Quadratics - Past Paper Questions

1) Solve the equation $2x^2 + 3x - 1 = 0$ giving your answer correct to one decimal place. 4

2) Solve the equation $4x^2 - 7x + 1 = 0$ giving your answer correct to one decimal place. 4

3) Solve the equation $2x^2 + 4x - 9 = 0$ giving your answer correct to one decimal place. 4

4) Solve the equation $2x^2 - 6x - 5 = 0$ giving your answer correct to one decimal place. 4

5) Solve the equation $2x^2 + 3x - 7 = 0$ giving your answer correct to one decimal place. 4

6) Solve the equation $3x^2 + 5x - 7 = 0$ giving your answer correct to one decimal place. 4

7) Solve the equation $x^2 + 2x = 9$ giving your answer correct to one decimal place. 3

8) Find the roots of the equation $2x^2 + 9x - 5 = 0$. 3

9) Solve the equation $2x^2 + 7x - 3 = 0$ giving the roots correct to one decimal place. 4

10) Solve the equation $x^2 + 5x + 3 = 0$ giving the roots correct to one decimal place. 4

11) Solve the equation $3x^2 + 7x - 5 = 0$ giving the roots correct to one decimal place. 4

12) Solve the equation $x^2 - 4x - 6 = 0$ giving the roots correct to one decimal place. 4

13) Solve the equation $x^2 - 5x - 2 = 0$ giving the roots correct to one decimal place. 4

14) Solve the equation $4x^2 - 7x + 1 = 0$ giving the roots correct to one decimal place. 4

15) Solve the equation $5x^2 + 4x - 2 = 0$ giving the roots correct to 2 decimal places. 4

16) Solve the equation $2x^2 - 7x + 1 = 0$ giving the roots correct to 2 decimal places. 4

17) Solve the equation $3x^2 - 2x - 10 = 0$. Give your answer correct to 2 significant figures. 4

18) Solve the equation $2x^2 + 3x - 7 = 0$. Give your answer correct to 2 significant figures. 4

19) Maria has been asked to find the roots of the equation $x^2 + 3x + 5 = 0$
She decides to use the quadratic formula

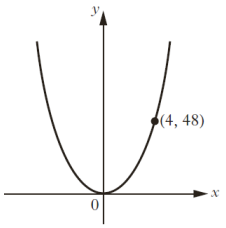
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

a) Calculate the value of $b^2 - 4ac$ 1
b) Now explain why Maria cannot find the roots. 2

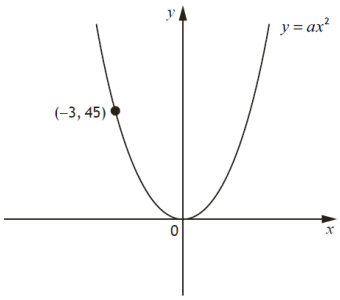
20) Express $x^2 - 14x + 44$ in the form $(x - a)^2 + b$. 2

21) Given that $x^2 - 10x + 18 = (x - a)^2 + b$, find the values of a and b. 3

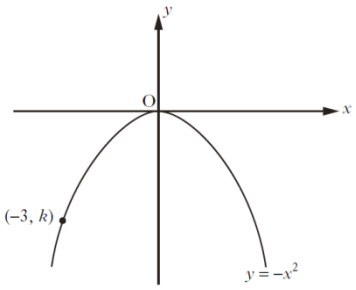
22) The diagram below shows the graph with equation $y = kx^2$ passing through the point (4, 48).
Find the value of k. 2



23) The diagram shows part of the graph of $y = ax^2$.
Find the value of a. 2



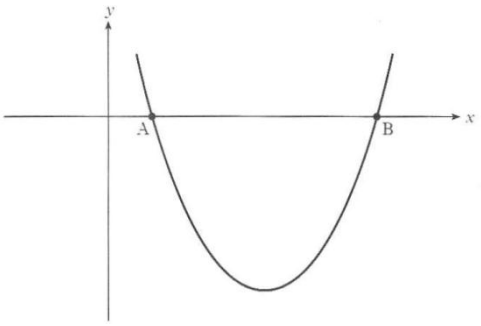
24) The diagram below shows the graph of $y = -x^2$
The point (–3, k) lies on the graph.
Find the value of k. 1



