A / A* questions

2011

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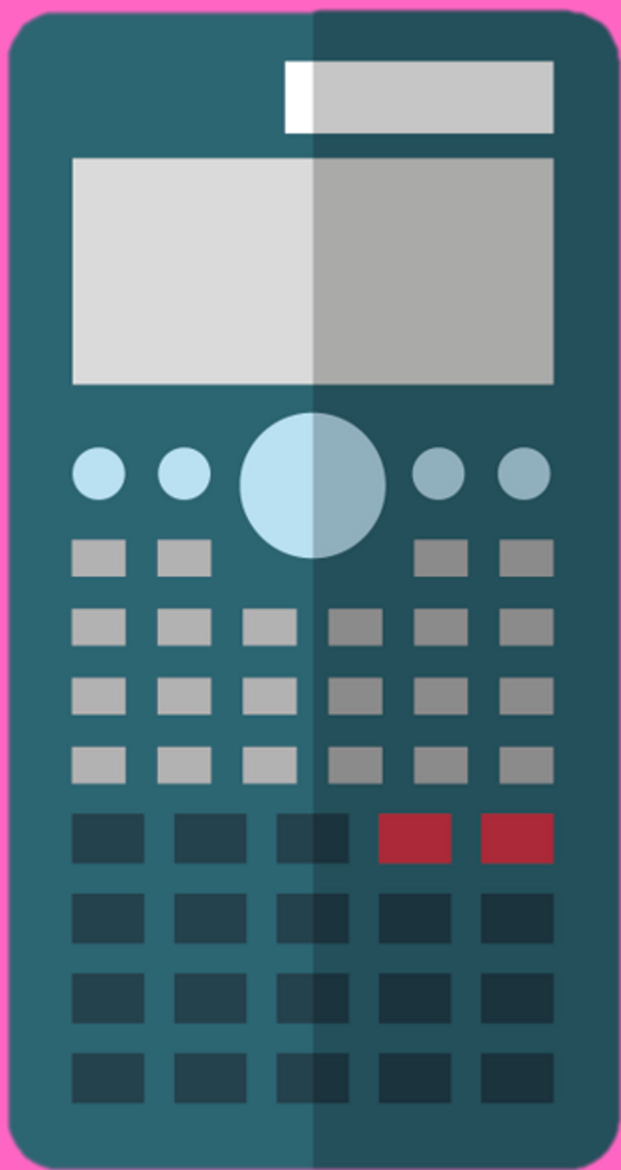

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5 A hummingbird beats its wings 24 times per second.

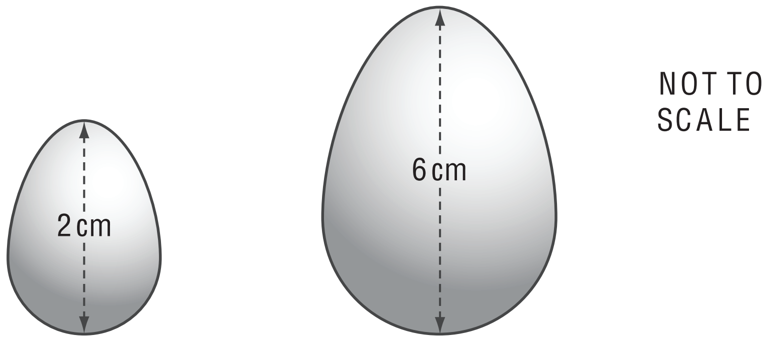
(a) Calculate the number of times the hummingbird beats its wings in one hour.

Answer(a) .... [1]

(b) Write your answer to **part (a)** in standard form.

Answer(b) .... [1]

6



A company makes solid chocolate eggs and their shapes are mathematically similar.
The diagram shows eggs of height 2 cm and 6 cm.
The mass of the small egg is 4 g.

Calculate the mass of the large egg.

Answer .... g [2]

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7 Find the length of the straight line from Q (–8, 1) to R (4 , 6).

Answer QR = ... [3]

For Examiner's Use

11 A rectangular photograph measures 23.3 cm by 19.7 cm, each correct to 1 decimal place.
Calculate the lower bound for

(a) the perimeter,

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

(b) the area.

Answer(b) .... cm^2 [1]

---

12 A train leaves Barcelona at 21 28 and takes 10 hours and 33 minutes to reach Paris.

(a) Calculate the time the next day when the train arrives in Paris.

Answer(a) .... [1]

(b) The distance from Barcelona to Paris is 827 km.

Calculate the average speed of the train in kilometres per hour.

Answer(b) .... km/h [3]

For Examiner's Use

13 The scale on a map is 1: 20 000.

(a) Calculate the actual distance between two points which are 2.7 cm apart on the map.
Give your answer in kilometres.

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

(b) A field has an area of 64 400 m^2.
Calculate the area of the field on the map in cm^2.

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

---

14 Solve the equation $2x^2 + 3x - 6 = 0$.
Show all your working and give your answers correct to 2 decimal places.

Answer $x =$ .... or $x =$ .... [4]

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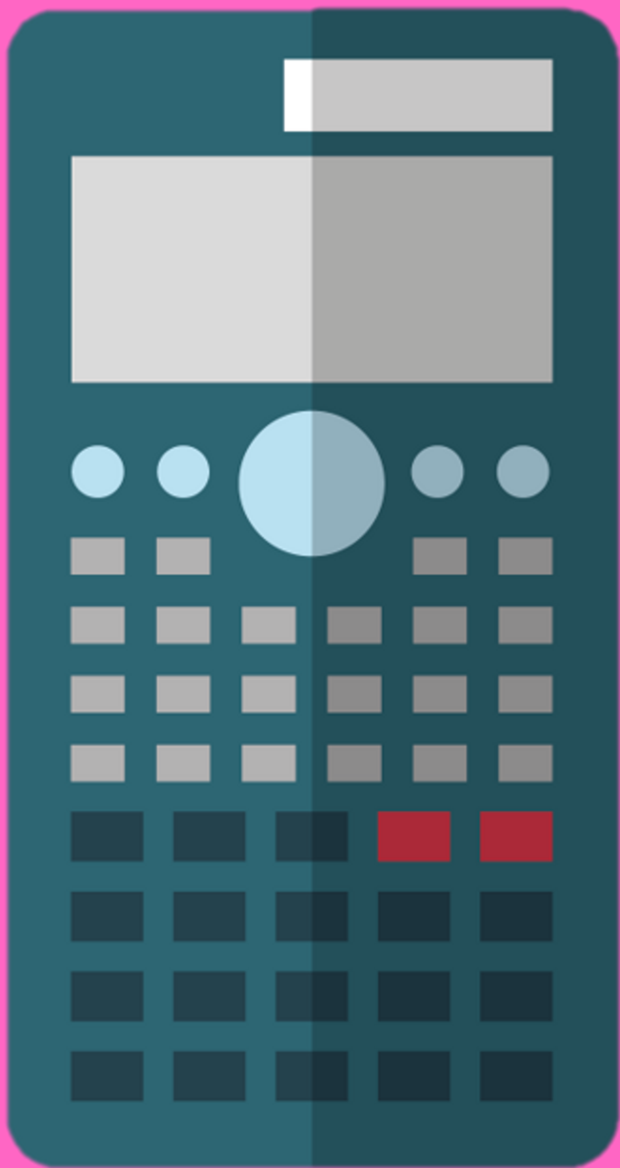

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1 A school has a sponsored swim in summer and a sponsored walk in winter.
In 2010, the school raised a total of $1380.
The ratio of the money raised in summer : winter = 62 : 53.

(a) **(i)** Show clearly that $744 was raised by the swim in **summer**.

Answer (a)(i)

[1]

(ii) Alesha's swim raised $54.10. Write this as a percentage of $744.

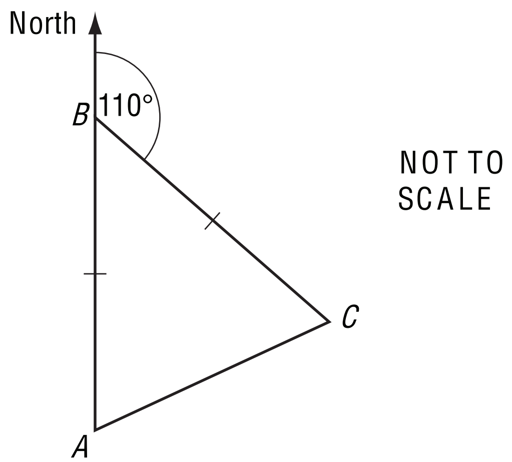
Answer(a)(ii) .... % [1]

(iii) Bryan's swim raised $31.50.
He received 75 cents for each length of the pool which he swam.

Calculate the number of lengths Bryan swam.

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

(b) The route for the **sponsored walk in winter** is triangular.

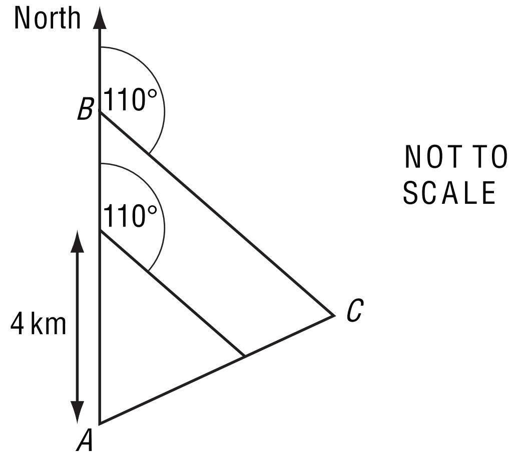


(i) Senior students start at *A*, walk North to *B*, then walk on a bearing 110° to *C*.
They then return to *A*.
AB = *BC*.

Calculate the bearing of *A* from *C*.

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

(ii)



$AB = BC = 6$ km.
Junior students follow a **similar** path but they only walk 4 km North from A, then 4 km on a bearing 110° before returning to A.

Senior students walk a total of 18.9 km.

Calculate the distance walked by junior students.

Answer(b)(ii) .... km [3]

(c) The total amount, \$1380, raised in 2010 was 8% **less** than the total amount raised in 2009.

Calculate the total amount raised in 2009.

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

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9 Peter wants to plant x plum trees and y apple trees.

He wants at least 3 plum trees and at least 2 apple trees.

(a) Write down one inequality in x and one inequality in y to represent these conditions.

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

(b) There is space on his land for no more than 9 trees.

Write down an inequality in x and y to represent this condition.

Answer(b) .... [1]

(c) Plum trees cost \$6 and apple trees cost \$14.

Peter wants to spend no more than \$84.

Write down an inequality in x and y, and show that it simplifies to $3x + 7y \leqslant 42$.

Answer(c)

[1]

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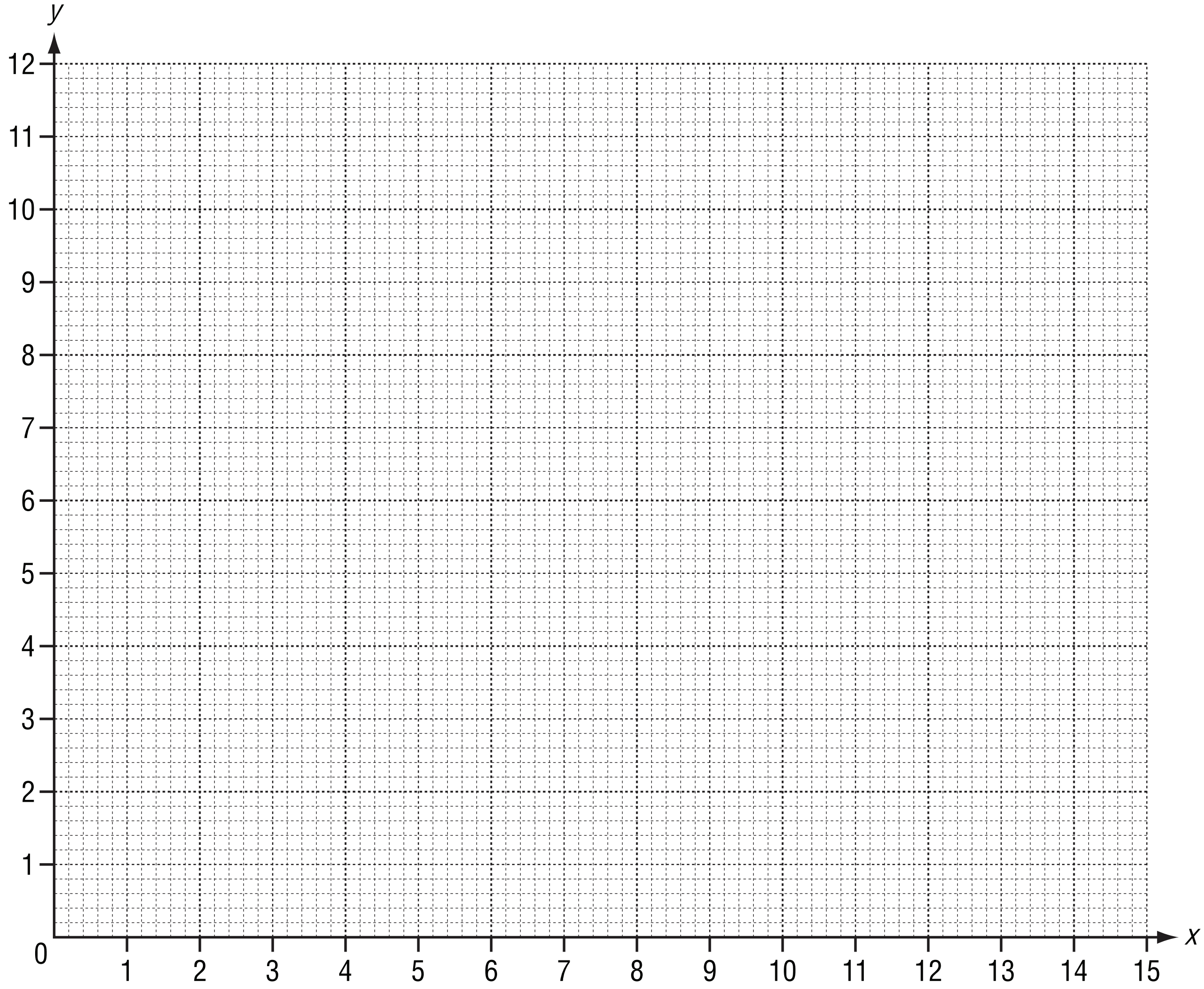
(d) On the grid, draw four lines to show the four inequalities and shade the **unwanted** regions.



