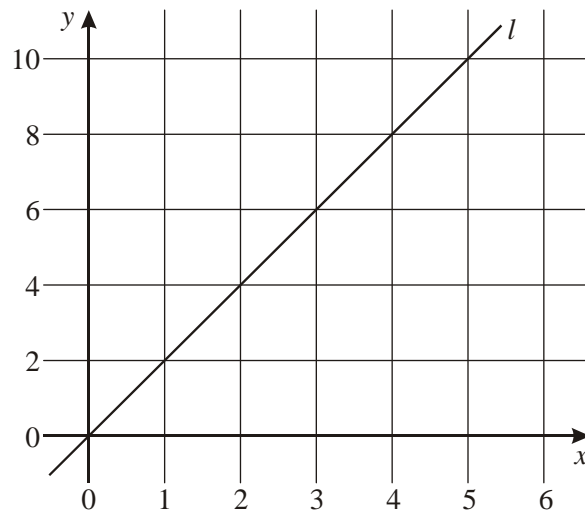


# Quadratics

112 min  
110 marks

1. The following diagram shows a straight line  $l$ .

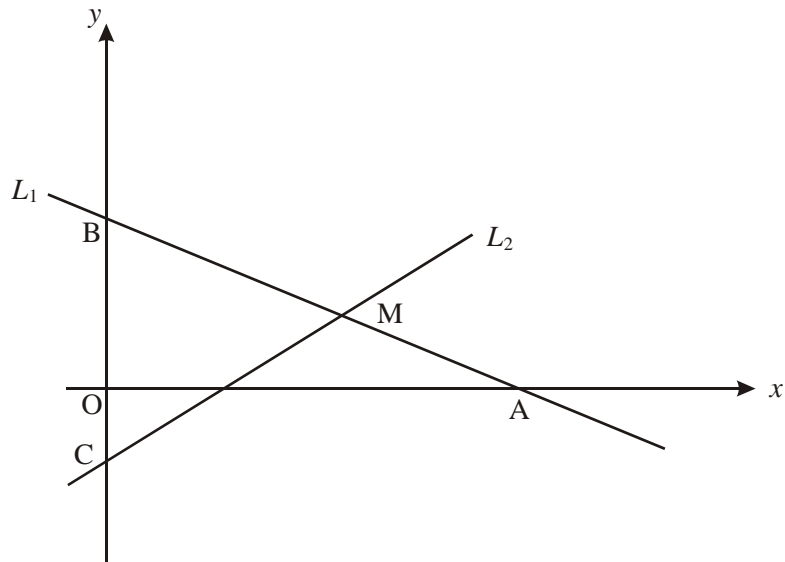


- (a) Find the equation of the line  $l$ .
- (b) The line  $n$  is parallel to  $l$  and passes through the point (0, 8). Write down the equation of the line  $n$ .
- (c) The line  $n$  crosses the horizontal axis at the point P. Find the coordinates of P.

**(Total 4 marks)**

2. The line  $L_1$  shown on the set of axes below has equation  $3x + 4y = 24$ .  $L_1$  cuts the  $x$ -axis at A and cuts the  $y$ -axis at B.

Diagram not drawn to scale



- (a) Write down the coordinates of A and B.

(2)

M is the midpoint of the line segment [AB].

- (b) Write down the coordinates of M.

(2)

The line  $L_2$  passes through the point M and the point C (0, -2).

- (c) Write down the equation of  $L_2$ .

(2)

- (d) Find the length of

(i) MC;

(2)

(ii) AC.

(2)

(e) The length of AM is 5. Find

(i) the size of angle CMA;

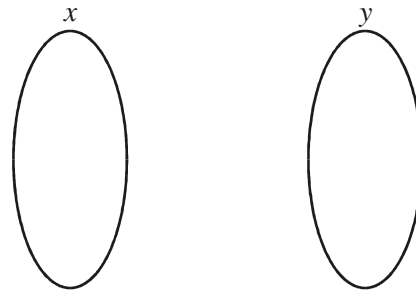
(3)

(ii) the area of the triangle with vertices C, M and A.

(2)

**(Total 15 marks)**

3. (a) Represent the function  $y = 2x^2 - 5$ , where  $x \in \{-2, -1, 0, 1, 2, 3\}$  by a mapping diagram.

