

Firrhill High School  
Mathematics Department

Level 5

Assessment Questions

# Quadratic Equations

(1) 2010 Paper 2 Q.3

Use the quadratic formula to solve the equation,

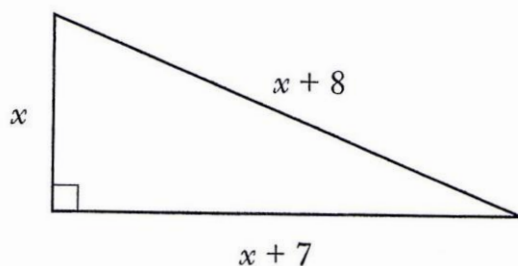
$$3x^2 + 5x - 7 = 0.$$

Give your answers correct to **1 decimal place**.

4	

(2) 2010 Paper 2 Q.12

A right-angled triangle has dimensions, in centimetres, as shown.



**Calculate** the value of  $x$ .

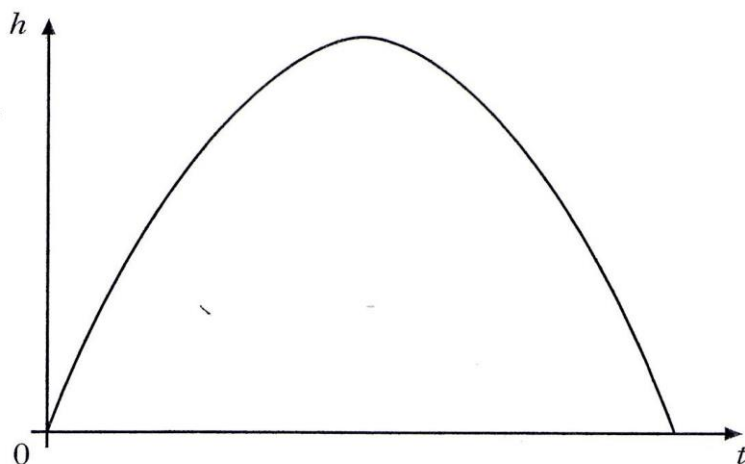
KU	RE
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(3) 2009 Paper 1 Q.10

The diagram below shows the path of a rocket which is fired into the air.

The height,  $h$  metres, of the rocket after  $t$  seconds is given by

$$h(t) = -2t(t - 14).$$



(a) For how many seconds is the rocket in flight?

(b) What is the maximum height reached by the rocket?

KU	RE
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	2

(4) 2009 Paper 2 Q.3

Solve the quadratic equation  $x^2 - 4x - 6 = 0$ .

Give your answers **correct to 1 decimal place**.

	4	

(5) 2009 Paper 2 Q.10

The weight,  $W$  kilograms, of a giraffe is related to its age,  $M$  months, by the formula

$$W = \frac{1}{4}(M^2 - 4M + 272).$$

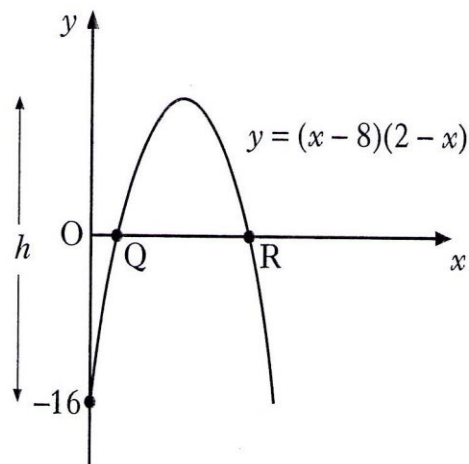
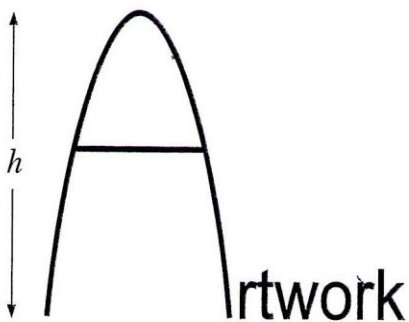
At what age will a giraffe weigh 83 kilograms?

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(6) 2008 Paper 1 Q.8

The curved part of the letter A in the *Artwork* logo is in the shape of a parabola.

The equation of this parabola is  $y = (x - 8)(2 - x)$ .



(a) Write down the coordinates of Q and R.

(b) Calculate the height,  $h$ , of the letter A.

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(7) 2008 Paper 1 Q.12

Given that

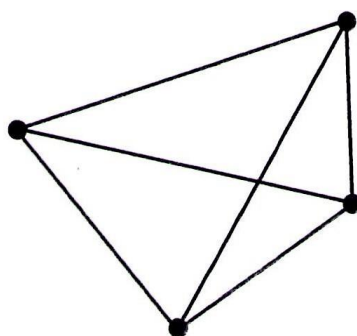
$$x^2 - 10x + 18 = (x - a)^2 + b,$$

find the values of  $a$  and  $b$ .

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(8) 2008 Paper 2 Q.11

The minimum number of roads joining 4 towns to each other is 6 as shown.



The minimum number of roads,  $r$ , joining  $n$  towns to each other is given by the formula

$$r = \frac{1}{2}n(n-1).$$

(a) State the minimum number of roads needed to join 7 towns to each other.

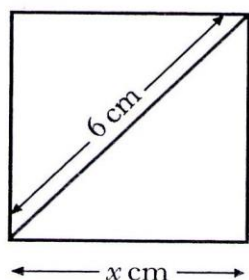
(b) When  $r = 55$ , show that  $n^2 - n - 110 = 0$ .