25) The equation of the parabola in the diagram is

$$y = (x - 3)^2 - 4$$

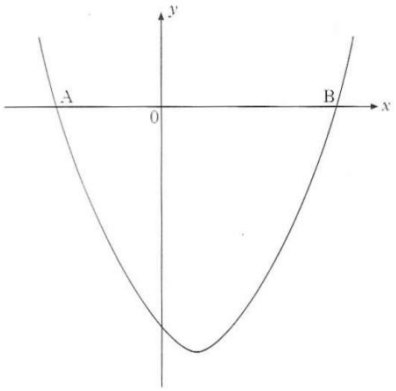
a) State the coordinates of the minimum turning point of the parabola. 2
b) State the equation of the axis of symmetry of the parabola. 1
c) A is the point (1,0). State the coordinates of B. 1



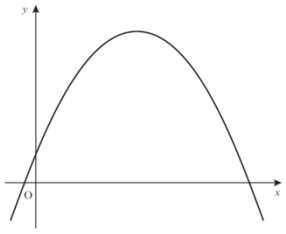
26) The equation of the parabola in the diagram is

$$y = (x - 1)^2 - 16$$

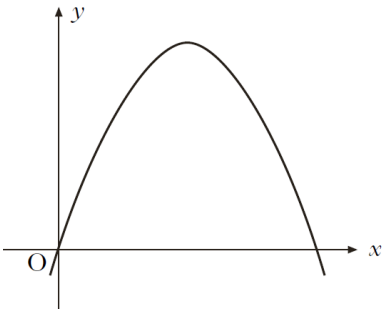
a) State the coordinates of the minimum turning point of the parabola. 2
b) State the equation of the axis of symmetry of the parabola. 1
c) The parabola cuts the x-axis at A and B. Find the length of AB. 3



27) The diagram 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



28) The graph of the parabola with equation $y = 8x - x^2$ is shown opposite.



a) By factorising $8x - x^2$, find the roots of the equation $8x - x^2 = 0$ 2

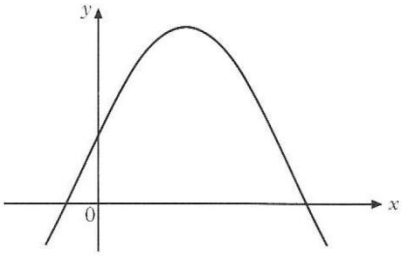
b) State the equation of the axis of symmetry of the parabola. 1

c) Find the coordinates of the turning point. 2

29) a) Factorise $7 + 6x - x^2$ 2

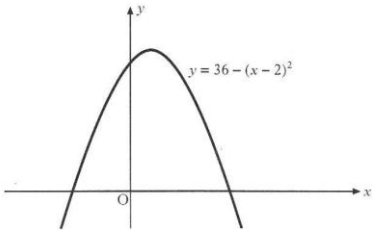
b) Hence write down the roots of the equation $7 + 6x - x^2 = 0$ 1

c) The graph of $y = 7 + 6x - x^2$ is shown in the diagram.



Find the coordinates of the turning point. 3

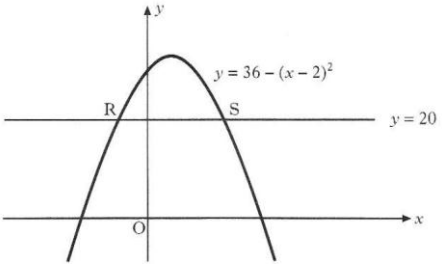
30) The diagram below shows part of the graph of $y = 36 - (x - 2)^2$.



a) State the coordinates of the maximum turning point. 2

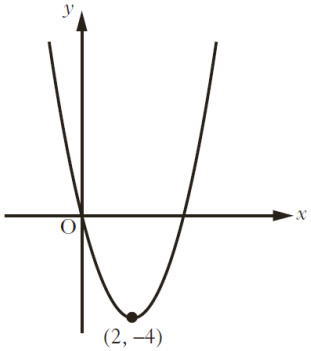
b) State the equation of the axis of symmetry. 1

The line $y = 20$ is drawn.
It cuts the graph of $y = 36 - (x - 2)^2$ at R and S as shown below.



c) S is the point (6,20). Find the coordinates of R. 2

31) The graph 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.



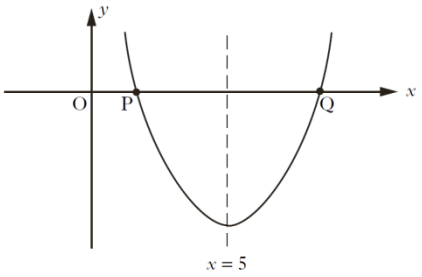
a) State the values of:

(i) a 1

(ii) b. 1

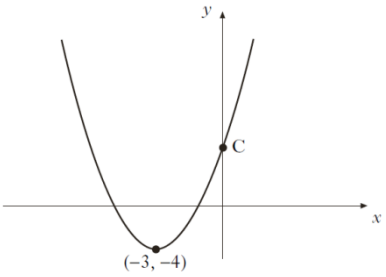
b) Write down the equation of the axis of symmetry of the graph. 1

32) The graph shows part of a parabola with equation of the form $y = (x + a)^2 + b$.
The equation of the axis of symmetry of the parabola is $x = 5$.



