A / A* questions
2015

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0580/22
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2015
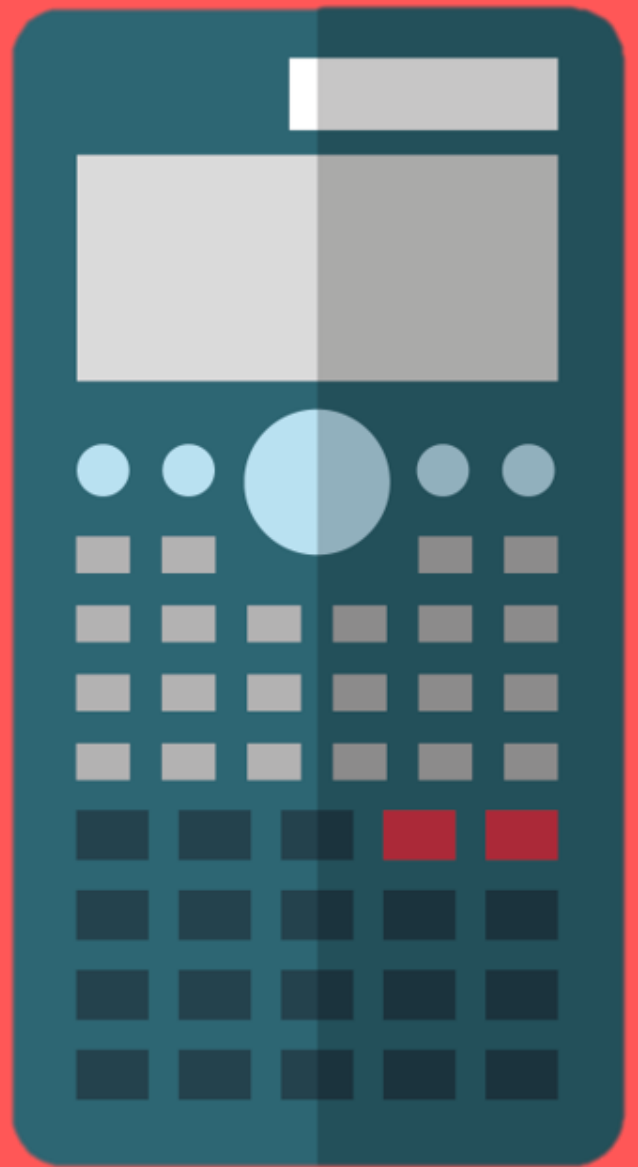
17 (a)
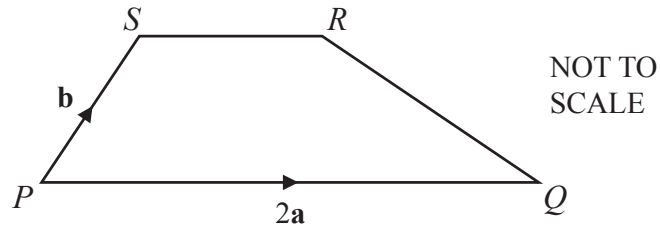
PQRS is a trapezium with *PQ* = 2*SR*.
$\overrightarrow{PQ}$ = 2**a** and $\overrightarrow{PS}$ = **b**.

Find $\overrightarrow{QR}$ in terms of **a** and **b** in its simplest form.

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

(b)
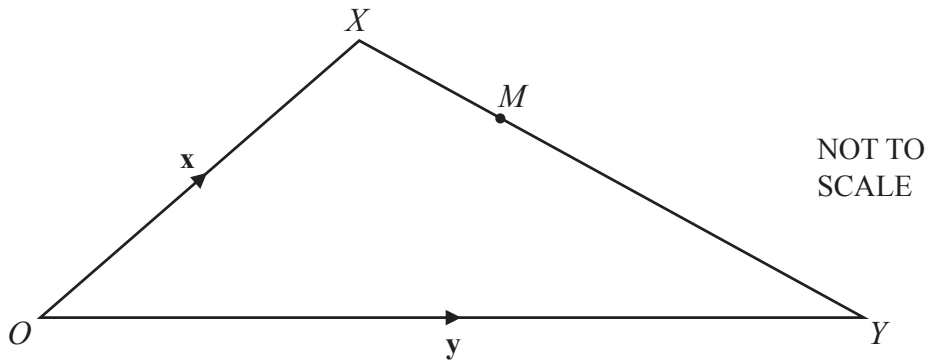
$\overrightarrow{OX}$ = **x** and $\overrightarrow{OY}$ = **y**.
M is a point on *XY* such that *XM* : *MY* = 3 : 5.

Find $\overrightarrow{OM}$ in terms of **x** and **y** in its simplest form.

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

18
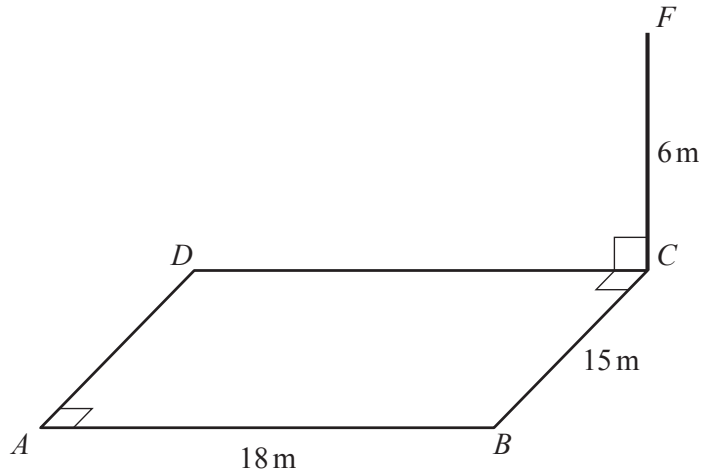
The diagram shows a rectangular playground *ABCD* on horizontal ground.
A vertical flagpole *CF*, 6 metres high, stands in corner *C*.
AB = 18 m and *BC* = 15 m.

Calculate the angle of elevation of *F* from *A*.

Answer .... [4]

_____

19 Fritz drives a distance of 381 km in 2 hours and 18 minutes.
He then drives 75 km at a constant speed of 30 km/h.

Calculate his average speed for the whole journey.

Answer .... km/h [4]

_____

21 (a) Simplify

(i) x^0,

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

(ii) $m^4 \times m^3$,

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

(iii) $(8p^6)^{\frac{1}{3}}$.

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

(b) $243^x = 3^2$

Find the value of x.

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

_____

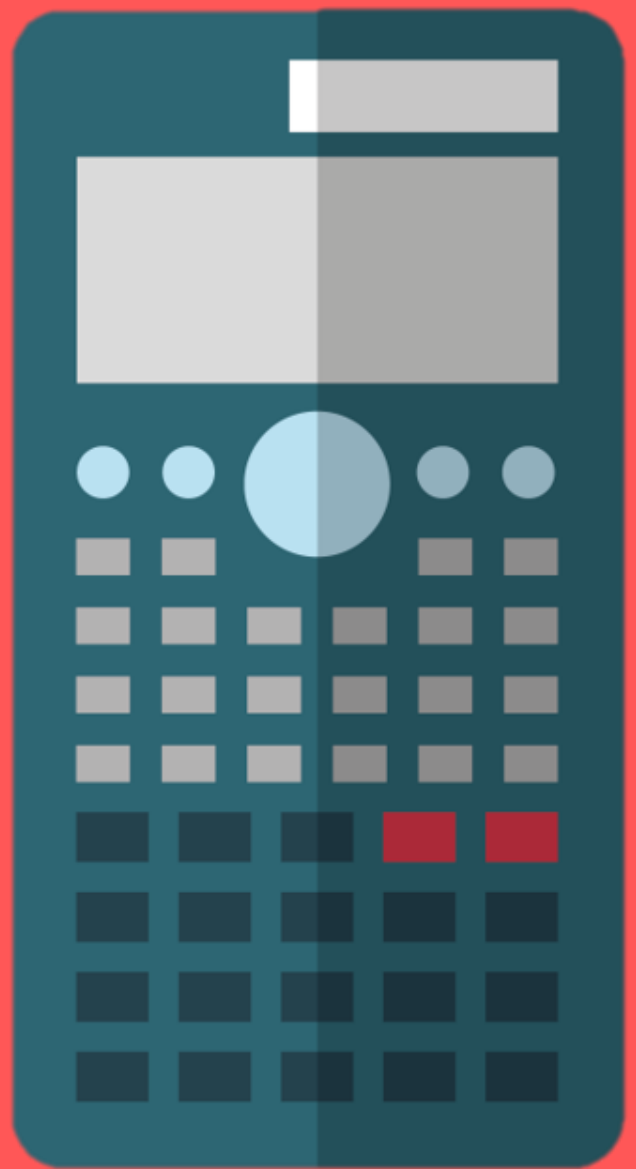**Question 22 is printed on the next page.**

0580/42

FEB/MAC

YEAR

2015

6 **In this question write any probability as a fraction.**

Navpreet has 15 cards with a shape drawn on each card.
5 cards have a square, 6 cards have a triangle and 4 cards have a circle drawn on them.

(a) Navpreet selects a card at random.

Write down the probability that the card has a circle drawn on it.

Answer(a) .... [1]

(b) Navpreet selects a card at random and replaces it.
She does this 300 times.

Calculate the number of times she expects to select a card with a circle drawn on it.

Answer(b) .... [1]

(c) Navpreet selects a card at random, replaces it and then selects another card.

Calculate the probability that

(i) one card has a square drawn on it and the other has a circle drawn on it,

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

(ii) neither card has a circle drawn on it.

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

(d) Navpreet selects two cards at random, without replacement.

Calculate the probability that

(i) only one card has a triangle drawn on it,

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

(ii) the two cards have different shapes drawn on them.

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

8 **(a)** The diagram shows a sector of a circle
with centre O and radius 24 cm.

A

NOT TO
SCALE

$x°$ O

24 cm

B
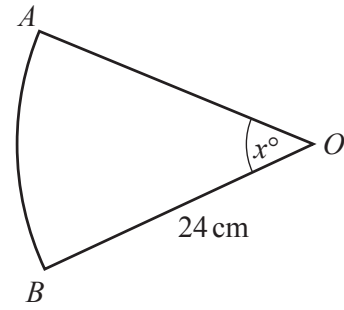
(i) The total perimeter of the sector is 68 cm.

Calculate the value of x.

Answer(a)(i) $x =$ .... [3]

(ii) The points A and B of the sector are joined together to
make a hollow cone.
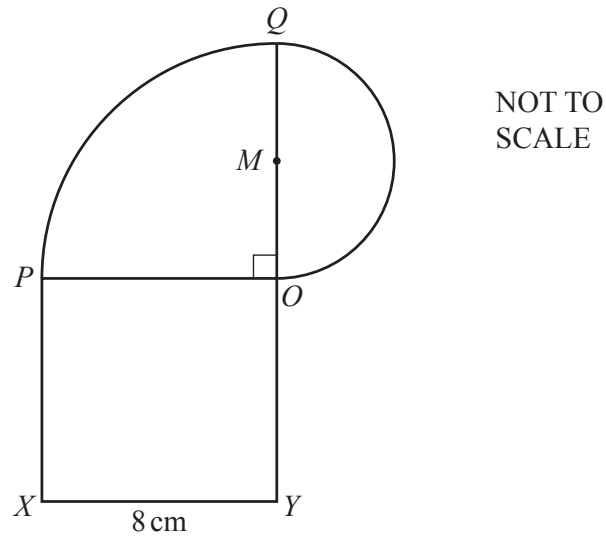The arc AB becomes the circumference of the base of the cone.

O

NOT TO
SCALE

AB
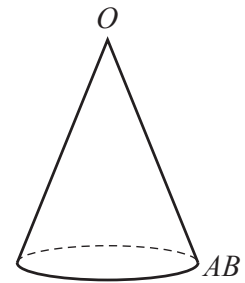
Calculate the volume of the cone.

[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 [6]

(b)

NOT TO
SCALE

The diagram shows a shape made from a square, a quarter circle and a semi-circle.
OPXY is a square of side 8 cm.
OPQ is a quarter circle, centre *O*.
The line *OMQ* is the diameter of the semi-circle.

Calculate the area of the shape.

Answer(b) .... cm² [5]

10 The school cook buys potatoes in small sacks, each of mass 4 kg, and large sacks, each of mass 10 kg.
He buys x small sacks and y large sacks.
Today, he buys less than 80 kg of potatoes.

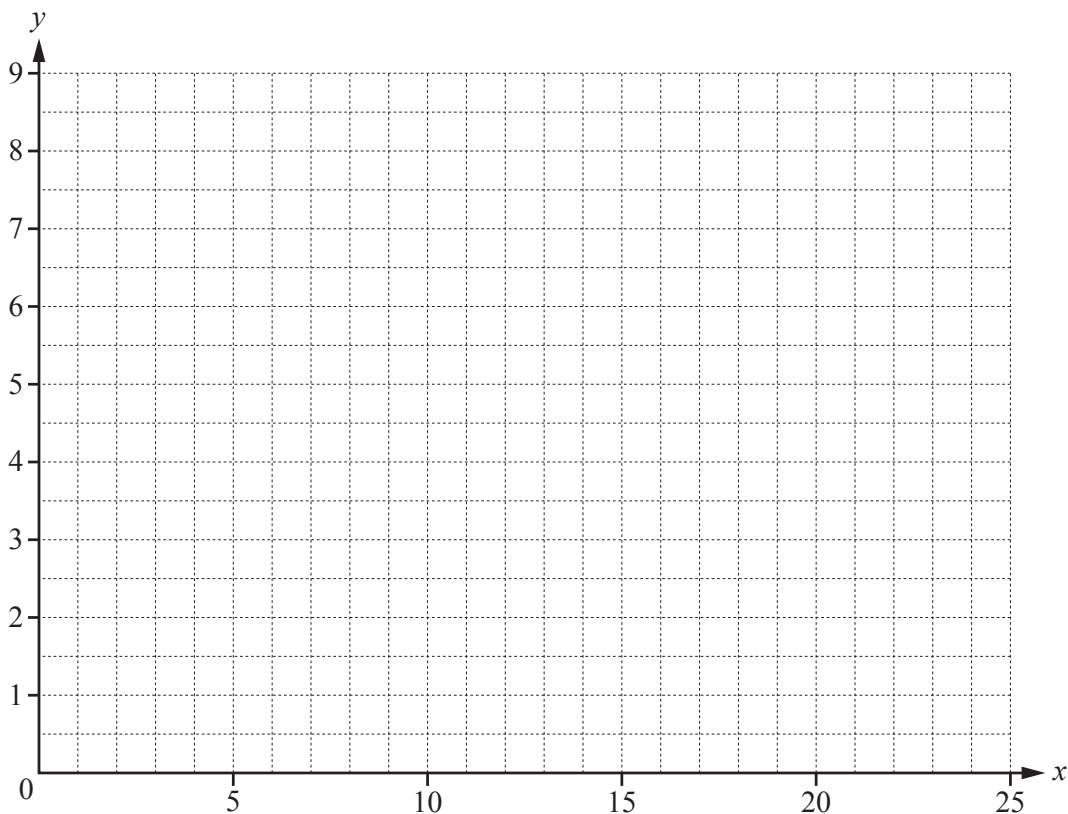**(a)** Show that $2x + 5y < 40$.

Answer(a)

[1]

(b) He buys more large sacks than small sacks.
He buys no more than 6 large sacks.

