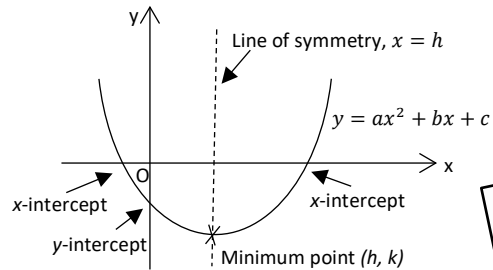


Sec 2 Math: Reading Quadratic Graph Sketch

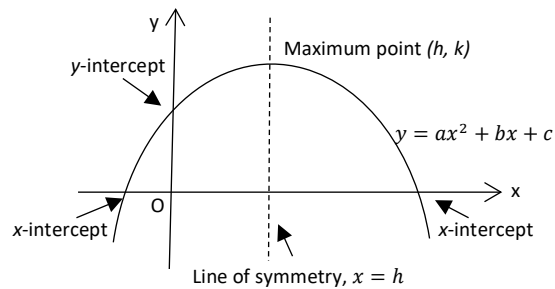
A) How to Read Graphs

The equation of a quadratic graph is $y = ax^2 + bx + c$.

i) When $a > 0$, the curve is U-shaped and has a minimum point.



(ii) When $a < 0$, the curve is \cap -shaped and has a maximum point.



(iii) To find the **y-intercept** of the curve:

substitute $x = 0$ into the equation of the curve to find the value of y .

(iv) To find the **x-intercepts** of the curve:

substitute $y = 0$ into the equation of the curve to find the values of x .

(v) **Line of symmetry equation** is: $x = \frac{x_1 + x_2}{2}$,

where x_1 and x_2 are the values of the two x -intercepts

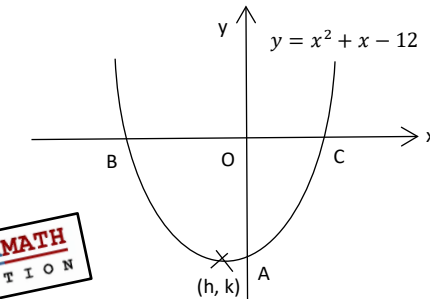
vi) The line of symmetry is a vertical line that cuts through the min/max point (h, k) .

The value of h is the same as the x value of the line of symmetry.

To find the value k , substitute $x = h$ into the equation of the curve.

B) Example (Reading U-shaped Graphs)

The diagram shows the graph of $y = x^2 + x - 12$.



(a) The graph cuts the y -axis at A .
Write down the coordinates of A .

(b) The graph cuts the x -axis at B and C .
Find the coordinates of B and C .

(c) (h, k) is the graph's minimum point.
Find the values of h and k .

a) A is the curve's y -intercept.

$$\begin{aligned} \text{Sub } x &= 0, \\ y &= (0)^2 + (0) - 12 \\ &= -12 \end{aligned}$$

$$A(0, -12)$$

b) B and C are the curve's x -intercepts. Sub $y = 0$,
 $x^2 + x - 12 = 0$

$$(x - 3)(x + 4) = 0$$

$$x - 3 = 0 \text{ or } x + 4 = 0$$

$$x = 3 \text{ or } x = -4$$

$$B(-4, 0) \text{ and } C(3, 0)$$

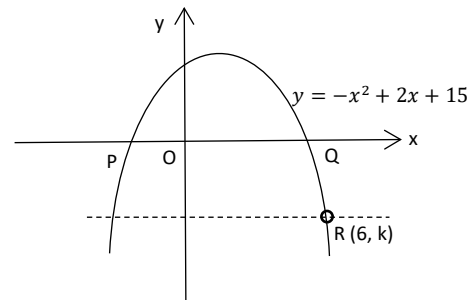
$$\text{c) } h = \frac{3 + (-4)}{2} = -0.5$$

$$\begin{aligned} \text{Sub } h &= -0.5, \\ k &= (-0.5)^2 + (-0.5) - 12 = -12.25 \end{aligned}$$

$$\therefore h = -0.5, \quad k = -12.25$$

C) Example (Reading \cap -shaped Graphs)

The diagram shows the graph of $y = -x^2 + 2x + 15$.



