

## Factored Form

Investigation: See website.

### Summary

The factored form of a quadratic relationship has the form  $y = a(x - r)(x - s)$ , where  $r$  and  $s$  are the zeroes. [i.e. The equation  $y = (x - 2)(x + 6)$  has zeroes of 2 and -6.]

Example 1: Consider the equation  $y = \frac{1}{2}(x - 1)(x + 2)$

- a) State the zeroes of this relationship.

The zeroes are 1 and -2.

- b) Determine the y-intercept.

To find the y-intercept, we let  $x = 0$ .

$$y = \frac{1}{2}(0 - 1)(0 + 2)$$

$$y = \frac{1}{2}(-1)(2)$$

$$y = -1$$

- c) Determine the axis of symmetry.

The axis of symmetry is halfway between the zeroes. We only need the x-coordinate for this, so:

$$\frac{1 + (-2)}{2} = -\frac{1}{2}$$

The axis of symmetry is  $x = -\frac{1}{2}$ .

- d) Determine the vertex.

We sub in  $x = -\frac{1}{2}$  ...

$$y = \frac{1}{2}\left(-\frac{1}{2} - 1\right)\left(-\frac{1}{2} + 2\right)$$

$$y = \frac{1}{2}\left(-\frac{3}{2}\right)\left(\frac{3}{2}\right)$$

$$y = -\frac{9}{8}$$

The vertex is  $\left(-\frac{1}{2}, -\frac{9}{8}\right)$

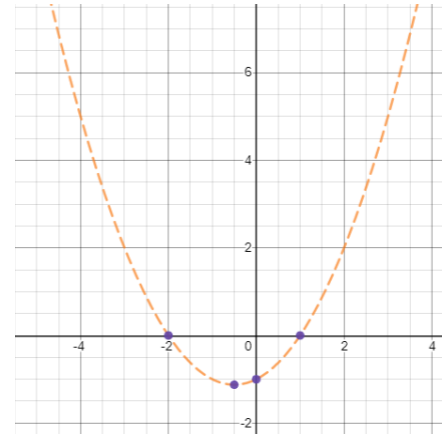
e) Use this information to sketch a graph.

We plot all the points we have, and use this to make a rough sketch.

Zeroes: 1 and -2

Y-intercept: -1

Vertex:  $\left(-\frac{1}{2}, -\frac{9}{8}\right)$



Example 2: Determine an equation of the graph shown.

The zeroes are -3 and 1, so we'll fill them into the factored form:

$$y = a(x-r)(x-s)$$

$$y = a(x - (-3))(x - (1))$$

$$y = a(x+3)(x-1)$$

The only thing we need now is to determine the value of  $a$ . We plug in a **different** point (not the zeroes) to solve for  $a$ . Let's use the y-intercept, which is 6.

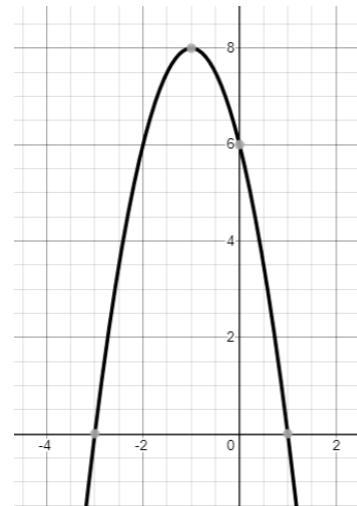
$$y = a(x+3)(x-1)$$

$$6 = a(0+3)(0-1)$$

$$6 = a(3)(-1)$$

$$6 = -3a$$

$$-2 = a$$



Therefore the equation of the parabola is  $y = -2(x+3)(x-1)$ .

Practice: pg. 155 #4abc, 5abc, 7, 11, 13