Write down two inequalities to show this information.

Answer(b) ....

.... [2]

(c) On the grid, show the information in **part (a)** and **part (b)** by drawing three straight lines and shading the unwanted regions.

[5]

(d) Find the greatest mass of potatoes the cook can buy today.
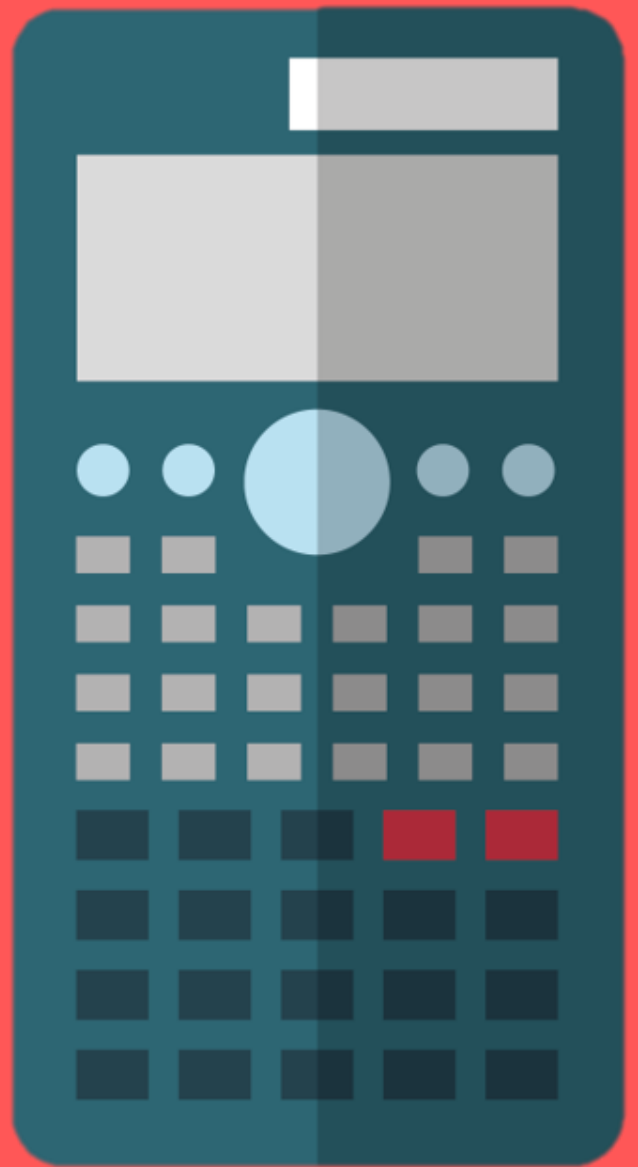
Answer(d) .... kg [2]

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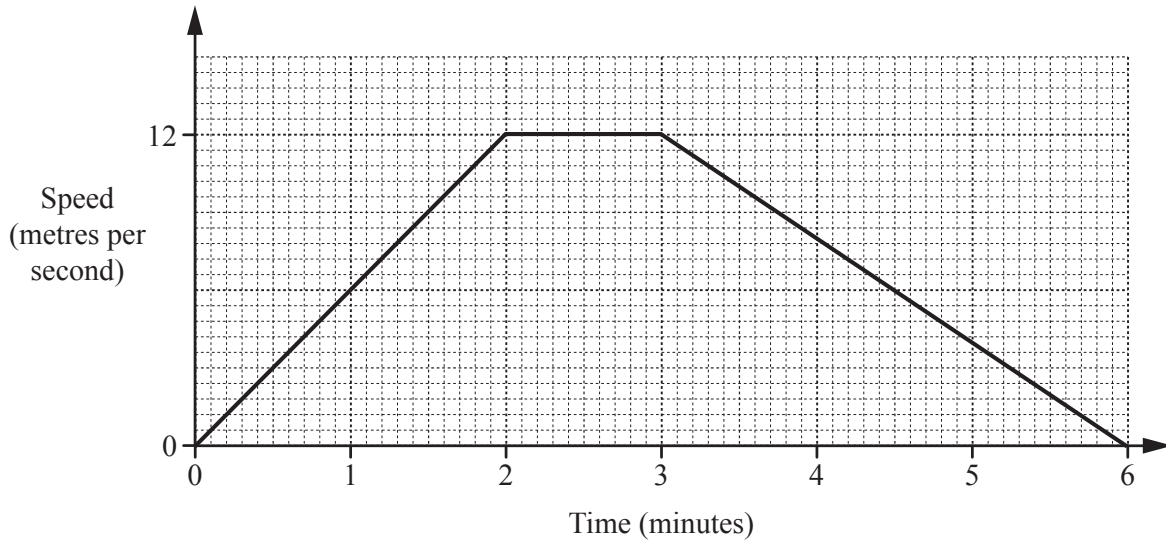**Question 11 is printed on the next page.**

0580/21
YEAR
2015

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5**4**

10

A tram leaves a station and accelerates for 2 **minutes** until it reaches a speed of 12 metres per second.
It continues at this speed for 1 minute.
It then decelerates for 3 minutes until it stops at the next station.
The diagram shows the speed-time graph for this journey.

Calculate the distance, in metres, between the two stations.

Answer .... m [3]

_____

11 Find the *n*th term of each sequence.

(a)   4,   8,   12,   16,   20, ...

Answer(a) .... [1]

(b)   11,   20,   35,   56,   83, ...

Answer(b) .... [2]

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0580/21/M/J/15

15
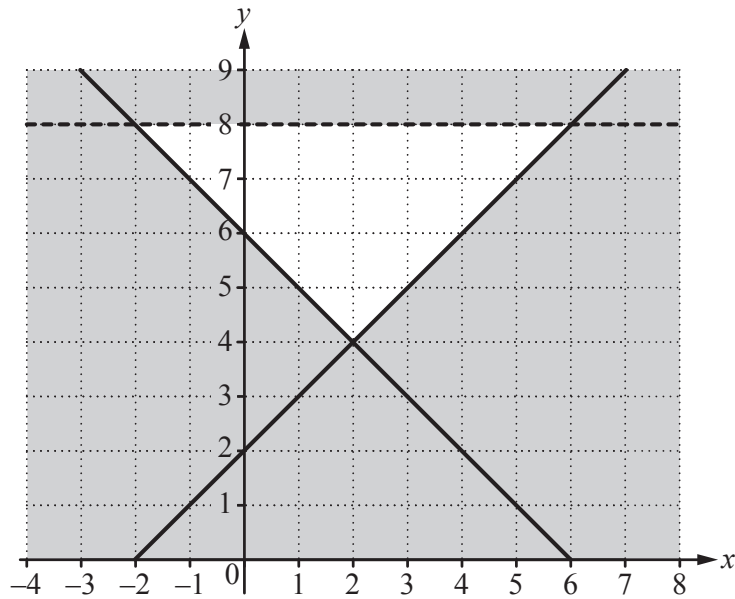
Write down the 3 inequalities which define the unshaded region.

Answer ....

....

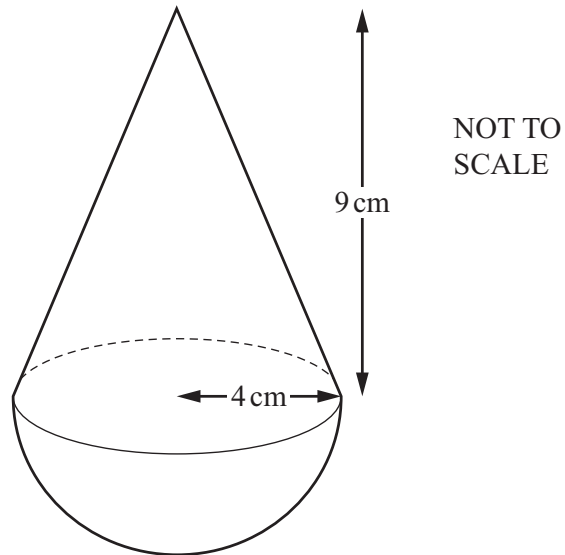... [4]

16 Georg invests $5000 for 14 years at a rate of 2% per year compound interest.

Calculate the interest he receives.
Give your answer correct to the nearest dollar.

Answer $ .... [4]

21

NOT TO SCALE

9 cm

4 cm

The diagram shows a toy.
The shape of the toy is a cone, with radius 4 cm and height 9 cm, on top of a hemisphere with radius 4 cm.

Calculate the volume of the toy.
Give your answer correct to the nearest cubic centimetre.

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

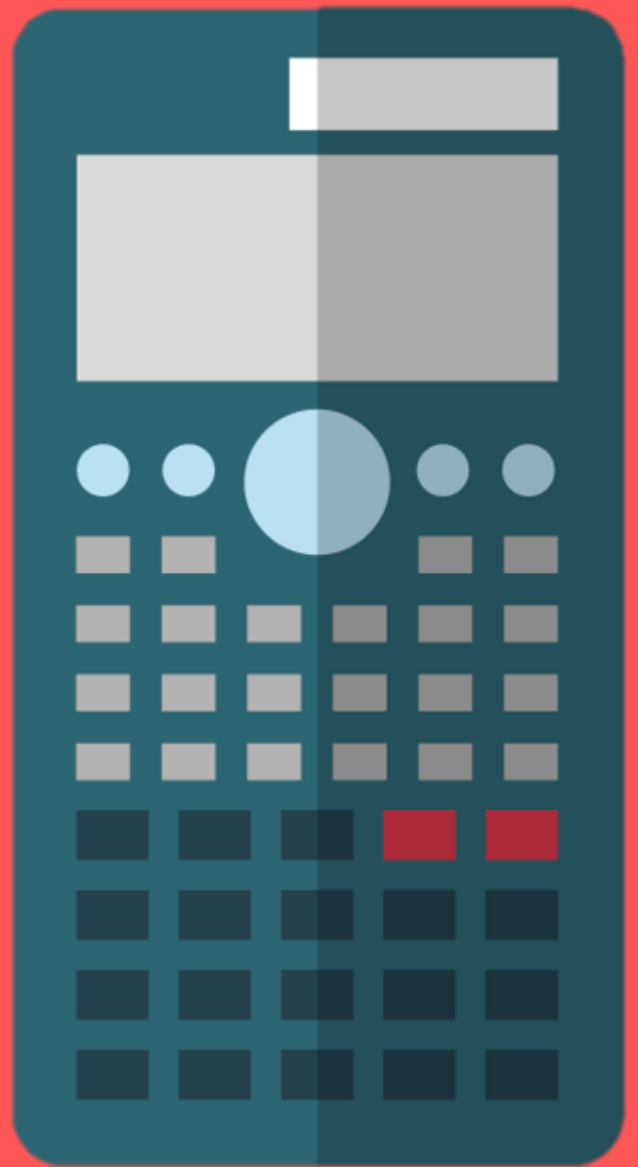[The volume, V, of a sphere with radius r is $V = \frac{4}{3}\pi r^3$.]

Answer .... cm^3 [4]

0580/41

MAY/JUNE

YEAR

2015

5 **(a)** Andrei stands on level horizontal ground, 294 m from the foot of a vertical tower which is 55 m high.

   (i) Calculate the angle of elevation of the top of the tower.

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

   (ii) Andrei walks a distance *x* metres directly towards the tower.
   The angle of elevation of the top of the tower is now 24.8°.

   Calculate the value of *x*.

Answer(a)(ii) *x* = ... [4]

8 **(a)** Jamil, Kiera and Luther collect badges.
Jamil has x badges.
Kiera has 12 badges more than Jamil.
Luther has 3 times as many badges as Kiera.
Altogether they have 123 badges.

Form an equation and solve it to find the value of x.

Answer(a) $x =$ .... [3]

(b) Find the integer values of t which satisfy the inequalities.

$$4t + 7 < 39 \leqslant 7t + 2$$

Answer(b) .... [3]

(c) Solve the following equations.

(i) $\dfrac{21 - x}{x + 3} = 4$
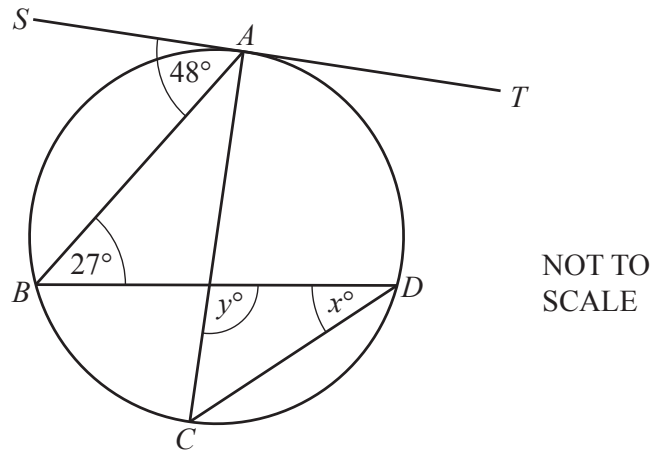
Answer(c)(i) $x =$ .... [3]

(ii) $3x^2 + 7x - 5 = 0$

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

Answer(c)(ii) $x =$ .... or $x =$ .... [4]

_____

9 **(a)** The points *A*, *B*, *C* and *D* lie on a circle.
   AC is a diameter of the circle.
   ST is the tangent to the circle at *A*.

NOT TO
SCALE

   Find the value of

   (i) *x*,

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

   (ii) *y*.

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

(b) The diagram shows a shaded shape formed by three semi-circular arcs.
The radius of each semi-circle is shown in the diagram.

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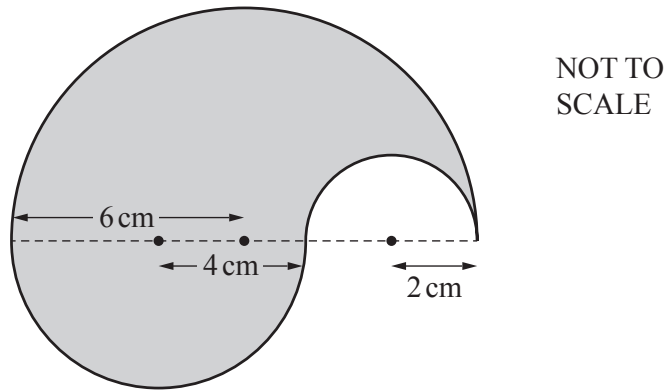
(i) Calculate the perimeter of the shaded shape.

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

(ii) The shaded shape is made from metal 1.6 mm thick.

Calculate the volume of metal used to make this shape.
Give your answer in cubic millimetres.

Answer(b)(ii) .... mm³ [5]

11 (a) Make x the subject of the formula.

$$A - x = \frac{xr}{t}$$

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

(b) Find the value of a and the value of b when $x^2 - 16x + a = (x + b)^2$.

Answer(b) a = ...

b = ... [3]

(c) Write as a single fraction in its simplest form.

$$\frac{6}{x-4} - \frac{5}{3x-2}$$

Answer(c) .... [3]

0580/22
MAY/JUNE
YEAR
2015

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5 A biased 4-sided dice is rolled.
The possible scores are 1, 2, 3 or 4.
The probability of rolling a 1, 3 or 4 is shown in the table.