[7]

(e) Calculate the smallest cost when Peter buys a total of 9 trees.

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

Question 10 is printed on the next page.

10 The first and the nth terms of sequences A, B and C are shown in the table below.

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(a) Complete the table for each sequence.

	1st term	2nd term	3rd term	4th term	5th term	nth term
Sequence A	1					n^3
Sequence B	4					$4n$
Sequence C	4					$(n + 1)^2$

[5]

(b) Find

(i) the 8th term of sequence A,

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

(ii) the 12th term of sequence C.

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

(c) **(i)** Which term in sequence A is equal to 15 625?

Answer(c)(i) .... [1]

(ii) Which term in sequence C is equal to 10 000?

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

(d) The first four terms of sequences D and E are shown in the table below.

Use the results from **part (a)** to find the 5th and the nth terms of the sequences D and E.

	1st term	2nd term	3rd term	4th term	5th term	nth term
Sequence D	5	16	39	80		
Sequence E	0	1	4	9		

[4]

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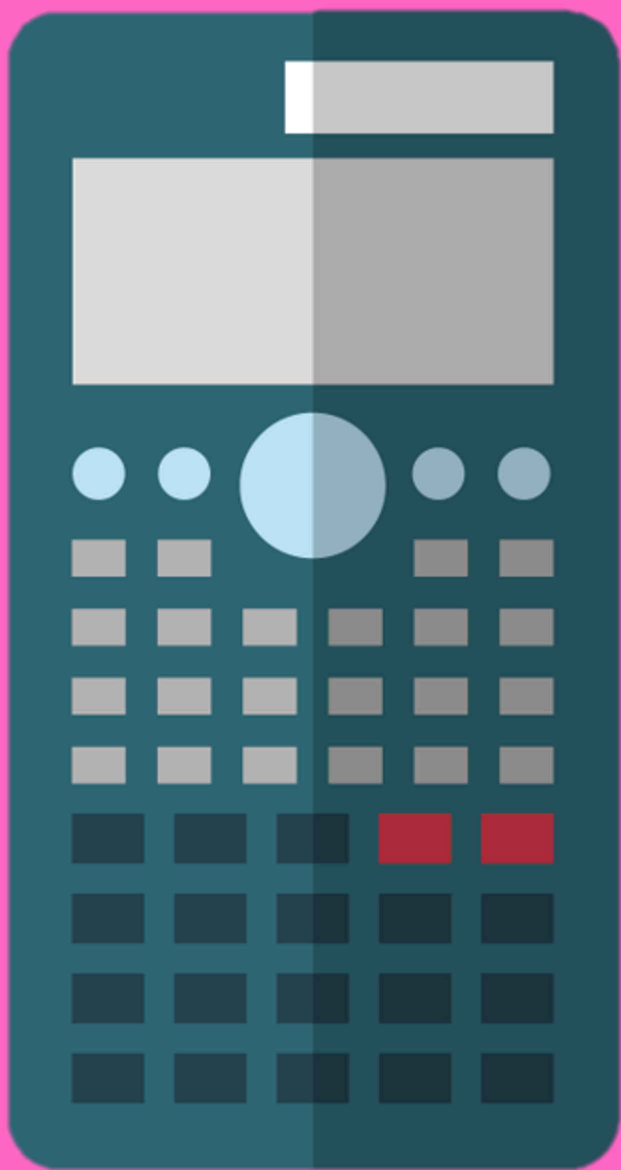

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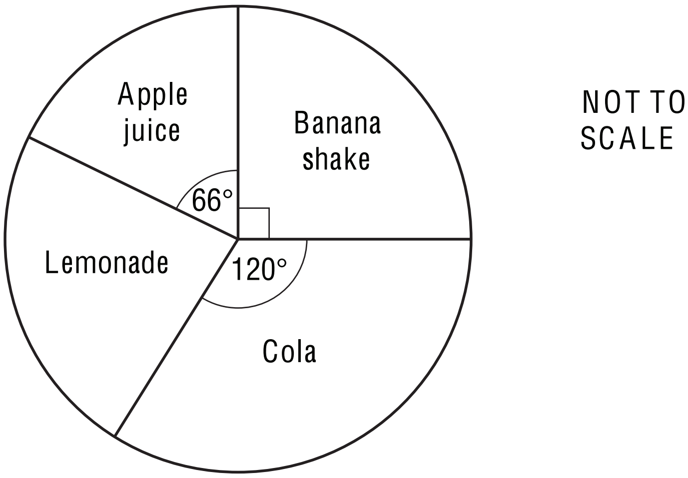
14 60 students recorded their favourite drink.
The results are shown in the pie chart.



(a) **Calculate** the angle for the sector labelled Lemonade.

Answer(a) .... [1]

(b) Calculate the number of students who chose Banana shake.

Answer(b) .... [1]

(c) The pie chart has a radius of 3 cm.
Calculate the arc length of the sector representing Cola.

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

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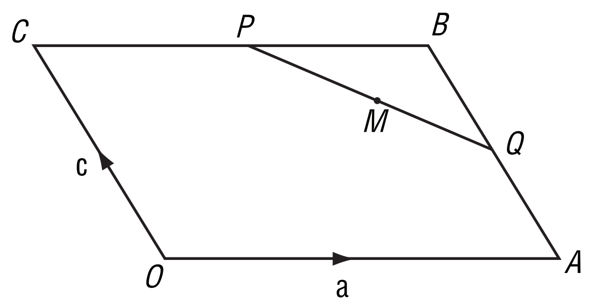
15 Write the following as a single fraction in its simplest form.

$$\frac{x+1}{x+5} - \frac{x}{x+1}$$

Answer .... [4]

16



NOT TO SCALE

O is the origin and *OABC* is a parallelogram.
CP = *PB* and *AQ* = *QB*.

$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OC} = \mathbf{c}$.
Find in terms of **a** and **c**, in their simplest form,

(a) $\overrightarrow{PQ}$,

Answer(a) $\overrightarrow{PQ}$ = ... [2]

(b) the position vector of *M*, where *M* is the midpoint of *PQ*.

Answer(b) .... [2]

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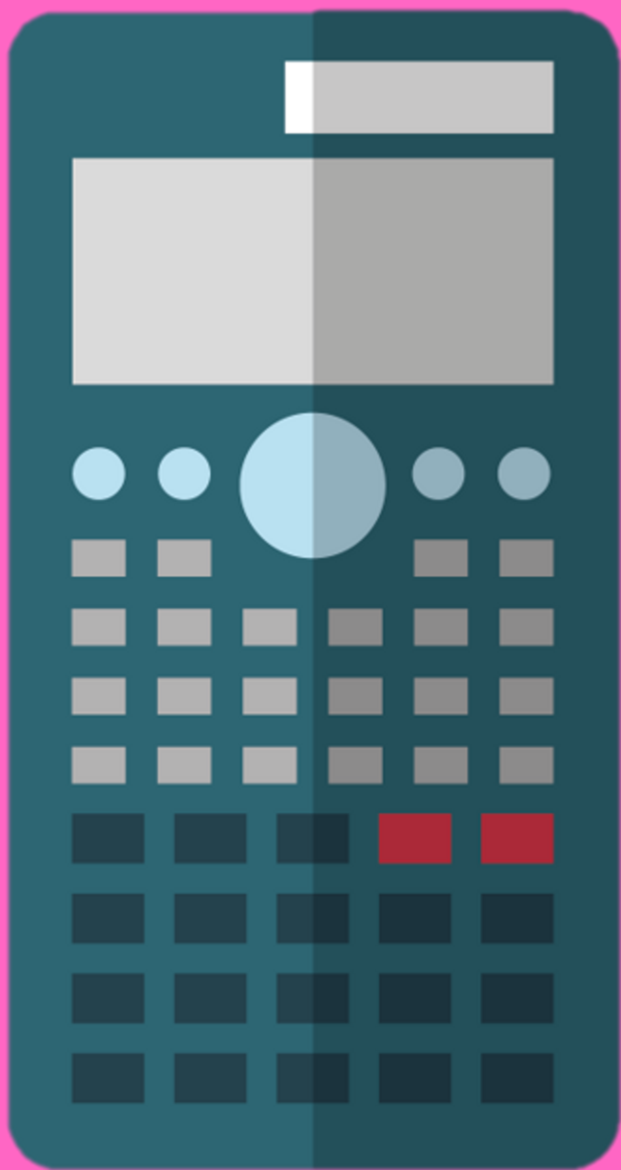

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1 **(a)** Work out the following.

(i) $\dfrac{1}{0.2^2}$

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

(ii) $\sqrt{5.1^2 + 4 \times 7.3^2}$

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

(iii) $25^{\frac{1}{2}} \times 1000^{-\frac{2}{3}}$

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

(b) Mia invests \$7500 at 3.5% per year **simple** interest.
Calculate the total amount she has after 5 years.

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

(c) Written as the product of prime factors $48 = 2^4 \times 3$.

(i) Write 60 as the product of prime factors.

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

(ii) Work out the highest common factor (HCF) of 48 and 60.

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

(iii) Work out the lowest common multiple (LCM) of 48 and 60.

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

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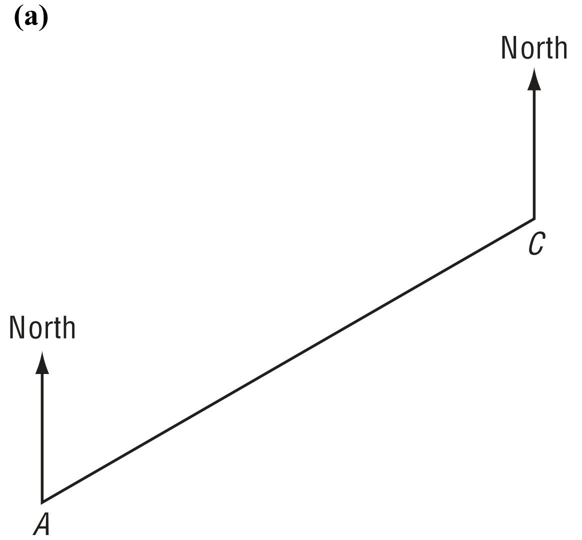
3 **(a)**



The scale drawing shows the positions of two towns *A* and *C* on a map.
On the map, 1 centimetre represents 20 kilometres.

(i) Find the distance in kilometres from town *A* to town *C*.

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

(ii) Measure and write down the bearing of town *C* from town *A*.

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

(iii) Town *B* is 140 km from town *C* on a bearing of 150°.

Mark accurately the position of town *B* on the scale drawing. [2]

(iv) Find the bearing of town *C* from town *B*.

Answer(a)(iv) .... [1]

(v) A lake on the map has an area of 0.15 cm^2.

Work out the actual area of the lake.

Answer(a)(v) .... km^2 [2]

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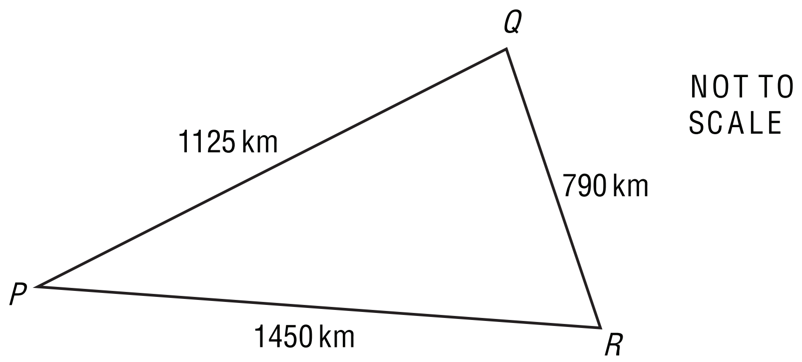
(b) A plane leaves town C at 11 57 and flies 1500 km to another town, landing at 14 12.

