

Algebra  
2002 - 2011



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11 Factorise completely.

$$p^2x - 4q^2x$$

*Answer* ..... [3]

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- 16** The time,  $t$ , for a pendulum to swing varies directly as the **square root** of its length,  $l$ .  
When  $l = 9$ ,  $t = 6$ .

(a) Find a formula for  $t$  in terms of  $l$ .

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

(b) Find  $t$  when  $l = 2.25$ .

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

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- 14** (a) Write down the value of  $x^{-1}$ ,  $x^0$ ,  $x^{\frac{1}{2}}$ , and  $x^2$  when  $x = \frac{1}{4}$ .

Answer (a)  $x^{-1}$  .....

$x^0 =$  .....

$x^{\frac{1}{2}} =$  .....

$x^2 =$  ..... [2]

(b) Write  $y^{-1}$ ,  $y^0$ ,  $y^2$  and  $y^3$  in increasing order of size when  $y < -1$ .

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

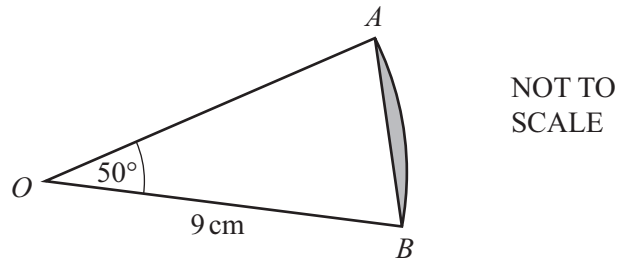
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18 Write as a single fraction, in its simplest form.

$$\frac{1-x}{x} - \frac{2+x}{1-2x}$$

Answer ..... [4]

19



The diagram shows a sector  $AOB$  of a circle, centre  $O$ , radius 9 cm with angle  $AOB = 50^\circ$ .

Calculate the area of the segment shaded in the diagram.

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

- 2 (a) Find the integer values for  $x$  which satisfy the inequality  $-3 < 2x - 1 \leq 6$ .

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

- (b) Simplify  $\frac{x^2 + 3x - 10}{x^2 - 25}$ .

Answer(b) ..... [4]

- (c) (i) Show that  $\frac{5}{x-3} + \frac{2}{x+1} = 3$  can be simplified to  $3x^2 - 13x - 8 = 0$ .

Answer(c)(i)

[3]

- (ii) Solve the equation  $3x^2 - 13x - 8 = 0$ .

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

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

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.

$$\boxed{\$c} + \boxed{\$d \text{ per day}}$$

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.

$$\begin{aligned} \text{Answer(b) } c &= \dots\dots\dots \\ d &= \dots\dots\dots \end{aligned} \quad [4]$$

- (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.

$$\text{Answer(c) } \dots\dots\dots \text{ km/h} \quad [3]$$

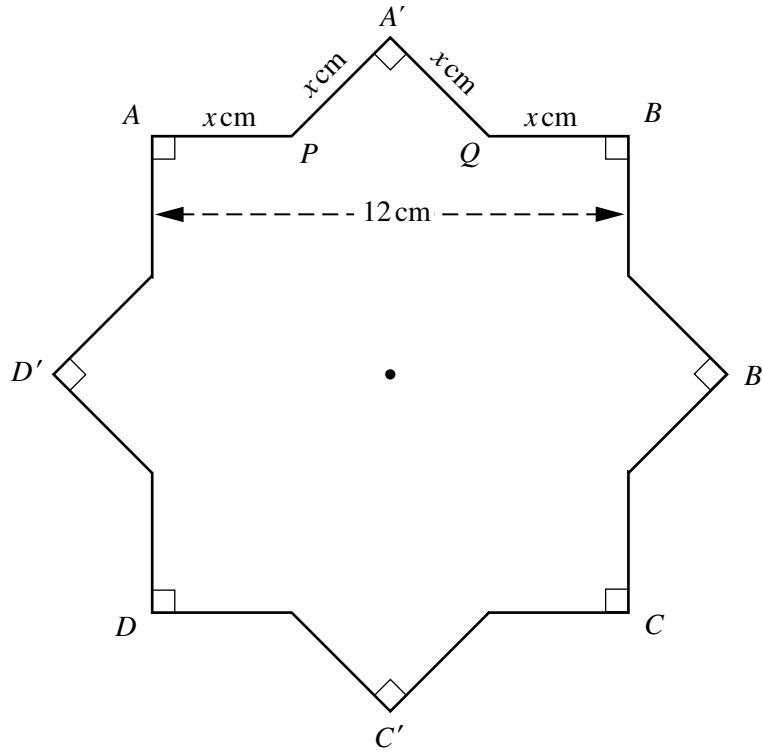
- (d) Two years ago \$540 was put in a savings account to pay for the holiday.

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

How much is in the account now?