(c) Hence find **algebraically** the value of  $n$ .

1	
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(9) 2007 Paper 1 Q.9

A square of side  $x$  centimetres has a diagonal 6 centimetres long.



Calculate the value of  $x$ , giving your answer as a surd in its simplest form.

3	

(10) 2007 Paper 2 Q.2

Solve the equation

$$3x^2 - 2x - 10 = 0.$$

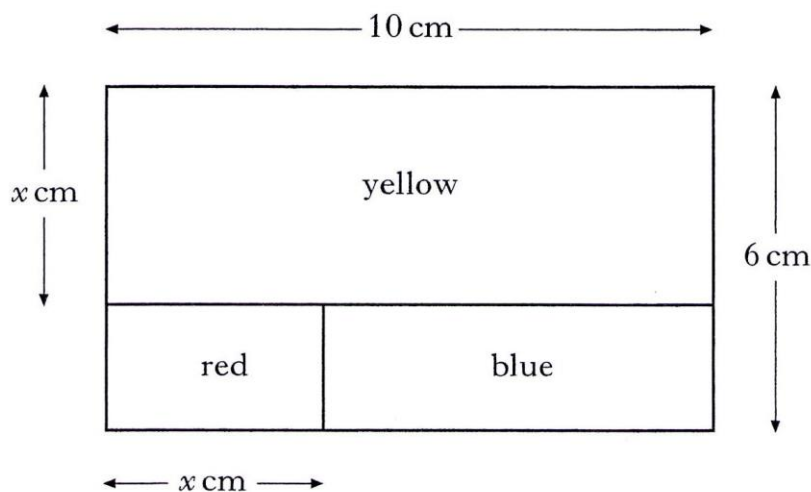
Give your answer **correct to 2 significant figures**.

4

(11) 2007 Paper 2 Q.11

- (a) A decorator's logo is rectangular and measures 10 centimetres by 6 centimetres.

It consists of three rectangles: one red, one yellow and one blue.



The yellow rectangle measures 10 centimetres by  $x$  centimetres.

The width of the red rectangle is  $x$  centimetres.

Show that the area,  $A$ , of the blue rectangle is given by the expression

$$A = x^2 - 16x + 60.$$

2

- (b) The area of the blue rectangle is equal to  $\frac{1}{5}$  of the total area of the logo.

Calculate the value of  $x$ .

4

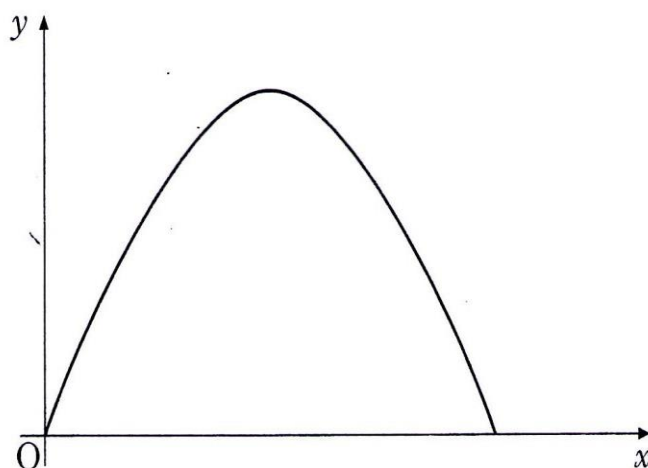
(12) 2007 Paper 2 Q.13

The profit made by a publishing company of a magazine is calculated by the formula

$$y = 4x(140 - x),$$

where  $y$  is the profit (in pounds) and  $x$  is the selling price (in pence) of the magazine.

The graph below represents the profit  $y$  against the selling price  $x$ .



Find the maximum profit the company can make from the sale of the magazine.

KU	RE
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(13) 2006 Paper 2 Q.9

The number of diagonals,  $d$ , in a polygon of  $n$  sides is given by the formula

$$d = \frac{1}{2}n(n-3).$$

(a) How many diagonals does a polygon of 7 sides have?

(b) A polygon has 65 diagonals.

Show that for this polygon,  $n^2 - 3n - 130 = 0$ .

(c) Hence find the number of sides in this polygon.

	2
	2
	3

The graph of  $y=x^2$  has been moved to the position shown in Figure 1.

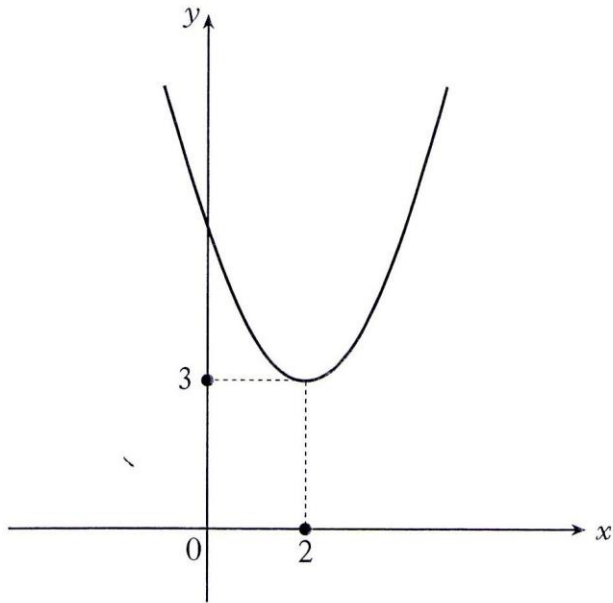


Figure 1

The equation of this graph is  $y=(x-2)^2+3$ .