Calculate the average speed of the plane.

Answer(b) .... km/h [3]

(c)



The diagram shows the distances between three towns P, Q and R.

Calculate angle PQR.

Answer(c) Angle PQR = ... [4]

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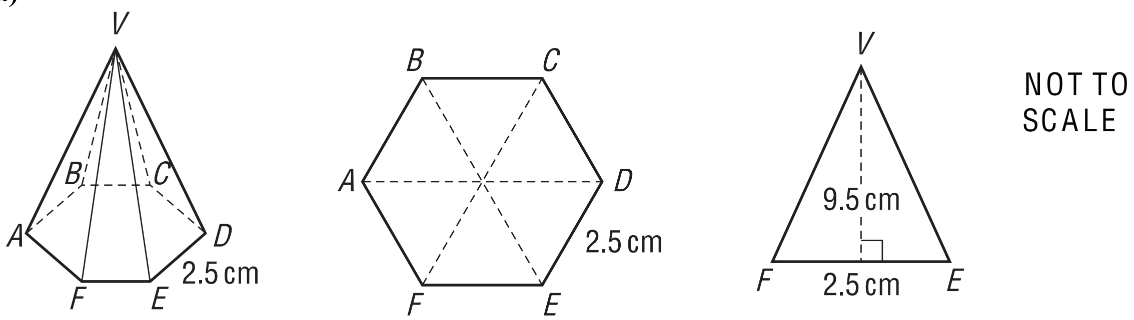
7 (a)

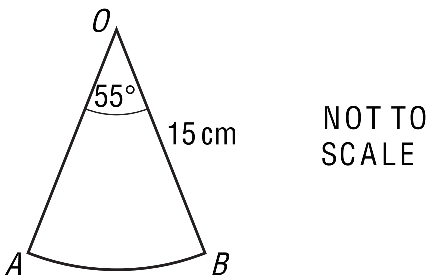


A solid pyramid has a **regular hexagon** of side 2.5 cm as its base.
Each sloping face is an isosceles triangle with base 2.5 cm and height 9.5 cm.

Calculate the **total** surface area of the pyramid.

Answer(a) .... cm^2 [4]

(b)



A sector *OAB* has an angle of 55° and a radius of 15 cm.

Calculate the area of the sector and show that it rounds to 108 cm^2, correct to 3 significant figures.

Answer (b)

[3]

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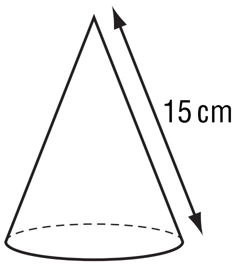
(c)



The sector radii *OA* and *OB* in **part (b)** are joined to form a cone.

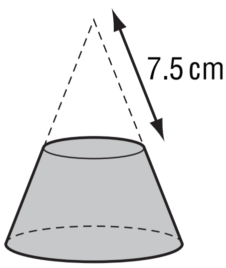
(i) Calculate the base radius of the cone.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

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

(ii) Calculate the perpendicular height of the cone.

Answer(c)(ii) .... cm [3]

(d)



A solid cone has the same dimensions as the cone in **part (c)**.
A small cone with slant height 7.5 cm is removed by cutting parallel to the base.

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(d) .... cm^3 [3]

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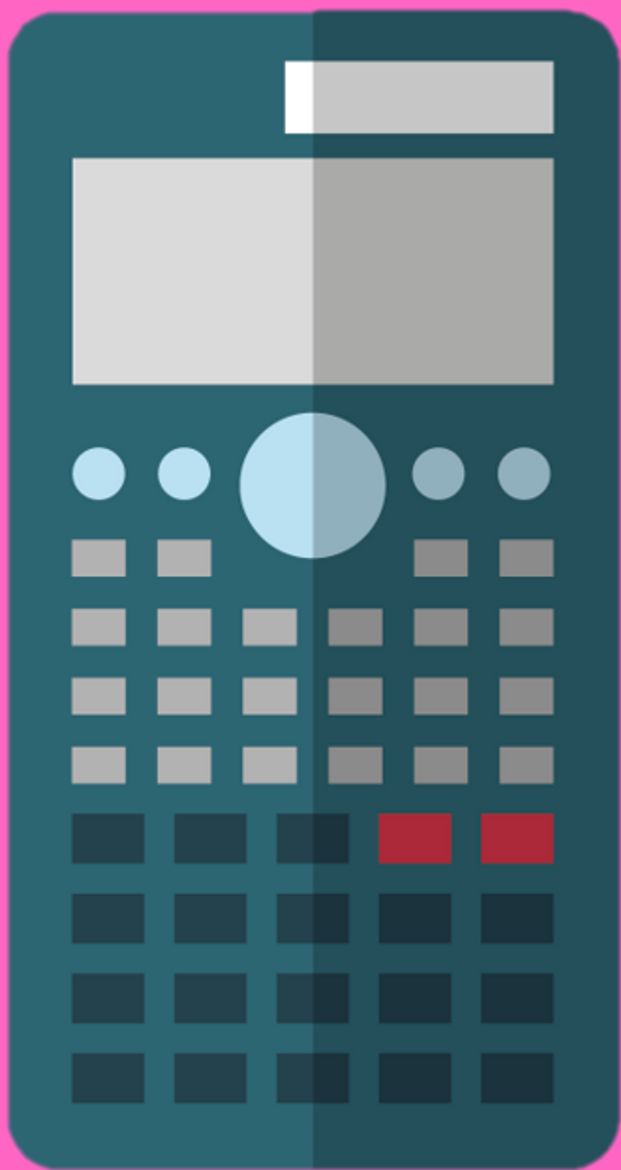

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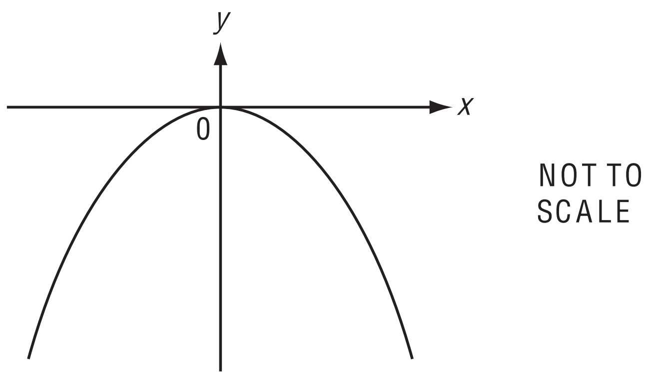
4 Helen measures a rectangular sheet of paper as 197 mm by 210 mm, each correct to the nearest millimetre.
Calculate the upper bound for the perimeter of the sheet of paper.

Answer .... mm [2]

5



The sketch shows the graph of $y = ax^n$ where a and n are integers.

Write down a possible value for a and a possible value for n.

Answer a = ...

n = ... [2]

6 **(a)** Write 16 460 000 in standard form.

Answer(a) .... [1]

(b) Calculate $7.85 \div (2.366 \times 10^2)$, giving your answer in standard form.

Answer(b) .... [2]

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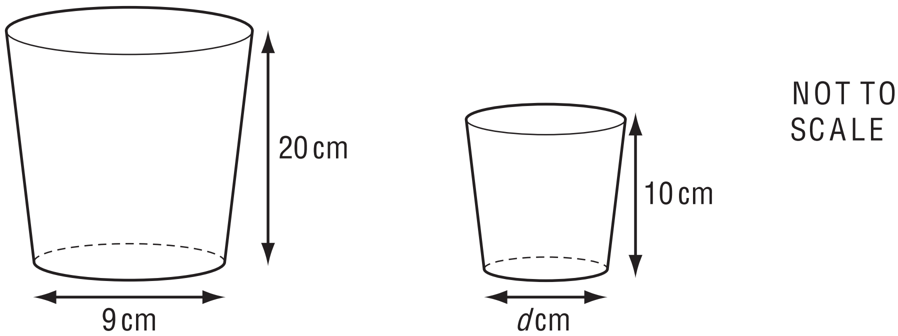
16 Write $\dfrac{2}{x-2}+\dfrac{3}{x+2}$ as a single fraction.

Give your answer in its simplest form.

Answer .... [3]

17



The diagrams show two mathematically similar containers.
The larger container has a base with diameter 9 cm and a height 20 cm.
The smaller container has a base with diameter *d* cm and a height 10 cm.

(a) Find the value of *d*.

Answer(a) d = ... [1]

(b) The larger container has a capacity of 1600 ml.

Calculate the capacity of the smaller container.

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

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18 Simplify the following.

(a) $(3x^3)^3$

Answer(a) .... [2]

(b) $(125x^6)^{\frac{2}{3}}$

Answer(b) .... [2]

---

19 The scale of a map is 1 : 250 000.

(a) The actual distance between two cities is 80 km.

Calculate this distance on the map. Give your answer in centimetres.

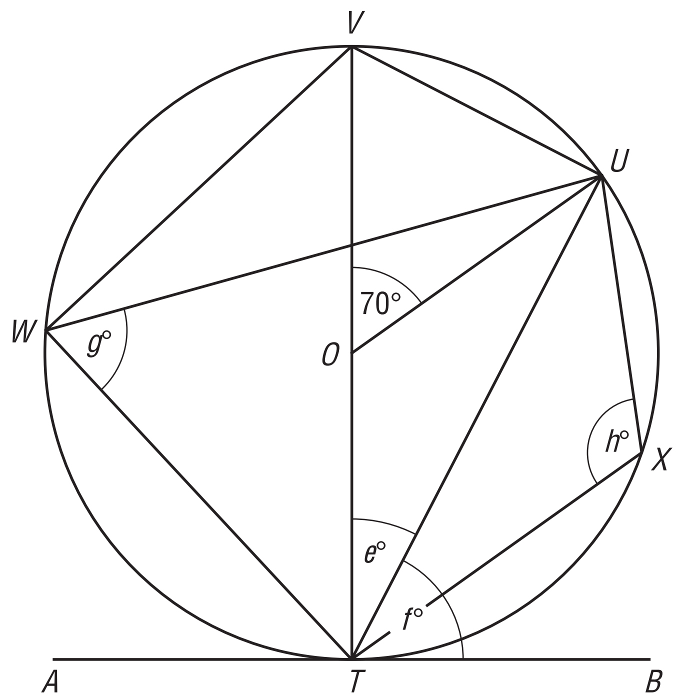
Answer(a) .... cm [2]

(b) On the map a large forest has an area of 6 cm^2.

Calculate the actual area of the forest. Give your answer in square kilometres.

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

20



NOT TO SCALE

The diagram shows a circle, centre O.
VT is a diameter and ATB is a tangent to the circle at T.
U, V, W and X lie on the circle and angle $VOU = 70°$.

Calculate the value of

(a) e,

Answer(a) e = ... [1]

(b) f,

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

(c) g,

Answer(c) g = ... [1]

(d) h.

