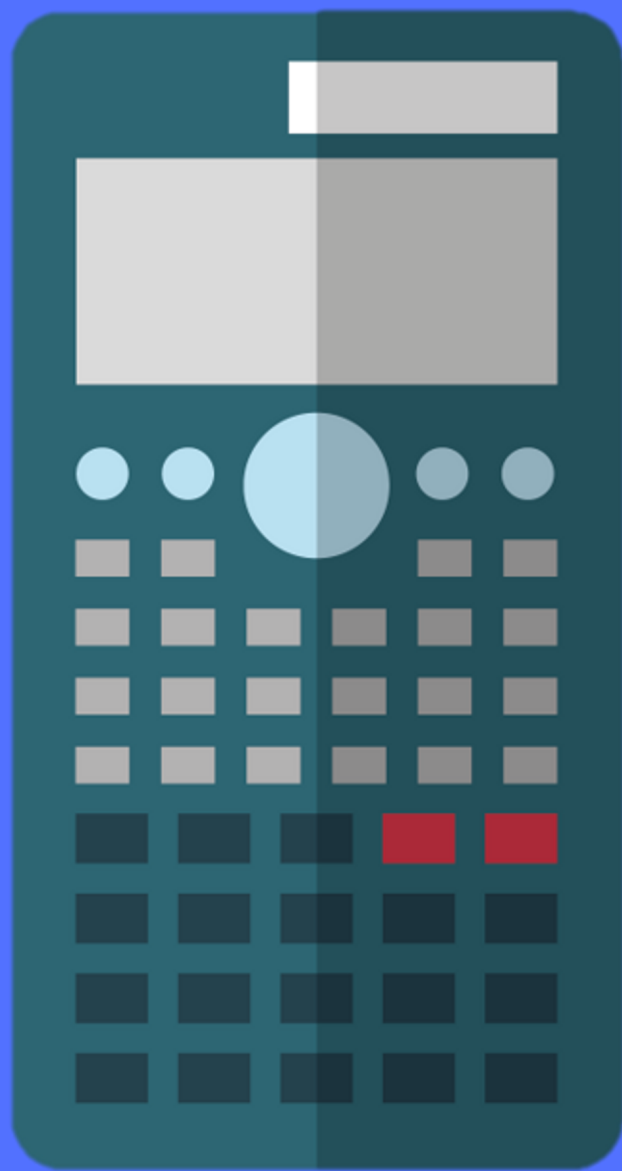
OCT/NOV

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- 2 There are three different areas, A, B and C, for seating in a theatre.  
The numbers of seats in each area are in the ratio  $A : B : C = 11 : 8 : 7$ .  
There are 920 seats in area B.

- (a) (i) Show that there are 805 seats in area C.

*Answer(a)(i)*

[1]

- (ii) Write the number of seats in area B as a percentage of the total number of seats.

*Answer(a)(ii)* ..... % [2]

- (b) The cost of a ticket for a seat in each area of the theatre is shown in the table.

Area A	\$11.50
Area B	\$15
Area C	\$22.50

For a concert 80% of area B tickets were sold and  $\frac{3}{5}$  of area C tickets were sold.  
The total amount of money taken from ticket sales was \$35 834.

Calculate the number of area A tickets that were sold.

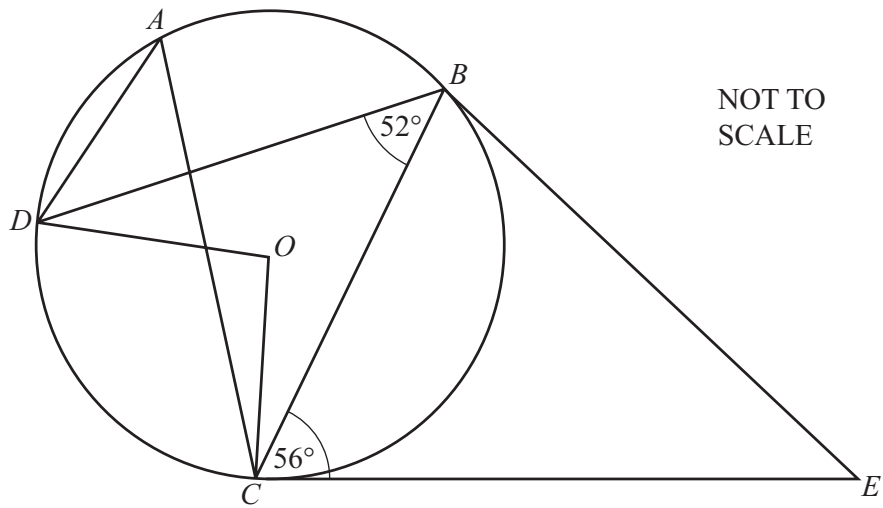
*Answer(b)* ..... [5]

- (c) The total ticket sales of \$35 834 was 5% less than the ticket sales at the previous concert.

Calculate the ticket sales at the previous concert.