The graph of  $y=x^2$  has now been moved to the position shown in Figure 2.

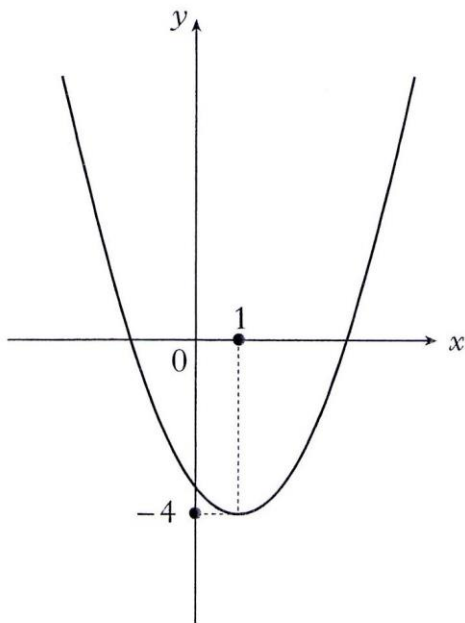


Figure 2

Write down the equation of the graph in Figure 2.

(15) 2006 Paper 2 Q.9

The number of diagonals,  $d$ , in a polygon of  $n$  sides is given by the formula

$$d = \frac{1}{2}n(n-3).$$

(a) How many diagonals does a polygon of 7 sides have?

2

(b) A polygon has 65 diagonals.

Show that for this polygon,  $n^2 - 3n - 130 = 0$ .

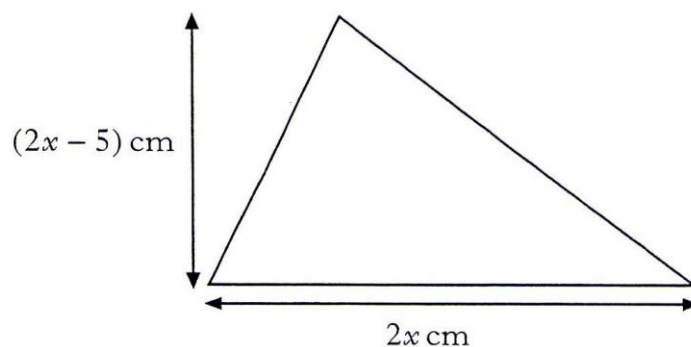
2

(c) Hence find the number of sides in this polygon.

3

(16) 2005 Paper 1 Q.12

The height of a triangle is  $(2x - 5)$  centimetres and the base is  $2x$  centimetres.



The area of the triangle is 7 square centimetres.

Calculate the value of  $x$ .

5

(17) 2005 Paper 2 Q.4

Solve the equation

$$x^2 + 2x = 9.$$

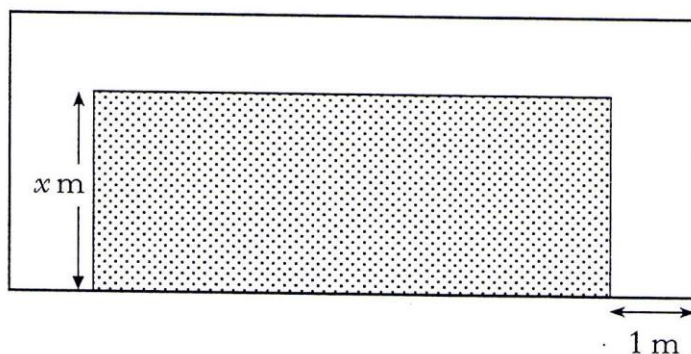
Give your answers **correct to 1 decimal place**.

3



(18) 2004 Paper 2 Q.11

A rectangular lawn has a path, 1 metre wide, on 3 sides as shown.



The breadth of the lawn is  $x$  metres.

The length of the lawn is three times its breadth.

The area of the lawn equals the area of the path.

(a) Show that  $3x^2 - 5x - 2 = 0$ .

(b) Hence find the **length** of the lawn.

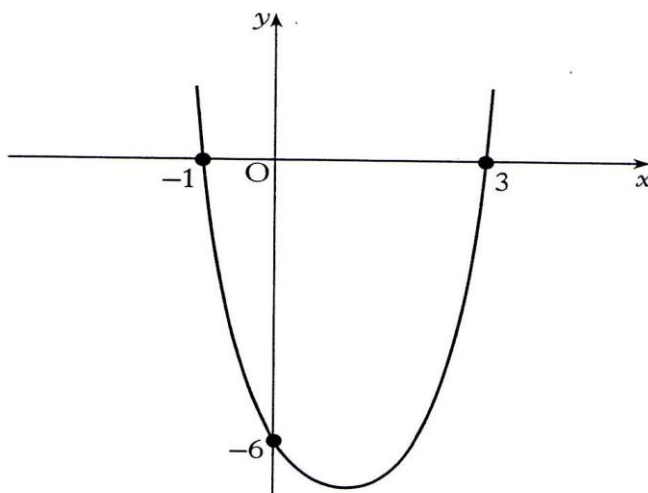
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(19) 2003 Paper 2 Q.8

The diagram below shows part of the graph of a quadratic function, with equation of the form  $y = k(x - a)(x - b)$ .

