

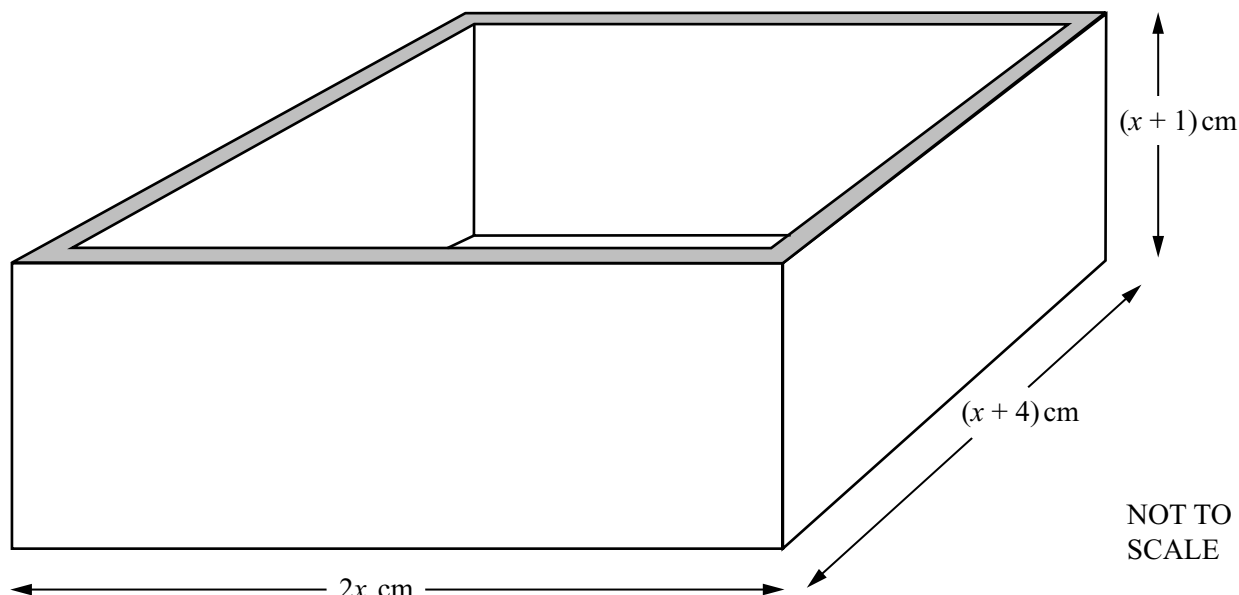
An equilateral 16-sided figure $APA'QB \dots$ is formed when the square $ABCD$ is rotated 45° clockwise about its centre to position $A'B'C'D'$.

$AB = 12$ 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]

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]



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 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]

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]

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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- 2 (a) (i) Factorise $x^2 - x - 20$. [2]

(ii) Solve the equation $x^2 - x - 20 = 0$. [1]

- (b) Solve the equation $3x^2 - 2x - 2 = 0$.
Show all your working and give your answers correct to 2 decimal places. [4]

(c) $y = m^2 - 4n^2$.

(i) Factorise $m^2 - 4n^2$. [1]

(ii) Find the value of y when $m = 4.4$ and $n = 2.8$. [1]

(iii) $m = 2x + 3$ and $n = x - 1$.
Find y in terms of x , in its simplest form. [2]

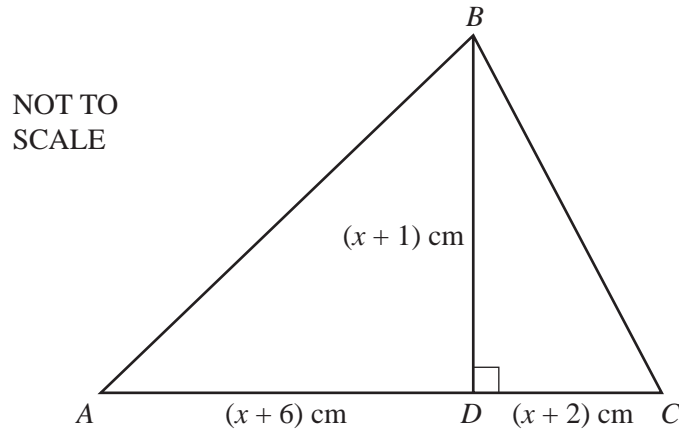
(iv) Make n the subject of the formula $y = m^2 - 4n^2$. [3]

- (d) (i) $m^4 - 16n^4$ can be written as $(m^2 - kn^2)(m^2 + kn^2)$.
Write down the value of k . [1]

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

6 (a)

For
Examiner's
Use



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 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]

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.

(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.