$$\text{Answer(d) } \$ \dots\dots\dots \quad [2]$$

6



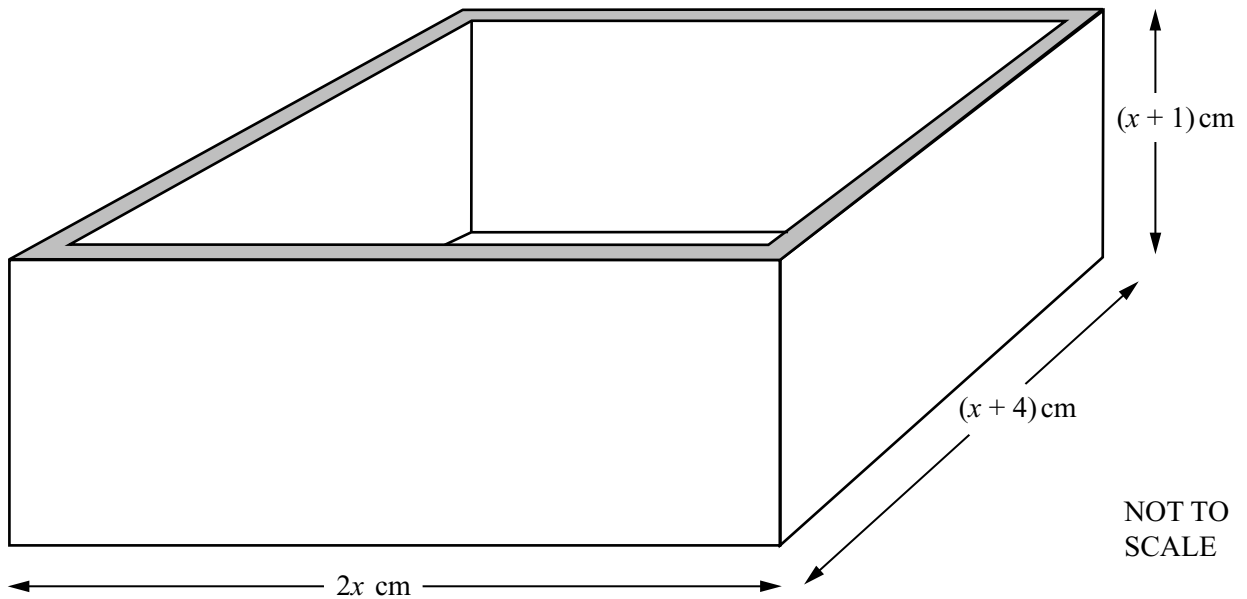
An equilateral 16-sided figure  $APA'QB \dots\dots$  is formed when the square  $ABCD$  is rotated  $45^\circ$  clockwise about its centre to position  $A'B'C'D'$ .

$AB = 12$  cm and  $AP = x$  cm.

- (a) (i) Use triangle  $PA'Q$  to explain why  $2x^2 = (12 - 2x)^2$ . [3]
- (ii) Show that this simplifies to  $x^2 - 24x + 72 = 0$ . [3]
- (iii) Solve  $x^2 - 24x + 72 = 0$ . Give your answers correct to 2 decimal places. [4]
- (b) (i) Calculate the perimeter of the 16-sided figure. [2]
- (ii) Calculate the area of the 16-sided figure. [3]



6



A rectangular-based **open** box has **external** dimensions of  $2x$  cm,  $(x + 4)$  cm and  $(x + 1)$  cm.

- (a) (i) Write down the volume of a cuboid with these dimensions. [1]  
 (ii) Expand and simplify your answer. [1]
- (b) The box is made from wood 1 cm thick.
- (i) Write down the **internal** dimensions of the box in terms of  $x$ . [3]  
 (ii) Find the volume of the **inside** of the box and show that the volume of the wood is  $8x^2 + 12x$  cubic centimetres. [3]
- (c) The volume of the wood is  $1980 \text{ cm}^3$ .
- (i) Show that  $2x^2 + 3x - 495 = 0$  and solve this equation. [5]  
 (ii) Write down the **external** dimensions of the box. [2]

5 Maria walks 10 kilometres to a waterfall at an average speed of  $x$  kilometres per hour.

- (a) Write down, in terms of  $x$ , the time taken in hours. [1]
- (b) Maria returns from the waterfall but this time she walks the 10 kilometres at an average speed of  $(x + 1)$  kilometres per hour. The time of the return journey is 30 minutes less than the time of the first journey.  
Write down an equation in  $x$  and show that it simplifies to  $x^2 + x - 20 = 0$ . [4]
- (c) Solve the equation  $x^2 + x - 20 = 0$ . [2]
- (d) Find the time Maria takes to walk to the waterfall. [2]

7 To raise money for charity, Jalaj walks 22 km, correct to the nearest kilometre, every day for 5 days.

(a) Complete the statement in the answer space for the distance,  $d$  km, he walks in one day.

Answer (a) .....  $\leq d <$  ..... [2]

(b) He raises \$1.60 for every kilometre that he walks.

Calculate the least amount of money that he raises at the end of the 5 days.

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

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8 Solve the simultaneous equations

$$\frac{1}{2}x + 2y = 16,$$

$$2x + \frac{1}{2}y = 19.$$

Answer  $x =$  .....

$y =$  ..... [3]

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9 The wavelength,  $w$ , of a radio signal is inversely proportional to its frequency,  $f$ .  
When  $f = 200$ ,  $w = 1500$ .

(a) Find an equation connecting  $f$  and  $w$ .

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

(b) Find the value of  $f$  when  $w = 600$ .

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

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13 Solve the equation

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

Answer  $x =$  ..... [3]

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14 A company makes two models of television.

Model *A* has a rectangular screen that measures 44 cm by 32 cm.

Model *B* has a larger screen with these measurements increased in the ratio 5:4.

(a) Work out the measurements of the larger screen.

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

(b) Find the **fraction**  $\frac{\text{model } A \text{ screen area}}{\text{model } B \text{ screen area}}$  in its simplest form.

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

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15 Angharad had an operation costing \$500.

She was in hospital for  $x$  days.

The cost of nursing care was \$170 for each day she was in hospital.

(a) Write down, in terms of  $x$ , an expression for the total cost of her operation and nursing care.

Answer(a)\$ ..... [1]

(b) The total cost of her operation and nursing care was \$2370.

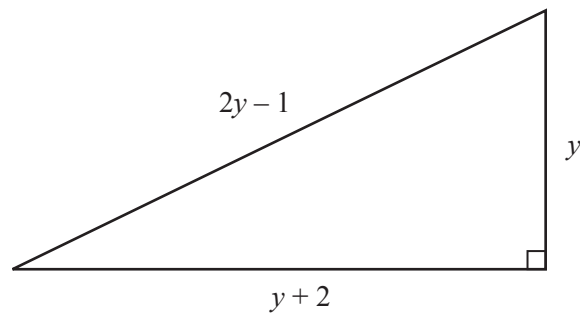
Work out how many days Angharad was in hospital.