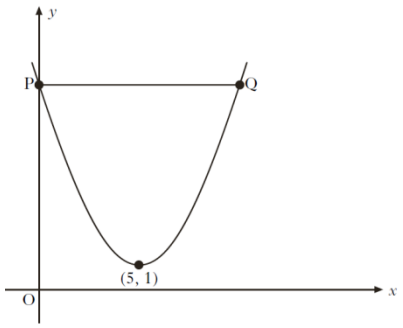
a) State the value of a. 1
b) P is the point (2, 0). State the coordinates of Q. 1
c) Calculate the value of b. 2

33) The diagram shows part of a parabola with equation of the form $y = (x + a)^2 + b$



a) Write down the equation of the axis of symmetry of the graph. 1
b) Write down the equation of the parabola. 2
c) Find the coordinates of C. 2

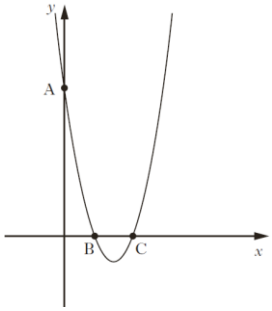
34) The graph shows part of a parabola with equation of the form $y = (x + a)^2 + b$



a) State the values of a and b. 2
b) State the equation of the axis of symmetry of the parabola. 1
c) The line PQ is parallel to the x-axis.
Find the coordinates of points P and Q. 3

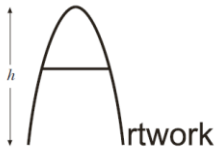
35) A parabola has equation $= (x - 2)^2 - 5$.
a) Write down the coordinates of the turning point of the parabola. 2
b) Does this parabola have a maximum or a minimum turning point? 1

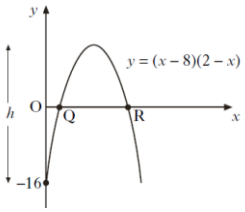
36) The equation $x^2 - 6x + 8 = 0$ can also be written as $(x - 2)(x - 4) = 0$.
a) Write down the roots of the equation $x^2 - 6x + 8 = 0$. 1
Part of the graph of $y = x^2 - 6x + 8 = 0$ is shown below.



b) State the coordinates of the points A, B and C. 3
c) What is the equation of the axis of symmetry of this graph? 1

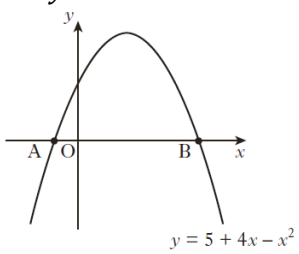
37) The curved part of the letter A in the *Artwork* logo is in the shape of a parabola.
The equation of this parabola is $y = (x - 8)(2 - x)$.





a) Write down the coordinates of Q and R. 2
b) Calculate the height, *h*, of the letter A**.** 3

38) 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).

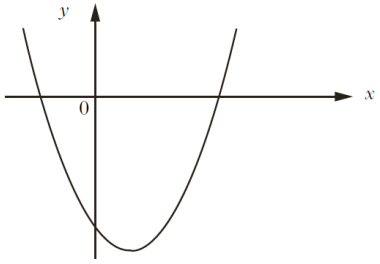
a) State the equation of the axis of symmetry of the graph. 2

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

39) a) Factorise $x^2 - 4x - 21$. 2

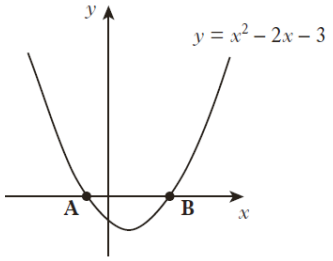
b) Hence write down the roots of the equation $x^2 - 4x - 21 = 0$. 1

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



Find the coordinates of the turning point. 3

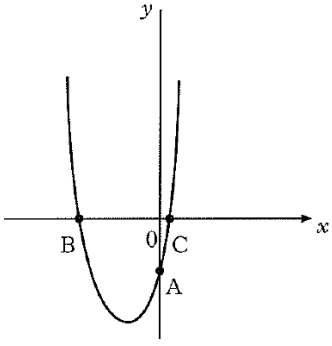
40) The parabola with equation $y = x^2 - 2x - 3$ cuts the *x*-axis at the points A and B as shown in the diagram.



a) Find the coordinates of A and B. 4

b) Write down the equation of the axis of symmetry of $y = x^2 - 2x - 3$. 1

41) The diagram shows part of the graph of $y = 4x^2 + 4x - 3$.
The graph cuts the y-axis at A and the x-axis at B and C.