Score	1	2	3	4
Probability	0.15		0.3	0.35

Complete the table. [2]

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6 Solve.
$$5(w + 4 \times 10^3) = 6 \times 10^4$$

Answer w = ... [2]

7
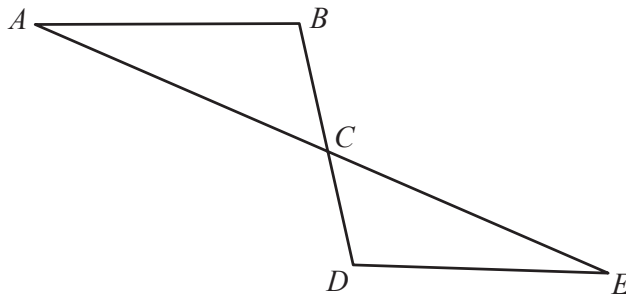
NOT TO SCALE

The diagram shows two straight lines, *AE* and *BD*, intersecting at *C*.
Angle *ABC* = angle *EDC*.
Triangles *ABC* and *EDC* are congruent.

Write down **two** properties of line segments *AB* and *DE*.

Answer AB and *DE* are ....

and .... [2]

---

8   5,   11,   21,   35,   53,   ...

Find the *n*th term of this sequence.

Answer .... [2]

---

9   Write the recurring decimal $0.2\dot{5}$ as a fraction.
[$0.2\dot{5}$ means 0.2555...]

Answer .... [2]

---

10   One year ago Ahmed's height was 114 cm.
Today his height is 120 cm.
Both measurements are correct to the nearest centimetre.

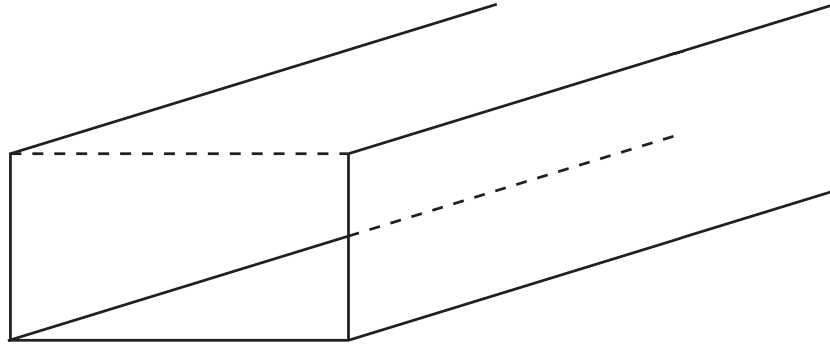Work out the upper bound for the increase in Ahmed's height.

Answer .... cm [2]

---

11 $\mathbf{M} = \begin{pmatrix} 3 & 1 \\ -11 & -2 \end{pmatrix}$

Find $\mathbf{M}^{-1}$, the inverse of $\mathbf{M}$.

Answer $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

14

The diagram shows a channel for water.
The channel lies on horizontal ground.
This channel has a constant rectangular cross section with area 0.95 m².
The channel is full and the water flows through the channel at a rate of 4 metres/**minute**.

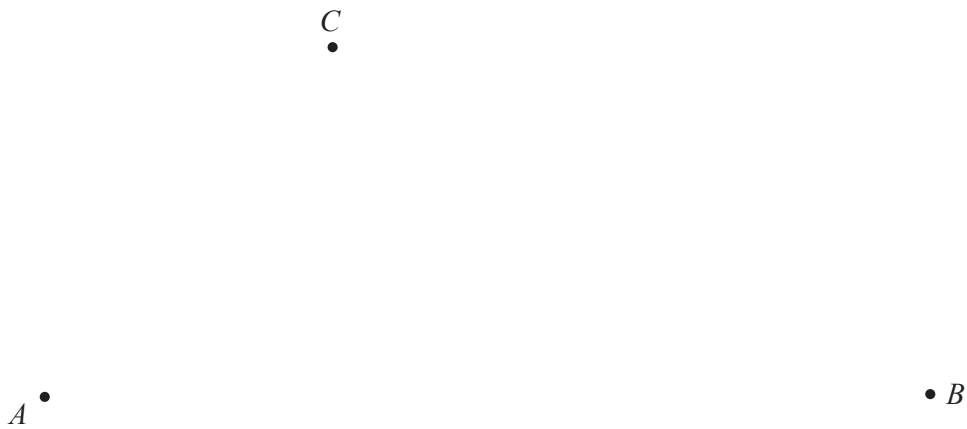Calculate the number of cubic metres of water that flow along the channel in 3 **hours**.

Answer .... m³ [3]

15 Write as a single fraction in its simplest form.

$$\frac{3}{x + 2} - \frac{4}{2x - 5}$$

Answer .... [3]

19 The diagram shows the positions of three points *A*, *B* and *C*.

C
•

•
A

• B

(a) Draw the locus of points which are 4 cm from *C*. [1]

(b) **Using a straight edge and compasses only**, construct the locus of points which are equidistant from *A* and *B*. [2]

(c) Shade the region which is

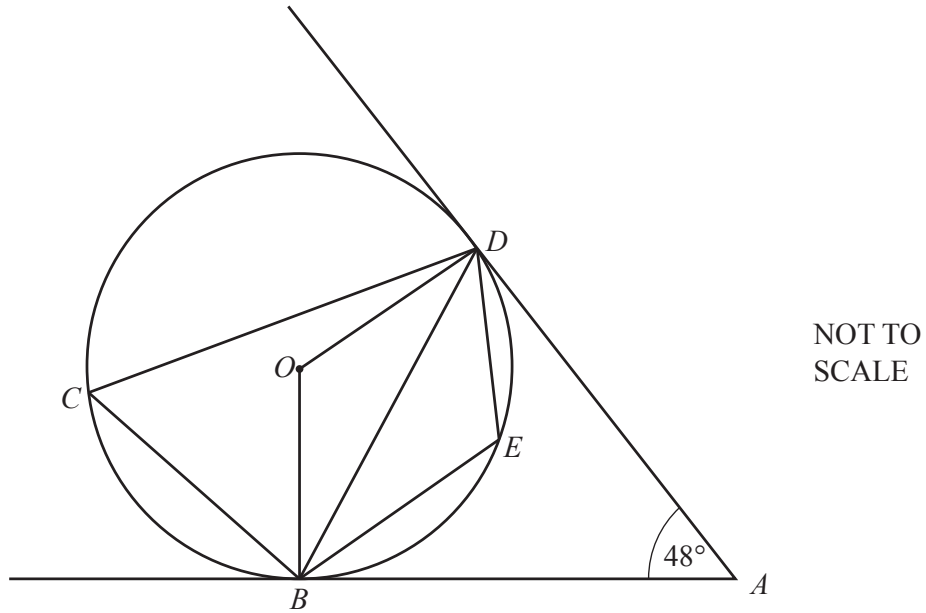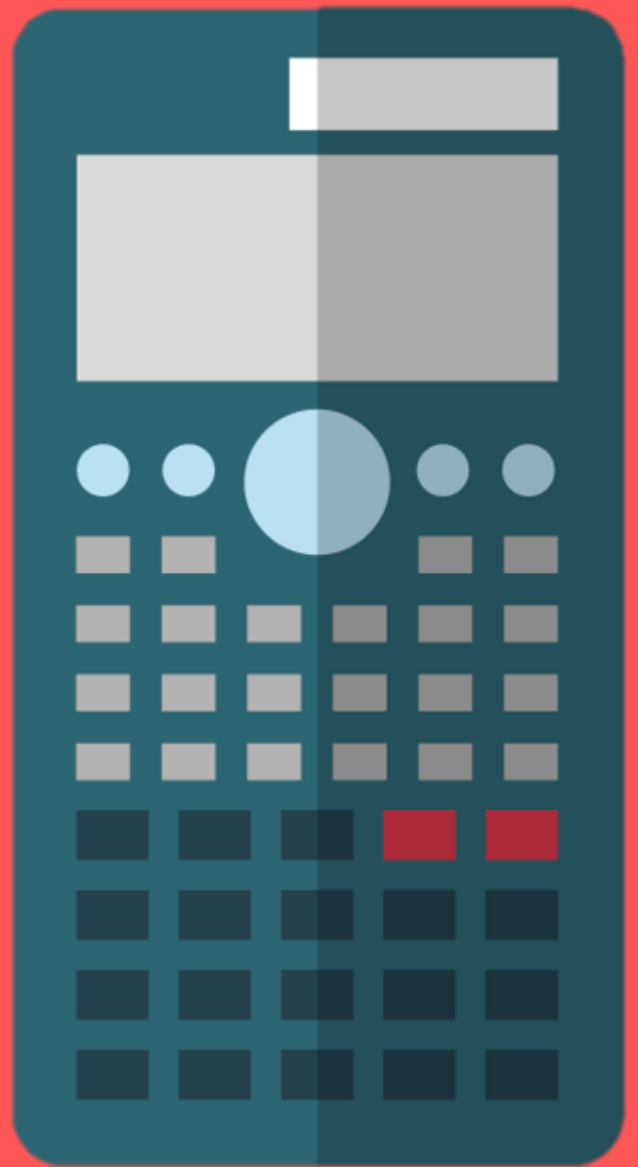 • less than 4 cm from *C*
and
  • nearer to *B* than to *A*. [1]

0580/42

MAY/JUNE

YEAR

2015

2

NOT TO SCALE

In the diagram, *B*, *C*, *D* and *E* lie on the circle, centre *O*.
AB and *AD* are tangents to the circle.
Angle *BAD* = 48°.

(a) Find

   (i) angle *ABD*,

Answer(a)(i) Angle *ABD* = ... [1]

  (ii) angle *OBD*,

Answer(a)(ii) Angle *OBD* = ... [1]

 (iii) angle *BCD*,

Answer(a)(iii) Angle *BCD* = ... [2]

 (iv) angle *BED*.

Answer(a)(iv) Angle *BED* = ... [1]

(b) The radius of the circle is 15 cm.

Calculate the area of triangle *BOD*.

Answer(b) .... cm² [2]

(c) Give a reason why *ABOD* is a cyclic quadrilateral.

Answer(c) ....

.... [1]

3 On the first part of a journey, Alan drove a distance of x km and his car used 6 litres of fuel.

The rate of fuel used by his car was $\dfrac{600}{x}$ litres per 100 km.

(a) Alan then drove another $(x + 20)$ km and his car used another 6 litres of fuel.

    (i) Write down an expression, in terms of x, for the rate of fuel used by his car on this part of the journey.
    Give your answer in litres per 100 km.

Answer(a)(i) .... litres per 100 km [1]

    (ii) On this part of the journey the rate of fuel used by the car **decreased** by 1.5 litres per 100 km.

    Show that $x^2 + 20x - 8000 = 0$.

Answer(a)(ii)

[4]

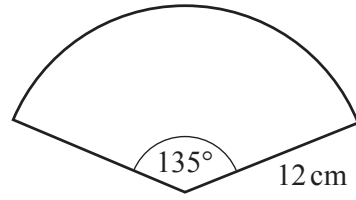**(b)** Solve the equation $x^2 + 20x - 8000 = 0$.

Answer(b) x = ... or x = ... [3]

(c) Find the rate of fuel used by Alan's car for the complete journey.
Give your answer in litres per 100 km.

Answer(c) .... litres per 100 km [2]

 [Turn over

4 **(a)** A sector of a circle has radius 12 cm and an angle of 135°.

(i) Calculate the length of the arc of this sector.
Give your answer as a multiple of π.
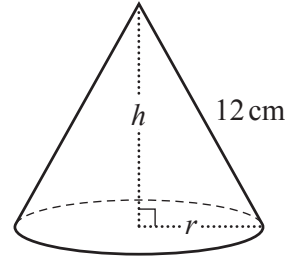
NOT TO SCALE

135° 12 cm

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

(ii) The sector is used to make a cone.

(a) Calculate the base radius, *r*.

NOT TO SCALE

h 12 cm

r

Answer(a)(ii)(a) *r* = ... cm [2]

(b) Calculate the height of the cone, *h*.

Answer(a)(ii)(b) *h* = ... cm [3]

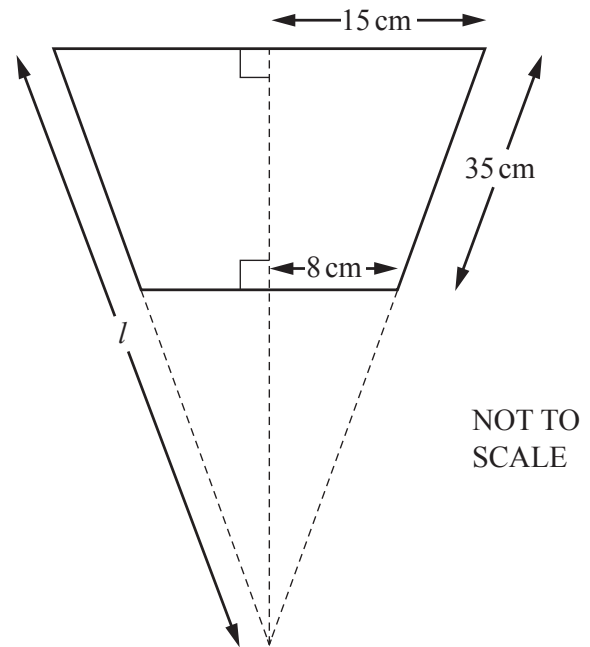**(b)** The diagram shows a plant pot.
It is made by removing a small cone from a larger cone and adding a circular base.
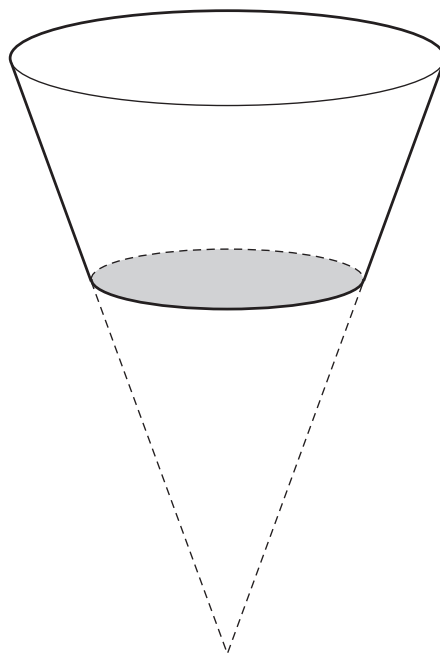
NOT TO SCALE

This is the cross section of the plant pot.

(i) Find *l*.

