

1. (a) Factorize $x^2 - 3x - 10$.
 (b) Solve the equation $x^2 - 3x - 10 = 0$.

Working:

$$x^2 - 3x - 10$$

$$= (x - 5)(x + 2)$$

$$(x - 5)(x + 2) = 0$$

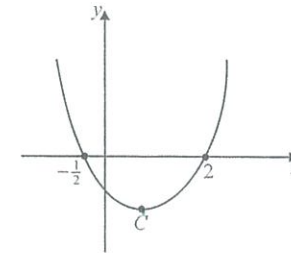
Answers:

- (a) $(x - 5)(x + 2)$
 (b) $x = 5, x = -2$

(Total 4 marks)

2. The diagram represents the graph of the function

$$f: x \mapsto (x - p)(x - q).$$



- (a) Write down the values of p and q .
 (b) The function has a minimum value at the point C . Find the x -coordinate of C .

Working:

x coordinate of C :

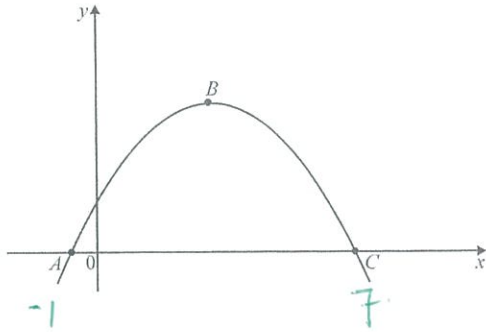
$$\frac{-\frac{1}{2} + 2}{2} = \frac{3}{4}$$

Answers:

- (a) $p = -\frac{1}{2}, q = 2$
 (b) $\frac{3}{4}$

(Total 4 marks)

3. The diagram shows the parabola $y = (7-x)(1+x)$. The points A and C are the x -intercepts and the point B is the maximum point.



Find the coordinates of A , B and C .

Working:

$$\begin{aligned} y &= (7-x)(1+x) \\ &= (7-3)(1+3) \\ &= (4)(4) \\ &= 16 \end{aligned}$$

Point B.

$$\frac{7-1}{2} = 3$$

Answer:

$A(-1, 0), B(3, 16); C(7, 0)$

(Total 4 marks)

4. The quadratic equation $4x^2 + 4kx + 9 = 0$, $k > 0$ has exactly one solution for x . Find the value of k .

Working:

one solution: $\Delta = b^2 - 4ac = 0$

$$\Delta = (4k)^2 - 4(4)(9) = 0$$

$$0 = 16k^2 - 144$$

$$k^2 = \frac{144}{16} = 9$$

$$k = \pm 3$$

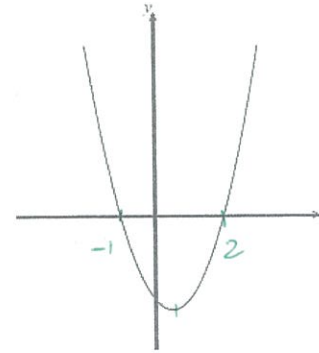
since $k > 0$
 $\therefore k = 3$

Answer:

$k = 3$

(Total 4 marks)

5. The following diagram shows part of the graph of f , where $f(x) = x^2 - x - 2$.



- (a) Find both x -intercepts.

(4)

- (b) Find the x -coordinate of the vertex.

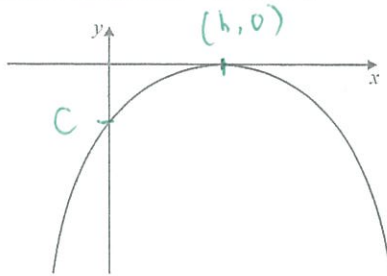
a) $f(x) = x^2 - x - 2$
 $= (x-2)(x+1)$
 $\therefore x$ intercepts @ 2, -1

b) x -coordinate of vertex

$$x = \frac{2-1}{2} = \frac{1}{2}$$

(2)
(Total 6 marks)

6. The diagram shows the graph of the function $y = ax^2 + bx + c$.



Complete the table below to show whether each expression is positive, negative or zero.

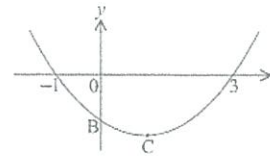
| Expression | positive | negative | zero |
|-------------|----------|----------|------|
| a | | ✓ | |
| c | | ✓ | |
| $b^2 - 4ac$ | ✓ | | ✓ |
| b | | | |

Working:

$$\begin{aligned}
 y &= a(x-h)^2 + 0 \\
 y &= a(x^2 - 2hx + h^2) \\
 &= \underbrace{-ax^2}_{a} + \underbrace{2hx}_{b} - \underbrace{ah^2}_{c}
 \end{aligned}$$

(Total 4 marks)

7. Part of the graph of $f(x) = (x-p)(x-q)$ is shown below.



midpoint

$$\frac{-1+3}{2} = 1$$

The vertex is at C. The graph crosses the y-axis at B.