*Answer(c)* \$..... [3]

3



$A, B, C$  and  $D$  are points on a circle, centre  $O$ .  
 $CE$  is a tangent to the circle at  $C$ .

(a) Find the sizes of the following angles and give a reason for each answer.

- (i) Angle  $DAC = \dots\dots\dots$  because  $\dots\dots\dots$   
 $\dots\dots\dots$  [2]
- (ii) Angle  $DOC = \dots\dots\dots$  because  $\dots\dots\dots$   
 $\dots\dots\dots$  [2]
- (iii) Angle  $BCO = \dots\dots\dots$  because  $\dots\dots\dots$   
 $\dots\dots\dots$  [2]

(b)  $CE = 8.9$  cm and  $CB = 7$  cm.

(i) Calculate the length of  $BE$ .

*Answer(b)(i)*  $BE = \dots\dots\dots$  cm [4]

(ii) Calculate angle  $BEC$ .

*Answer(b)(ii)* Angle  $BEC = \dots\dots\dots$  [3]

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8 (a) A straight line joins the points  $(-1, -4)$  and  $(3, 8)$ .

(i) Find the midpoint of this line.

Answer(a)(i) (....., .....) [2]

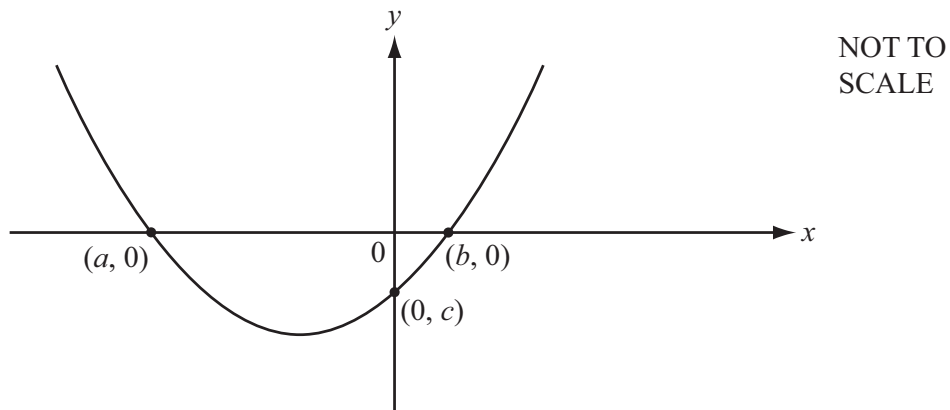
(ii) Find the equation of this line.  
Give your answer in the form  $y = mx + c$ .

Answer(a)(ii)  $y =$  ..... [3]

(b) (i) Factorise  $x^2 + 3x - 10$ .

Answer(b)(i) ..... [2]

(ii) The graph of  $y = x^2 + 3x - 10$  is sketched below.



Write down the values of  $a$ ,  $b$  and  $c$ .

Answer(b)(ii)  $a =$  .....

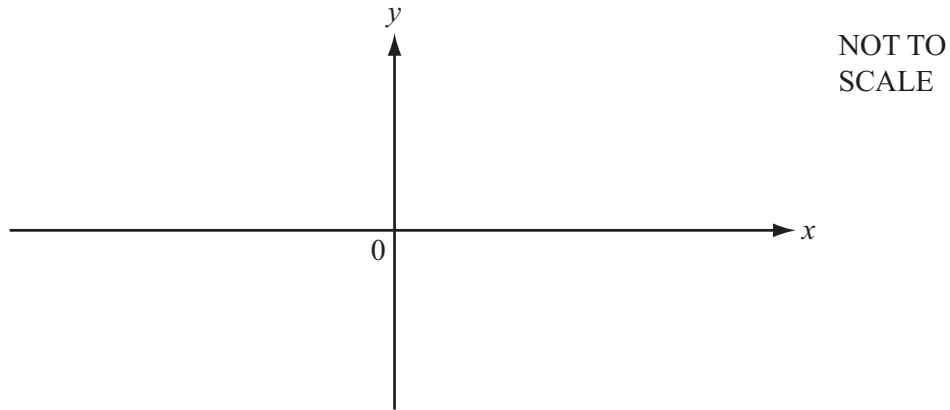
$b =$  .....

$c =$  ..... [3]

(iii) Write down the equation of the line of symmetry of the graph of  $y = x^2 + 3x - 10$ .

Answer(b)(iii) ..... [1]

- (c) Sketch the graph of  $y = 18 + 7x - x^2$  on the axes below.  
Indicate clearly the values where the graph crosses the  $x$  and  $y$  axes.



[4]

(d) (i)  $x^2 + 12x - 7 = (x + p)^2 - q$

Find the value of  $p$  and the value of  $q$ .

*Answer(d)(i)*  $p = \dots\dots\dots$

$q = \dots\dots\dots$  [3]

- (ii) Write down the minimum value of  $y$  for the graph of  $y = x^2 + 12x - 7$ .

*Answer(d)(ii)*  $\dots\dots\dots$  [1]