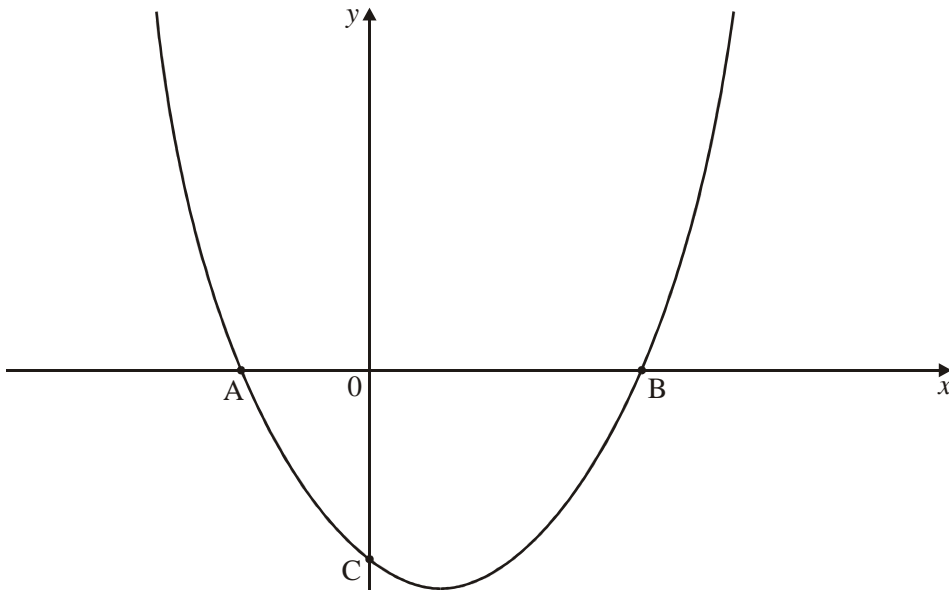


(b) List the elements of the domain of this function.

(c) List the elements of the range of this function.

**(Total 6 marks)**

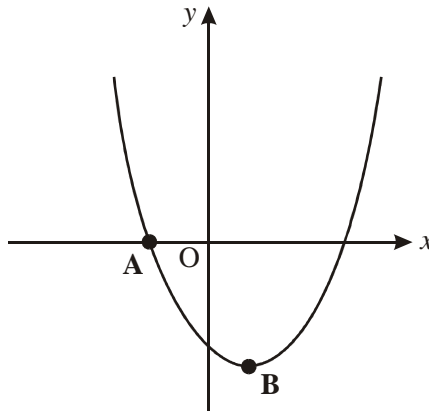
4. The graph of the function  $y = x^2 - x - 2$  is drawn below.



- (a) Write down the coordinates of the point C.
- (b) Calculate the coordinates of the points A and B.

**(Total 8 marks)**

5. The diagram shows the graph of  $y = x^2 - 2x - 8$ . The graph crosses the  $x$ -axis at the point A, and has a vertex at B.



- (a) Factorize  $x^2 - 2x - 8$ .
- (b) Write down the coordinates of each of these points
- (i) A;
- (ii) B.

**(Total 4 marks)**

6. (a) Sketch the graph of the function  $y = 2x^2 - 6x + 5$ .
- (b) Write down the coordinates of the local maximum or minimum of the function.
- (c) Find the equation of the axis of symmetry of the function.

**(Total 6 marks)**

7. (a) Solve the equation  $x^2 - 5x + 6 = 0$ .

- (b) Find the coordinates of the points where the graph of  $y = x^2 - 5x + 6$  intersects the  $x$ -axis.

**(Total 4 marks)**

8. Let  $f(x) = x^2 - 6x + 8$ .

(a) Factorise  $x^2 - 6x + 8$ .

(2)

(b) Hence, or otherwise, solve the equation  $x^2 - 6x + 8 = 0$ .