←—— 15 cm ——→

35 cm

←8 cm→

l

NOT TO
SCALE

Answer(b)(i) *l* = ... cm [3]

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

Answer(b)(ii) .... cm² [3]

(c) Some cones are mathematically similar.
For these cones, the mass, *M* grams, is proportional to the cube of the base radius, *r* cm.
One of the cones has mass 1458 grams and base radius 4.5 cm.
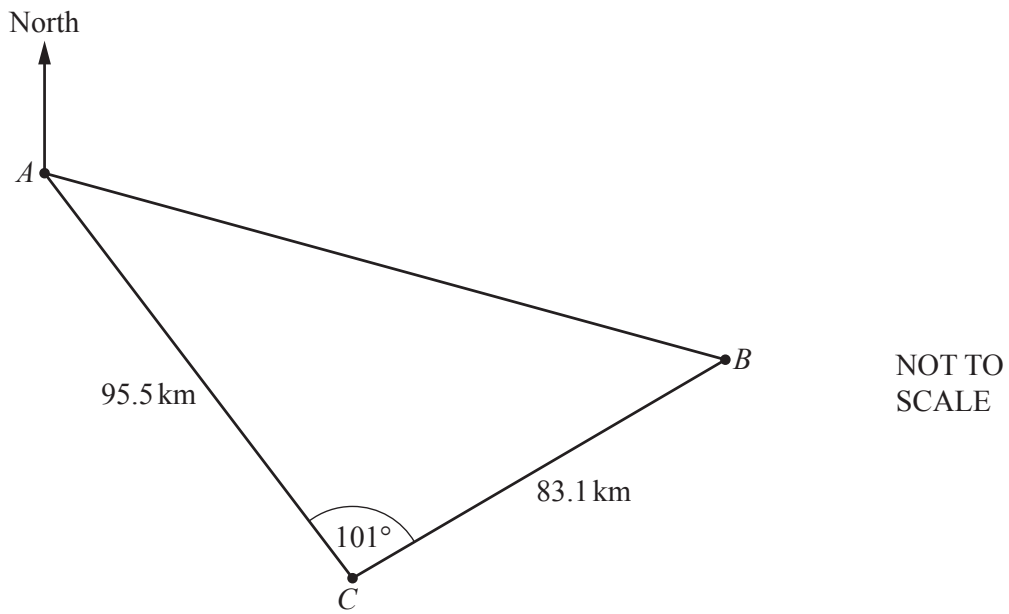
(i) Find an expression for *M* in terms of *r*.

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

(ii) Two of the cones have radii in the ratio 2 : 3.

Write down the ratio of their masses.

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

6 The diagram shows the positions of two ships, *A* and *B*, and a coastguard station, *C*.

North

A

95.5 km

101°

C

B

83.1 km

NOT TO
SCALE

(a) Calculate the distance, *AB*, between the two ships.
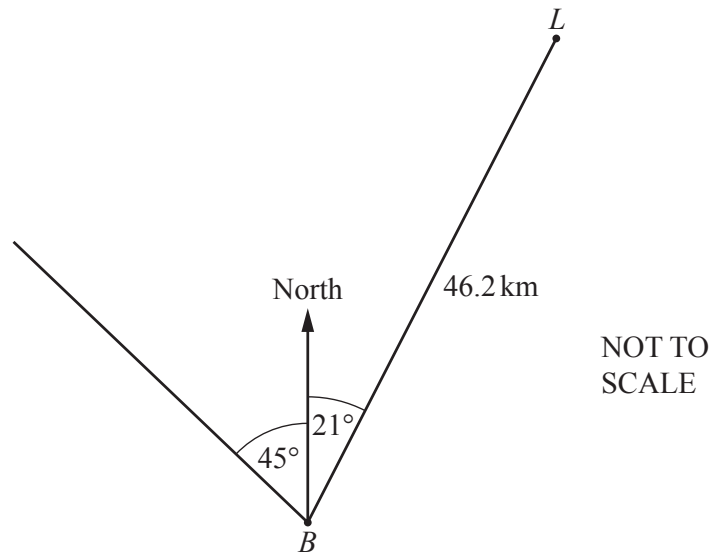Show that it rounds to 138 km, correct to the nearest kilometre.

Answer(a)

[4]

(b) The bearing of the coastguard station *C* from ship *A* is 146°.

Calculate the bearing of ship *B* from ship *A*.

Answer(b) .... [4]

(c)

At noon, a lighthouse, *L*, is 46.2 km from ship *B* on the bearing 021°.
Ship *B* sails north west.

Calculate the distance ship *B* must sail from its position at noon to be at its closest distance to the lighthouse.

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

10 **(a)** $\overrightarrow{PQ} = \begin{pmatrix} 5 \\ -8 \end{pmatrix}$

(i) Find the value of $|\overrightarrow{PQ}|$.

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

(ii) Q is the point $(2, -3)$.

Find the co-ordinates of the point P.

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

(b)
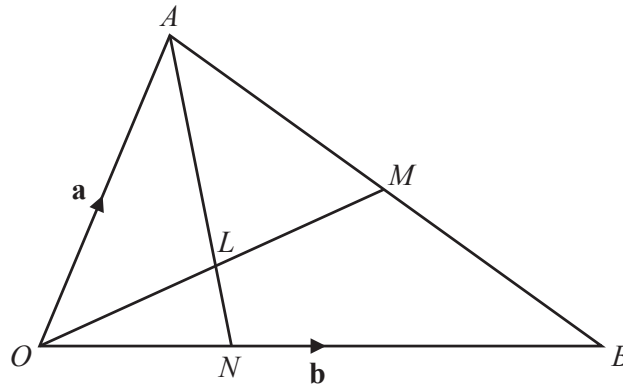
NOT TO
SCALE

In the diagram, M is the midpoint of AB and L is the midpoint of OM.
The lines OM and AN intersect at L and $ON = \frac{1}{3}OB$.
$\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.

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

(a) $\overrightarrow{OM}$,

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

(b) $\overrightarrow{OL}$,

Answer(b)(i)(b) $\overrightarrow{OL}$ = ... [1]

(c) $\overrightarrow{AL}$.

Answer(b)(i)(c) $\overrightarrow{AL}$ = ... [2]

0580/23

MAY/JUNE

YEAR 2015

11

NOT TO
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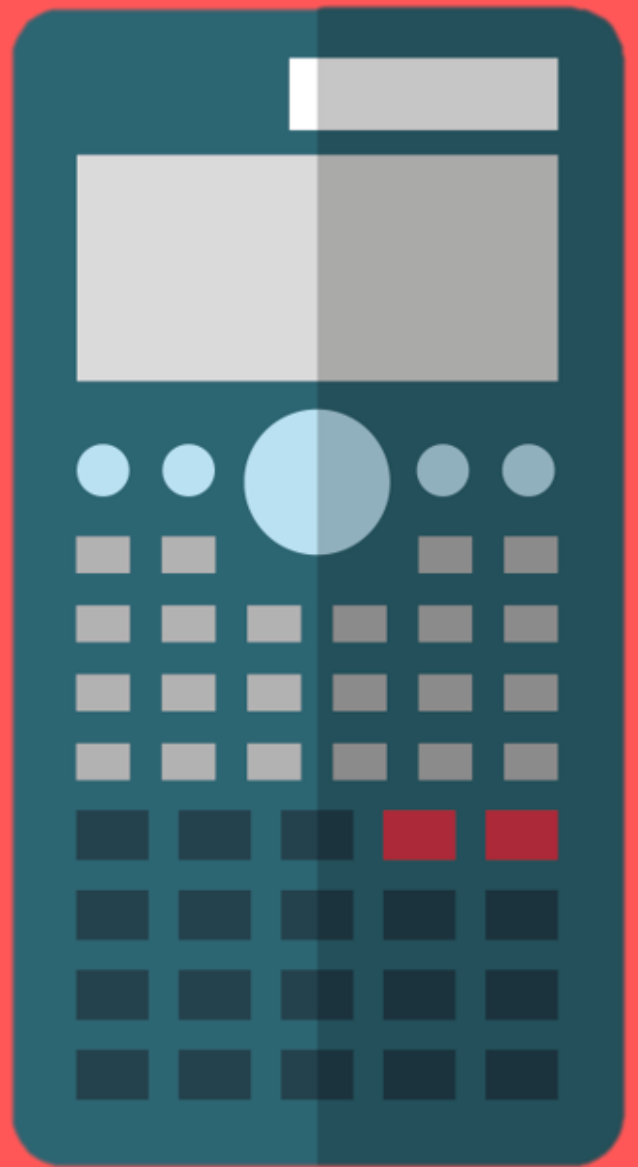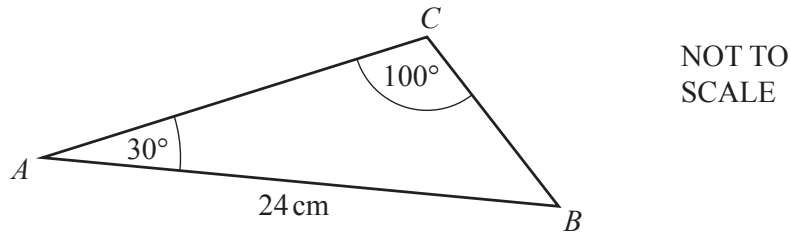
Use the sine rule to calculate *BC*.

Answer BC = ... cm [3]

12

NOT TO
SCALE
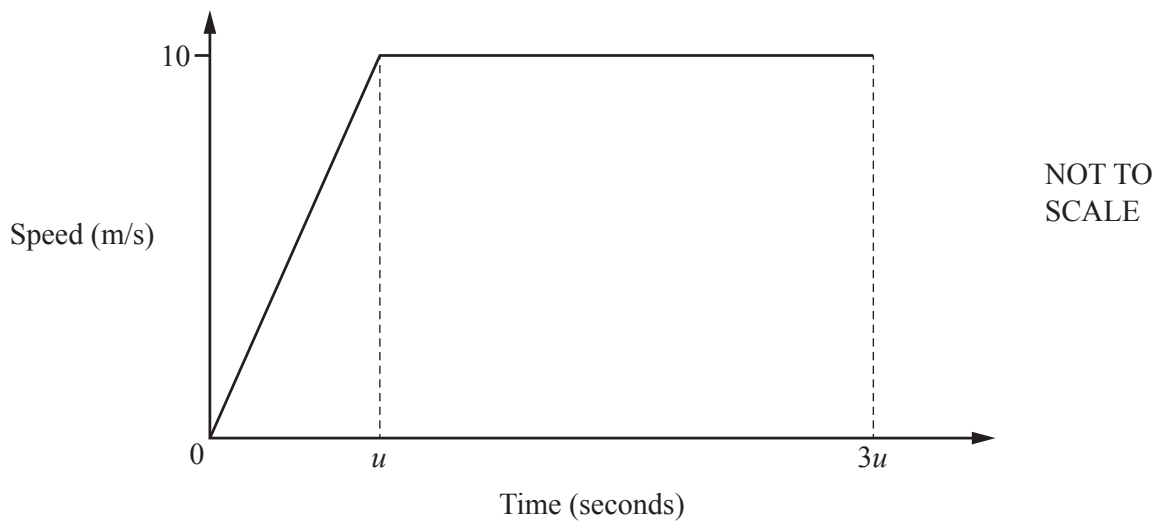
A car starts from rest and accelerates for *u* seconds until it reaches a speed of 10 m/s.
The car then travels at 10 m/s for 2*u* seconds.
The diagram shows the speed-time graph for this journey.

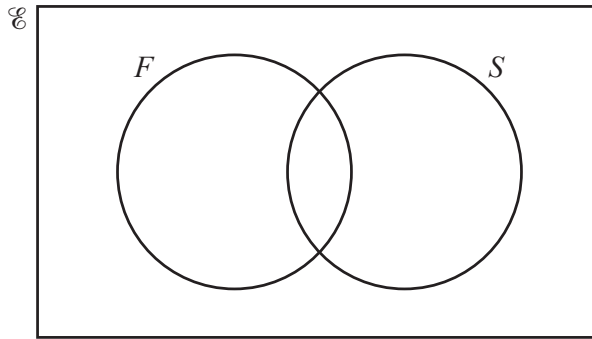The distance travelled by the car in the first 3*u* seconds is 125 m.

(a) Find the value of *u*.

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

(b) Find the acceleration in the first *u* seconds.

Answer(b) .... m/s² [1]

16 **(a)** In this part, you may use this Venn diagram to help you answer the questions.

In a class of 30 students, 25 study French (*F*), 18 study Spanish (*S*).
One student does not study French or Spanish.

(i) Find the number of students who study French and Spanish.

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

(ii) One of the 30 students is chosen at random.

Find the probability that this student studies French but not Spanish.

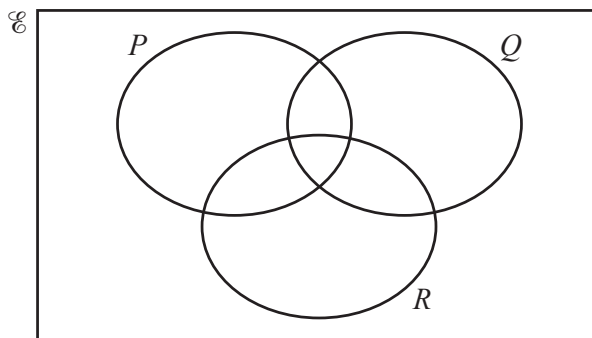*Answer(a)*(ii) .... [1]

(iii) A student who does not study Spanish is chosen at random.
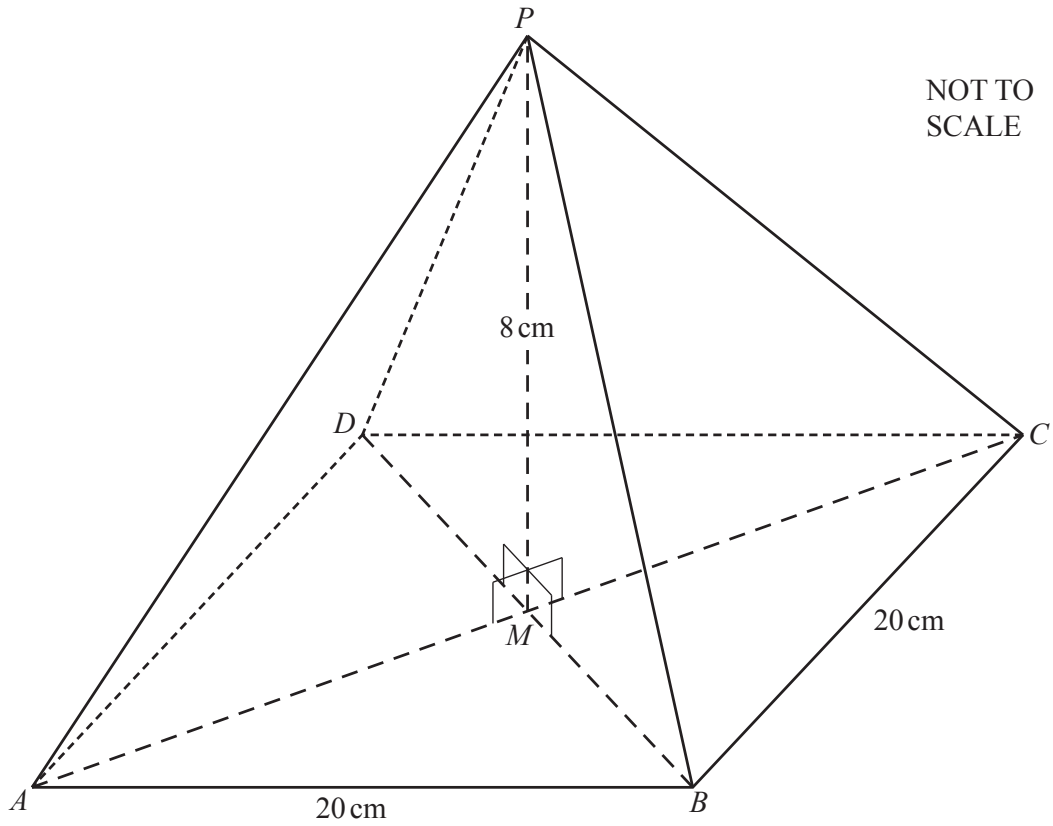
Find the probability that this student studies French.

