National 5 & Int. 2   Quadratic Equations

2018 P1 Q5	Solve $$x^2 - 11x + 24 = 0.$$	2
Ans	$x = 8$, $x = 3$	

2018 P1 Q19	(a) (i) Express $x^2 - 6x - 81$ in the form $(x-p)^2 + q$.
	
	    (ii) Hence state the equation of the axis of symmetry of the graph of $y = x^2 - 6x - 81$.
	
	(b) The roots of the equation $x^2 - 6x - 81 = 0$ can be expressed in the form $x = d \pm d\sqrt{e}$.
	    Find, algebraically, the values of d and e.
		2
		
		1
		
		4

Ans	*(a)(i)* $(x-3)^2 - 90$ *(ii)* $x = 3$ *(b) d = 3 , e = 10*	
2017 P2 Q4	Solve the equation $2x^2 + 5x - 4 = 0$. Give your answers correct to one decimal place.	3
Ans	$x = \text{-}3{\cdot}1$, $x = 0{\cdot}6$	
2016 P1 Q6	Determine the nature of the roots of the function $f(x) = 7x^2 + 5x - 1$.	2
Ans	*Discriminant = 53, so there are two real and distinct roots.*	

The diagrams below show a rectangle and a triangle.

All measurements are in centimetres.

$2x + 1$

$x + 8$

$3x$

$2(x+5)$
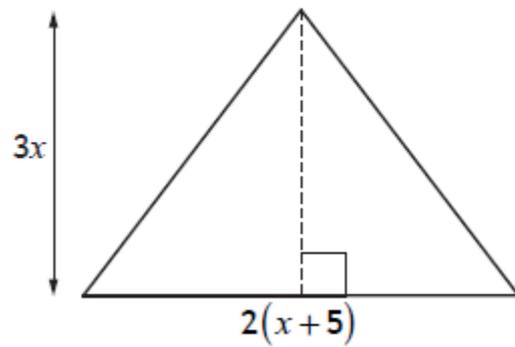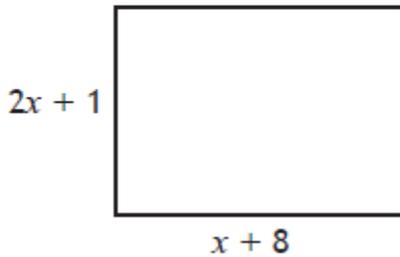
(a) Find an expression for the area of the rectangle.

1

(b) Given that the area of the rectangle is equal to the area of the triangle, show that $x^2 - 2x - 8 = 0$.

3

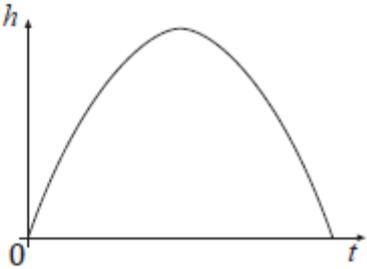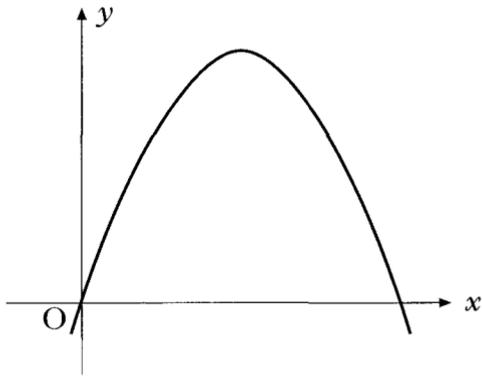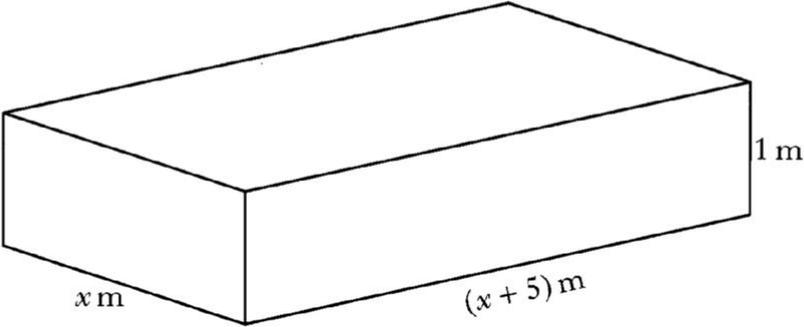(c) Hence find, algebraically, the length and breadth of the rectangle.