The graph cuts the  $y$ -axis at  $(0, -6)$  and the  $x$ -axis at  $(-1, 0)$  and  $(3, 0)$ .



(a) Write down the values of  $a$  and  $b$ .

(b) Calculate the value of  $k$ .

(c) Find the coordinates of the minimum turning point of the function.

2

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2

(20) 2002 Paper 1 Q.9

Two functions are given below.

$$f(x) = x^2 + 2x - 1$$

$$g(x) = 5x + 3$$

Find the values of  $x$  for which  $f(x) = g(x)$ .

3

(21) 2002 Paper 2 Q.3

Solve the equation

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

Give your answers **correct to 1 decimal place**.

4

(22) Model paper based on 2000 Paper 2 Q.3

Solve the equation  $x^2 + 3x - 5 = 0$ .

Give your answer **correct to 2 significant figures**.

4

(23) Model Paper based on 1998 Paper 1 Q.8c

(c) Solve, **algebraically**, the equation

$$x^2 = 7x.$$

3

(24) 1997 Q.11b

(b) Solve **algebraically** the equation

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

3

(25) Model Paper based on 1999 Paper 2 Q.11

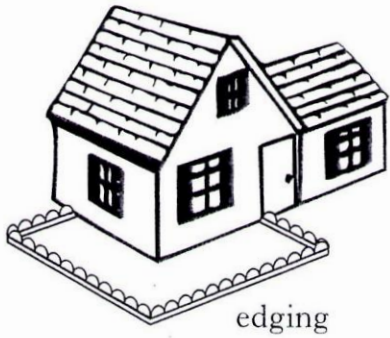


figure 1

A gardener creates an L-shaped flower-bed. He uses the house walls and concrete edging for the boundary as shown in figure 1.

He plans his flower-bed as shown in figure 2.

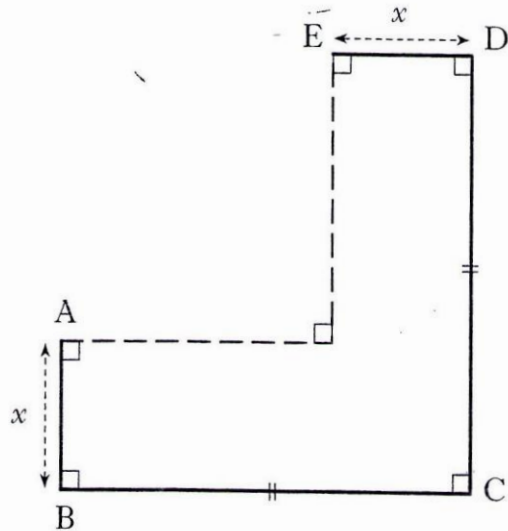


figure 2

- (a) He uses a total of **6 metres of edging**.

$$AB = ED = x \text{ metres}$$

$$BC = DC$$

Show that the length, in metres, of BC can be expressed as  $BC = 3 - x$ .

- (b) Hence show that the area,  $A$ , in square metres, of the flower-bed can be expressed as

$$A = 6x - 3x^2.$$

- (c) Calculate **algebraically** the maximum area of the flower-bed.

KU	RE
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(26) 1996 Q.10c

(c) Solve **algebraically** the equation

$$6y - y^2 = 0.$$

2
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(27) 1995 Q.13

Solve the equation

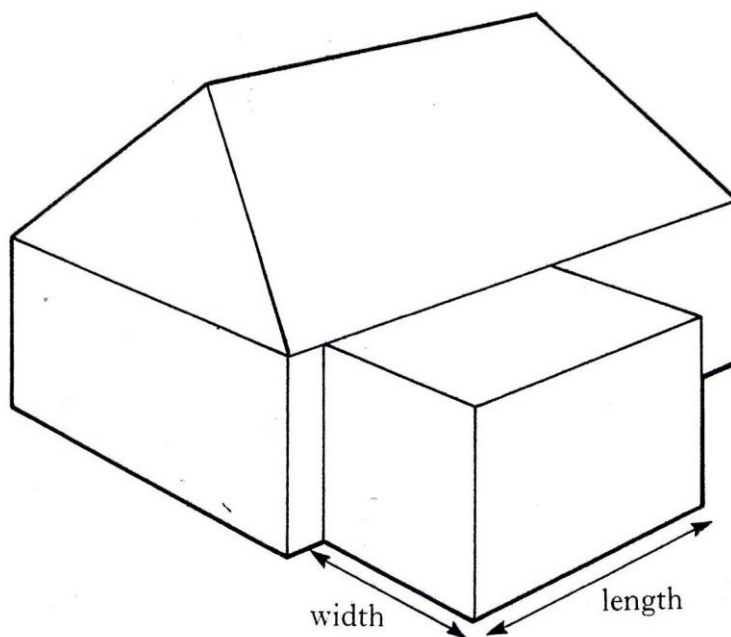
$$x^2 + 2x - 6 = 0.$$

Give your answers correct to 2 significant figures.

KU	RA
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(28) 1994 Q.16

A family want to build an extension at the rear of their house.



An architect advises that the extension should have its length 2 metres more than its width.

(a) If the width of the extension is  $w$  metres, write down an expression for its length.

Planning regulations state that the area of the ground floor of the extension must not exceed 40% of the area of the ground floor of the original house.

(b) The ground floor of the original house is 12 metres by 10 metres.

Show that, if the largest extension is to be built,  $w^2 + 2w - 48 = 0$ .