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

(b)

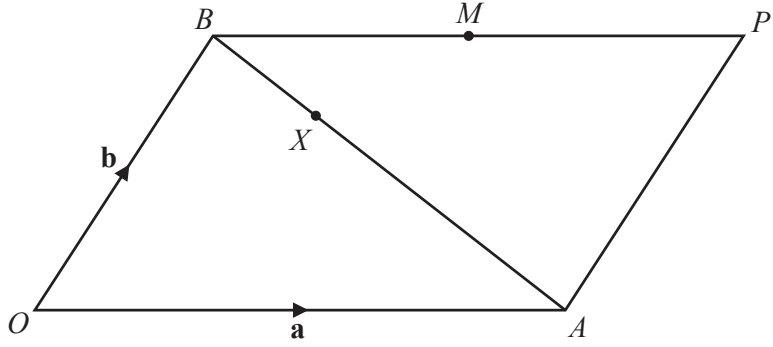On this Venn diagram, shade the region $R \cap (P \cup Q)'$. [1]

18

NOT TO
SCALE

The diagram shows a solid pyramid on a square horizontal base *ABCD*.
The diagonals *AC* and *BD* intersect at *M*.
P is vertically above *M*.
AB = 20 cm and *PM* = 8 cm.

Calculate the total surface area of the pyramid.

Answer .... cm^2 [5]

19

NOT TO SCALE

OAPB is a parallelogram.
O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
M is the midpoint of *BP*.

(a) Find, in terms of **a** and **b**, giving your answer in its simplest form,

    (i) $\overrightarrow{BA}$,

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

    (ii) the position vector of *M*.

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

(b) *X* is on *BA* so that   *BX* : *XA* = 1 : 2.

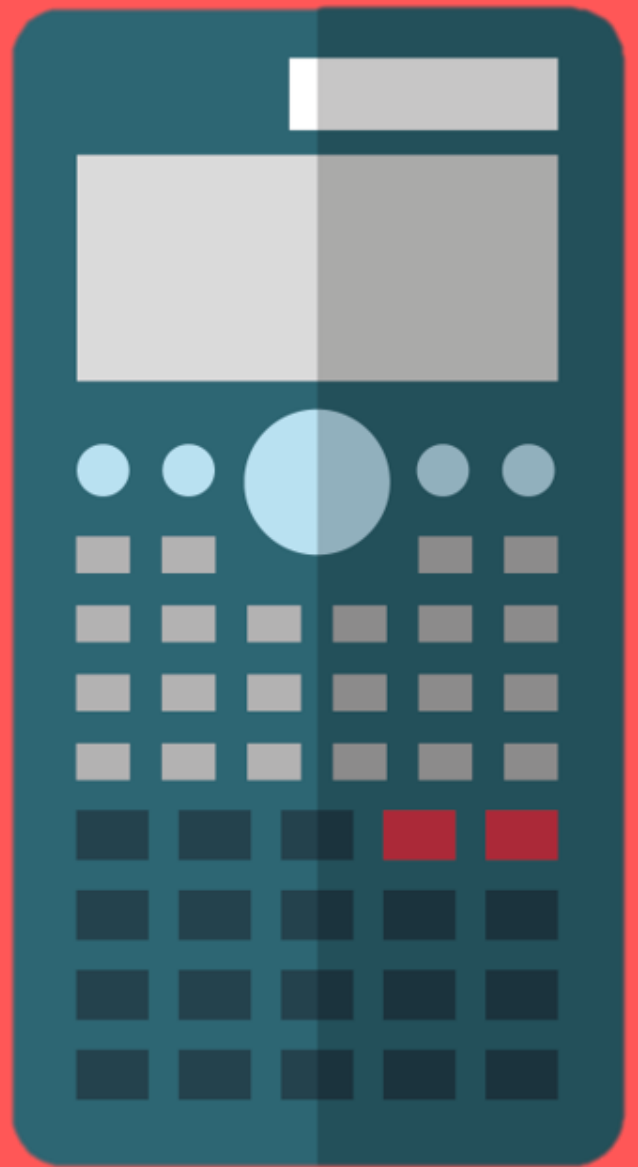Show that *X* lies on *OM*.

Answer(b)

[4]

Question 20 is printed on the next page.

0580/43

YEAR

2015

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6 **(a)**
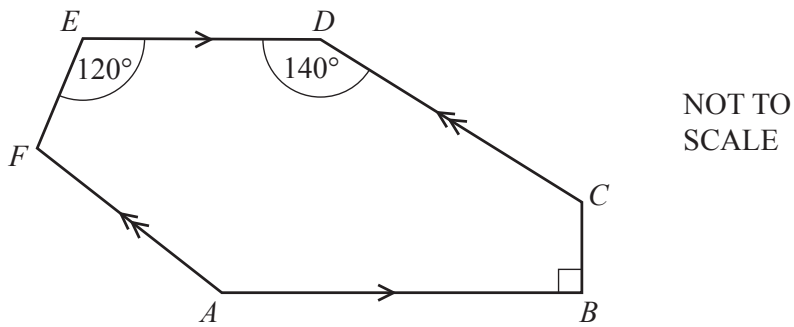
In the hexagon *ABCDEF*, *AB* is parallel to *ED* and *AF* is parallel to *CD*.
Angle *ABC* = 90°, angle *CDE* = 140° and angle *DEF* = 120°.

Calculate angle *EFA*.

Answer(a) Angle *EFA* = ... [4]

(b)
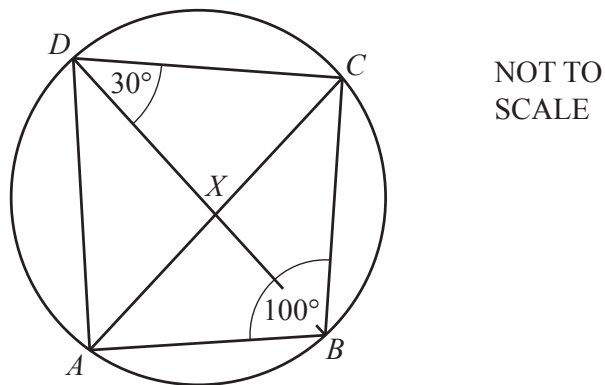
In the cyclic quadrilateral *ABCD*, angle *ABC* = 100° and angle *BDC* = 30°.
The diagonals intersect at *X*.

(i) Calculate angle *ACB*.

Answer(b)(i) Angle *ACB* = ... [2]

(ii) Angle *BXC* = 89°.

Calculate angle *CAD*.

Answer(b)(ii) Angle *CAD* = ... [2]

(iii) Complete the statement.

Triangles *AXD* and *BXC* are .... [1]

(c)
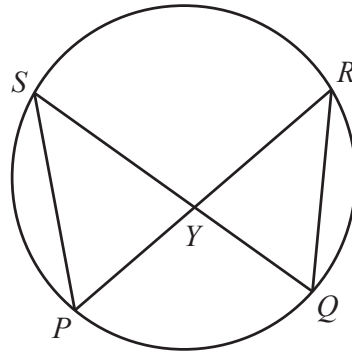
P, Q, R and *S* lie on a circle.
PR and *QS* intersect at *Y*.
PS = 11 cm, *QR* = 10 cm and the area of triangle *QRY* = 23 cm².

Calculate the area of triangle *PYS*.

Answer(c) .... cm² [2]

(d) A regular polygon has *n* sides.
Each exterior angle is equal to $\frac{n}{10}$ degrees.

(i) Find the value of *n*.

Answer(d)(i) *n* = ... [3]

(ii) Find the size of an interior angle of this polygon.

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

7 **(a)** The total surface area of a cone is given by the formula $A = \pi r l + \pi r^2$.

    (i) Find A when $r = 6.2$ cm and $l = 10.8$ cm.

<div align="right">

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

</div>

    (ii) Rearrange the formula to make l the subject.

<div align="right">

Answer(a)(ii) $l =$ .... [2]

</div>

  (b) **(i)** Irina walks 10 km at 4 km/h and then a further 8 km at 5 km/h.

        Calculate Irina's average speed for the whole journey.

<div align="right">

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

</div>

    (ii) Dariella walks x km at 5 km/h and then runs $(x + 4)$ km at 10 km/h.
        The average speed of this journey is 7 km/h.

        Find the value of x.
        Show all your working.

<div align="right">

Answer(b)(ii) $x =$ .... [5]

</div>

(c) (i) Priyantha sells her model car for \$19.80 at a profit of 20%.

Calculate the original price of the model car.

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

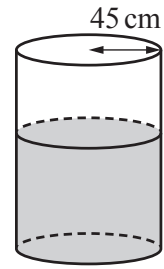**(ii)** Dev sells his model car for \$*x* at a profit of *y* %.

Find an expression, in terms of *x* and *y*, for the original price of this model car.
Write your answer as a single fraction.

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

8 (a) A cylindrical tank contains $180\,000\,\text{cm}^3$ of water.
The radius of the tank is $45\,\text{cm}$.

Calculate the height of water in the tank.

45 cm

NOT TO
SCALE

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

(b)

D
70 cm
C
40 cm
150 cm
A
50 cm
B
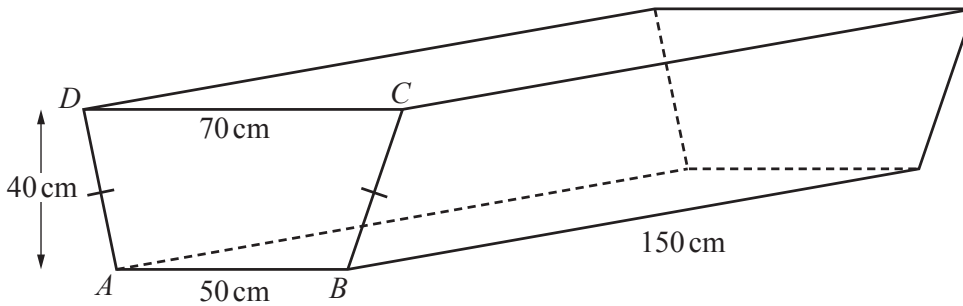
NOT TO
SCALE

The diagram shows an empty tank in the shape of a horizontal prism of length $150\,\text{cm}$.
The cross section of the prism is an isosceles trapezium *ABCD*.
$AB = 50\,\text{cm}$, $CD = 70\,\text{cm}$ and the vertical height of the trapezium is $40\,\text{cm}$.

(i) Calculate the volume of the tank.

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

(ii) Write your answer to **part (b)(i)** in litres.

Answer(b)(ii) .... litres [1]
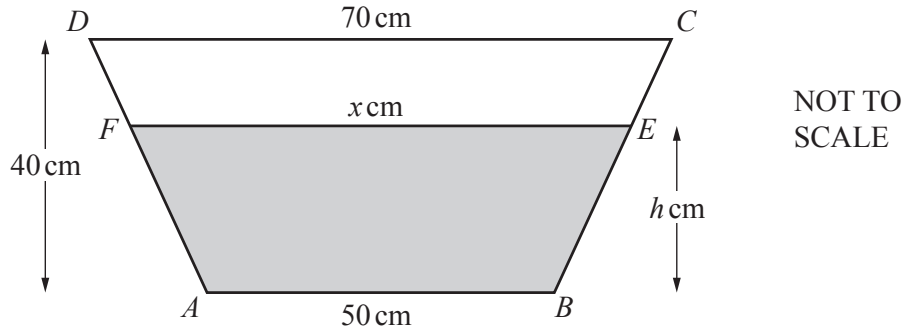
(c) The $180\,000\,\text{cm}^3$ of water flows from the tank in **part (a)** into the tank in **part (b)** at a rate of $15\,\text{cm}^3$/s.

Calculate the time this takes.
Give your answer in hours and minutes.

Answer(c) .... h .... min [3]

(d)

The $180\,000\,\text{cm}^3$ of water reaches the level EF as shown above.
$EF = x\,\text{cm}$ and the height of the water is $h\,\text{cm}$.

(i) Using the properties of similar triangles, show that $h = 2(x - 50)$.

Answer(d)(i)

[2]

(ii) Using $h = 2(x - 50)$, show that the shaded area, in cm^2, is $x^2 - 2500$.

Answer(d)(ii)

[1]

(iii) Find the value of x.

Answer(d)(iii) $x =$ .... [2]

(iv) Find the value of h.

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

11 The first four terms of sequences A, B, C and D are shown in the table.

Sequence	1st term	2nd term	3rd term	4th term	5th term		nth term
A	$\frac{1}{3}$	$\frac{2}{4}$	$\frac{3}{5}$	$\frac{4}{6}$			
B	3	4	5	6			
C	-1	0	1	2			
D	-3	0	5	12			

(a) Complete the table.

[8]

(b) Which term in sequence A is equal to $\frac{36}{37}$?

Answer(b) .... [2]

(c) Which term in sequence D is equal to 725?

Answer(c) .... [2]

0580/21

OCT/NOV

YEAR

2015

8

11 cm

37°

A

P

O

NOT TO SCALE

In the diagram, *AP* is a tangent to the circle at *P*.
O is the centre of the circle, angle *PAO* = 37° and *AP* = 11 cm.

(a) Write down the size of angle *OPA*.

Answer(a) Angle *OPA* = ... [1]

(b) Work out the radius of the circle.

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

___

9 Factorise completely.

(a) $ax + ay + 3cx + 3cy$

Answer(a) .... [2]

(b) $3a^2 - 12b^2$

Answer(b) .... [3]

___

10 Write the recurring decimal $0.1\dot{5}$ as a fraction.
   [$0.1\dot{5}$ means 0.1555...]

Answer .... [2]

11
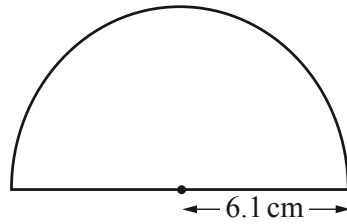
NOT TO
SCALE

←— 6.1 cm —→

A protractor is a semi-circle of radius 6.1 cm.

Calculate the **perimeter** of the protractor.

Answer .... cm [3]

12 *V* is directly proportional to the cube of (*r* + 1).
   When *r* = 1, *V* = 24.

Work out the value of *V* when *r* = 2.

Answer V = ... [3]

13 Make *x* the subject of the formula.

$$y = ax^2 + b$$

Answer x = ... [3]

_____

14 A car travels at 56 km/h.

Find the time it takes to travel 300 metres.
Give your answer in seconds correct to the nearest second.