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

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- 5 The length,  $y$ , of a solid is inversely proportional to the square of its height,  $x$ .
- (a) Write down a general equation for  $x$  and  $y$ .  
Show that when  $x = 5$  and  $y = 4.8$  the equation becomes  $x^2y = 120$ . [2]
- (b) Find  $y$  when  $x = 2$ . [1]
- (c) Find  $x$  when  $y = 10$ . [2]
- (d) Find  $x$  when  $y = x$ . [2]
- (e) Describe exactly what happens to  $y$  when  $x$  is doubled. [2]
- (f) Describe exactly what happens to  $x$  when  $y$  is decreased by 36%. [2]
- (g) Make  $x$  the subject of the formula  $x^2y = 120$ . [2]

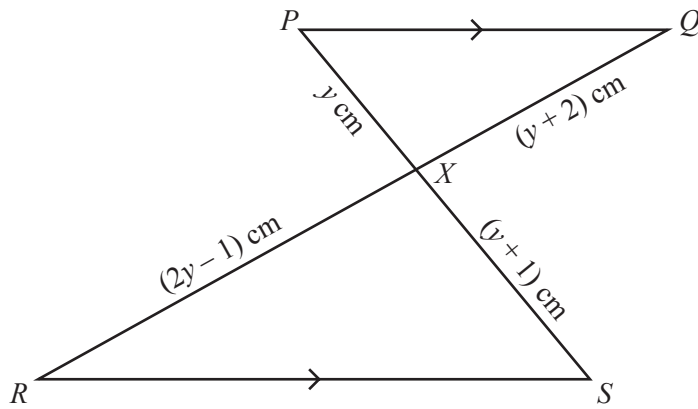
(b)

NOT TO  
SCALE

The diagram shows a right-angled triangle.  
The lengths of the sides are given in terms of  $y$ .

- (i) Show that  $2y^2 - 8y - 3 = 0$ . [3]  
(ii) Solve the equation  $2y^2 - 8y - 3 = 0$ , giving your answers to 2 decimal places. [4]  
(iii) Calculate the area of the triangle. [2]
-

(b)

NOT TO  
SCALE

In the diagram  $PQ$  is parallel to  $RS$ .

$PS$  and  $QR$  intersect at  $X$ .

$PX = y$  cm,  $QX = (y + 2)$  cm,  $RX = (2y - 1)$  cm and  $SX = (y + 1)$  cm.

(i) Show that  $y^2 - 4y - 2 = 0$ . [3]

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

Show all your working and give your answers correct to two decimal places. [4]

(iii) Write down the length of  $RX$ . [1]

8 A packet of sweets contains chocolates and toffees.

(a) There are  $x$  chocolates which have a total mass of 105 grams.

Write down, in terms of  $x$ , the mean mass of a chocolate. [1]

(b) There are  $x + 4$  toffees which have a total mass of 105 grams.

Write down, in terms of  $x$ , the mean mass of a toffee. [1]

(c) The difference between the two mean masses in **parts (a)** and **(b)** is 0.8 grams.

Write down an equation in  $x$  and show that it simplifies to  $x^2 + 4x - 525 = 0$ . [4]

(d) (i) Factorise  $x^2 + 4x - 525$ . [2]

(ii) Write down the solutions of  $x^2 + 4x - 525 = 0$ . [1]

(e) Write down the total number of sweets in the packet. [1]

(f) Find the mean mass of a sweet in the packet. [2]

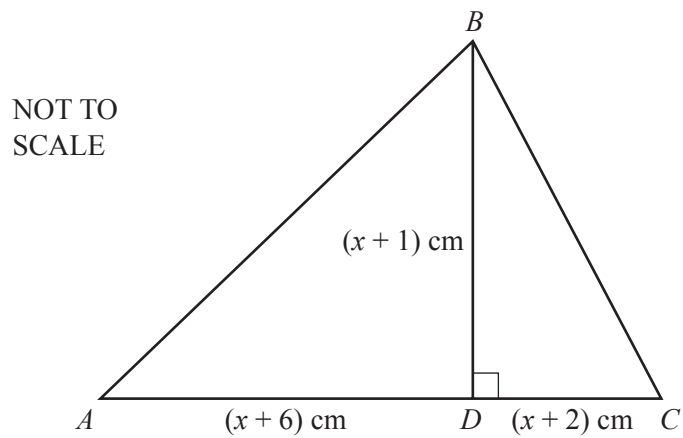
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$m^4 - 16n^4$  can be written as  $(m^2 - kn^2)(m^2 + kn^2)$ .  
k. [1]

Factorise completely  $m^4n - 16n^5$ . [2]



6 (a)



In triangle  $ABC$ , the line  $BD$  is perpendicular to  $AC$ .

$AD = (x + 6)$  cm,  $DC = (x + 2)$  cm and the height  $BD = (x + 1)$  cm.

The area of triangle  $ABC$  is  $40 \text{ cm}^2$ .

(i) Show that  $x^2 + 5x - 36 = 0$ .

*Answer (a)(i)*

[3]

(ii) Solve the equation  $x^2 + 5x - 36 = 0$ .

*Answer(a)(ii)*  $x = \dots\dots\dots$  or  $x = \dots\dots\dots$  [2]

(iii) Calculate the length of  $BC$ .

*Answer(a)(iii)*  $BC = \dots\dots\dots$  cm [2]

(b) Amira takes 9 hours 25 minutes to complete a long walk.

(i) Show that the time of 9 hours 25 minutes can be written as  $\frac{113}{12}$  hours.

*Answer (b)(i)*

[1]

(ii) She walks  $(3y + 2)$  kilometres at 3 km/h and then a further  $(y + 4)$  kilometres at 2 km/h.

Show that the total time taken is  $\frac{9y + 16}{6}$  hours.

*Answer(b)(ii)*

[2]

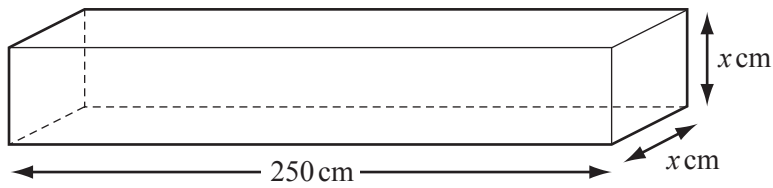
(iii) Solve the equation  $\frac{9y + 16}{6} = \frac{113}{12}$ .

*Answer(b)(iii) y =* ..... [2]

(iv) Calculate Amira's average speed, in kilometres per hour, for the whole walk.