Answer(d) h = ... [1]

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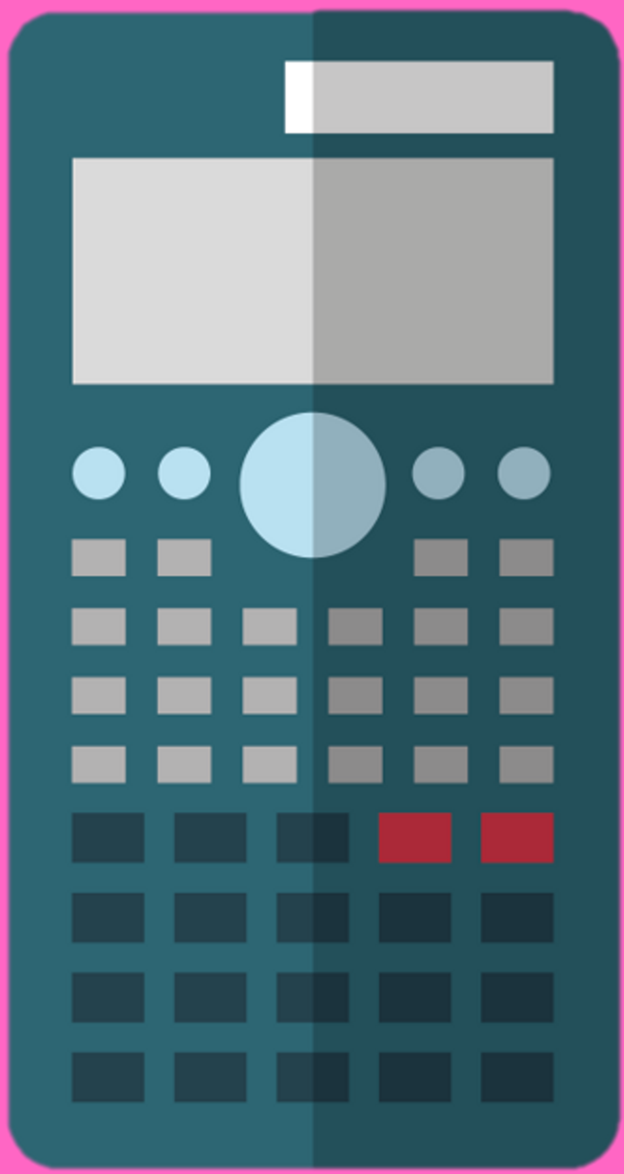

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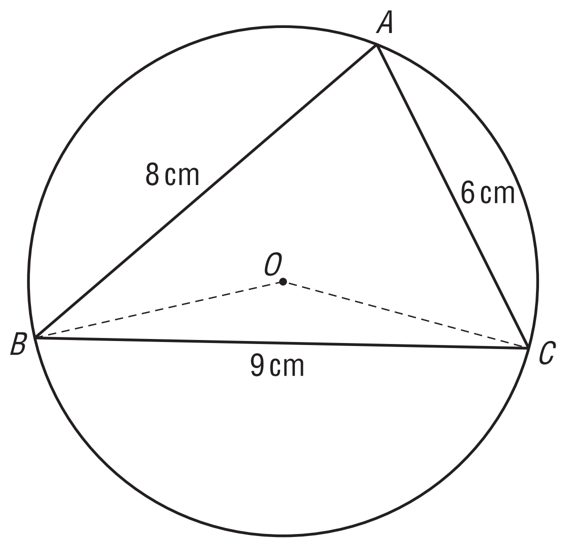

The circle, centre O, passes through the points A, B and C.

In the triangle ABC, $AB = 8$ cm, $BC = 9$ cm and $CA = 6$ cm.

(a) Calculate angle BAC and show that it rounds to 78.6°, correct to 1 decimal place.

Answer(a)

[4]

(b) M is the midpoint of BC.

(i) Find angle BOM.

Answer(b)(i) Angle BOM = ... [1]

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(ii) Calculate the radius of the circle and show that it rounds to 4.59 cm, correct to 3 significant figures.

Answer(b)(ii)

[3]

(c) Calculate the area of the triangle *ABC* as a percentage of the area of the circle.

Answer(c) .... % [4]

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7 Katrina puts some plants in her garden.

The probability that a plant will produce a flower is $\frac{7}{10}$.

If there is a flower, it can only be red, yellow or orange.

When there is a flower, the probability it is red is $\frac{2}{3}$ and the probability it is yellow is $\frac{1}{4}$.

(a) Draw a tree diagram to show **all** this information.

Label the diagram and write the probabilities on each branch.

Answer(a)

[5]

(b) A plant is chosen at random.

Find the probability that it will **not** produce a yellow flower.

Answer(b) .... [3]

(c) If Katrina puts 120 plants in her garden, how many orange flowers would she expect?

Answer(c) .... [2]

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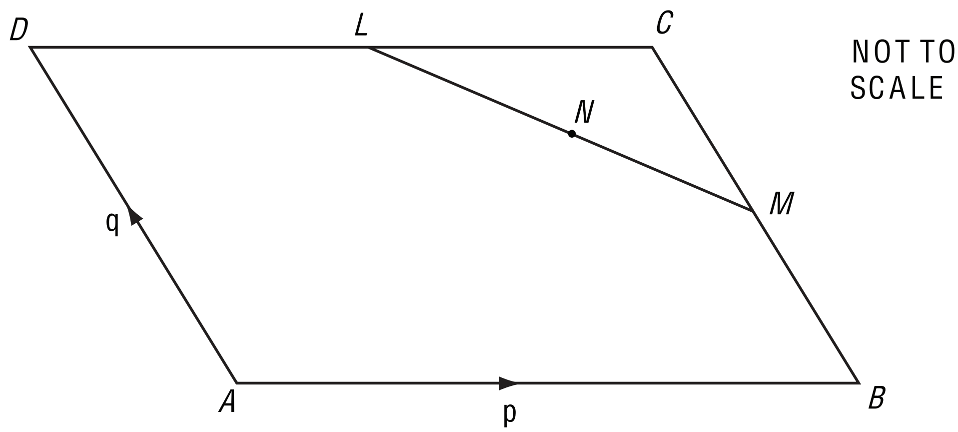
10 (a)



ABCD is a parallelogram.
L is the midpoint of *DC*, *M* is the midpoint of *BC* and *N* is the midpoint of *LM*.
$\overrightarrow{AB} = \mathbf{p}$ and $\overrightarrow{AD} = \mathbf{q}$.

(i) Find the following in terms of **p** and **q**, in their simplest form.

(a) $\overrightarrow{AC}$

Answer(a)(i)(a) $\overrightarrow{AC}$ = ... [1]

(b) $\overrightarrow{LM}$

Answer(a)(i)(b) $\overrightarrow{LM}$= .... [2]

(c) $\overrightarrow{AN}$

Answer(a)(i)(c) $\overrightarrow{AN}$= .... [2]

(ii) Explain why your answer for $\overrightarrow{AN}$ shows that the point *N* lies on the line *AC*.

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

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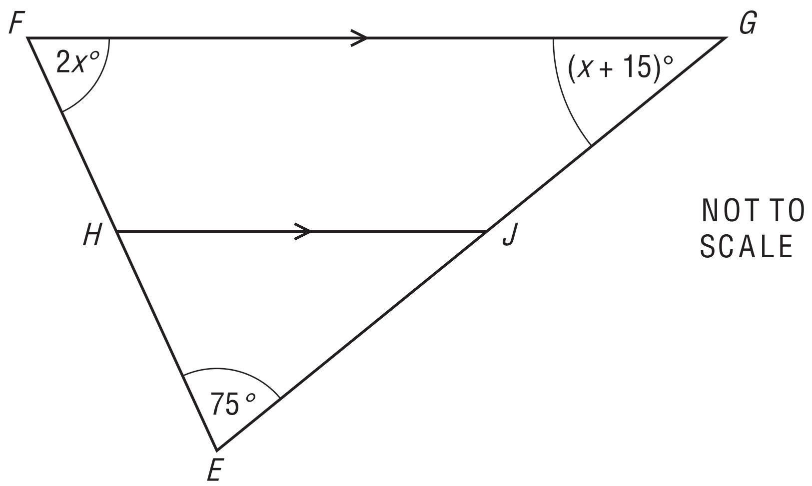
(b)



EFG is a triangle.
HJ is parallel to *FG*.
Angle *FEG* = 75°.
Angle *EFG* = 2*x*° and angle *FGE* = (*x* + 15)°.

(i) Find the value of *x*.

Answer(b)(i) *x* = ... [2]

(ii) Find angle *HJG*.

Answer(b)(ii) Angle *HJG* = ... [1]

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11 (a) (i) The first three positive integers 1, 2 and 3 have a sum of 6.

Write down the sum of the first 4 positive integers.

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

(ii) The formula for the sum of the first n integers is $\frac{n(n+1)}{2}$.

Show the formula is correct when $n = 3$.

Answer(a)(ii)

[1]

(iii) Find the sum of the first 120 positive integers.

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

(iv) Find the sum of the integers

121 + 122 + 123 + 124 + …………………………… + 199 + 200.

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

(v) Find the sum of the even numbers

2 + 4 + 6 + ………………………… + 800.

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

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(b) **(i)** Complete the following statements about the sums of cubes and the sums of integers.

$1^3 = 1$ $\quad\quad$ $1 = 1$

$1^3 + 2^3 = 9$ $\quad\quad$ $1 + 2 = 3$

$1^3 + 2^3 + 3^3 =$ .... $\quad\quad$ $1 + 2 + 3 =$ ....

$1^3 + 2^3 + 3^3 + 4^3 =$ .... $\quad\quad$ $1 + 2 + 3 + 4 =$ .... [2]

(ii) The sum of the first 14 integers is 105.

Find the sum of the first 14 cubes.

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

(iii) Use the formula in **part(a)(ii)** to write down a formula for the sum of the first n cubes.

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

(iv) Find the sum of the first 60 cubes.

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

(v) Find n when the sum of the first n cubes is 278 784.

Answer(b)(v) $n =$ .... [2]

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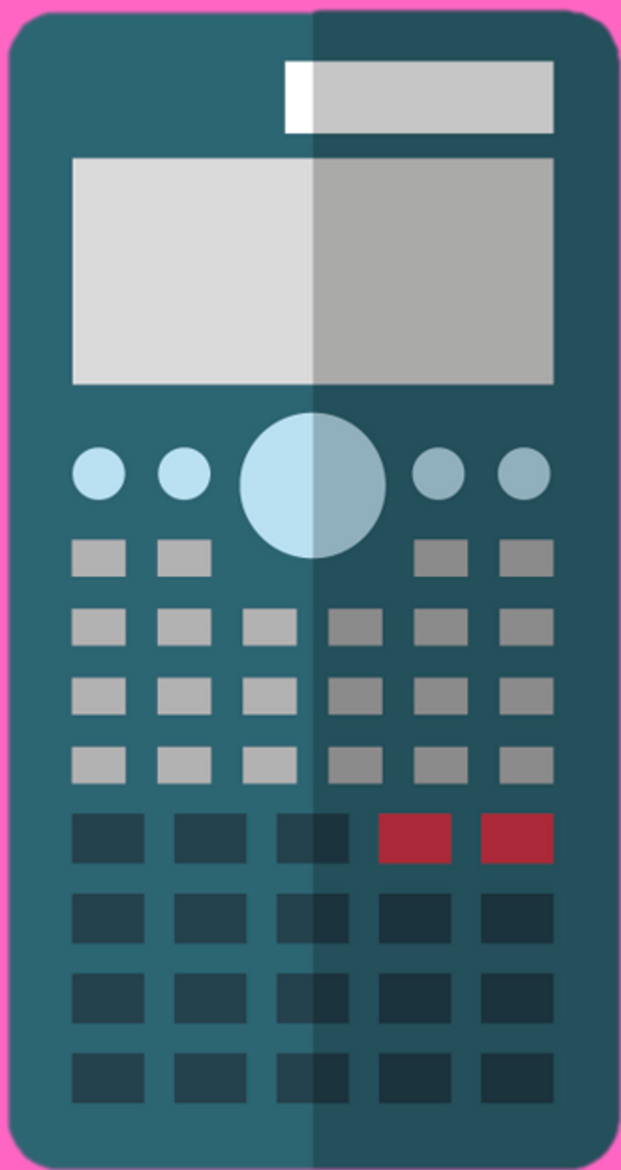

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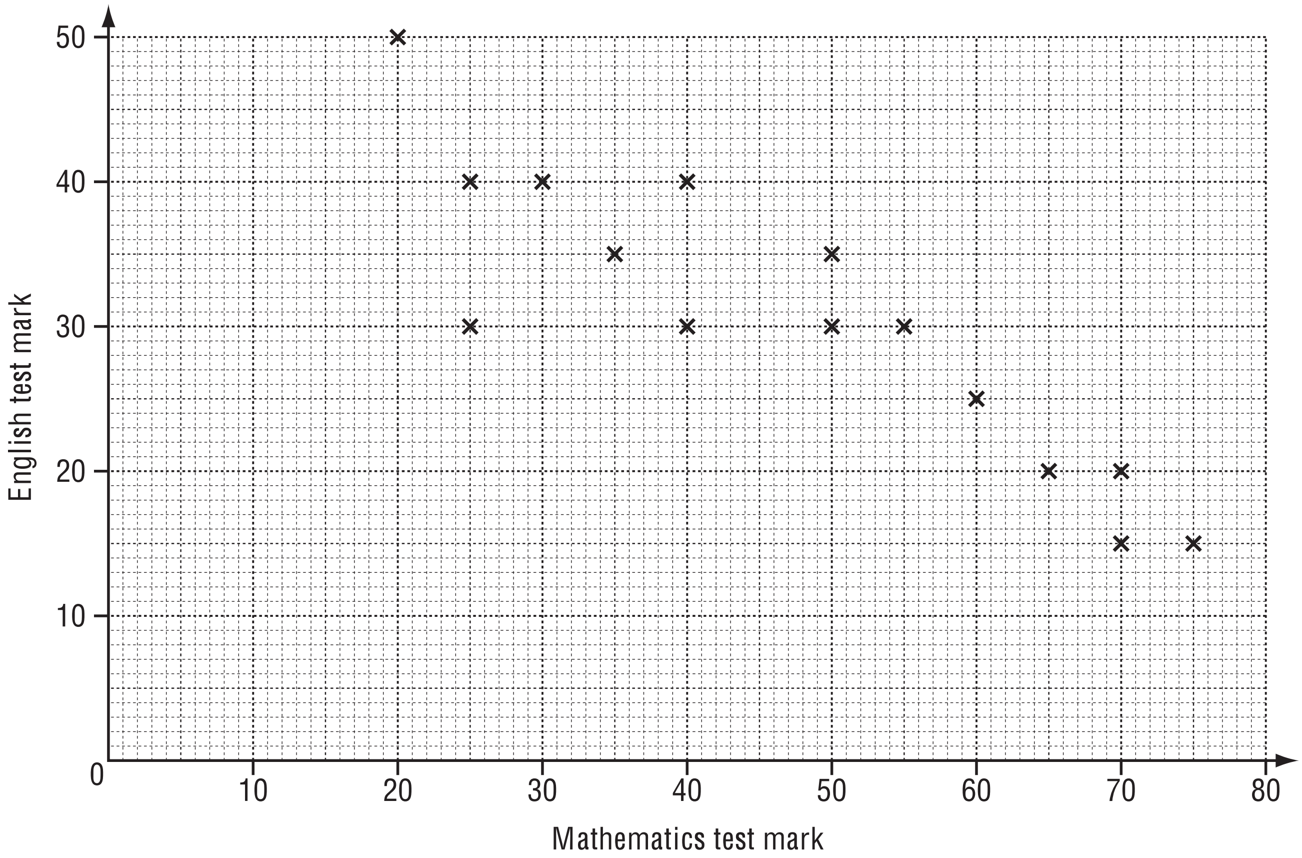

The scatter diagram shows the marks obtained in a Mathematics test and the marks obtained in an English test by 15 students.