(2)

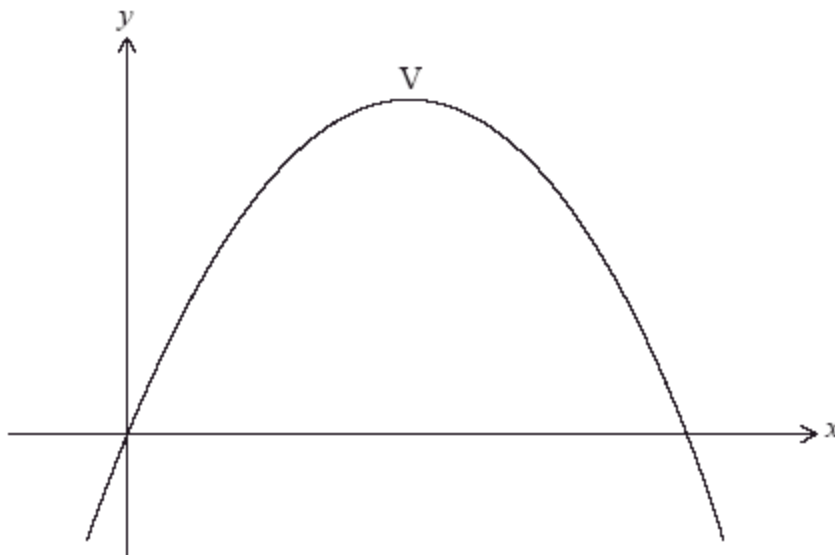
Let  $g(x) = x + 3$ .

(c) Write down the solutions to the equation  $f(x) = g(x)$ .

(2)

**(Total 6 marks)**

9. A quadratic curve with equation  $y = ax(x - b)$  is shown in the following diagram.



The  $x$ -intercepts are at  $(0, 0)$  and  $(6, 0)$ , and the vertex  $V$  is at  $(h, 8)$ .

(a) Find the value of  $h$ .

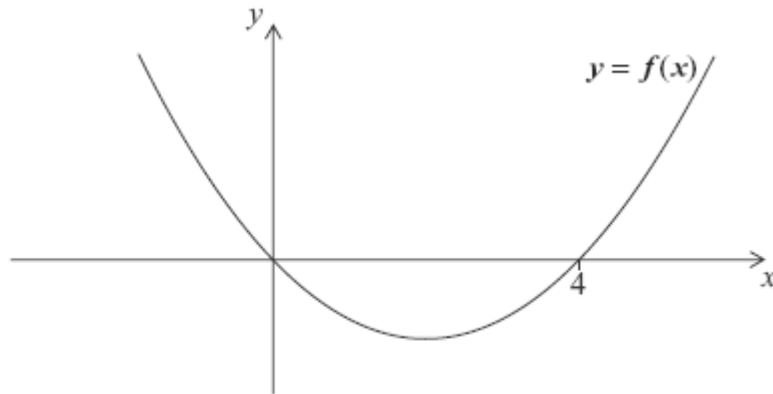
(2)

(b) Find the equation of the curve.

(4)

**(Total 6 marks)**

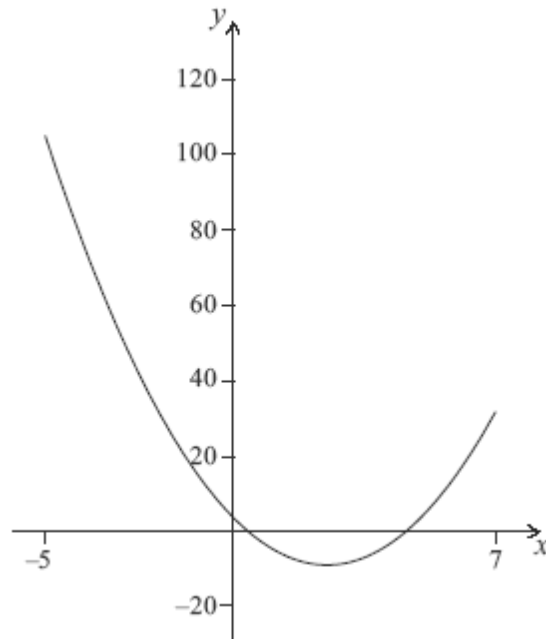
10. The following is the graph of the quadratic function  $y = f(x)$ .



- (a) Write down the solutions to the equation  $f(x) = 0$ . (2)
- (b) Write down the equation of the axis of symmetry of the graph of  $f(x)$ . (2)
- (c) The equation  $f(x) = 12$  has two solutions. One of these solutions is  $x = 6$ . Use the symmetry of the graph to find the other solution. (1)
- (d) The minimum value for  $y$  is  $-4$ . Write down the range of  $f(x)$ . (1)

**(Total 6 marks)**

11. The graph of  $y = 2x^2 - rx + q$  is shown for  $-5 \leq x \leq 7$ .



The graph cuts the y-axis at (0, 4).

- (a) Write down the value of  $q$ .