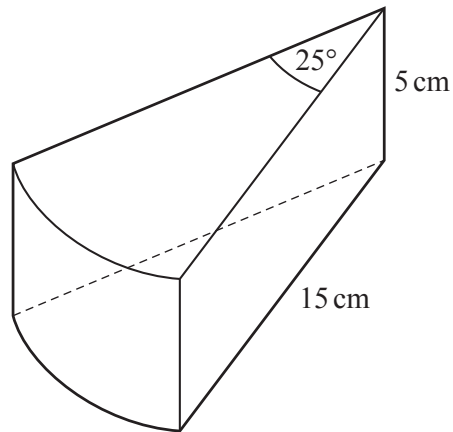*Answer* .... s [4]

_____

15 Simplify. $\dfrac{x^2 - 16}{x^2 - 3x - 4}$

Answer .... [4]

_____

19

25°

5 cm

NOT TO
SCALE

15 cm

The diagram shows a wooden prism of height 5 cm.
The cross section of the prism is a sector of a circle with sector angle 25°.
The radius of the sector is 15 cm.
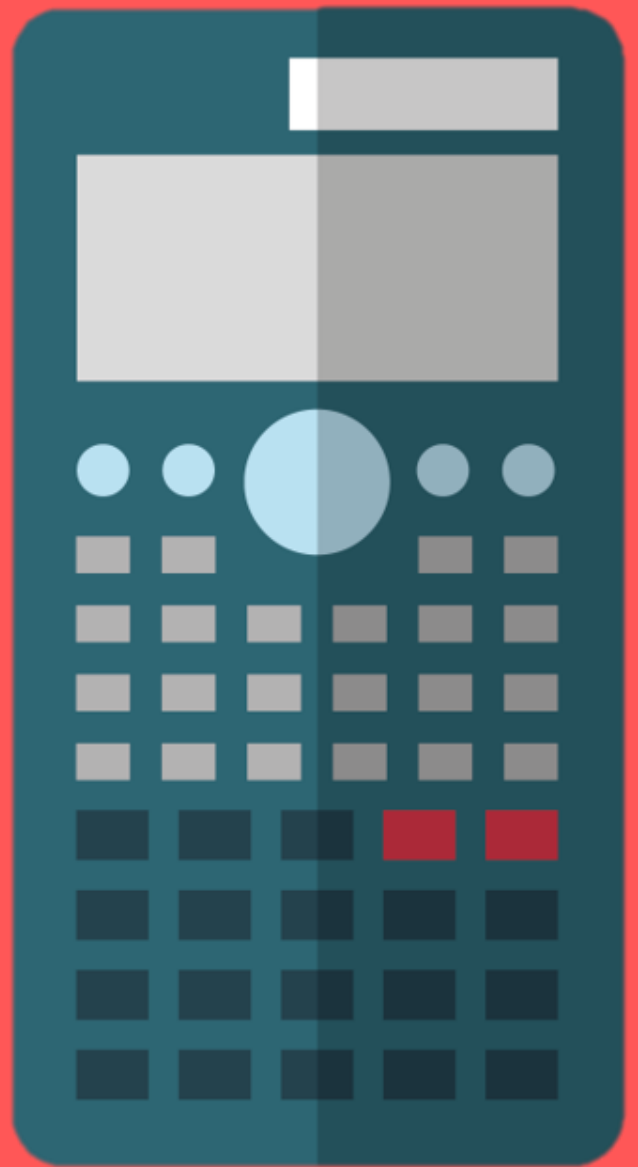
Calculate the **total** surface area of the prism.

Answer .... cm² [5]

0580/41

OCT/NOV

YEAR 2015

1 **(a)** Luc is painting the doors in his house.
He uses $\frac{3}{4}$ of a tin of paint for each door.

Work out the least number of tins of paint Luc needs to paint 7 doors.

Answer(a) .... [3]

(b) Jan buys tins of paint for $17.16 each.
He sells the paint at a profit of 25%.

For how much does Jan sell each tin of paint?

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

(c) The cost of $17.16 for each tin of paint is 4% more than the cost in the previous year.

Work out the cost of each tin of paint in the previous year.

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

(d) In America a tin of paint costs $17.16 .
In Italy the same tin of paint costs €13.32 .
The exchange rate is $1 = €0.72 .

Calculate, in dollars, the difference in the cost of the tin of paint.

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

(e) Paint is sold in cylindrical tins of height 11 cm.
Each tin holds 750 ml of paint.

    (i) Write 750 ml in cm^3.

Answer(e)(i) .... cm^3 [1]

    (ii) Calculate the radius of the tin.
            Give your answer correct to 1 decimal place.

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

    (iii) A mathematically similar tin has a height of 22 cm.

             How many **litres** of paint does this tin hold?

Answer(e)(iii) .... litres [2]

(f) The mass of a tin of paint is 890 grams, correct to the nearest 10 grams.

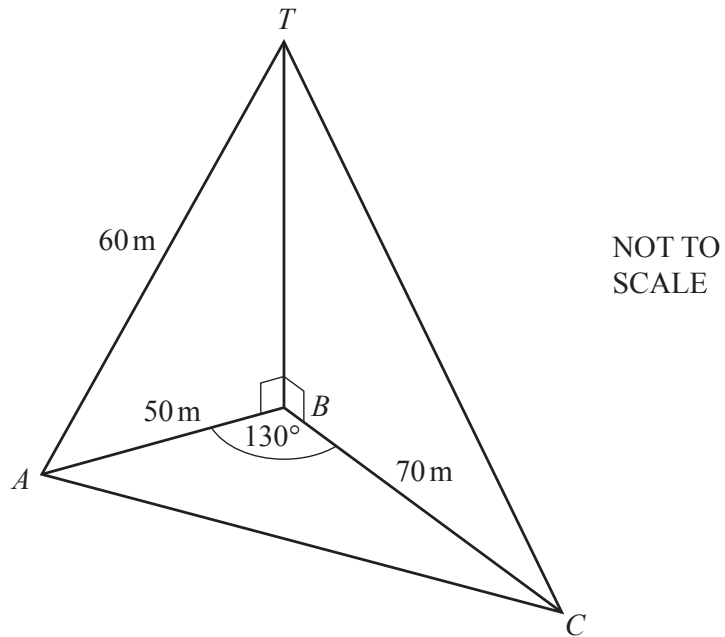Work out the upper bound of the total mass of 10 tins of paint.

Answer(f) .... g [1]

(g) The probability that a tin of paint is dented is 0.07 .

Out of 3000 tins of paint, how many would you expect to be dented?

Answer(g) .... [2]

(h) Tins of paint are filled at the rate of 2 m^3 per minute.

How many 750 ml tins of paint can be filled in 1 hour?

Answer(h) .... [3]

3   (a)

A, *B* and *C* are points on horizontal ground.
BT is a vertical pole.
AT = 60 m, *AB* = 50 m, *BC* = 70 m and angle *ABC* = 130°.

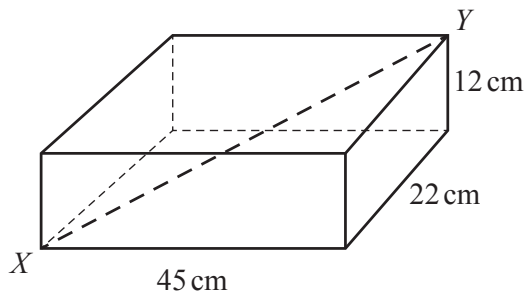**(i)** Calculate the angle of elevation of *T* from *C*.

Answer(a)(i) .... [5]

(ii) Calculate the length *AC*.

Answer(a)(ii) *AC* = ... m [4]

(iii) Calculate the area of triangle *ABC*.

Answer(a)(iii) .... m² [2]

(b)

A cuboid has length 45 cm, width 22 cm and height 12 cm.

Calculate the length of the straight line *XY*.

Answer(b) XY = ... cm [4]

7 The scale drawing shows the positions of three towns *A*, *B* and *C* on a map.
The scale of the map is 1 centimetre represents 10 kilometres.

North

North

C

A

B
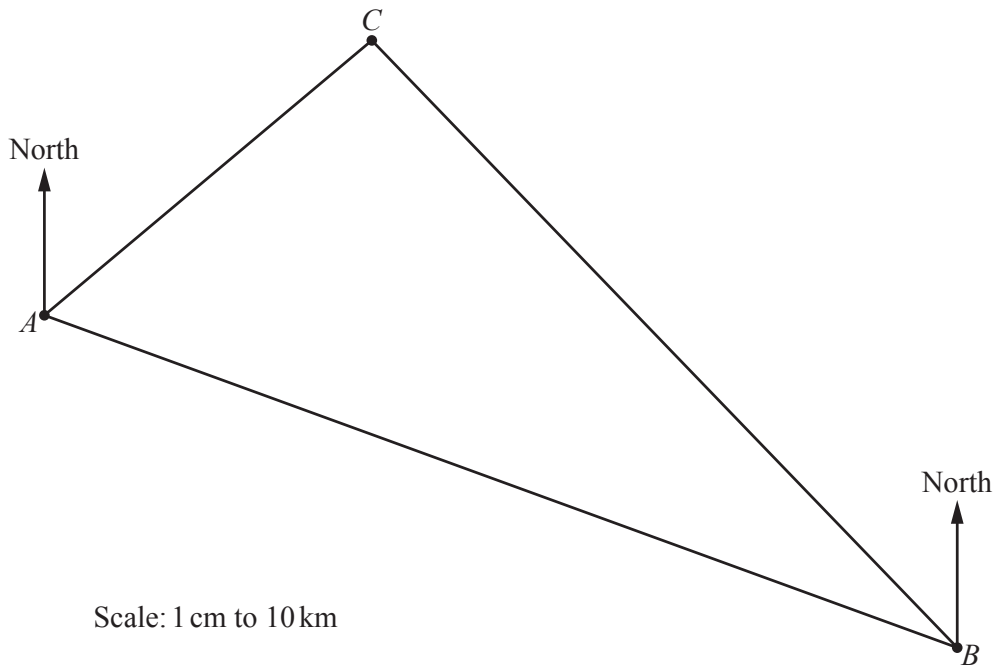
Scale: 1 cm to 10 km

(a) Find the actual distance *AB*.

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

(b) Measure the bearing of *A* from *B*.

Answer(b) .... [1]

(c) Write the scale 1 cm to 10 km in the form 1 : *n*.

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

(d) A national park lies **inside** the triangle *ABC*.
The four boundaries of the national park are

- equidistant from *C* and *B*
- equidistant from *AC* and *CB*
- 15 km from *CB*
- along *AB*.

On the scale drawing, shade the region which represents the national park.
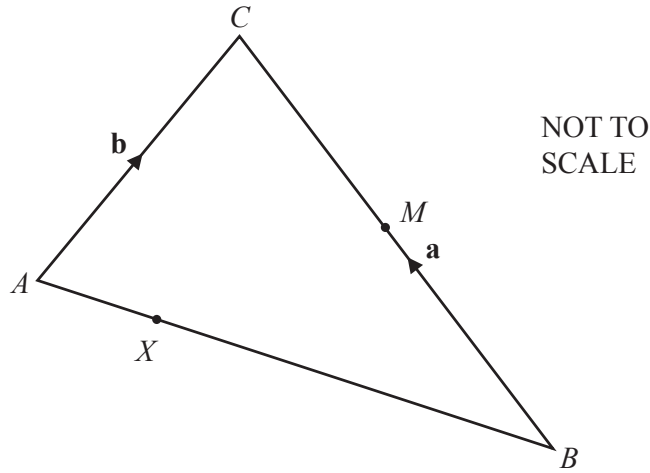**Leave in your construction arcs.** [7]

(e) On the scale drawing, a lake inside the national park has area 0.4 cm².

Calculate the actual area of the lake.

Answer(e) .... km² [2]

10

NOT TO SCALE

$\overrightarrow{BC} = \textbf{a}$ and $\overrightarrow{AC} = \textbf{b}$.

(a) Find $\overrightarrow{AB}$ in terms of **a** and **b**.

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

(b) *M* is the midpoint of *BC*.
X divides *AB* in the ratio 1 : 4.

Find $\overrightarrow{XM}$ in terms of **a** and **b**.
Show all your working and write your answer in its simplest form.

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

0580/22

OCT/NOV

YEAR

2015

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1   Write down the difference in temperature between 8°C and −9°C.

Answer ....°C [1]

_____

2
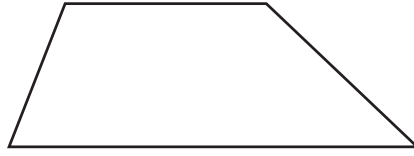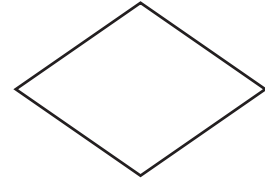

        Parallelogram   Trapezium   Rhombus

   Write down which one of these shapes has

   •   rotational symmetry of order 2
   and
   •   no line symmetry.

Answer..[1]

_____

3   Carlos changed $950 into euros (€) when the exchange rate was €1 = $1.368 .

   Calculate how many euros Carlos received.

Answer €..[2]

_____

4 $\overrightarrow{AB} = \begin{pmatrix} -3 \\ 5 \end{pmatrix}$

   Find $|\overrightarrow{AB}|$.

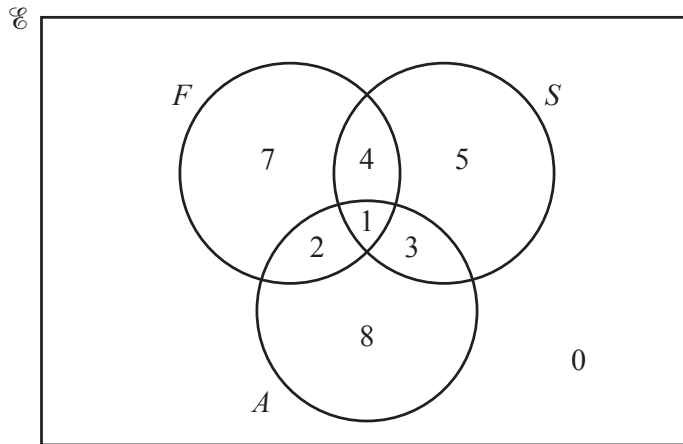*Answer* ....[2]

_____

5 Calculate the volume of a hemisphere with radius 5 cm.

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

Answer .... cm³ [2]

6 The Venn diagram shows the number of students who study French (*F*), Spanish (*S*) and Arabic (*A*).

(a) Find n($A \cup (F \cap S)$).

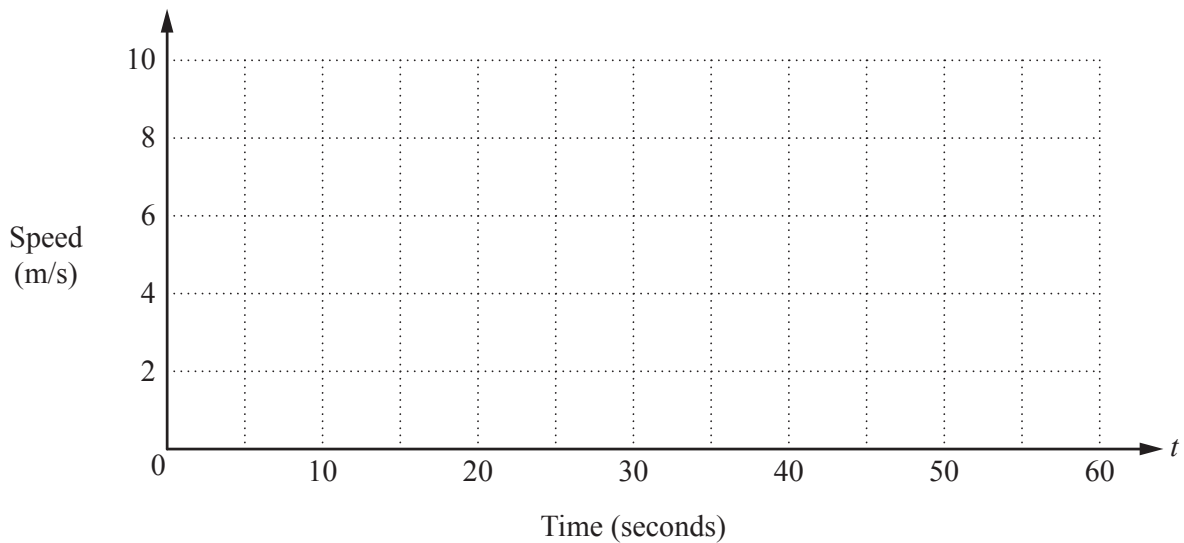*Answer(a)* ....[1]

(b) On the Venn diagram, shade the region $F' \cap S$. [1]

19 Solve the equation $5x^2 - 6x - 3 = 0$.
Show all your working and give your answers correct to 2 decimal places.

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

20 A car passes through a checkpoint at time $t = 0$ seconds, travelling at 8 m/s.
It travels at this speed for 10 seconds.
The car then decelerates at a constant rate until it stops when $t = 55$ seconds.