(c) Find the dimensions of the largest extension which can be built.

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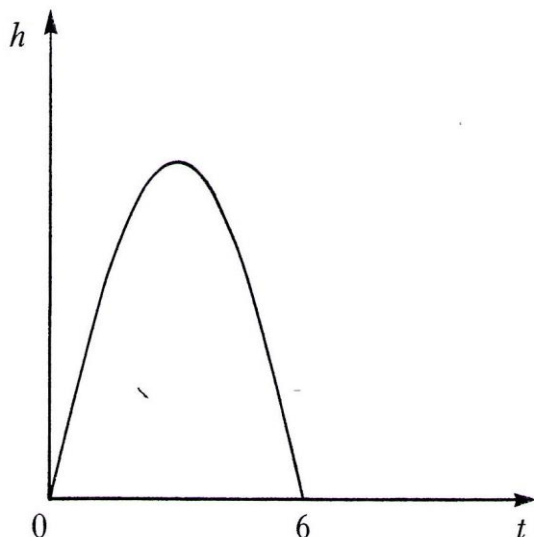
(29) 1992 Paper 1 Q.6 (You may use a calculator)

An object is launched into the air.

The height,  $h$  metres, of the object after  $t$  seconds is given by

$$h = 18t - 3t^2.$$

The diagram below shows the graph of  $h$  against  $t$ .



What is the maximum height of the object?

(3KU)

(30) 1992 Paper 2 Q.6

In a competition, each team plays every other team twice – once at home, once away.

The total number of games played in the competition is given by the expression

$$t^2 - t,$$

where  $t$  represents the number of teams entered.

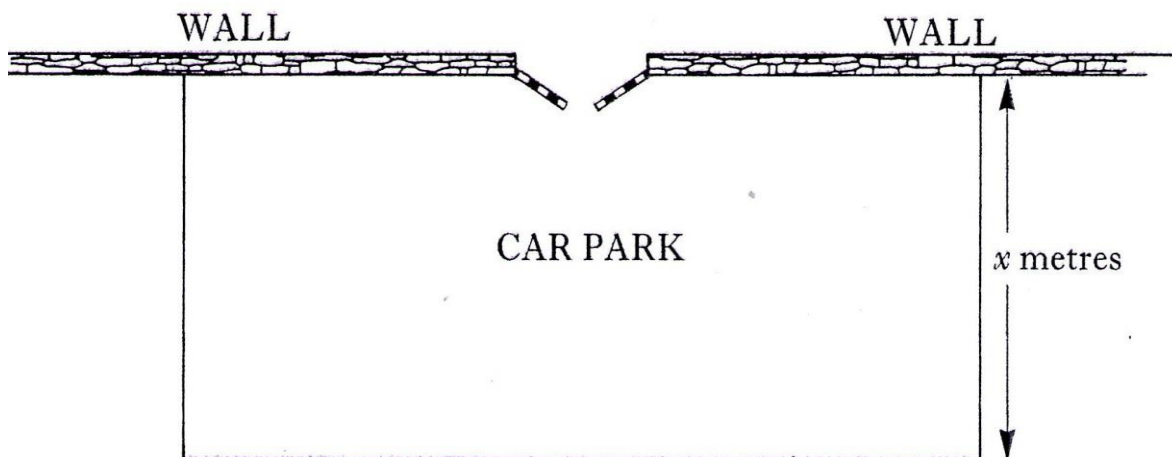
(a) If the total number of games played in a competition was 380, how many teams entered the competition? (4)

(b) Is it possible to run a competition like this in which the total number of games is exactly 200?

Explain your answer clearly. (4)

(31) 1991 Paper 2 Q.4

A temporary rectangular car park is made by using an existing straight wall and 420 metres of fencing. (The entrance to the car park is contained within the stretch of wall.)



- (a) If  $x$  metres is the breadth of the car park, show that the area  $A$ , in square metres, enclosed by the car park, is given by the function

$$A(x) = 420x - 2x^2. \quad (3)$$

- (b) Find the dimensions of the car park which has the largest area.

Explain how you obtained your answer. (4)

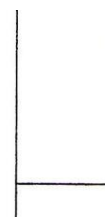
(32) 1990 paper 1 Q.10

Solve the equation

$$2p^2 - p - 10 = 0,$$

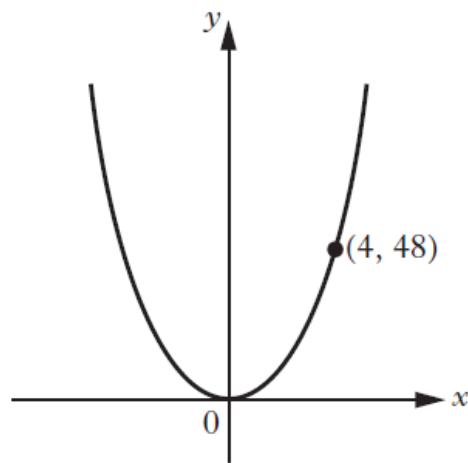
where  $p$  is a **real number**.