(a) Describe the correlation.

Answer(a) .... [1]

(b) The mean for the Mathematics test is 47.3 .
The mean for the English test is 30.3 .

Plot the mean point (47.3, 30.3) on the scatter diagram above. [1]

(c) **(i)** Draw the line of best fit on the diagram above. [1]

(ii) One student missed the English test.
She received 45 marks in the Mathematics test.

Use your line to estimate the mark she might have gained in the English test.

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

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15 A container ship travelled at 14 km/h for 8 hours and then slowed down to 9 km/h over a period of 30 minutes.

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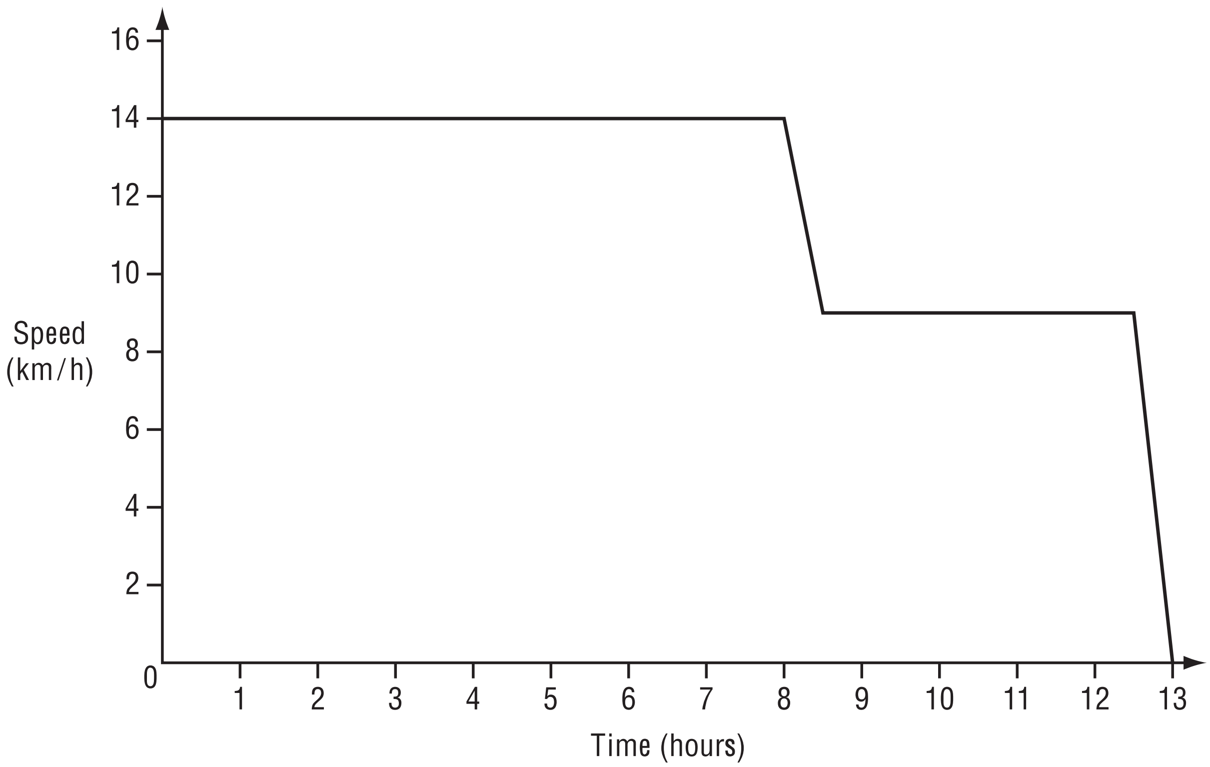
It travelled at this speed for another 4 hours and then slowed to a stop over 30 minutes.

The speed-time graph shows this voyage.



(a) Calculate the total distance travelled by the ship.

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

(b) Calculate the average speed of the ship for the whole voyage.

Answer(b) .... km/h [1]

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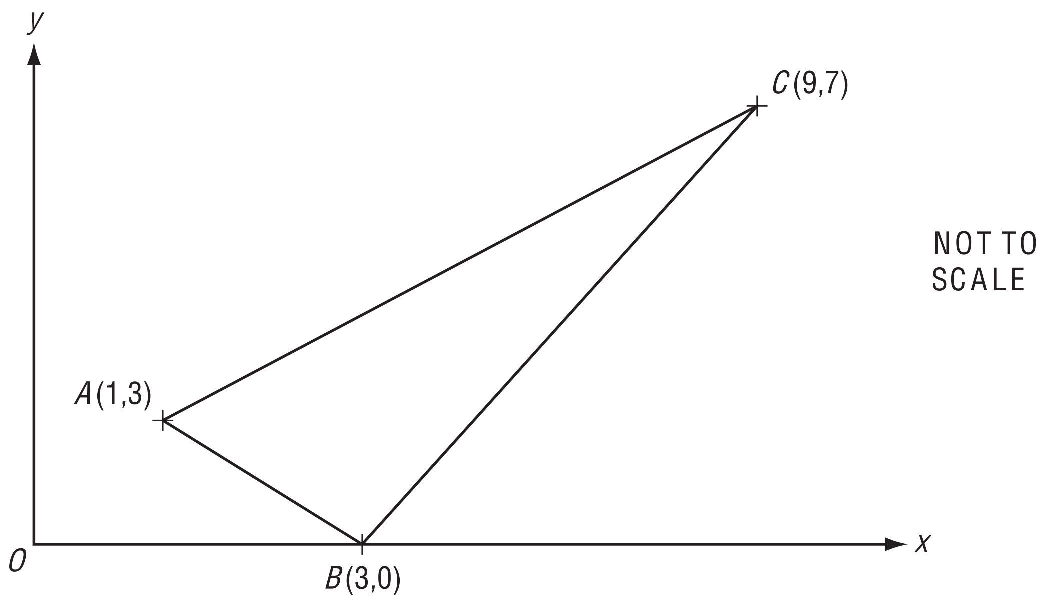
16



The co-ordinates of *A*, *B* and *C* are shown on the diagram, which is not to scale.

(a) Find the length of the line *AB*.

Answer(a) AB = ... [3]

(b) Find the equation of the line *AC*.

Answer(b) .... [3]

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18 The first four terms of a sequence are

$T_1 = 1^2 \quad T_2 = 1^2 + 2^2 \quad T_3 = 1^2 + 2^2 + 3^2 \quad T_4 = 1^2 + 2^2 + 3^2 + 4^2.$

(a) The nth term is given by $T_n = \frac{1}{6}n(n+1)(2n+1)$.

Work out the value of T_{23}.

Answer(a) T_{23} = ... [2]

(b) A new sequence is formed as follows.

$U_1 = T_2 - T_1 \quad U_2 = T_3 - T_2 \quad U_3 = T_4 - T_3 \quad \ldots\ldots$

(i) Find the values of U_1 and U_2.

Answer(b)(i) U_1 = ... and U_2 = ... [2]

(ii) Write down a formula for the nth term, U_n .

Answer(b)(ii) U_n = ... [1]

(c) The first four terms of another sequence are

$V_1 = 2^2 \quad V_2 = 2^2 + 4^2 \quad V_3 = 2^2 + 4^2 + 6^2 \quad V_4 = 2^2 + 4^2 + 6^2 + 8^2.$

By comparing this sequence with the one in **part (a)**, find a formula for the nth term, V_n .

Answer(c) V_n = ... [2]

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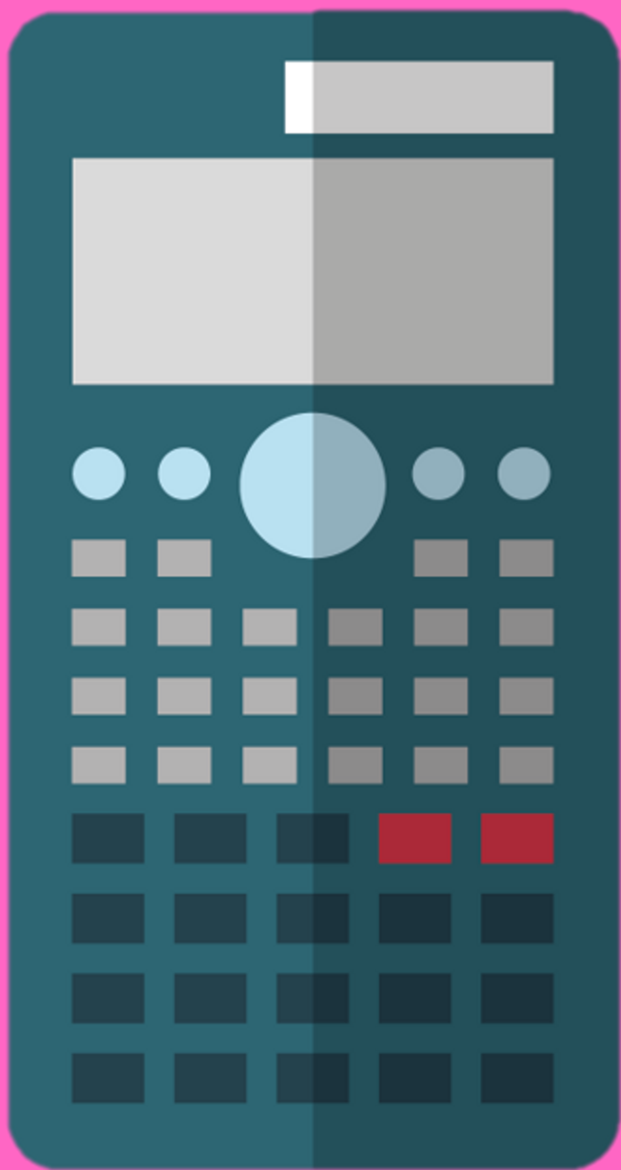

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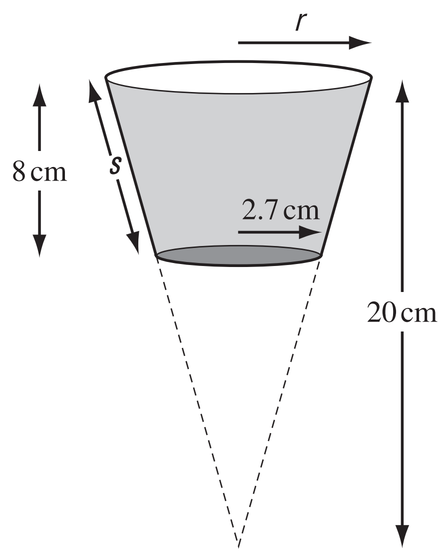

The diagram shows a plastic cup in the shape of a cone with the end removed.
The vertical height of the cone in the diagram is 20 cm.
The height of the cup is 8 cm.
The base of the cup has radius 2.7 cm.

(a) **(i)** Show that the radius, r, of the circular top of the cup is 4.5 cm.

Answer(a)(i)

[2]

(ii) Calculate the volume of water in the cup when it is full.

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

Answer(a)(ii) .... cm^3 [4]

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(b) **(i)** Show that the slant height, s, of the cup is 8.2 cm.