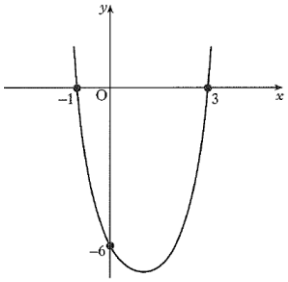


a) Write down the coordinates of A. 1

b) Find the coordinates of B and C. 3

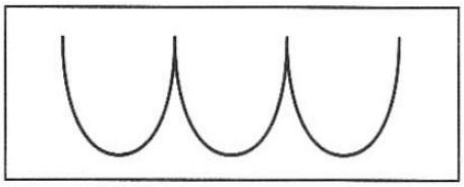
c) Calculate the minimum value of $4x^2 + 4x - 3$. 2

42) The diagram 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).

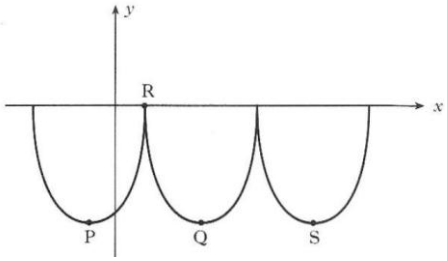


a) Write down the values of a and b. 2
b) Calculate the value of k. 2
c) Find the coordinates of the minimum turning point of the function. 2

43) William Watson's Fast Foods use a logo based on parts of 3 identical parabolas.

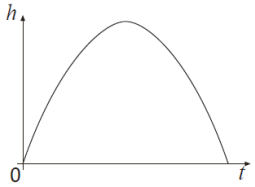


This logo is represented on the diagram below.



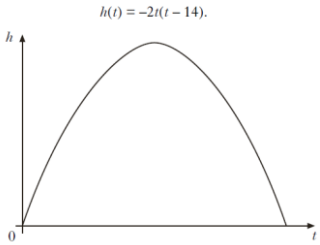
The first parabola has turning point P and equation $y = (x + 2)^2 - 16$.
a) State the coordinates of P. 2
b) If R is the point (2,0), find the coordinates of Q, the minimum turning point of the second parabola. 1
c) Find the equation of the parabola with turning point S. 2

44) The diagram 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 60m? 4
b) Will the rocket reach a height of 70m? 3

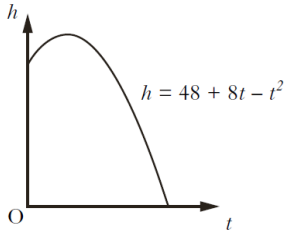
45) The diagram below shows the path of a rocket which is fired into the air.
The height, *h* metres, of the rocket after *t* seconds is given by



a) For how many seconds is the rocket in flight? 2

b) What is the maximum height reached by the rocket? 2

46) 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. 4

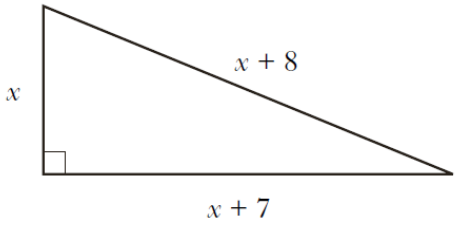
47) Two functions are given below.

$$f(x) = x^2 - 4x \qquad g(x) = 2x + 7$$

a) If $f(x) = g(x)$, show that $x^2 - 6x - 7 = 0$. 2

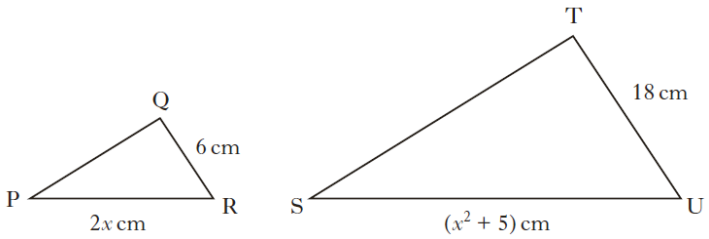
b) Hence find **algebraically** the values of *x* for which $f(x) = g(x)$. 2