3

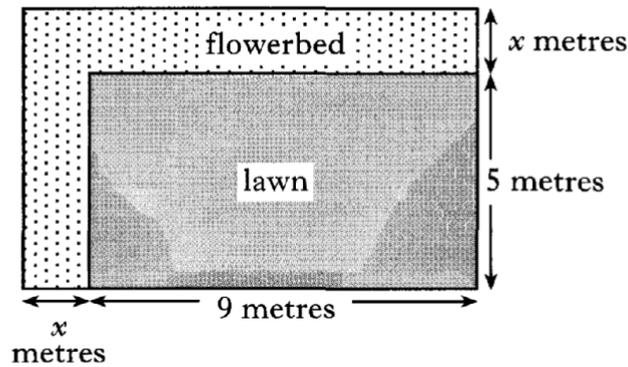| Ans | (a $(x + 8)(2x + 1)$ (b) *Proof*   (c) *length = 12cm ,   breadth = 9cm* |

A rectangular picture measuring 9 centimetres by 13 centimetres is placed on a rectangular piece of card.

The area of the card is 270 square centimetres.

There is a border x centimetres wide on all sides of the picture.
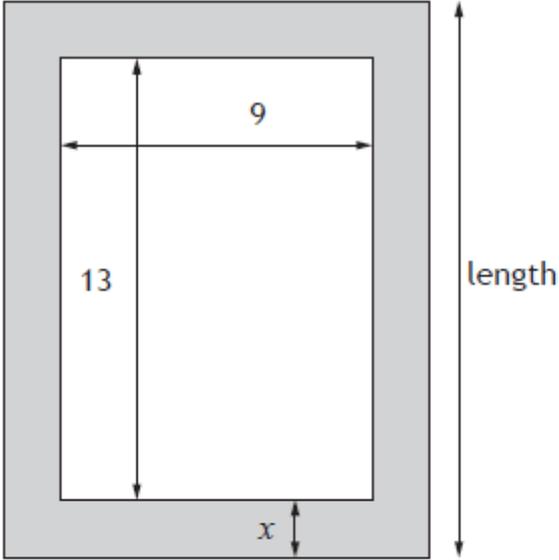
(a) (i) Write down an expression for the length of the card in terms of x. **1**

(ii) Hence show that $4x^2 + 44x - 153 = 0$. **2**

(b) Calculate x, the width of the border.

Give your answer correct to one decimal place. **4**

Ans	(a)(i) $2x + 13$ (ii) Proof (b) $x = 2\cdot8cm$

Find the roots of the equation

$$2x^2 + 9x - 5 = 0.$$

3

Ans	$x = -5$, $x = 0\cdot5$

2014 P1 Q13a	The diagram below shows the path of a small rocket which is fired into the air. The height, h metres, of the rocket after t seconds is given by $$h(t)=16t-t^2$$ (a) After how many seconds will the rocket first be at a height of 60 metres?	4
Ans	6 seconds	
2014 P2 Q6	Solve the equation $$2x^2 - 7x + 1 = 0,$$ giving the answers correct to two decimal places.	4
Ans	$x = 3{\cdot}35$, $x = 0{\cdot}15$	
2013 P2 Q5	Solve the equation $$x^2 - 5x - 2 = 0,$$ giving the roots correct to one decimal place.	4
Ans	$x = -0{\cdot}4$, $x = 5{\cdot}4$	
2012 P2 Q4	Solve the equation $$3x^2 + 7x - 5 = 0,$$ giving the roots correct to one decimal place.	4
Ans	$x = -2{\cdot}9$, $x = 0{\cdot}6$	
2011 P1 Q9a,b	(a) Factorise $x^2 - 4x - 21$. (b) Hence write down the roots of the equation $$x^2 - 4x - 21 = 0.$$	2 1
Ans	(a) $(x + 3)(x - 7)$ (b) $x = -3$, $x = 7$	

Solve the equation

$$4x^2 - 7x + 1 = 0,$$

giving the roots correct to 1 decimal place.

4

Ans | $x = 0.2$, $x = 1.6$

Maria has been asked to find the roots of the equation

$$x^2 + 3x + 5 = 0.$$

She decides to use the quadratic formula

$$x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}.$$

(a) Calculate the value of $b^2 - 4ac$.

1

(b) Now explain why Maria cannot find the roots.