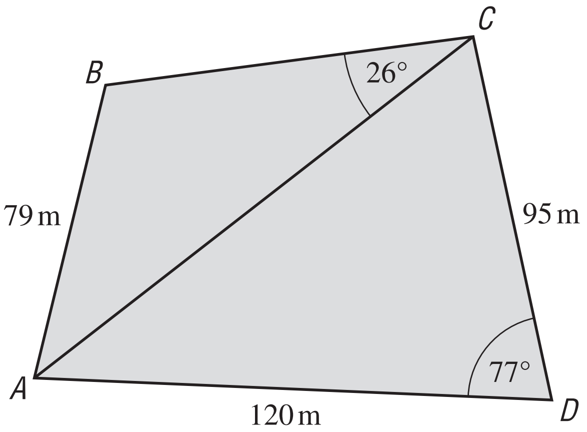
Answer(b)(i)

[3]

(ii) Calculate the curved surface area of the outside of the cup.
[The curved surface area, A, of a cone with radius r and slant height l is $A = \pi rl$.]

Answer(b)(ii) .... cm^2 [5]

6



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The quadrilateral *ABCD* represents an area of land.
There is a straight road from *A* to *C*.
AB = 79 m, *AD* = 120 m and *CD* = 95 m.
Angle *BCA* = 26° and angle *CDA* = 77°.

(a) Show that the length of the road, *AC*, is 135 m correct to the nearest metre.

Answer(a)

[4]

(b) Calculate the size of the **obtuse** angle *ABC*.

Answer(b) Angle *ABC* = ... [4]

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(c) A straight path is to be built from B to the nearest point on the road AC.

Calculate the length of this path.

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

(d) Houses are to be built on the land in triangle ACD.
Each house needs at least $180\,\text{m}^2$ of land.

Calculate the maximum number of houses which can be built.
Show all of your working.

Answer(d) .... [4]

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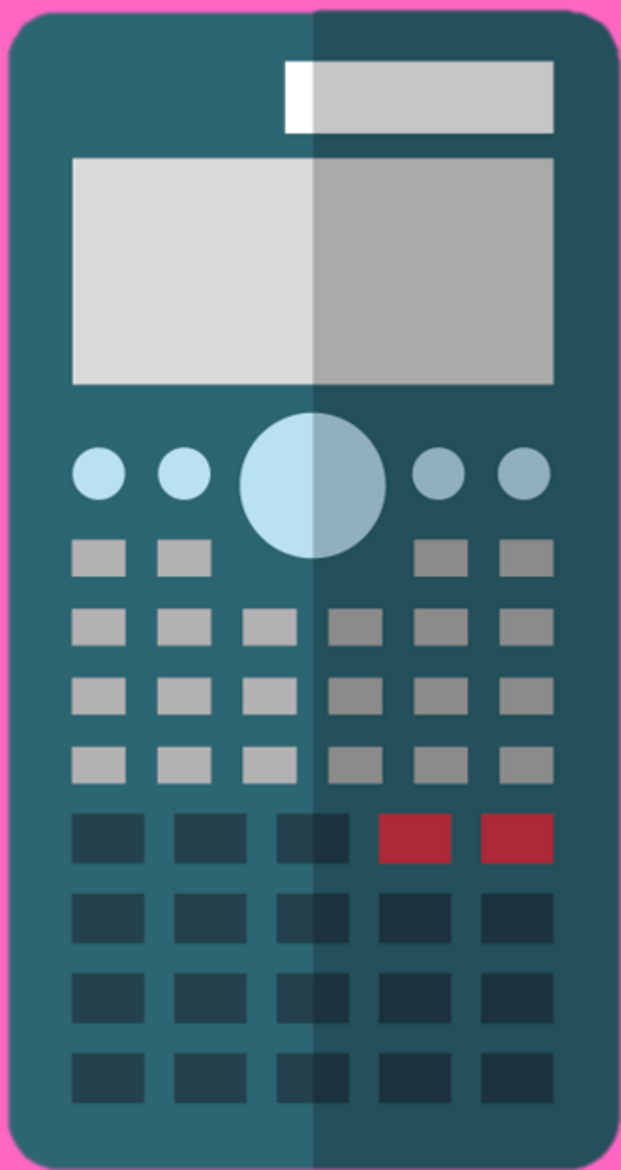

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1 A bus leaves a port every 15 minutes, starting at 09 00.
The last bus leaves at 17 30.

How many times does a bus leave the port during one day?

Answer .... [2]

2 Factorise completely $ax + bx + ay + by$.

Answer .... [2]

3 Use your calculator to find the value of

(a) $3^0 \times 2.5^2$,

Answer(a) .... [1]

(b) 2.5^{-2}.

Answer(b) .... [1]

4 The cost of making a chair is $28 correct to the nearest dollar.

Calculate the lower and upper bounds for the cost of making 450 chairs.

Answer lower bound $ ....

upper bound $ .... [2]

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11 Find the values of m and n.

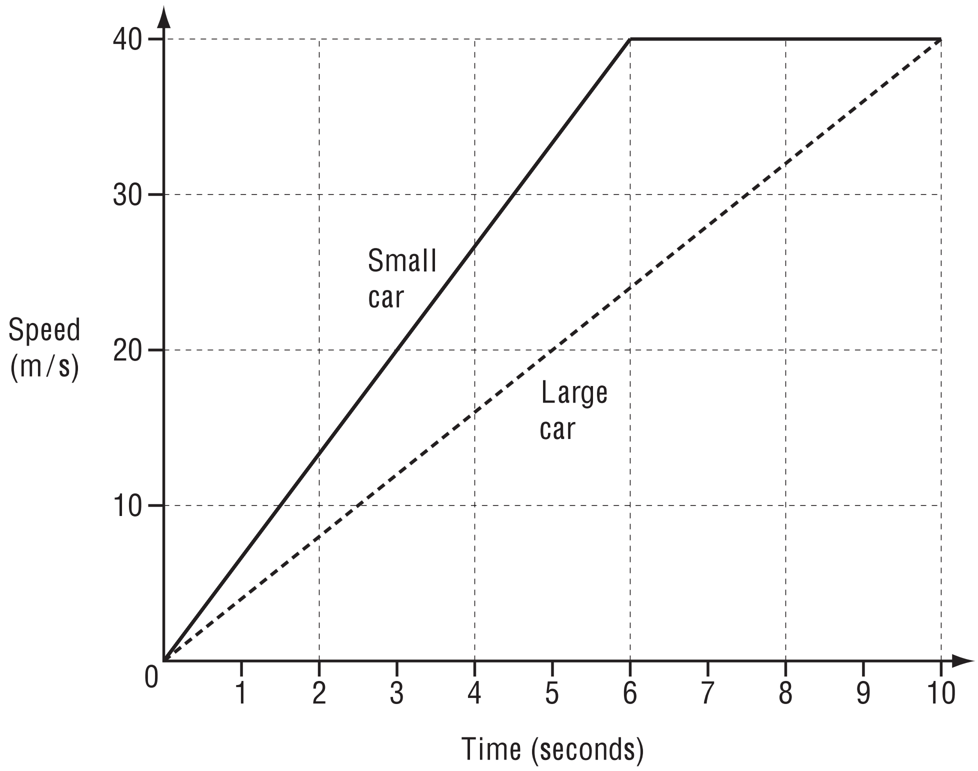
(a) $2^m = 0.125$

Answer(a) $m =$ .... [2]

(b) $2^{4n} \times 2^{2n} = 512$

Answer(b) $n =$ .... [2]

12



A small car accelerates from 0 m/s to 40 m/s in 6 seconds and then travels at this constant speed.
A large car accelerates from 0 m/s to 40 m/s in 10 seconds.

Calculate how much further the small car travels in the first 10 seconds.

Answer .... m [4]

16 In a survey of 60 cars, the type of fuel that they use is recorded in the table below.

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Each car only uses one type of fuel.

Petrol	Diesel	Liquid Hydrogen	Electricity
40	12	2	6

(a) Write down the mode.

Answer(a) .... [1]

(b) Olav drew a pie chart to illustrate these figures.

Calculate the angle of the sector for Diesel.

Answer(b) .... [2]

(c) Calculate the probability that a car chosen at random uses Electricity.

Write your answer as a fraction in its simplest form.

Answer(c) .... [2]

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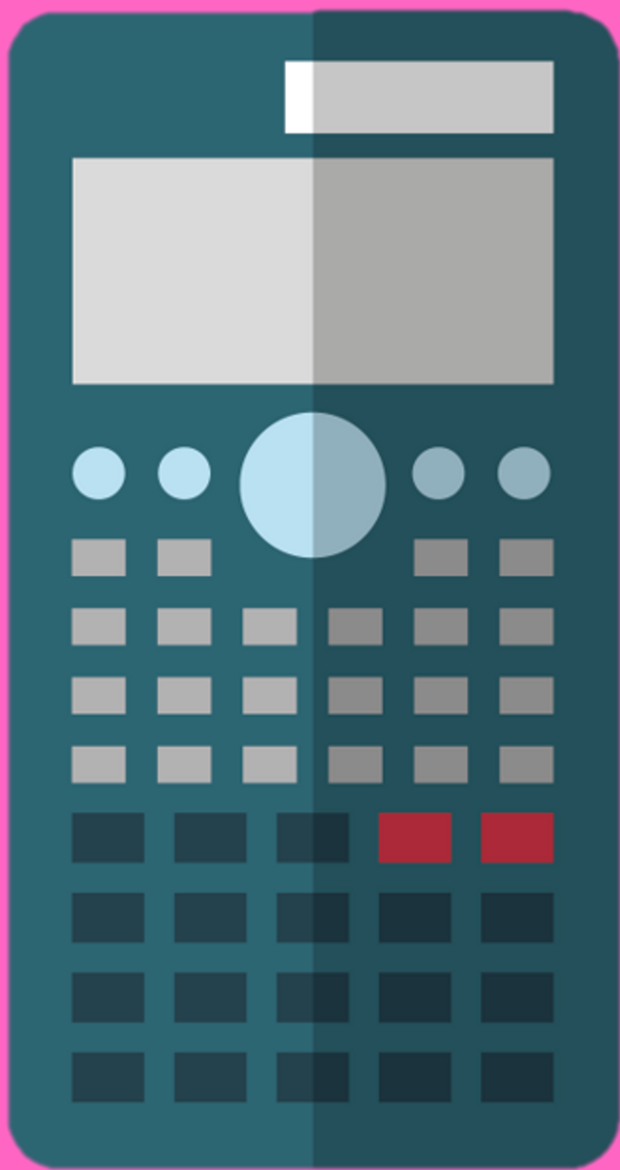

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1 Children go to camp on holiday.

(a) Fatima buys bananas and apples for the camp.

(i) Bananas cost \$0.85 per kilogram.

Fatima buys 20kg of bananas and receives a discount of 14%.

How much does she spend on bananas?

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

(ii) Fatima spends \$16.40 on apples after a discount of 18%.

Calculate the original price of the apples.

Answer(a)(ii) \$ .... [3]

(iii) The ratio number of bananas : number of apples = 4 : 5.

There are 108 bananas.

Calculate the number of apples.

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

(b) The cost to hire a tent consists of two parts.

$c	+	$d per day

The total cost for 4 days is $27.10 and for 7 days is $34.30.

Write down two equations in c and d and solve them.

Answer(b) $c =$ ....

$d =$ .... [4]

(c) The children travel 270 km to the camp, leaving at 07 43 and arriving at 15 13.

Calculate their average speed in km/h.

Answer(c) .... km/h [3]

(d) Two years ago $540 was put in a savings account to pay for the holiday.

The account paid **compound** interest at a rate of 6% per year.

How much is in the account now?

Answer(d) $ .... [2]

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(d) **(i)** Show that f(x) = g(x) can be written as $4x^2 - 3x - 2 = 0$.

Answer (d)(i)

[1]

(ii) Solve the equation $4x^2 - 3x - 2 = 0$.

Show all your working and give your answers correct to 2 decimal places.

Answer(d)(ii) x = ... or x = ... [4]

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4 Boris has a recipe which makes 16 biscuits.

The ingredients are

160 g flour,

160 g sugar,

240 g butter,

200 g oatmeal.

(a) Boris has only 350 grams of oatmeal but plenty of the other ingredients.

(i) How many biscuits can he make?

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

(ii) How many grams of butter does he need to make this number of biscuits?

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

(b) The ingredients are mixed together to make dough.

This dough is made into a sphere of volume 1080 cm^3.

Calculate the radius of this sphere.

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

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

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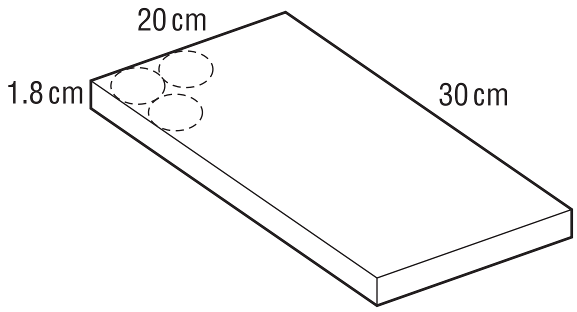
(c)



The $1080\,cm^3$ of dough is then rolled out to form a cuboid $20\,cm \times 30\,cm \times 1.8\,cm$.