(3)



33 2015 Int 2 Paper 1

4. The diagram below shows the graph with equation  $y = kx^2$  passing through the point  $(4, 48)$ .



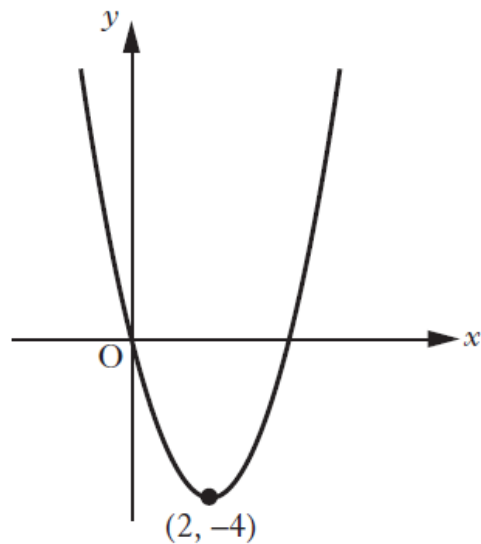
Find the value of  $k$ .

2

34 2015 Int 2 Paper 1

7. The graph below shows part of the parabola with equation of the form

$$y = (x + a)^2 + b.$$



The minimum turning point  $(2, -4)$  is shown in the diagram.

(a) State the values of:

(i)  $a$

1

(ii)  $b$ .

1

(b) Write down the equation of the axis of symmetry of the graph.

1

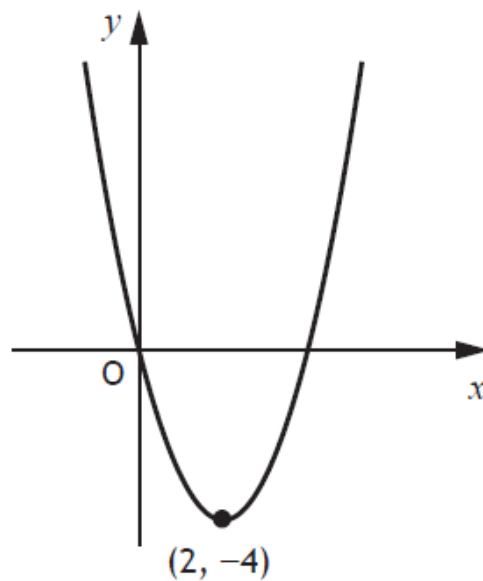
14. Find the roots of the equation

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

3

7. The graph below shows part of the parabola with equation of the form

$$y = (x + a)^2 + b.$$



The minimum turning point  $(2, -4)$  is shown in the diagram.

(a) State the values of

(i)  $a$

1

(ii)  $b$ .

1

(b) Write down the equation of the axis of symmetry of the graph.

1

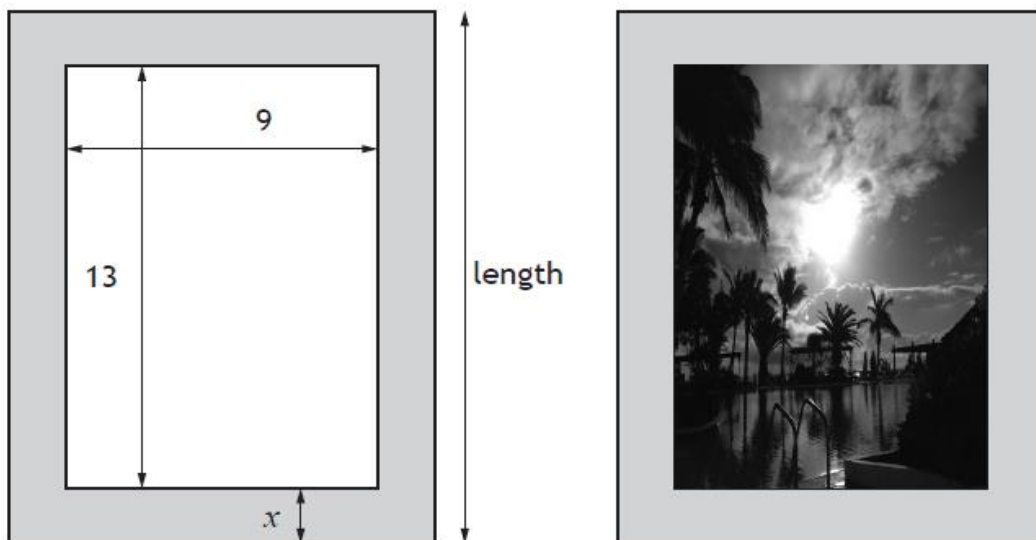


37 2015 N5 Paper 2

14. 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.

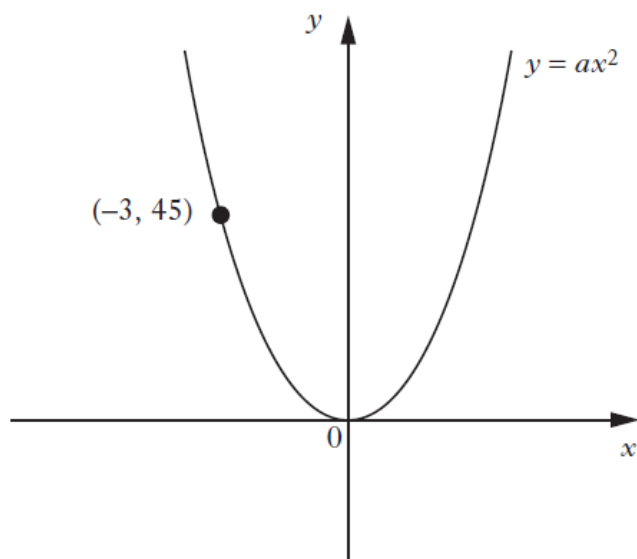
There is a border  $x$  centimetres wide on all sides of the picture.