(a) On the grid, draw the speed-time graph.

[2]

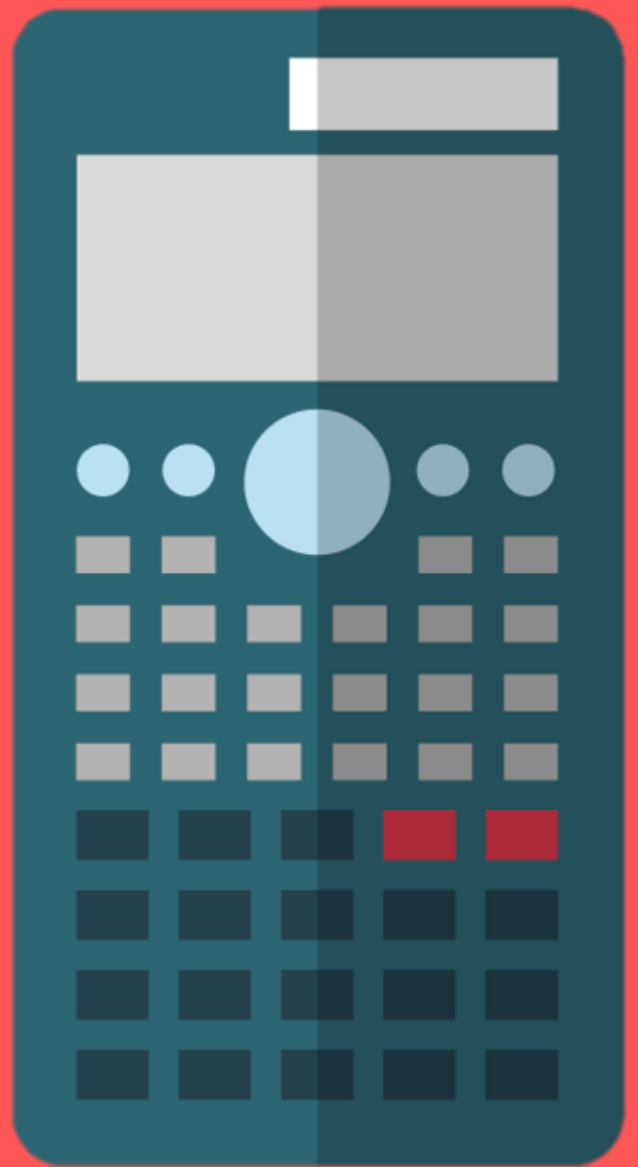**(b)** Calculate the total distance travelled by the car after passing through the checkpoint.

Answer(b) .... m [3]
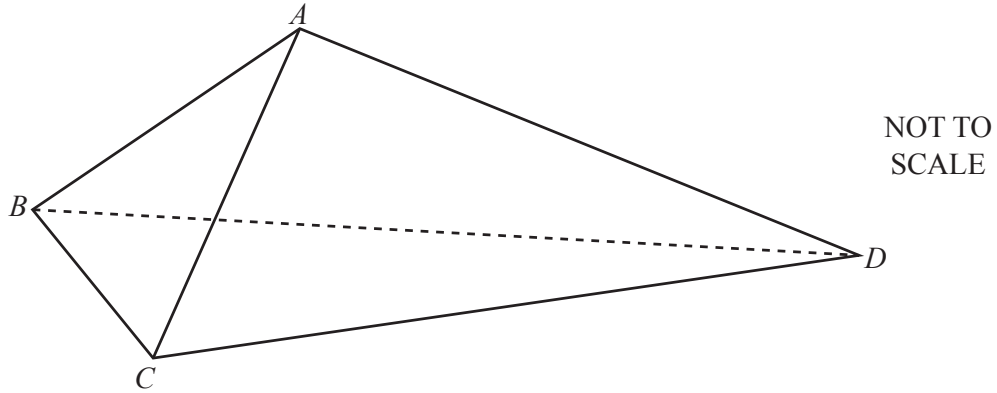
23 A box contains 6 red pencils and 8 blue pencils.
A pencil is chosen at random and not replaced.
A second pencil is then chosen at random.

(a) Complete the tree diagram.

First pencil   Second pencil

$$\frac{6}{14}$$ Red

....   Red

$$\frac{8}{13}$$ Blue

....   Blue

....   Red

....   Blue

[2]

(b) Calculate the probability that

(i) both pencils are red,

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

(ii) at least one of the pencils is red.

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

0580/42

OCT/NOV

YEAR

2015

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4

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The diagram shows a tent *ABCD*.
The front of the tent is an isosceles triangle *ABC*, with *AB* = *AC*.
The sides of the tent are congruent triangles *ABD* and *ACD*.

(a) *BC* = 1.2 m and angle *ABC* = 68°.

Find *AC*.

Answer(a) *AC* = ... m [3]

(b) *CD* = 2.3 m and *AD* = 1.9 m.

Find angle *ADC*.

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

(c) The floor of the tent, triangle *BCD*, is also an isosceles triangle with *BD* = *CD*.

Calculate the area of the floor of the tent.

Answer(c) ....m² [4]

(d) When the tent is on horizontal ground, *A* is a vertical distance 1.25 m above the ground.

Calculate the angle between *AD* and the ground.

Answer(d) .... [3]

7
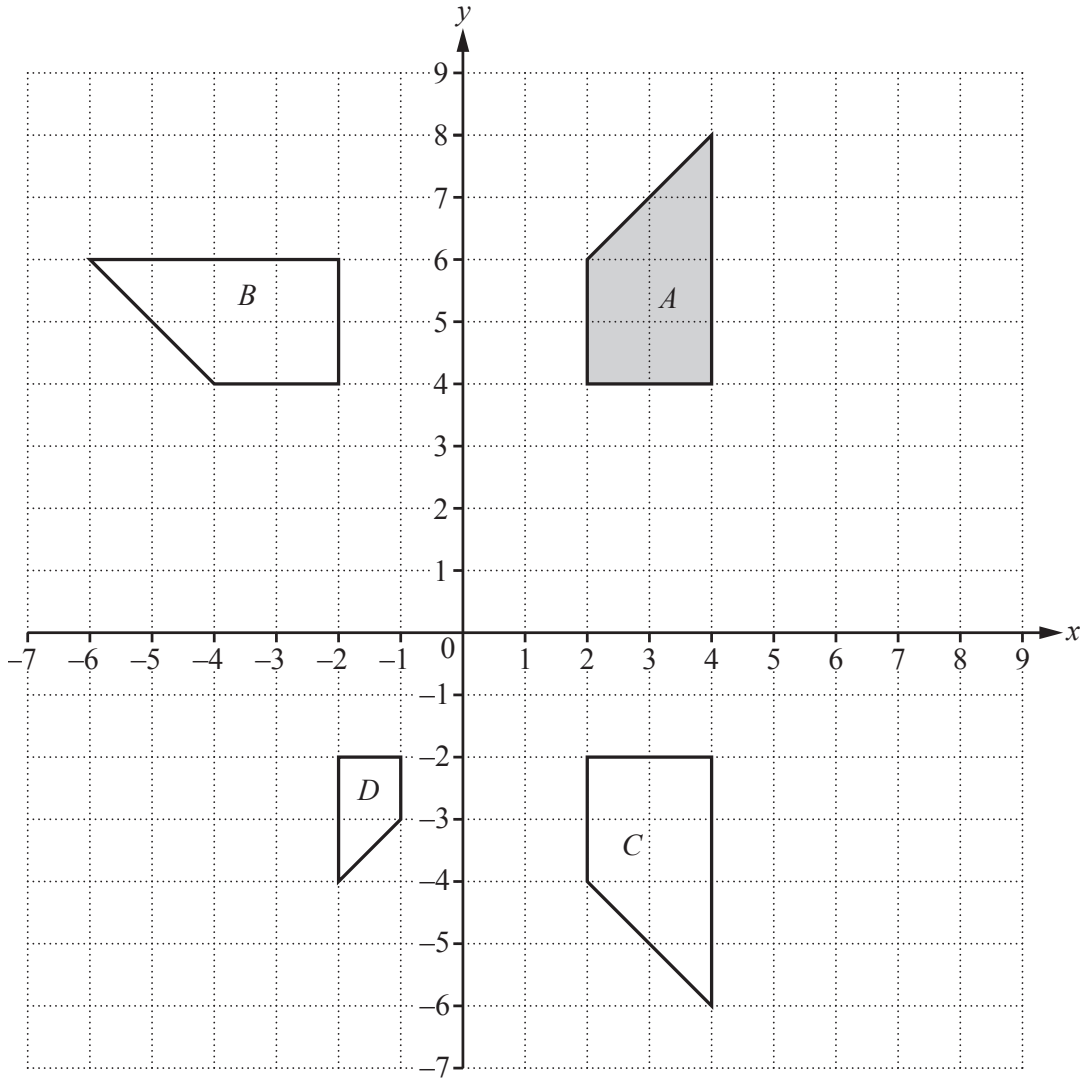
(a) Describe fully the **single** transformation that maps

   (i) shape *A* onto shape *B*,

    Answer(a)(i) ....

    .... [3]

  (ii) shape *A* onto shape *C*,

    Answer(a)(ii) ....

    .... [2]

 (iii) shape *A* onto shape *D*.

    Answer(a)(iii) ....

    .... [3]

(b) Find the 2 × 2 matrix that represents the transformation in **part (a)(iii)**.

Answer(b) $\begin{pmatrix} & \\ & \end{pmatrix}$ [2]

(c) On the grid, draw the image of shape *A* after a translation by the vector $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$. [2]

(d) Describe fully the **single** transformation represented by the matrix $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$.

Answer(d) ....

.... [2]

10 The table shows the first five terms of sequences A, B and C.

Sequence	1st term	2nd term	3rd term	4th term	5th term	6th term
A	3	4	5	6	7	
B	0	1	4	9	16	
C	−3	−3	−1	3	9	

(a) Complete the table for the 6th term of each sequence. [2]

(b) Write down the *n*th term of sequence A.

Answer(b) .... [1]

(c) **(i)** Find the *n*th term of sequence B.

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

(ii) Find the value of *n* when the *n*th term of sequence B is 8281.

Answer(c)(ii) *n* = ... [2]

(d) **(i)** Find the *n*th term of sequence C in its simplest form.

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

(ii) Find the 8th term of sequence C.

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

(e) The *n*th term of another sequence D is $\left(-\dfrac{1}{2}\right)^{n-1}$.

Complete the table for the first four terms of sequence D.

Sequence	1st term	2nd term	3rd term	4th term
D				

[3]

0580/23

OCT/NOV

YEAR
2015

14 Two containers are mathematically similar.
Their volumes are $54\,cm^3$ and $128\,cm^3$.
The height of the smaller container is $4.5\,cm$.

Calculate the height of the larger container.

Answer .... cm [3]

_____

15 Work out $\dfrac{2}{3} + \dfrac{1}{6} - \dfrac{1}{4}$, giving your answer as a fraction in its lowest terms.

Do not use a calculator and show all the steps of your working.

Answer .... [3]

_____

16 Make a the subject of the formula $s = ut + \dfrac{1}{2}at^2$.

Answer a = ... [3]

_____

0580/23/O/N/15 **[Turn over**

19 *y* is inversely proportional to $(x + 2)^2$.
When $x = 1$, $y = 2$.

Find *y* in terms of *x*.

Answer y = ... [2]

_____

20 The volume of a cuboid is $878\,cm^3$, correct to the nearest cubic centimetre.
The length of the base of the cuboid is $7\,cm$, correct to the nearest centimetre.
The width of the base of the cuboid is $6\,cm$, correct to the nearest centimetre.

Calculate the lower bound for the height of the cuboid.

Answer .... cm [3]

_____

23
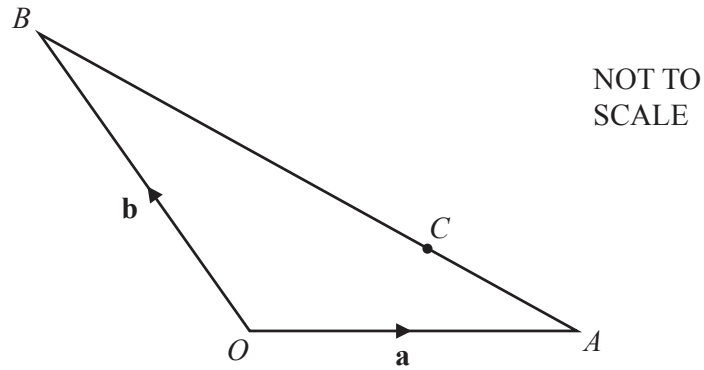
In the diagram, O is the origin, $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$.
C is on the line AB so that $AC:CB = 1:2$.

Find, in terms of $\mathbf{a}$ and $\mathbf{b}$, in its simplest form,

(a) $\overrightarrow{AC}$,

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

(b) the position vector of C.

Answer(b) .... [2]

26
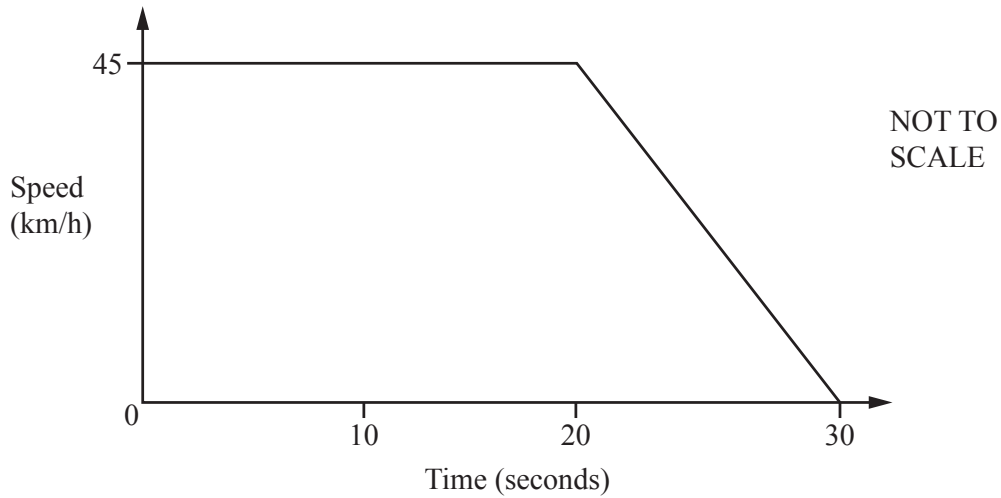
The diagram shows the speed-time graph of a car.
The car travels at 45 km/h for 20 seconds.
The car then decelerates for 10 seconds until it stops.

(a) Change 45 km/h into m/s.

Answer(a) .... m/s [2]

(b) Find the deceleration of the car, giving your answer in m/s^2.

Answer(b) .... m/s^2 [1]

(c) Find the distance travelled by the car during the 30 seconds, giving your answer in metres.