Boris cuts out circular biscuits of diameter 5 cm.

(i) How many whole biscuits can he cut from this cuboid?

Answer(c)(i) .... [1]

(ii) Calculate the volume of dough left over.

Answer(c)(ii) .... cm^3 [3]

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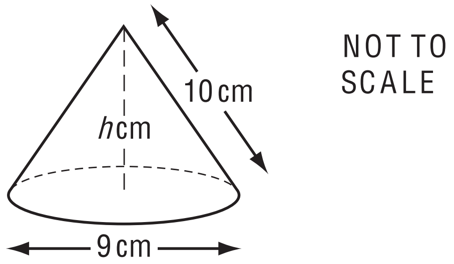
6



A solid cone has diameter 9 cm, slant height 10 cm and vertical height h cm.

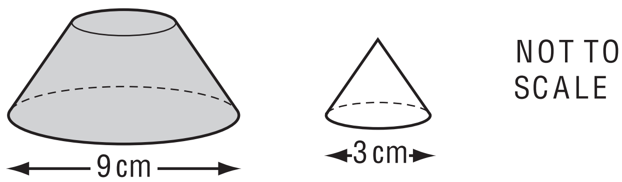
(a) **(i)** Calculate the curved surface area of the cone.
[The curved surface area, A, of a cone, radius r and slant height l is $A = \pi rl$.]

Answer(a)(i) .... cm^2 [2]

(ii) Calculate the value of h, the vertical height of the cone.

Answer(a)(ii) h = ... [3]

(b)



Sasha cuts off the top of the cone, making a smaller cone with diameter 3 cm.
This cone is **similar** to the original cone.

(i) Calculate the **vertical** height of this small cone.

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

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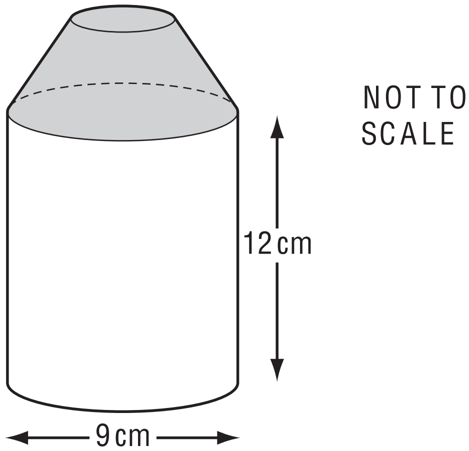
(ii) Calculate the curved surface area of this small cone.

Answer(b)(ii) .... cm^2 [2]

(c)



The shaded solid from **part (b)** is joined to a solid cylinder with diameter 9 cm and height 12 cm.
Calculate the **total** surface area of the whole solid.

Answer(c) .... cm^2 [5]

8

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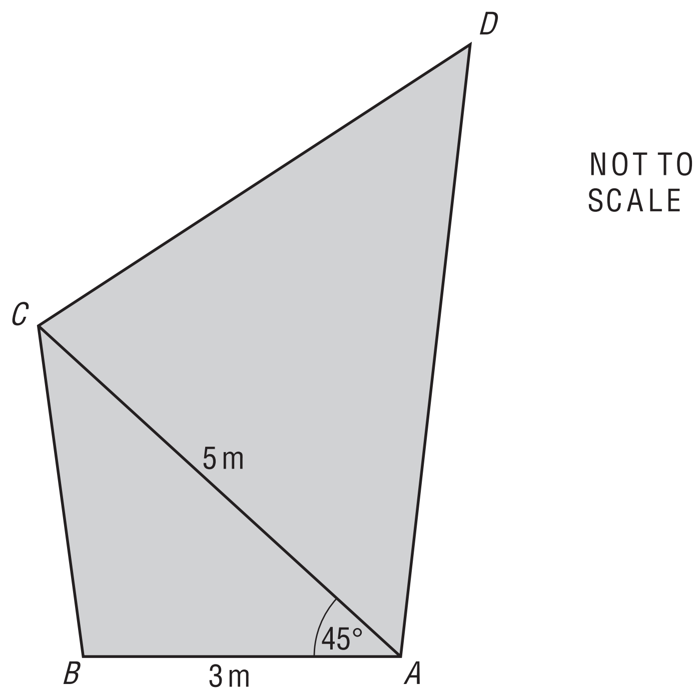

Parvatti has a piece of canvas *ABCD* in the shape of an irregular quadrilateral.

AB = 3 m, *AC* = 5 m and angle *BAC* = 45°.

(a) **(i)** Calculate the length of *BC* and show that it rounds to 3.58 m, correct to 2 decimal places.

You must show all your working.

Answer(a)(i)

[4]

(ii) Calculate angle *BCA*.

Answer(a)(ii) Angle *BCA* = ... [3]

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(b) $AC = CD$ and angle $CDA = 52°$.

(i) Find angle DCA.

Answer(b)(i) Angle DCA = ... [1]

(ii) Calculate the area of the canvas.

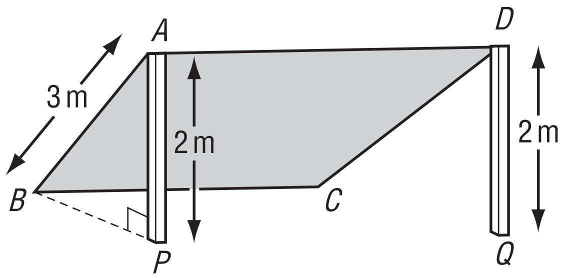
Answer(b)(ii) .... m^2 [3]

(c) Parvatti uses the canvas to give some shade.

She attaches corners A and D to the top of vertical poles, AP and DQ, each of height 2 m.

Corners B and C are pegged to the horizontal ground.

AB is a straight line and angle $BPA = 90°$.



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Calculate angle PAB.

Answer(c) Angle PAB = ... [2]

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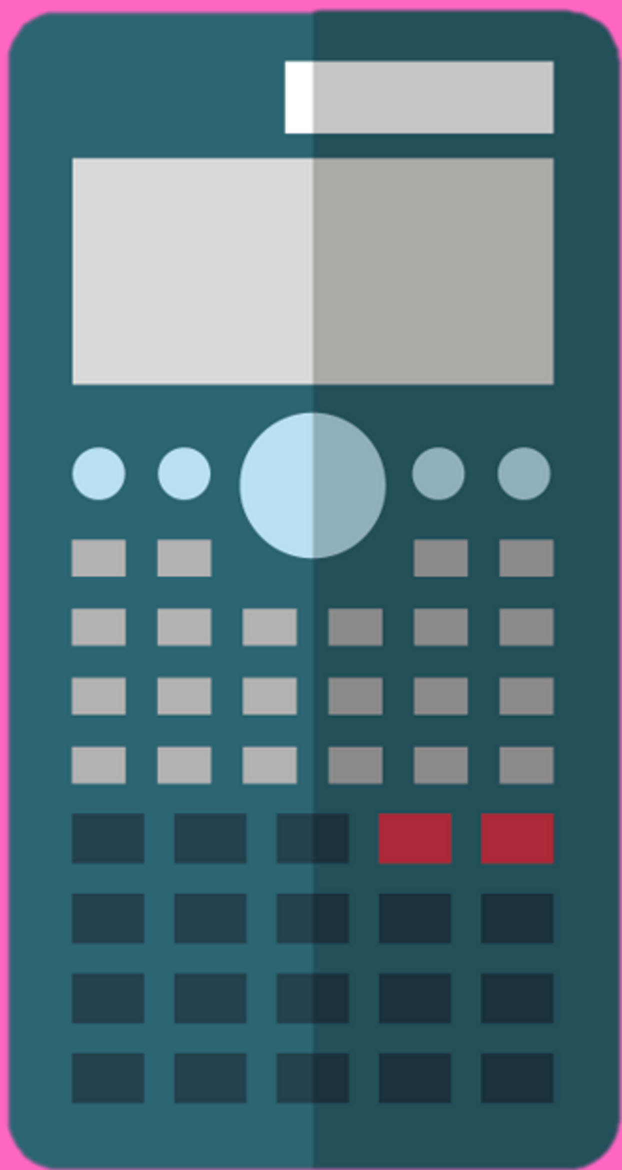

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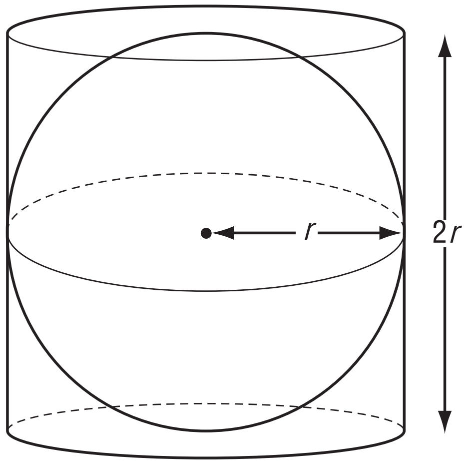

The sphere of radius r fits exactly inside the cylinder of radius r and height $2r$.
Calculate the percentage of the cylinder occupied by the sphere.

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

Answer .... % [3]

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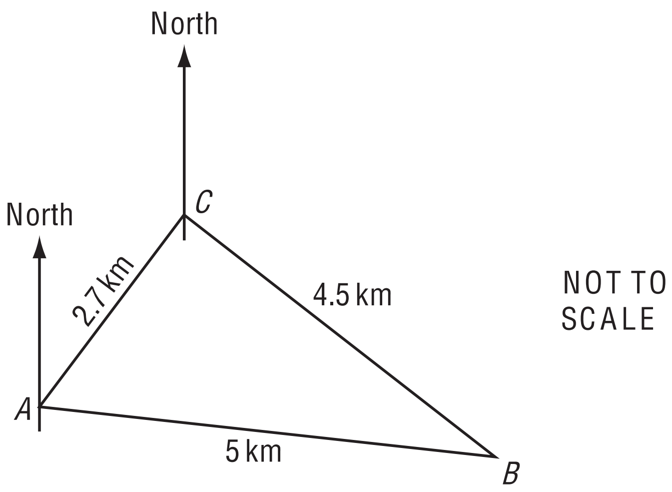
15 $ap = px + c$

Write p in terms of a, c and x.

Answer p = ... [3]

21



The diagram shows 3 ships A, B and C at sea.

$AB = 5\,\text{km}$, $BC = 4.5\,\text{km}$ and $AC = 2.7\,\text{km}$.

(a) Calculate angle ACB.
Show all your working.

Answer(a) Angle ACB = ... [4]

(b) The bearing of A from C is 220°.

Calculate the bearing of B from C.

Answer(b) .... [1]

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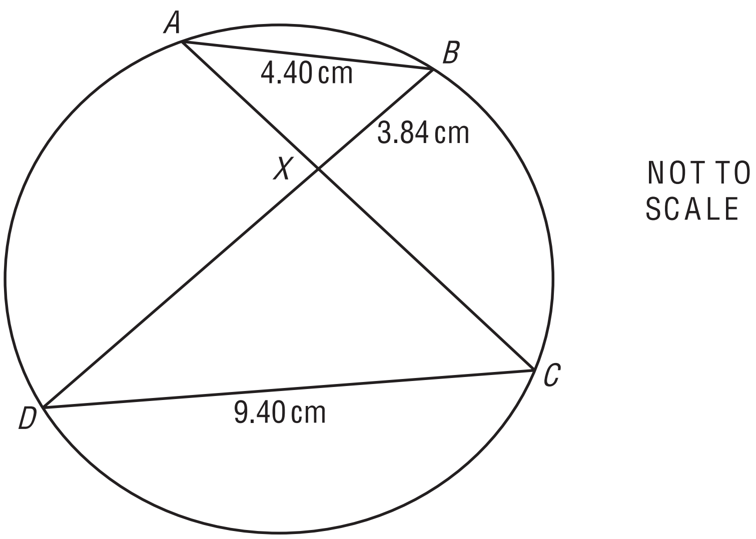

A, B, C and D lie on a circle.
AC and BD intersect at X.

(a) Give a reason why angle BAX is equal to angle CDX.

Answer(a) .... [1]

(b) $AB = 4.40$ cm, $CD = 9.40$ cm and $BX = 3.84$ cm.

(i) Calculate the length of CX.

Answer(b)(i) $CX =$ .... cm [2]

(ii) The area of triangle ABX is 5.41 cm^2.

Calculate the area of triangle CDX.

Answer(b)(ii) .... cm^2 [2]

Question 23 is printed on the next page.