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



Calculate the value of *x*. 5

49) Triangles PQR and STU are mathematically similar.
The scale factor is 3 and PR corresponds to SU.



a) Show that $x^2 - 6x + 5 = 0$. 2

b) Given QR is the shortest side of triangle PQR, find the value of *x*. 3

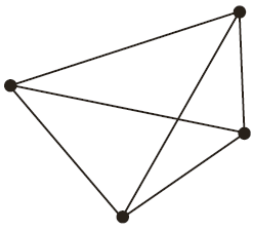
50) The weight, *W* kilograms, of a giraffe is related to its age, *M* months, by the formula

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

At what age will a giraffe weigh 83 kilograms? 4

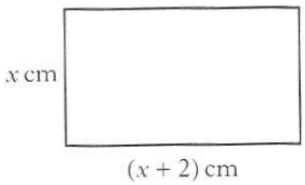
51) The number of diagonals, d, in a polygon with n sides is given by the formula $d = \frac{n(n-3)}{2}$.
A polygon has 20 diagonals. How many sides does it have? 4

52) 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. 1
b) When $r = 55$, show that $n^2 - n - 110 = 0$. 2
c) Hence find **algebraically** the value of n. 3

53) A rectangle has length $(x + 2)$ cm and breadth x cm.

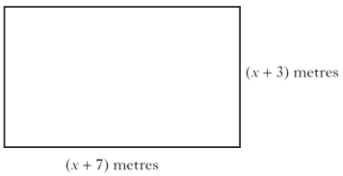


a) Write down an expression for the area of the rectangle. 1

A square has length $(x + 1)$ cm.

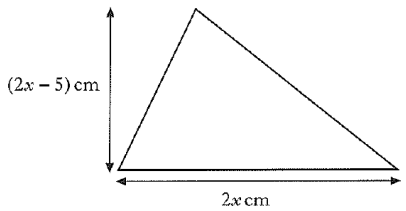
b) The area of the square above is greater than the area of the rectangle.
By how much greater? 2

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

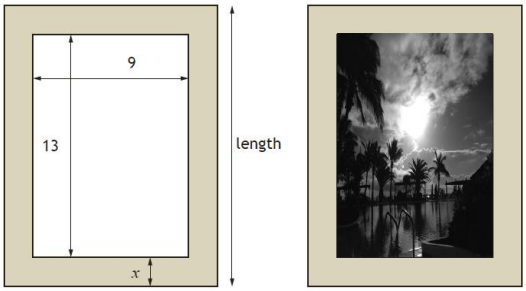


a) Show that the area, A square metres, of the garden is given by $A = x^2 + 10x + 21$. 2
b) The area of the garden is 45 square metres. Find x. 3

55) The height of the triangle is $(2x - 5)$cm and the base is $2x$ cm.
The area of the triangle is 7 cm^2.
Calculate the value of x. 5



56) 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.

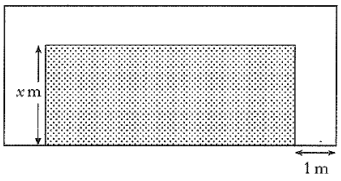


a) (i) Write down an expression for the length of the card in terms of x. 1

(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

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

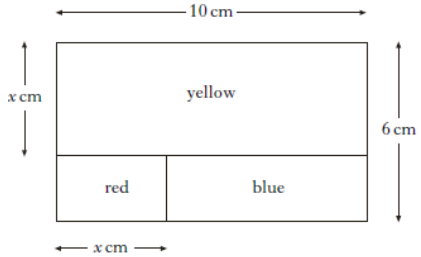


The breadth of the lawn is x metres.
The length of the lawn is 3 times its breadth.
The area of the lawn equals the area of the path.

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

b) Hence find the length of the lawn. 4

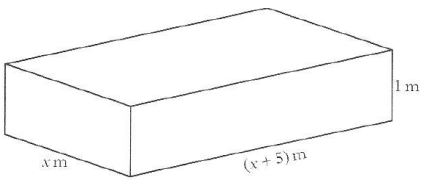
58) a) A decorator's logo is rectangular and measures 10 centimetres by 6 centimetres.
It consists of three rectangles: one red, one yellow and one blue.



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 ⅕ of the total area of the logo.
Calculate the value of x. 4

59) A cuboid is shown below.



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

a) Show that $x^2 + 5x - 24 = 0$. 2

b) Using the equation in part (a), find the breadth of the cuboid. 3