- Write down the value of p and of q .
- Find the coordinates of C.
- Write down the y-coordinate of B.

Working:

$$\begin{aligned}
 \text{a) } f(x) &= (x-p)(x-q) \\
 f(x) &= (x+1)(x-3) \\
 \text{b) } f(1) &= (1+1)(1-3) \\
 &= (2)(-2) \\
 &= -4. \\
 \therefore \text{ coordinates of C} &= (1, -1)
 \end{aligned}$$

Answers:

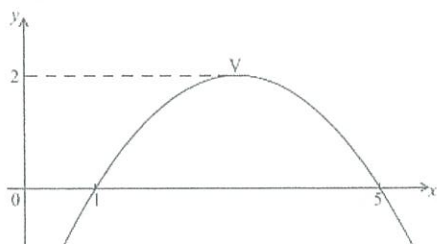
- $p = -1, q = 3$
- $C(1, -1)$
- $B = -3$

(Total 6 marks)

c). Find standard form.

$$\begin{aligned}
 f(x) &= (x+1)(x-3) \\
 &= x^2 - 3x + x - 3 \\
 &= x^2 - 2x - 3
 \end{aligned}$$

8. Part of the graph of the function $y = d(x - m)^2 + p$ is given in the diagram below. The x-intercepts are (1, 0) and (5, 0). The vertex is $V(m, 2)$.



(a) Write down the value of

- (i) m ;
(ii) p .

(b) Find d .

a) i) $m = \frac{1+5}{2} = 3$ ii) $p = 2$

b) $y = d(x - m)^2 + p$

$y = d(x - 3)^2 + 2$

use (1, 0)

$0 = d(1 - 3)^2 + 2$

$-2 = 4d$

$d = -\frac{1}{2}$

(Total 6 marks)

9. The equation $kx^2 + 3x + 1 = 0$ has exactly one solution. Find the value of k .

Working:

$kx^2 + 3x + 1 = 0$

$\Delta = b^2 - 4ac = 0$

$0 = 9 - 4(k)(1)$

$0 = 9 - 4k$

Answer:

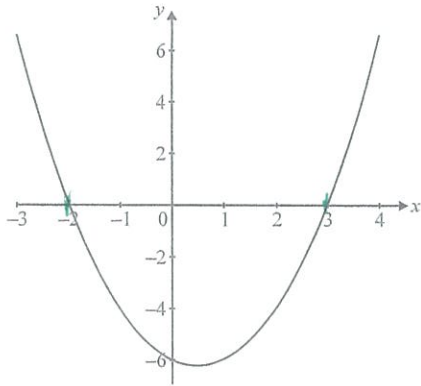
$k = \frac{9}{4}$

(Total 6 marks)

$4k = 9$

$k = \frac{9}{4}$

10. The diagram shows part of the graph with equation $y = x^2 + px + q$. The graph cuts the x -axis at -2 and 3 .



Find the value of

$$y = (x+2)(x-3)$$

- (a) p ;
(b) q .

Working:

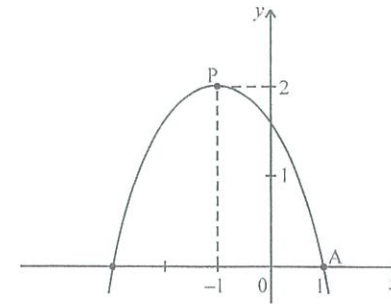
$$\begin{aligned} y &= (x+2)(x-3) \\ &= x^2 - 3x + 2x - 6 \\ y &= x^2 - x - 6 \end{aligned}$$

Answers:

- (a) $p = -1$
(b) $q = -6$

(Total 4 marks)

11. The diagram shows part of the graph of $y = a(x-h)^2 + k$. The graph has its vertex at P, and passes through the point A with coordinates $(1, 0)$.



- (a) Write down the value of
(i) h ;
(ii) k .
(b) Calculate the value of a .

Working:

$$\begin{aligned} y &= a(x-h)^2 + k \\ y &= a(x+1)^2 + 2 \\ \text{use } (1, 0) \end{aligned}$$

$$\begin{aligned} 0 &= a(1+1)^2 + 2 \\ -2 &= a(2)^2 \end{aligned}$$

$$\begin{aligned} 4a &= -2 \\ a &= -\frac{1}{2} \end{aligned}$$

Answers:

- (a) (i) $h = -1$
(ii) $k = 2$
(b) $a = -\frac{1}{2}$

(Total 6 marks)