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

7



NOT TO SCALE

A solid metal bar is in the shape of a cuboid of length of 250 cm.  
 The cross-section is a square of side  $x$  cm.  
 The volume of the cuboid is  $4840 \text{ cm}^3$ .

(a) Show that  $x = 4.4$ .

*Answer (a)*

[2]

(b) The mass of  $1 \text{ cm}^3$  of the metal is 8.8 grams.  
 Calculate the mass of the whole metal bar in kilograms.

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

(c) A box, in the shape of a cuboid measures 250 cm by 88 cm by  $h$  cm.  
 120 of the metal bars fit exactly in the box.  
 Calculate the value of  $h$ .

*Answer(c)*  $h =$  ..... [2]

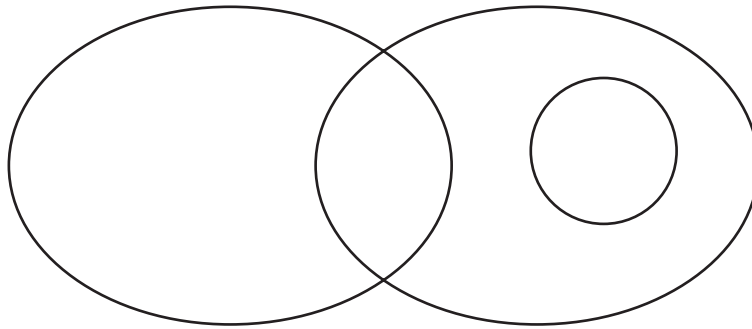
- 11 Make  $d$  the subject of the formula  $c = \frac{5d + 4w}{2w}$ .

Answer  $d =$

[3]

- 12  $Q = \{2, 4, 6, 8, 10\}$  and  $R = \{5, 10, 15, 20\}$ .  
 $15 \in P$ ,  $n(P) = 1$  and  $P \cap Q = \emptyset$ .

Label each set and complete the Venn diagram to show this information.



[3]

- 13 Solve the simultaneous equations.

$$\frac{2x + y}{2} = 7$$

$$\frac{2x - y}{2} = 17$$

Answer  $x =$  .....

$y =$  ..... [3]

9 (a) Solve the following equations.

(i)  $\frac{5}{w} = \frac{3}{w+1}$

Answer(a)(i)  $w = \dots\dots\dots$  [2]

(ii)  $(y+1)^2 = 4$

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

(iii)  $\frac{x+1}{3} - \frac{x-2}{5} = 2$

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

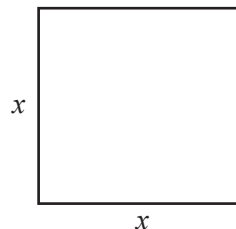
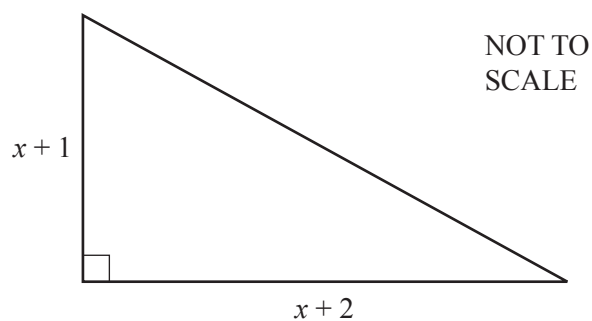
(b) (i) Factorise  $u^2 - 9u - 10$ .

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

(ii) Solve the equation  $u^2 - 9u - 10 = 0$ .

Answer(b)(ii)  $u = \dots\dots\dots$  or  $u = \dots\dots\dots$  [1]

(c)



The area of the triangle is equal to the area of the square.  
All lengths are in centimetres.

(i) Show that  $x^2 - 3x - 2 = 0$ .

*Answer(c)(i)*

[3]

(ii) Solve the equation  $x^2 - 3x - 2 = 0$ , giving your answers correct to 2 decimal places.  
Show all your working.

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

(iii) Calculate the area of one of the shapes.

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

- 8 (a)  $y$  is 5 less than the square of the sum of  $p$  and  $q$ .

Write down a formula for  $y$  in terms of  $p$  and  $q$ .

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

- (b) The cost of a magazine is  $\$x$  and the cost of a newspaper is  $\$(x - 3)$ .

The total cost of 6 magazines and 9 newspapers is  $\$51$ .

Write down and solve an equation in  $x$  to find the cost of a magazine.

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

- (c) Bus tickets cost \$3 for an adult and \$2 for a child.

There are  $a$  adults and  $c$  children on a bus.

The total number of people on the bus is 52.

The total cost of the 52 tickets is \$139.

Find the number of adults and the number of children on the bus.

*Answer(c)* Number of adults = .....

Number of children = ..... [5]

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- 9 (a) The cost of a bottle of water is  $\$w$ .

The cost of a bottle of juice is  $\$j$ .

The total cost of 8 bottles of water and 2 bottles of juice is  $\$12$ .

The total cost of 12 bottles of water and 18 bottles of juice is  $\$45$ .

Find the cost of a bottle of water and the cost of a bottle of juice.

*Answer(a)* Cost of a bottle of water = \$ .....

Cost of a bottle of juice = \$ ..... [5]

- (b) Roshni cycles 2 kilometres at  $y$  km/h and then runs 4 kilometres at  $(y - 4)$  km/h.  
The whole journey takes 40 **minutes**.

- (i) Write an equation in  $y$  and show that it simplifies to  $y^2 - 13y + 12 = 0$ .

*Answer(b)(i)*

[4]

(ii) Factorise  $y^2 - 13y + 12$ .

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

(iii) Solve the equation  $y^2 - 13y + 12 = 0$ .

*Answer(b)(iii)*  $y =$  ..... or  $y =$  ..... [1]

(iv) Work out Roshni's running speed.

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

(c) Solve the equation

$$u^2 - u - 4 = 0.$$

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

*Answer(c)*  $u =$  ..... or  $u =$  ..... [4]

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- 13 (a) Find the value of  $x$  when  $\frac{18}{24} = \frac{27}{x}$ .