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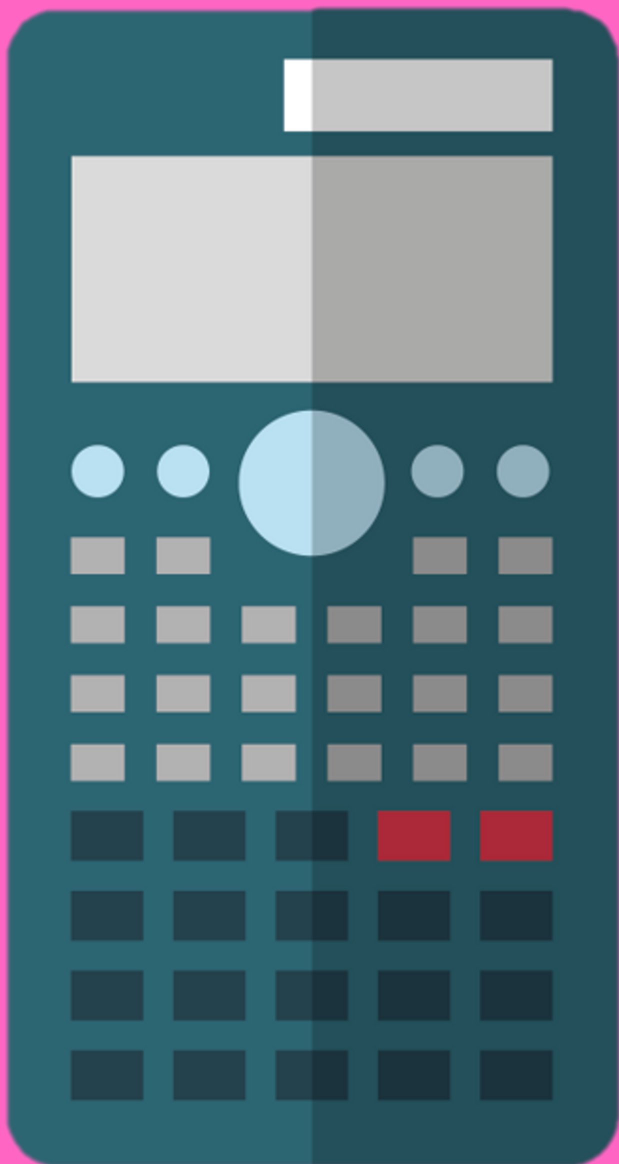

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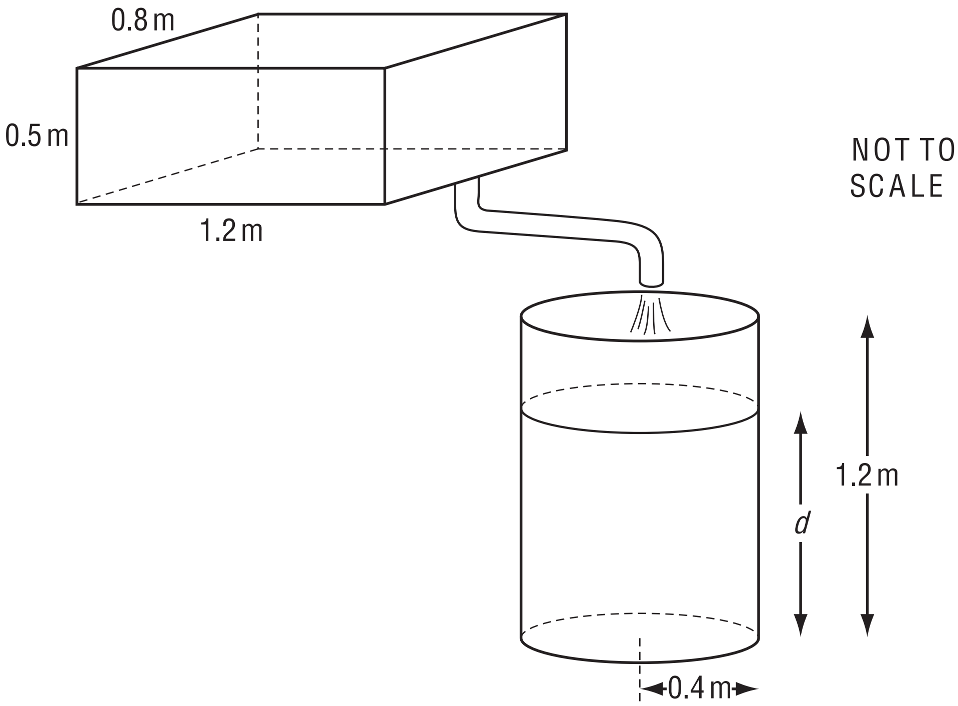

A rectangular tank measures 1.2 m by 0.8 m by 0.5 m.

(a) Water flows from the full tank into a cylinder at a rate of 0.3 m^3/min.

Calculate the time it takes for the full tank to empty.
Give your answer in minutes and seconds.

Answer(a) .... min .... s [3]

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(b) The radius of the cylinder is 0.4 m.

Calculate the depth of water, d, when all the water from the rectangular tank is in the cylinder.

Answer(b) d = ... m [3]

(c) The cylinder has a height of 1.2 m and is open at the top.
The inside surface is painted at a cost of \$2.30 per m^2.

Calculate the cost of painting the inside surface.

Answer(c) \$ .... [4]

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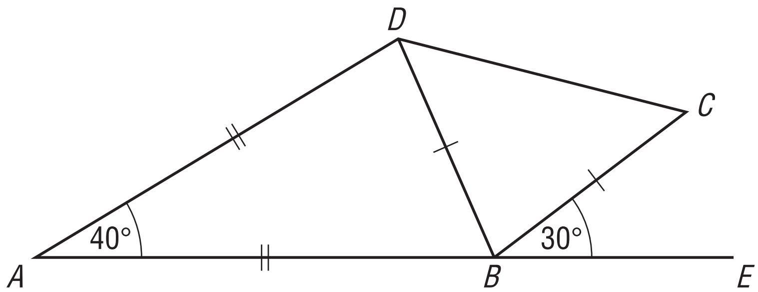
3 **(a)**



ABCD is a quadrilateral with angle *BAD* = 40°.
AB is extended to *E* and angle *EBC* = 30°.
AB = *AD* and *BD* = *BC*.

(i) Calculate angle *BCD*.

Answer(a)(i) Angle *BCD* = ... [3]

(ii) Give a reason why *DC* is not parallel to *AE*.

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

(b) A regular polygon has *n* sides.

Each exterior angle is $\frac{5n}{2}$ degrees.

Find the value of *n*.

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

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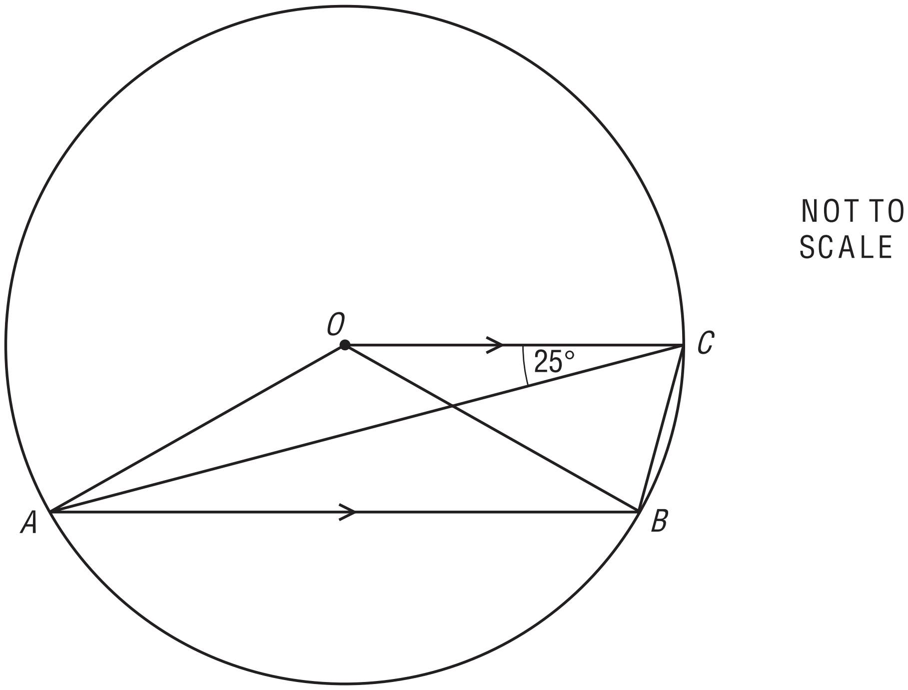
(c)

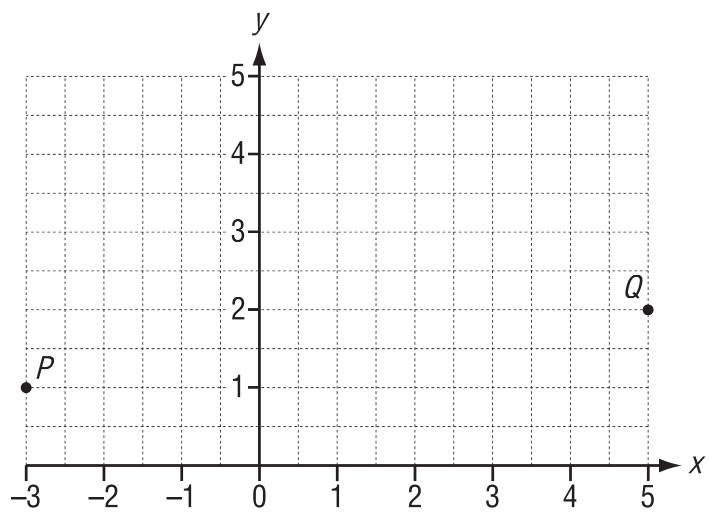


The diagram shows a circle centre *O*.
A, *B* and *C* are points on the circumference.
OC is parallel to *AB*.
Angle *OCA* = 25°.

Calculate angle *OBC*.

*Answer(c)*Angle *OBC* = ... [3]

11 (a)



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The points P and Q have co-ordinates (–3, 1) and (5, 2).

(i) Write $\overrightarrow{PQ}$ as a column vector.

Answer(a)(i) $\overrightarrow{PQ} = \begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

(ii) $\overrightarrow{QR} = 2\begin{pmatrix} -1 \\ 1 \end{pmatrix}$

Mark the point R on the grid. [1]

(iii) Write down the position vector of the point P.

Answer(a)(iii) $\begin{pmatrix} \quad \\ \quad \end{pmatrix}$ [1]

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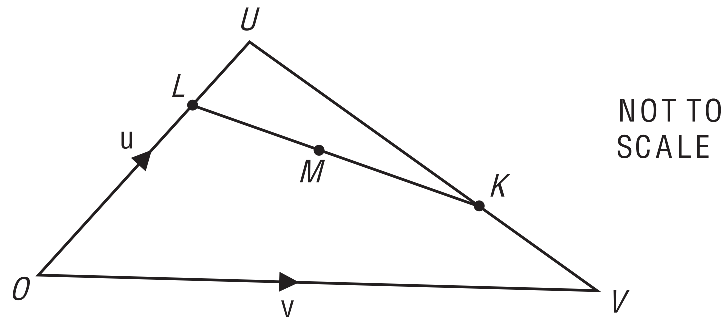
(b)



In the diagram, $\overrightarrow{OU} = \mathbf{u}$ and $\overrightarrow{OV} = \mathbf{v}$.

K is on UV so that $\overrightarrow{UK} = \frac{2}{3}\overrightarrow{UV}$ and L is on OU so that $\overrightarrow{OL} = \frac{3}{4}\overrightarrow{OU}$.

M is the midpoint of KL.

Find the following in terms of **u** and **v**, giving your answers in their simplest form.

(i) $\overrightarrow{LK}$

Answer(b)(i) $\overrightarrow{LK} =$ .... [4]

(ii) $\overrightarrow{OM}$

Answer(b)(ii) $\overrightarrow{OM} =$ .... [2]

Question 12 is printed on the next page.

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12 **(a)** The nth term of a sequence is $n(n+1)$.

(i) Write the two missing terms in the spaces. 2, 6, ... , 20, ... [2]

(ii) Write down an expression in terms of n for the $(n + 1)$th term.

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

(iii) The difference between the nth term and the $(n + 1)$th term is $pn + q$.

Find the values of p and q.

Answer(a)(iii) p = ...

q = ... [2]

(iv) Find the positions of the two consecutive terms which have a difference of 140.

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

(b) A sequence u_1, u_2, u_3, u_4, ………… is given by the following rules.

$u_1 = 2$, $u_2 = 3$ and $u_n = 2u_{n-2} + u_{n-1}$ for $n \geqslant 3$.

For example, the third term is u_3 and $u_3 = 2u_1 + u_2 = 2 \times 2 + 3 = 7$.
So, the sequence is 2, 3, 7, u_4, u_5, …..

(i) Show that $u_4 = 13$.

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

(ii) Find the value of u_5 .

Answer(b)(ii) u_5 = ... [1]

(iii) Two consecutive terms of the sequence are 3413 and 6827 .

Find the term before and the term after these two given terms.

Answer(b)(iii) .... , 3413, 6827, ... [2]

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