(a) Find the equation of the horizontal line passing through R .

(b) The graph cuts the x -axis at P and Q .
Find the coordinates of P and Q .

(c) Find the coordinates of the maximum point.

a) Sub $x = 6$ into the equation to find k :

$$k = -(6)^2 + 2(6) + 15$$

$$k = -9$$

\therefore equation of horizontal line is $y = -9$

b) P and Q are the curve's x -intercepts.

$$\begin{aligned} \text{Sub } y &= 0, \\ -x^2 + 2x + 15 &= 0 \end{aligned}$$

$$(-x + 5)(x + 3) = 0$$

$$-x + 5 = 0 \text{ or } x + 3 = 0$$

$$x = 5 \quad \text{or} \quad x = -3$$

$$P(-3, 0) \text{ and } Q(5, 0)$$

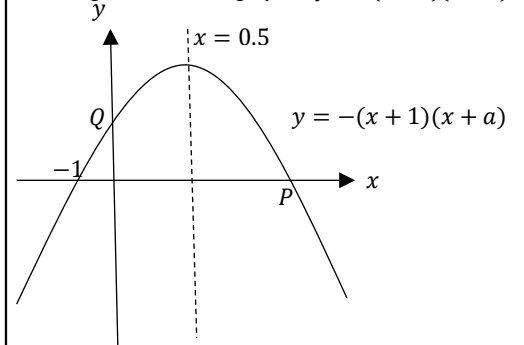
c) Line of symmetry: $x = \frac{5 + (-3)}{2} = 1$

$$\text{When } x = 1, y = -(1)^2 + 2(1) + 15 = 16$$

$$\text{Maximum point } (1, 16)$$

D) Example (Intermediate)

The diagram shows the graph of $y = -(x + 1)(x + a)$



(a) Find the coordinates of point P

(b) Find the value of a

(c) Find the coordinates of point Q .

$$\text{a) } 0.5 = \frac{P + (-1)}{2}$$

$$1 = P - 1$$

$$P = 2$$

Coordinates of P is $(2, 0)$

$$\text{b) } (2 + a) = 0$$

$$a = -2$$

value of a is -2

c) Q is the y -intercept,

Sub $x = 0$:

$$y = -(0 + 1)(0 - 2)$$

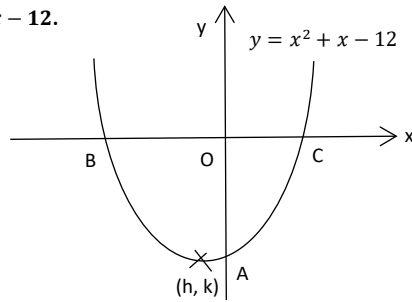
$$y = 2$$

Coordinates of Q is $(2, 0)$

Self Practice

1) Reading U-shaped Graphs

The diagram shows the graph of $y = x^2 + x - 12$.



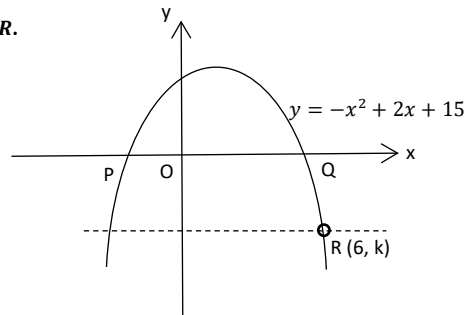
- (a) The graph cuts the y -axis at A . Write down the coordinates of A .
- (b) The graph cuts the x -axis at B and C . Find the coordinates of B and C .
- (c) (h, k) is the graph's minimum point. Find the values of h and k .

2) Reading n-shaped Graphs

(a) Find the equation of the horizontal line passing through R .

(b) The graph cuts the x -axis at P and Q . Find the coordinates of P and Q .

(c) Find the coordinates of the maximum point.



3) Example (Intermediate)

The diagram shows the graph of $y = -(x + 1)(x + a)$

(a) Find the coordinates of point P

(b) Find the value of a

(c) Find the coordinates of point Q.