- (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. 4  
 Give your answer correct to one decimal place.

38 2014 Int 2 Paper 1

6. The diagram below shows part of the graph of  $y = ax^2$ .



Find the value of  $a$ .

39 2014 Int 2 Paper 1

8. A parabola has equation  $y = (x - 2)^2 - 5$ .

(a) Write down the coordinates of the turning point of the parabola. 2

(b) Does this parabola have a maximum or a minimum turning point? 1

40 2014 Int 2 Paper 2

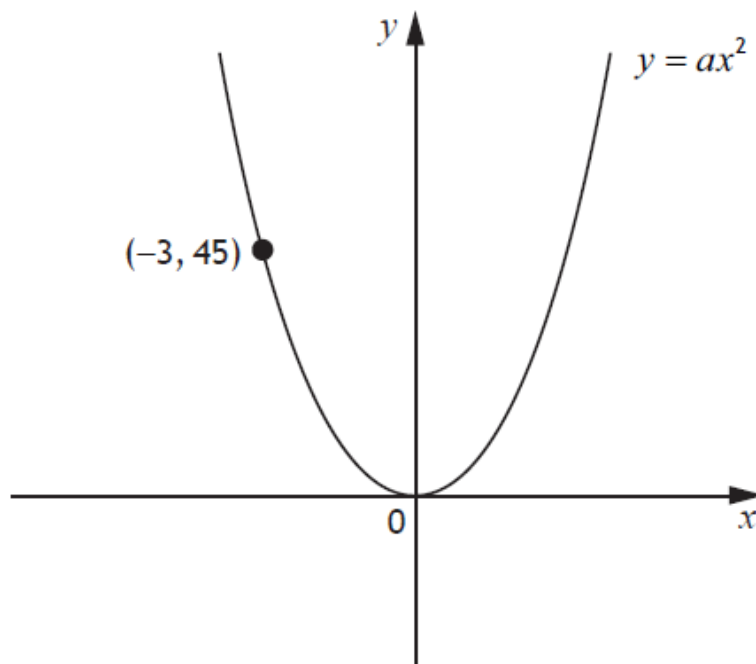
6. Solve the equation

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

giving the answers correct to two decimal places. 4

41 2014 N5 Paper 1

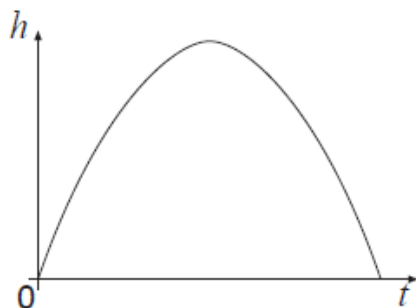
7. The diagram below shows part of the graph of  $y = ax^2$



Find the value of  $a$ . 2

13. 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

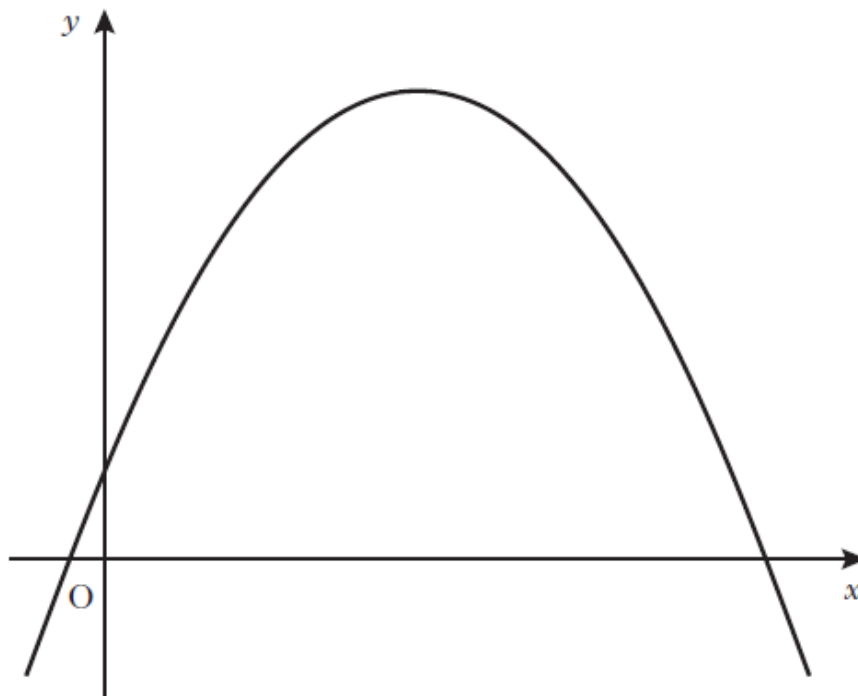
$$h(t) = 16t - t^2$$



- (a) After how many seconds will the rocket first be at a height of 60 metres? 4
- (b) Will the rocket reach a height of 70 metres?  
Justify your answer. 3

## 43 2013 Int 2 Paper 1

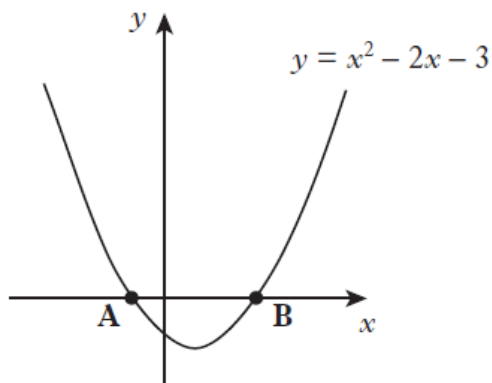
9. The diagram below shows part of the graph of  $y = 20 - (x - 4)^2$ .