1

Ans | (a) -11   (b) The square root of a negative number does not exist.

The diagram below represents a rectangular garden with length $(x + 7)$ metres and breadth $(x + 3)$ metres.
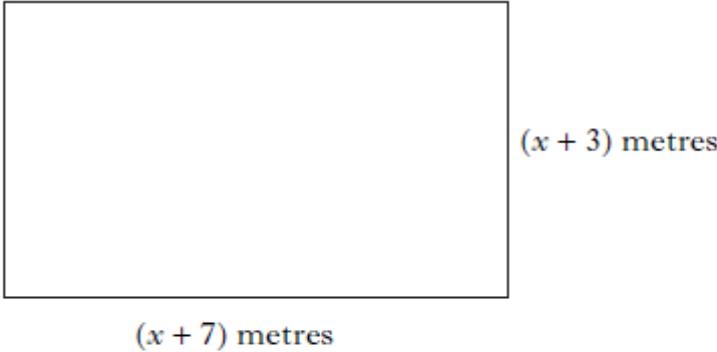
$(x + 3)$ metres

$(x + 7)$ metres

(a) Show that the area, A square metres, of the garden is given by

$$A = x^2 + 10x + 21.$$

2

(b) The area of the garden is 45 square metres. Find x.
   Show clearly all your working.

4

Ans | (b) $x = 2$

2009 P2 Q7	Solve the equation $$x^2 + 5x + 3 = 0,$$ giving the roots correct to one decimal place.	4
Ans	$x = -0.7$, $x = -4.3$	
2008 P2 Q6	Solve the equation $$5x^2 + 4x - 2 = 0,$$ giving the roots correct to 2 decimal places.	4
Ans	$x = 0.35$, $x = -1.15$	
2007 P1 Q7a	The graph shown below is part of the parabola with equation $y = 8x - x^2$. (a) By factorising $8x - x^2$, find the roots of the equation $$8x - x^2 = 0.$$	2
Ans	$x = 0$, $x = 8$	
2007 P2 Q8	Solve the equation $$2x^2 - 6x - 5 = 0,$$ giving the roots correct to one decimal place.	4
Ans	$x = -0.7$, $x = 3.7$	

A cuboid is shown below.

It has length $(x + 5)$ metres, breadth x metres, height 1 metre and volume 24 cubic metres.

(a) Show that

$$x^2 + 5x - 24 = 0.$$

2

(b) Using the equation in part (a), find the breadth of the cuboid.

3

Ans | (a) Proof   (b) 3 metres

Solve the equation

$$4x^2 - 7x + 1 = 0$$

giving the roots correct to one decimal place.

4

Ans | $x = 1·6$, $x = 0·2$

Solve the equation $2x^2 + 7x - 3 = 0$, giving the roots correct to one decimal place.

4

Ans | $x = -3·9$, $x = 0·4$

(a) Factorise $7 + 6x - x^2$.

2

(b) Hence write down the roots of the equation

$$7 + 6x - x^2 = 0.$$

1

Ans | (a) $(7 - x)(1 + x)$ (b) $x = 7$, -1

Solve the equation

$$2x^2 + 4x - 9 = 0,$$

giving the roots correct to one decimal place.

4

Ans | $x = -3·3$, $x = 1·3$

flowerbed x metres

lawn 5 metres

9 metres

x metres

The diagram shows a rectangular garden which consists of a rectangular lawn and a flowerbed along two sides of the lawn

• the lawn measures 9 metres by 5 metres
• the width of the flowerbed is x metres.

(a) State the length and breadth of the garden.

1

(b) Show that the area, A square metres, of the garden is given by

$$A = x^2 + 14x + 45.$$

2

(c) The area of the garden is 77 square metres. Find the width of the flowerbed.

Show clearly all your working.

3

| Ans | (a) Length = 9+x , Breadth = 5+x   (b) Proof   (c) Width = 2 metres |

Solve the equation

$$2p^2 - 3p - 1 = 0,$$

giving the roots correct to 1 decimal place.

4

| Ans | x = -0·3 , x = 1·8 |

Solve the equation

$$2x^2 + 3x - 1 = 0,$$

giving your answers correct to one decimal place.

4

| Ans | x = -1·8 , x = 0·3 |

Solve the quadratic equation

$$3x^2 + 3x - 7 = 0$$

using an appropriate formula.

Give your answers correct to 1 decimal place.

4

| Ans | x = 1·1 , x = -2·1 |