Answer(a)  $x =$  ..... [1]

- (b) Show that  $\frac{2}{3} \div 1\frac{1}{6} = \frac{4}{7}$ .

Write down all the steps in your working.

Answer(b)

[2]

- 14 (a) A drinking glass contains 55 cl of water.  
Write 55 cl in litres.

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

- (b) The mass of grain in a sack is 35 kg.  
The grain is divided equally into 140 bags.

Calculate the mass of grain in each bag.  
Give your answer in grams.

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

- 15 (a) Write 67.499 correct to the nearest integer.

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

- (b) Write 0.003040506 correct to 3 significant figures.

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

- (c)  $d = 56.4$ , correct to 1 decimal place.

Write down the lower bound of  $d$ .

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

10 The cost of a cup of tea is  $t$  cents.

The cost of a cup of coffee is  $(t + 5)$  cents.

The total cost of 7 cups of tea and 11 cups of coffee is 2215 cents.

Find the cost of one cup of tea.

*Answer* ..... cents [3]

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11 The volume of a solid varies directly as the **cube** of its length.  
When the length is 3 cm, the volume is  $108 \text{ cm}^3$ .

Find the volume when the length is 5 cm.

*Answer* .....  $\text{cm}^3$  [3]

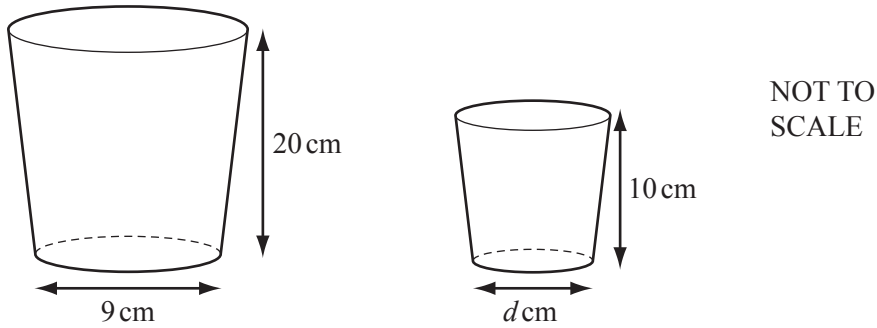
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- 16 Write  $\frac{2}{x-2} + \frac{3}{x+2}$  as a single fraction.

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]

3 (a)  $x = 3m - k$

Find the value of

(i)  $x$  when  $m = 2$  and  $k = -4$ ,

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

(ii)  $m$  when  $x = 19$  and  $k = 5$ .

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

(b) Expand the brackets.

$$g(7f - g^2)$$

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

(c) Factorise completely.

$$18h^2 - 12hj$$

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

(d) Make  $m$  the subject of the formula.

$$t = 8m + 15$$

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

(e) Solve the equation.

$$p + 3 = 3(p - 5)$$

Answer(e)  $p =$  ..... [3]

7 (a) Solve the equations.

(i)  $2x + 3 = 15 - x$

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

(ii)  $\frac{2y-1}{3} = 7$

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

(iii)  $2 = \frac{1}{u-1}$

*Answer(a)(iii)*  $u =$  ..... [3]

(b) Write down equations to show the following.

(i)  $p$  is equal to  $r$  plus two times  $q$ .

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

(ii)  $k$  is equal to the square of the sum of  $l$  and  $m$ .

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

(c) Pierre walks for 2 hours at  $w$  km/h and then for another 3 hours at  $(w - 1)$  km/h.

The total distance of Pierre's journey is 11.5 km.

Find the value of  $w$ .

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

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- 5 (a) Solve  $9 < 3n + 6 \leq 21$  for integer values of  $n$ .

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

- (b) Factorise completely.

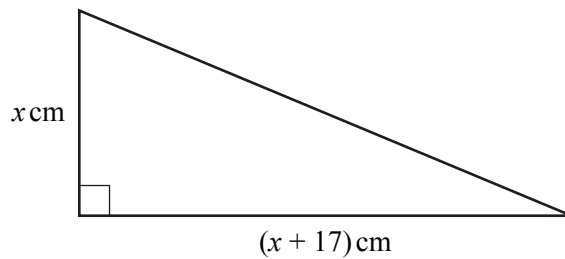
(i)  $2x^2 + 10xy$

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

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

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

- (c)



NOT TO  
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The area of this triangle is  $84 \text{ cm}^2$ .

- (i) Show that  $x^2 + 17x - 168 = 0$ .

Answer (c)(i)

[2]

- (ii) Factorise  $x^2 + 17x - 168$ .

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

- (iii) Solve  $x^2 + 17x - 168 = 0$ .

Answer(c)(iii)  $x =$  ..... or  $x =$  ..... [1]

(d) Solve

$$\frac{15-x}{2} = 3 - 2x.$$

*Answer(d)*  $x =$  ..... [3]

(e) Solve  $2x^2 - 5x - 6 = 0$ .

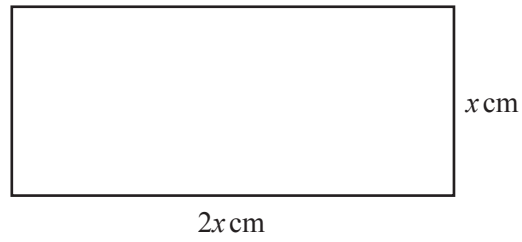
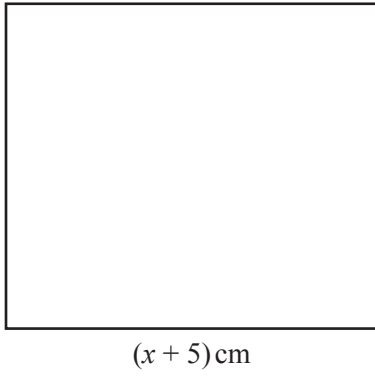
Show all your working and give your answers correct to 2 decimal places.

*Answer(e)*  $x =$  ..... or  $x =$  ..... [4]

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4

3



NOT TO  
SCALE

The diagram shows a square of side  $(x + 5)$  cm and a rectangle which measures  $2x$  cm by  $x$  cm.