- (a) State the coordinates of the maximum turning point. 2
- (b) State the equation of the axis of symmetry. 1

44 2013 Credit Paper 1

10. The parabola with equation  $y = x^2 - 2x - 3$  cuts the  $x$ -axis at the points A and B as shown in the diagram.



- (a) Find the coordinates of A and B.  
 (b) Write down the equation of the axis of symmetry of  $y = x^2 - 2x - 3$ .

4

1

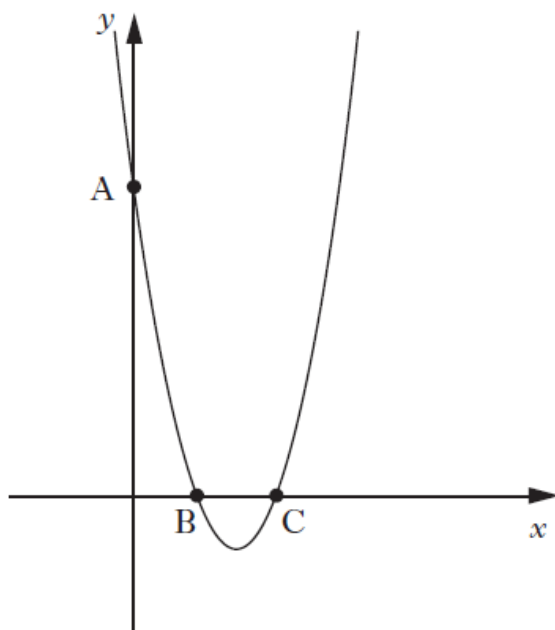
45 2012 Int 2 Paper 1

6. The equation  $x^2 - 6x + 8 = 0$  can also be written as  $(x - 2)(x - 4) = 0$ .

- (a) Write down the roots of the equation  $x^2 - 6x + 8 = 0$ .

1

Part of the graph of  $y = x^2 - 6x + 8$  is shown below.

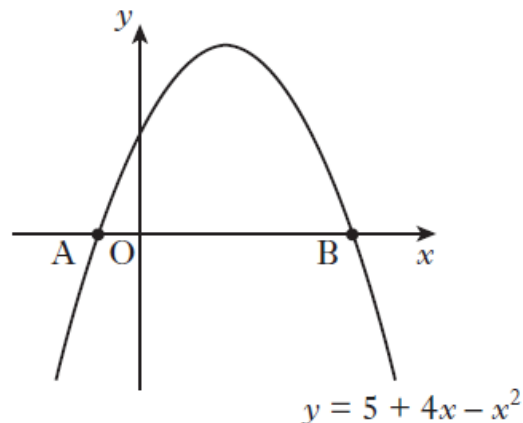


- (b) State the coordinates of the points A, B and C.  
 (c) What is the equation of the axis of symmetry of this graph?

3

1

6. The diagram shows part of the graph of  $y = 5 + 4x - x^2$ .



A is the point  $(-1, 0)$ .

B is the point  $(5, 0)$ .

(a) State the equation of the axis of symmetry of the graph.

2

(b) Hence, find the maximum value of  $y = 5 + 4x - x^2$ .

2

47 2011 Int 2 Paper 1

9. (a) Factorise  $x^2 - 4x - 21$ .

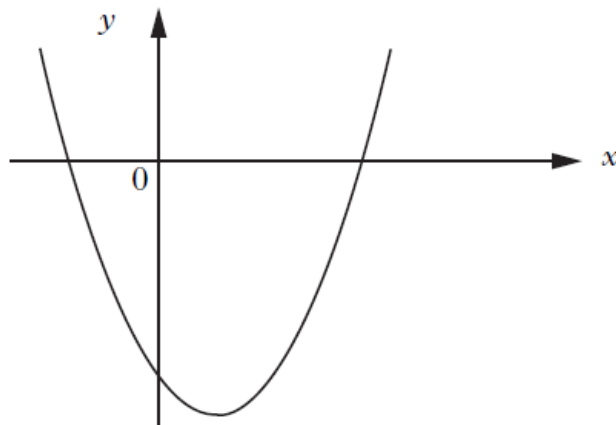
2

(b) Hence write down the roots of the equation

$$x^2 - 4x - 21 = 0.$$

1

(c) The graph of  $y = x^2 - 4x - 21$  is shown in the diagram.

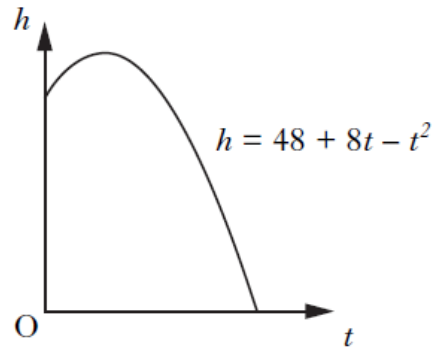


Find the coordinates of the turning point.

3

13. The diagram shows the path of a flare after it is fired.

The height,  $h$  metres above sea level, of the flare is given by  $h = 48 + 8t - t^2$  where  $t$  is the number of seconds after firing.



Calculate, **algebraically**, the time taken for the flare to enter the sea.

KU	RE
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