(1)

The axis of symmetry is  $x = 2.5$ .

- (b) Find the value of  $r$ .

(2)

- (c) Write down the minimum value of  $y$ .

(1)

- (d) Write down the range of  $y$ .

(2)

(Total 6 marks)



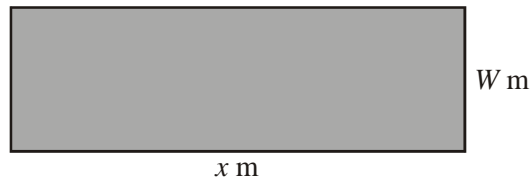
12. Two functions are defined as follows

$$f(x) = \begin{cases} 6 - x & \text{for } 0 \leq x < 6 \\ x - 6 & \text{for } x \geq 6 \end{cases}$$

$$g(x) = \frac{1}{2}x$$

- (a) Draw the graphs of the functions  $f$  and  $g$  in the interval  $0 \leq x \leq 14$ ,  $0 \leq y \leq 8$  using a scale of 1 cm to represent 1 unit on both axes. (5)
- (b) (i) Mark the intersection points A and B of  $f(x)$  and  $g(x)$  on the graph.  
(ii) Write down the coordinates of A and B. (3)
- (c) Calculate the midpoint M of the line AB. (2)
- (d) Find the equation of the straight line which joins the points M and N. (4)
- (Total 14 marks)**

13. The perimeter of this rectangular field is 220 m. One side is  $x$  m as shown.



- (a) Express the width ( $W$ ) in terms of  $x$ .
- (b) Write an expression, in terms of  $x$  only, for the area of the field.
- (c) If the length ( $x$ ) is 70 m, find the area.

**(Total 4 marks)**

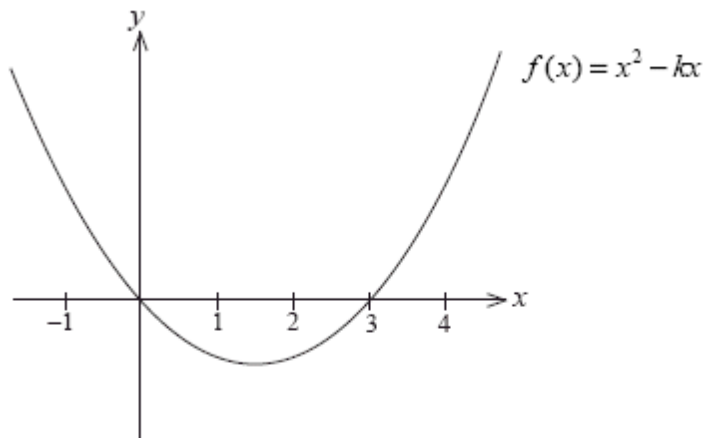
14. (a) Factorise the expression  $x^2 - kx$ .

**(1)**

- (b) Hence solve the equation  $x^2 - kx = 0$ .

**(1)**

The diagram below shows the graph of the function  $f(x) = x^2 - kx$  for a particular value of  $k$ .



- (c) Write down the value of  $k$  for this function.

**(1)**

- (d) Find the minimum value of the function  $y = f(x)$ .

(3)

(Total 6 marks)

15. The profit ( $P$ ) in Swiss Francs made by three students selling homemade lemonade is modelled by the function

$$P = -\frac{1}{20}x^2 + 5x - 30$$

where  $x$  is the number of glasses of lemonade sold.

- (a) **Copy** and complete the table below

$x$	0	10	20	30	40	50	60	70	80	90
$P$		15			90			75	50	

(3)

- (b) On graph paper draw axes for  $x$  and  $P$ , placing  $x$  on the horizontal axis and  $P$  on the vertical axis. Use suitable scales. Draw the graph of  $P$  against  $x$  by plotting the points. Label your graph.

(5)

- (c) **Use your graph** to find

- (i) the maximum possible profit;

(1)

- (ii) the number of glasses that need to be sold to make the maximum profit;

(1)

- (iii) the number of glasses that need to be sold to make a profit of 80 Swiss Francs;

(2)

- (iv) the amount of money initially invested by the three students.

(1)

- (d) The three students Baljeet, Jane and Fiona share the profits in the ratio of 1:2:3 respectively. If they sold 40 glasses of lemonade, calculate Fiona's share of the profits.

(2)

(Total 15 marks)