The area of the square is  $1 \text{ cm}^2$  more than the area of the rectangle.

(a) Show that  $x^2 - 10x - 24 = 0$ .

*Answer(a)*

[3]

(b) Find the value of  $x$ .

*Answer(b)*  $x =$  ..... [3]

(c) Calculate the acute angle between the diagonals of the rectangle.

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

---

- (c) Erik runs a race at an average speed of  $x$  m/s.  
His time is  $(3x - 9)$  seconds and the race distance is  $(2x^2 - 8)$  metres.

- (i) Write down an equation in  $x$  and show that it simplifies to

$$x^2 - 9x + 8 = 0. \quad [2]$$

- (ii) Solve  $x^2 - 9x + 8 = 0$ . [2]

- (iii) Write down Erik's time and the race distance. [2]
- 

- 17 Solve the equation

$$x^2 + 4x - 22 = 0.$$

Give your answers correct to 2 decimal places.

**Show all your working.**

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

---

- 8 (a) (i)** The cost of a book is  $\$x$ .  
Write down an expression in terms of  $x$  for the number of these books which are bought for  $\$40$ . [1]
- (ii)** The cost of each book is increased by  $\$2$ .  
The number of books which are bought for  $\$40$  is now one less than before.  
Write down an equation in  $x$  and show that it simplifies to  $x^2 + 2x - 80 = 0$ . [4]
- (iii)** Solve the equation  $x^2 + 2x - 80 = 0$ . [2]
- (iv)** Find the original cost of one book. [1]
- (b)** Magazines cost  $\$m$  each and newspapers cost  $\$n$  each.  
One magazine costs  $\$2.55$  more than one newspaper.  
The cost of two magazines is the same as the cost of five newspapers.
- (i)** Write down two equations in  $m$  and  $n$  to show this information. [2]
- (ii)** Find the values of  $m$  and  $n$ . [3]
-

- 1 Two quantities  $c$  and  $d$  are connected by the formula  $c = 2d + 30$ .  
Find  $c$  when  $d = -100$ .

Answer ..... [1]

---

2 (a)

$$\frac{2}{3} + \frac{5}{6} = \frac{x}{2}$$

Find the value of  $x$ .

Answer(a)  $x =$  ..... [1]

(b)

$$\frac{5}{3} \div \frac{3}{y} = \frac{40}{9}$$

Find the value of  $y$ .

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

---

- 3 Use your calculator to work out

(a)  $\sqrt{(7 + 6 \times 243^{0.2})}$ ,

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

(b)  $2 - \tan 30^\circ \times \tan 60^\circ$ .

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

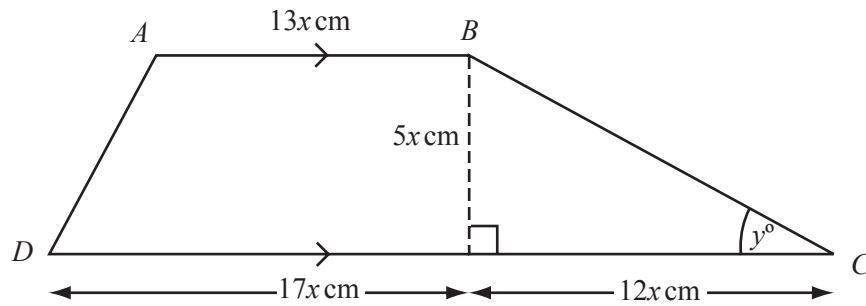
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- 4 Angharad sleeps for 8 hours each night, correct to the nearest 10 minutes.  
The total time she sleeps in the month of November (30 nights) is  $T$  hours.  
Between what limits does  $T$  lie?

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

---

16

NOT TO  
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$ABCD$  is a trapezium.

(a) Find the area of the trapezium in terms of  $x$  and simplify your answer.

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

(b) Angle  $BCD = y^\circ$ . Calculate the value of  $y$ .

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

17 Solve the equations

(a)  $0.2x - 3 = 0.5x$ ,

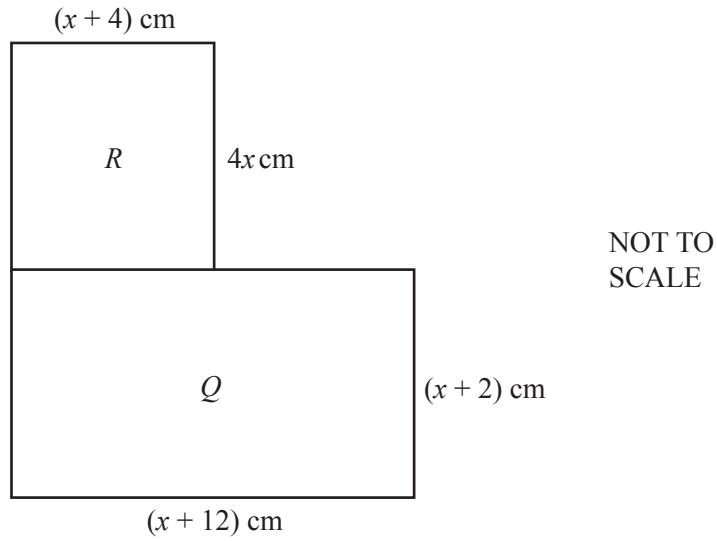
Answer(a)  $x =$  ..... [2]

(b)  $2x^2 - 11x + 12 = 0$ .

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



20



- (a) (i) Write down an expression for the area of rectangle  $R$ .