- 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]

- 2 (a) The surface area of a person's body, A square metres, is given by the formula

$$A = \sqrt{\frac{hm}{3600}}$$

where h is the height in centimetres and m is the mass in kilograms.

- (i) Dolores is 167 cm high and has a mass of 70 kg. Calculate the surface area of her body. [1]
(ii) Erik has a mass of 80 kg. Find his height if $A = 1.99$. [2]
(iii) Make h the subject of the formula. [3]

- (b) Factorise

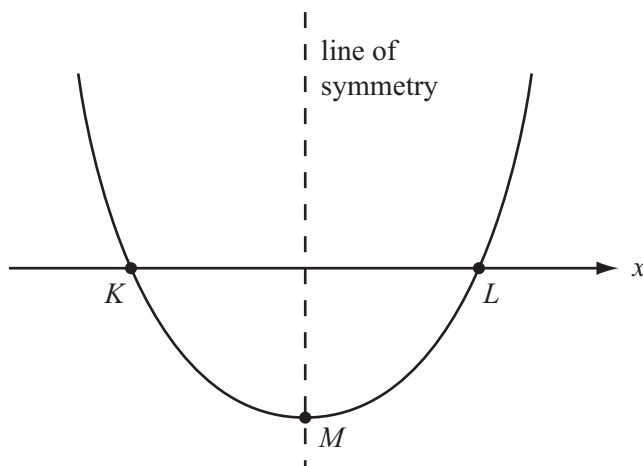
- (i) $x^2 - 16$, [1]
(ii) $x^2 - 16x$, [1]
(iii) $x^2 - 9x + 8$. [2]

- (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
 $x^2 - 9x + 8 = 0$. [2]
(ii) Solve $x^2 - 9x + 8 = 0$. [2]
(iii) Write down Erik's time and the race distance. [2]

- 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]
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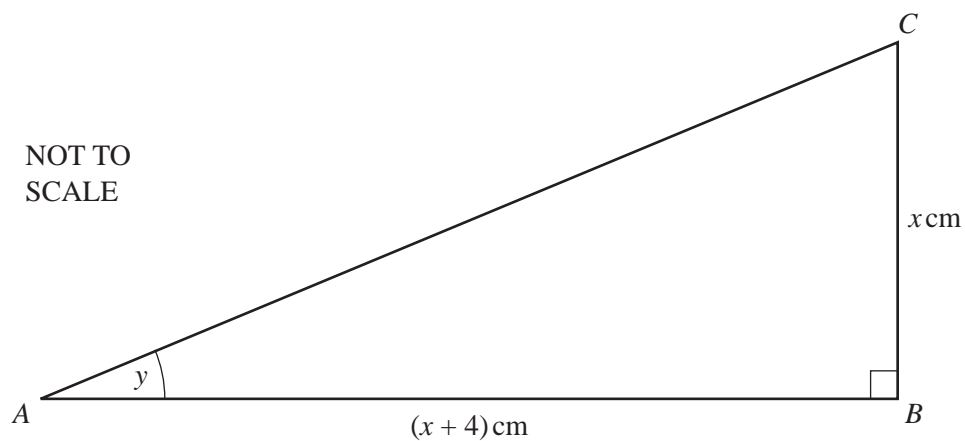
A sketch of the graph of the quadratic function $y = px^2 + qx + r$ is shown in the diagram.



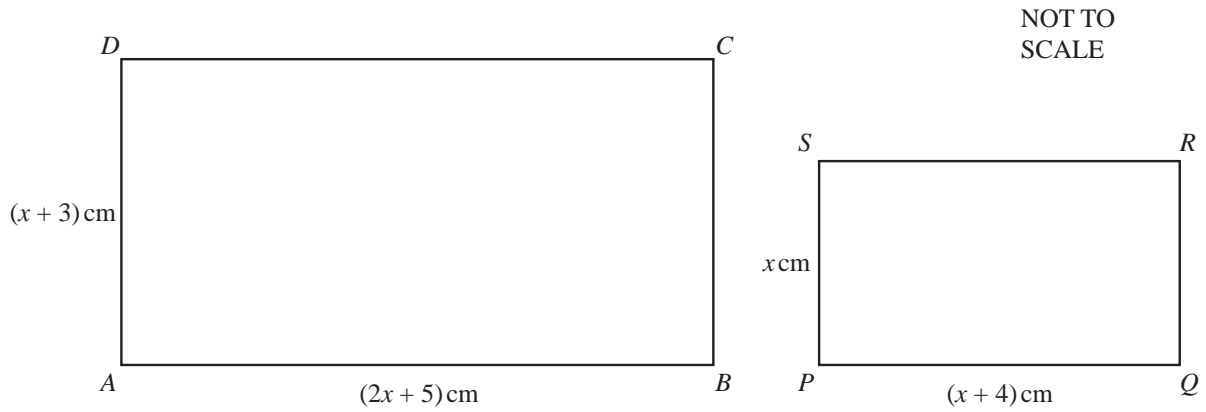
The graph cuts the x -axis at K and L .