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

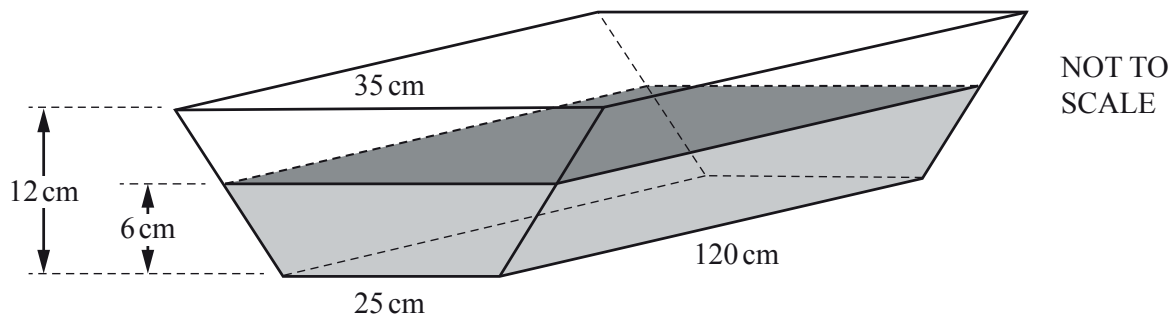# 0580/43

OCT/NOV

YEAR

2015

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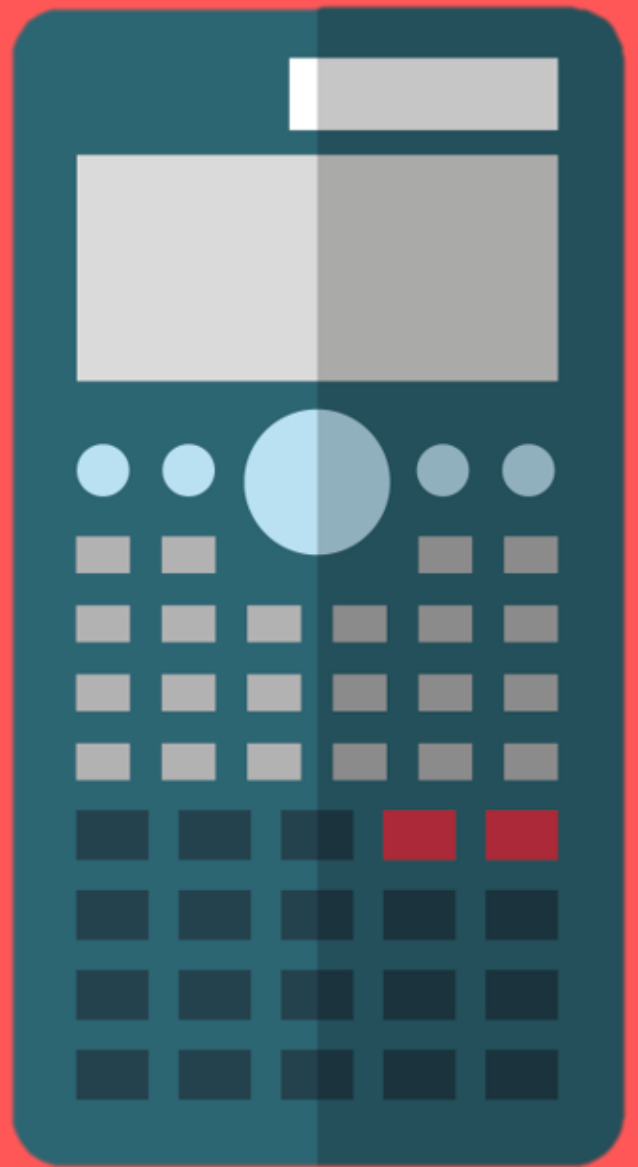
3 The diagram shows a horizontal water trough in the shape of a prism.

The cross section of this prism is a trapezium.
The trapezium has parallel sides of lengths 35 cm and 25 cm and a perpendicular height of 12 cm.
The length of the prism is 120 cm.

(a) Calculate the volume of the trough.

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

(b) The trough contains water to a depth of 6 cm.

(i) Show that the volume of water is 19 800 cm^3.

Answer (b)(i)

[2]

(ii) Calculate the percentage of the trough that contains water.

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

(c) The water is drained from the trough at a rate of 12 litres per hour.

Calculate the time it takes to empty the trough.
Give your answer in hours and minutes.

Answer(c) .... h .... min [4]

(d) The water from the trough just fills a cylinder of radius *r* cm and height 3*r* cm.

Calculate the value of *r*.

Answer(d) r = ... [3]

(e) The cylinder has a mass of 1.2 kg.
1 cm³ of water has a mass of 1 g.

Calculate the total mass of the cylinder and the water.
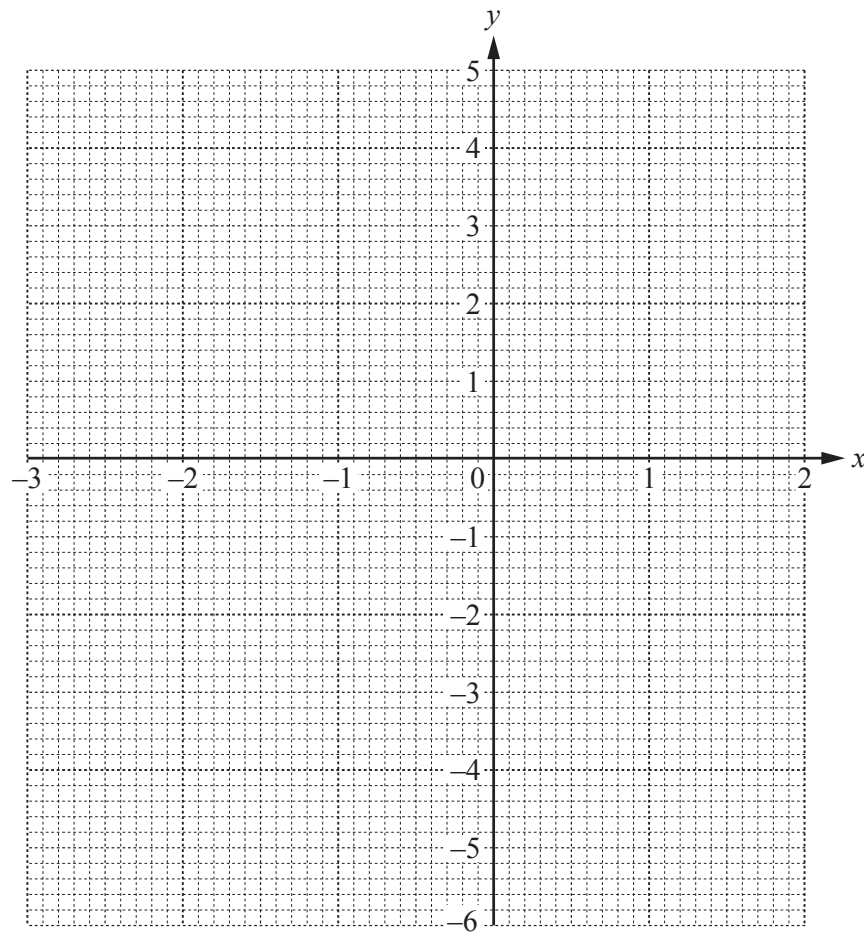Give your answer in kilograms.

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

4 $f(x) = x - \dfrac{1}{2x^2}, \ \ x \neq 0$

(a) Complete the table of values.

x	-3	-2	-1.5	-1	-0.5	-0.3		0.3	0.5	1	1.5	2
$f(x)$	-3.1	-2.1	-1.7		-2.5	-5.9		-5.3	-1.5		1.3	1.9

[2]

(b) On the grid, draw the graph of $y = f(x)$ for $-3 \leqslant x \leqslant -0.3$ and $0.3 \leqslant x \leqslant 2$.

[5]

(c) Use your graph to solve the equation $f(x) = 1$.

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

(d) There is only one negative integer value, k, for which $f(x) = k$ has only one solution for all real x.

Write down this value of k.

Answer(d) $k =$ .... [1]

(e) The equation $2x - \dfrac{1}{2x^2} - 2 = 0$ can be solved using the graph of $y = f(x)$ and a straight line graph.
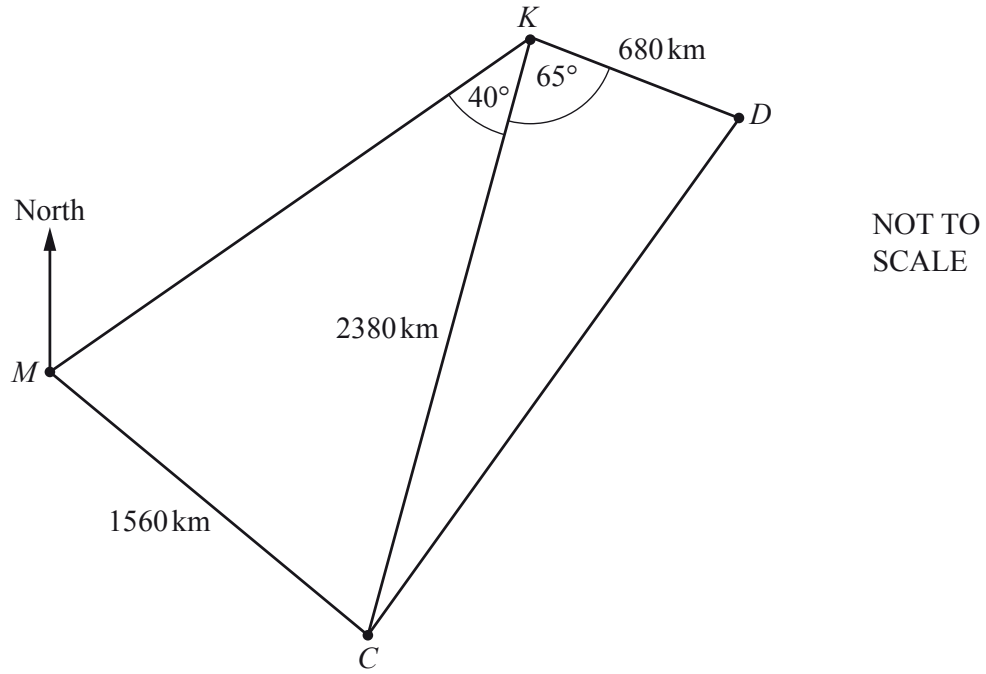
   (i) Find the equation of this straight line.

Answer(e)(i) $y =$ .... [1]

   (ii) On the grid, draw this straight line and solve the equation $2x - \dfrac{1}{2x^2} - 2 = 0$.

Answer(e)(ii) $x =$ .... [3]

5

The diagram shows some distances between Mumbai (*M*), Kathmandu (*K*), Dhaka (*D*) and Colombo (*C*).

(a) Angle *CKD* = 65°.

Use the cosine rule to calculate the distance *CD*.

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

(b) Angle *MKC* = 40°.

Use the sine rule to calculate the acute angle *KMC*.

Answer(b) Angle *KMC* = ... [3]

(c) The bearing of *K* from *M* is 050°.

Find the bearing of *M* from *C*.

Answer(c) .... [2]

(d) A plane from Colombo to Mumbai leaves at 21 15 and the journey takes 2 hours 24 minutes.

(i) Find the time the plane arrives at Mumbai.

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

(ii) Calculate the average speed of the plane.

Answer(d)(ii) .... km/h [2]

8 **(a)**
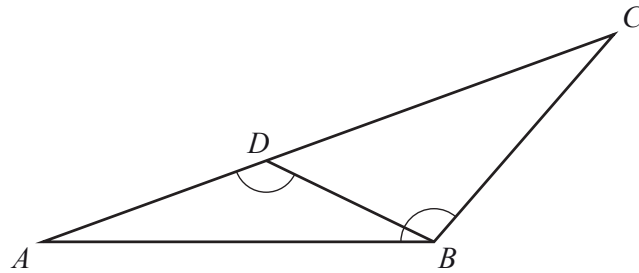
NOT TO SCALE

In the diagram, *D* is on *AC* so that angle *ADB* = angle *ABC*.

(i) Show that angle *ABD* is equal to angle *ACB*.

Answer(a)(i)

[2]

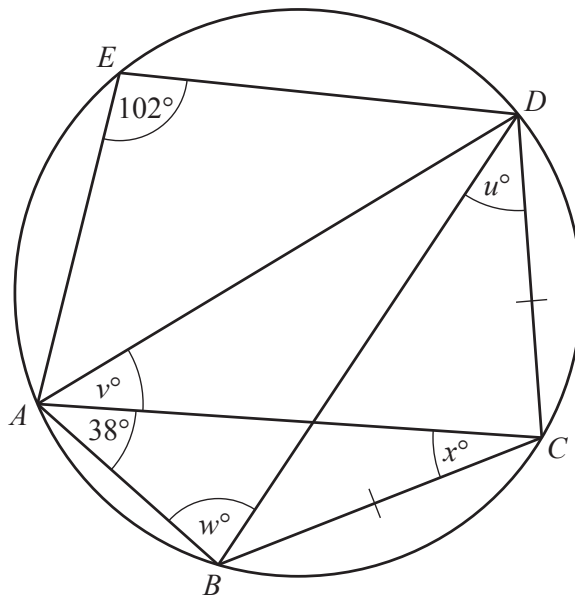**(ii)** Complete the statement.

Triangles *ABD* and *ACB* are .... [1]

(iii) *AB* = 12 cm, *BC* = 11 cm and *AC* = 16 cm.

Calculate the length of *BD*.

Answer(a)(iii) *BD* = ... cm [2]

(b)

NOT TO SCALE

A, *B*, *C*, *D* and *E* lie on the circle.
Angle *AED* = 102° and angle *BAC* = 38°.
BC = *CD*.

Find the value of

(i) *u*,

Answer(b)(i) *u* = ... [1]

(ii) *v*,

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

(iii) *w*,

Answer(b)(iii) *w* = ... [1]

(iv) *x*.

Answer(b)(iv) *x* = ... [1]

(c)
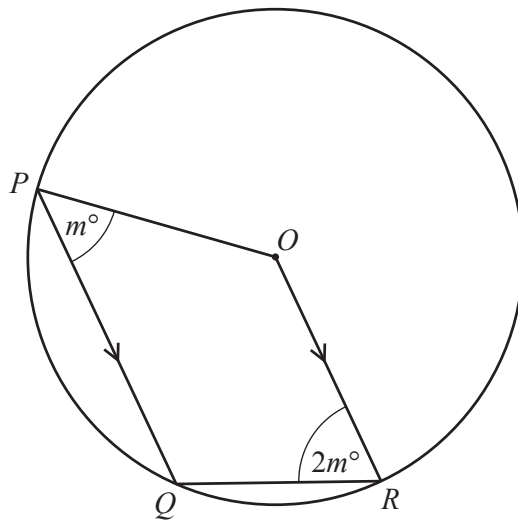
NOT TO
SCALE

In the diagram, *P*, *Q* and *R* lie on the circle, centre *O*.
PQ is parallel to *OR*.
Angle *QPO* = *m*° and angle *QRO* = 2*m*°.

Find the value of *m*.

Answer(c) m = ... [5]

10 Complete the table for each sequence.

Sequence	1st term	2nd term	3rd term	4th term	5th term	6th term		nth term
A	15	8	1	−6				
B	$\dfrac{5}{18}$	$\dfrac{6}{19}$	$\dfrac{7}{20}$	$\dfrac{8}{21}$				
C	2	5	10	17				
D	2	6	18	54				

[11]