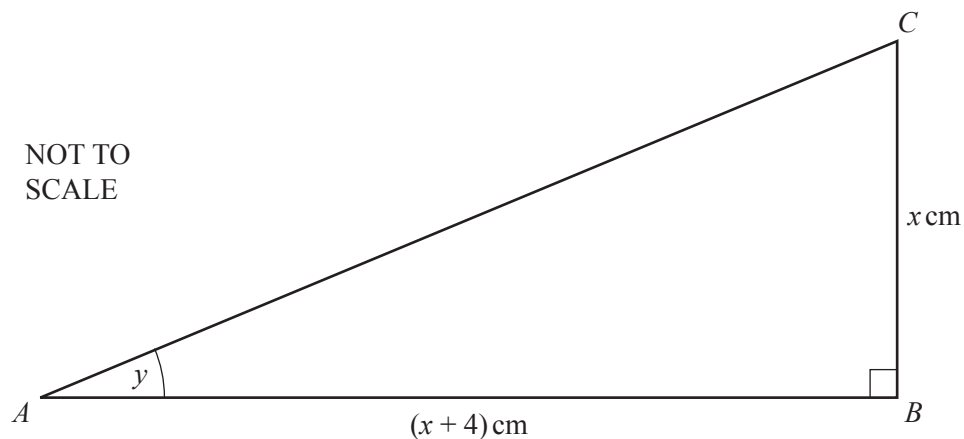
*Answer(a) (i)* .....cm<sup>2</sup> [1]

- (ii) Show that the total area of rectangles  $R$  and  $Q$  is  $5x^2 + 30x + 24$  square centimetres.

[1]

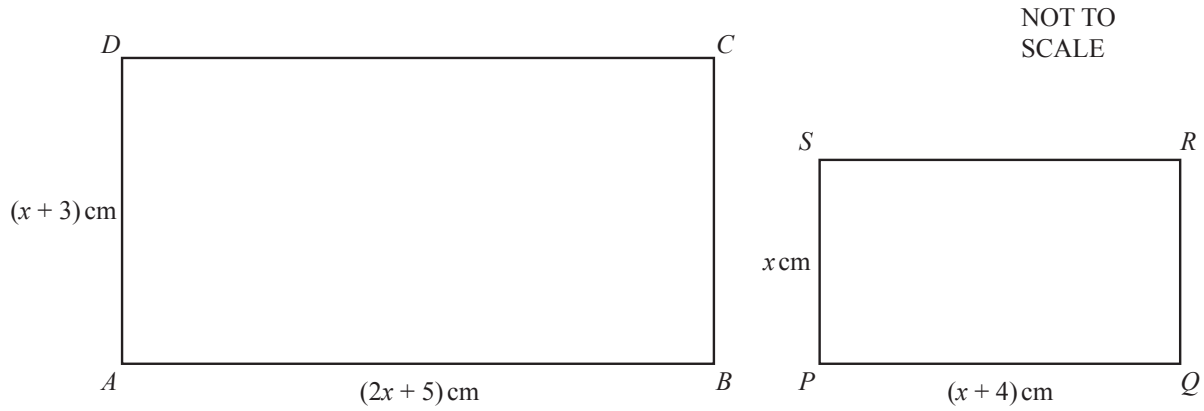
- (b) The total area of rectangles  $R$  and  $Q$  is  $64 \text{ cm}^2$ .  
Calculate the value of  $x$  correct to 1 decimal place.

*Answer(b) x =* ..... [4]



- (a) When the area of triangle  $ABC$  is  $48 \text{ cm}^2$ ,
- (i) show that  $x^2 + 4x - 96 = 0$ , [2]
  - (ii) solve the equation  $x^2 + 4x - 96 = 0$ , [2]
  - (iii) write down the length of  $AB$ . [1]
- (b) When  $\tan y = \frac{1}{6}$ , find the value of  $x$ . [2]
- (c) When the length of  $AC$  is  $9 \text{ cm}$ ,
- (i) show that  $2x^2 + 8x - 65 = 0$ , [2]
  - (ii) solve the equation  $2x^2 + 8x - 65 = 0$ ,  
(Show your working and give your answers correct to 2 decimal places.) [4]
  - (iii) calculate the perimeter of triangle  $ABC$ . [1]
-

5



The diagram shows two rectangles  $ABCD$  and  $PQRS$ .

$AB = (2x + 5)$  cm,  $AD = (x + 3)$  cm,  $PQ = (x + 4)$  cm and  $PS = x$  cm.

(a) For one value of  $x$ , the area of rectangle  $ABCD$  is  $59 \text{ cm}^2$  more than the area of rectangle  $PQRS$ .

(i) Show that  $x^2 + 7x - 44 = 0$ .

*Answer(a)(i)*

(ii) Factorise  $x^2 + 7x - 44$ . [3]

*Answer(a)(ii)* .....

(iii) Solve the equation  $x^2 + 7x - 44 = 0$ .

*Answer(a)(iii)*  $x =$  ..... or  $x =$  ..... [1]

(iv) Calculate the size of angle  $DBA$ .

*Answer(a)(iv)* Angle  $DBA =$  ..... [2]

(b) For a **different** value of  $x$ , the rectangles  $ABCD$  and  $PQRS$  are similar.

(i) Show that this value of  $x$  satisfies the equation  $x^2 - 2x - 12 = 0$ .

*Answer(b)(i)*

[3]

(ii) Solve the equation  $x^2 - 2x - 12 = 0$ , giving your answers correct to 2 decimal places.

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

(iii) Calculate the perimeter of the rectangle  $PQRS$ .

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

9 (a) Solve the equation  $\frac{m-3}{4} + \frac{m+4}{3} = -7$ .

Answer(a)  $m =$  ..... [4]

(b) (i)  $y = \frac{3}{x-1} - \frac{2}{x+3}$

Find the value of  $y$  when  $x = 5$ .

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

(ii) Write  $\frac{3}{x-1} - \frac{2}{x+3}$  as a single fraction.

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

(iii) Solve the equation  $\frac{3}{x-1} - \frac{2}{x+3} = \frac{1}{x}$ .

Answer(b)(iii)  $x =$  ..... [3]

(c)  $p = \frac{t}{q-1}$

Find  $q$  in terms of  $p$  and  $t$ .

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

---

- 12** The side of a square is 6.3 cm, correct to the nearest millimetre.  
The lower bound of the perimeter of the square is  $u$  cm and the upper bound of the perimeter is  $v$  cm.  
Calculate the value of

(a)  $u$ ,

*Answer(a)*  $u =$  ..... [1]

(b)  $v - u$ .

*Answer(b)*  $v - u =$  ..... [1]

---

**13**  $a \times 10^7 + b \times 10^6 = c \times 10^6$

Find  $c$  in terms of  $a$  and  $b$ .