The point M lies on the graph and on the line of symmetry.

- (a) When $p = 1$, $q = -2$, $r = -3$, find
- (i) the y -coordinate of the point where $x = 4$, [1]
 - (ii) the coordinates of K and L , [3]
 - (iii) the coordinates of M . [2]
- (b) Describe how the above sketch of the graph would change in each of the following cases.
- (i) p is negative. [1]
 - (ii) $p = 1$, $q = r = 0$. [1]
- (c) Another quadratic function is $y = ax^2 + bx + c$.
- (i) Its graph passes through the origin.
Write down the value of c . [1]
 - (ii) The graph also passes through the points $(3, 0)$ and $(4, 8)$.
Find the values of a and b . [4]
-



- (a) When the area of triangle ABC is 48 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 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]
-



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 cm^2 more than the area of rectangle $PQRS$.

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

where n is a positive integer and $\binom{n}{r} = \frac{n!}{(n-r)!r!}$.

(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 $PQRS$.

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.

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

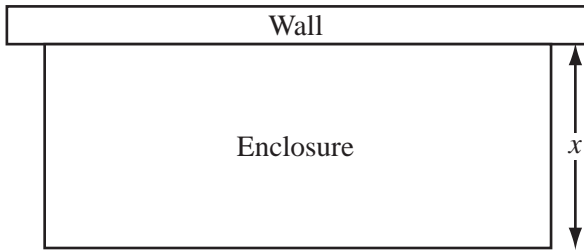
Answer(b)(iii) $x =$ [3]

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

Find q in terms of p and t .

Answer(c) $q =$

[3]



NOT TO SCALE

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]

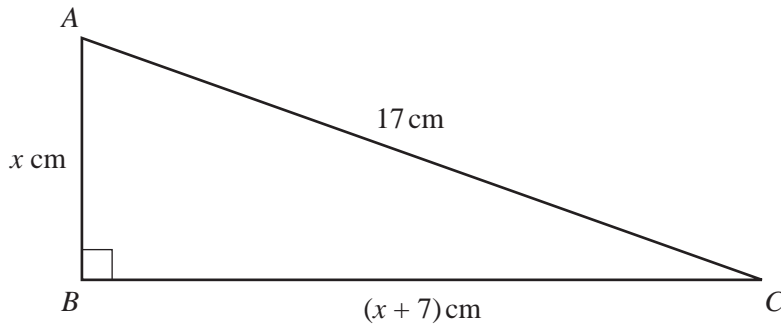
(c) Complete the table for $A = 72x - 2x^2$.

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)



NOT TO SCALE

For
Examine
Use

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]

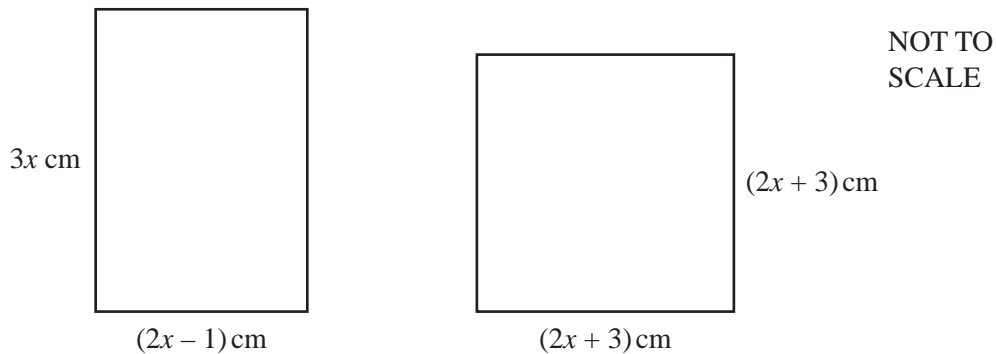
(iii) Write down the solutions of $x^2 + 7x - 120 = 0$.

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.

- 3 (a) Expand the brackets and simplify.

$$x(x+3)+4x(x-1)$$

- (d) Solve the equation.

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

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

Answer(a) [2]

- (b) Simplify $(3x^3)^3$.

Answer(b) [2]

- (c) Factorise the following completely.

(i) $7x^7 + 14x^{14}$

Answer(c)(i) [2]

(ii) $xy + xw + 2ay + 2aw$

Answer(c)(ii) [2]

(iii) $4x^2 - 49$