Give your answer in its simplest form.

*Answer*  $c =$  ..... [2]

---

- 14** Priyantha completes a 10 km run in 55 minutes 20 seconds.  
Calculate Priyantha's average speed in km/h.

*Answer* ..... km/h [3]

---

24 (a) Write  $\frac{1}{y} - \frac{2}{x}$  as a single fraction in its lowest terms.

*Answer(a)* [2]

(b) Write  $\frac{x^2 + x}{3x + 3}$  in its lowest terms.

*Answer(b)* [3]

25  $f: x \rightarrow 2x - 7$        $g: x \rightarrow \frac{1}{x}$

Find

(a)  $fg\left(\frac{1}{2}\right)$ ,

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

(b)  $gf(x)$ ,

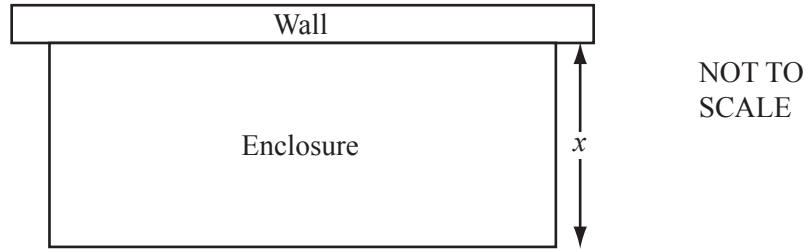
*Answer(b)*  $gf(x) =$  [1]

(c)  $f^{-1}(x)$ .

*Answer(c)*  $f^{-1}(x) =$  [2]



3



A farmer makes a rectangular enclosure for his animals.  
He uses a wall for one side and a total of 72 metres of fencing for the other three sides.

The enclosure has width  $x$  metres and area  $A$  square metres.

- (a) Show that  $A = 72x - 2x^2$ .

*Answer (a)*

[2]

- (b) Factorise completely  $72x - 2x^2$ .

*Answer(b)* .....

[2]

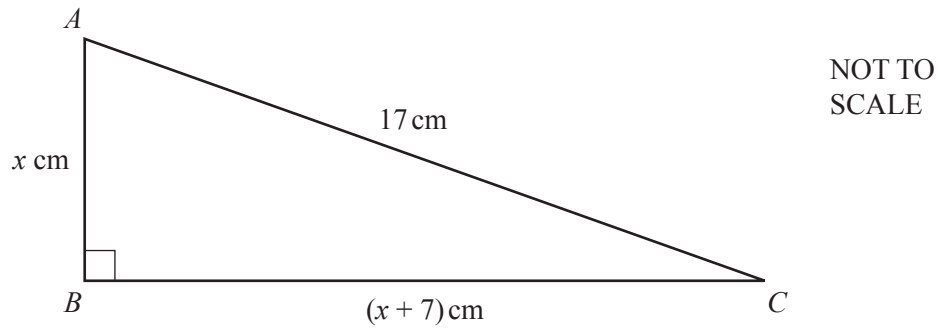
- (c) Complete the table for  $A = 72x - 2x^2$ .

$x$	0	5	10	15	20	25	30	35
$A$	0	310	520			550	360	

[3]

- (d) Draw the graph of  $A = 72x - 2x^2$  for  $0 \leq x \leq 35$  on the grid opposite.

5 (a)



In the right-angled triangle  $ABC$ ,  $AB = x$  cm,  $BC = (x + 7)$  cm and  $AC = 17$  cm.

(i) Show that  $x^2 + 7x - 120 = 0$ .

*Answer(a)(i)*

[3]

(ii) Factorise  $x^2 + 7x - 120$ .

*Answer(a)(ii)* .....

[2]

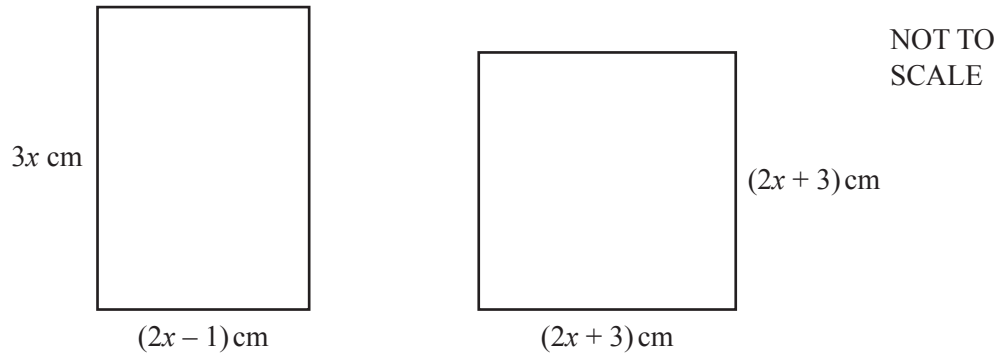
(iii) Write down the solutions of  $x^2 + 7x - 120 = 0$ .

*Answer(a)(iii)*  $x =$  ..... or  $x =$  ..... [1]

(iv) Write down the length of  $BC$ .

*Answer(a)(iv)*  $BC =$  ..... cm [1]

(b)



The rectangle and the square shown in the diagram above have the same area.

(i) Show that  $2x^2 - 15x - 9 = 0$ .

*Answer(b)(i)*

[3]

(ii) Solve the equation  $2x^2 - 15x - 9 = 0$ .

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

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

(iii) Calculate the perimeter of the square.

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

(d) Solve the equation.

$$2x^2 + 5x + 1 = 0$$

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

*Answer(d)*  $x =$  ..... or  $x =$  ..... [4]

---

15 (a) Factorise  $t^2 - 4$ .

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

(b) Factorise completely  $at^2 - 4a + 2t^2 - 8$ .

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

16

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A set of Russian dolls is made so that the volume,  $V$ , of each of them varies directly as the cube of its height,  $h$ .

The doll with a height of 3 cm has a volume of  $6.75 \text{ cm}^3$ .

(a) Find an equation for  $V$  in terms of  $h$ .

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

(b) Find the volume of a doll with a height of 2.5 cm.

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