

**Chapter**

# 17

## Quadratic functions

- A** Quadratic functions
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**Syllabus reference: 1.6, 6.3**

# A

## QUADRATIC FUNCTIONS

Using function notation,  $y = ax^2 + bx + c$  can be written as  $f(x) = ax^2 + bx + c$ .

State whether the following quadratic functions are satisfied by the given ordered pairs:

**a**  $y = 3x^2 + 2x$      $(2, 16)$

$$16 = 3(2)^2 + 2(2)$$

$$16 = 3(4) + 4$$

Yes

**b**  $f(x) = -x^2 - 2x + 1$      $(-3, 1)$

$$f(-3) = -(-3)^2 - 2(-3) + 1$$

$$-9 + 6 + 1$$

$$f(-3) = -2$$

No!

If  $y = x^2 - 6x + 8$ , find the value(s) of  $x$  when: **a**  $y = 15$  **b**  $y = -1$

$$15 = x^2 - 6x + 8$$
$$\begin{array}{r} -15 \\ -15 \end{array}$$

$$0 = x^2 - 6x - 7$$

$$0 = (x - 7)(x + 1)$$

$$x = 7$$
$$x = -1$$

A stone is thrown into the air. Its height above the ground  $t$  seconds after it is thrown is given by the function  $h(t) = -5t^2 + 30t + 2$  metres.

- a How high is the stone above the ground at time  $t = 3$  seconds?
- b From what height above the ground was the stone released?
- c At what time is the stone 27 m above the ground?

$$a) h(3) = -5(3)^2 + 30(3) + 2$$

$$b) h(0) = -5(0)^2 + 30(0) + 2$$

$$c) 27 = -5t^2 + 30t + 2$$

$$0 = -5t^2 + 30t - 25$$

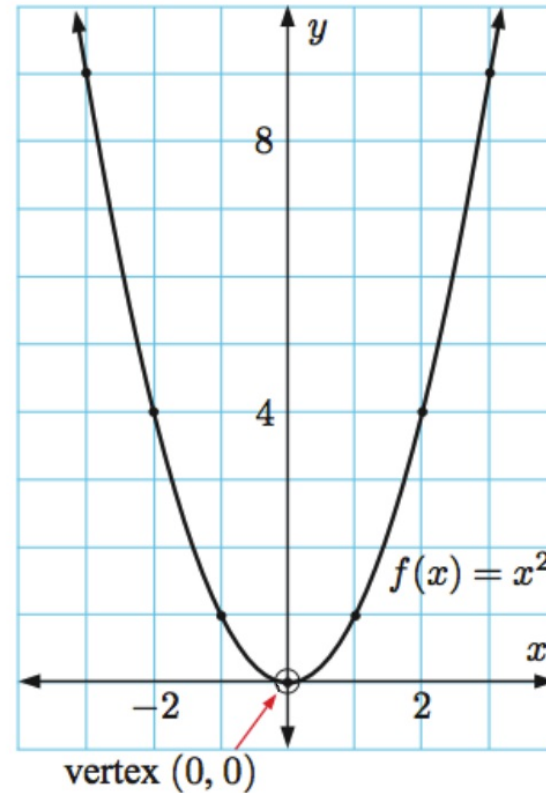
# B

## GRAPHS FROM TABLES OF VALUES

Consider the quadratic function  $f(x) = x^2$ .

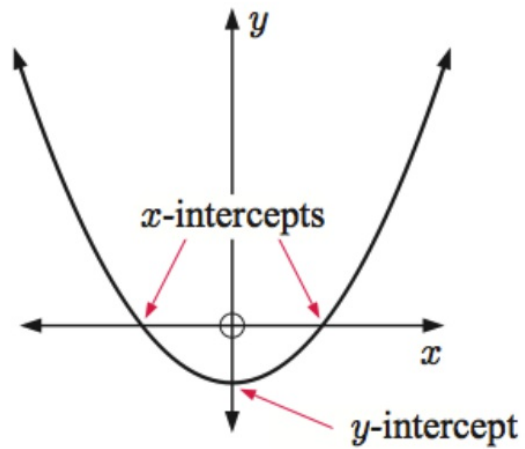
Notice that the curve  $f(x) = x^2$ :

- opens upwards
- has a **vertex** or **turning point** at  $(0, 0)$
- is **symmetric** about the  $y$ -axis.



# C

## AXES INTERCEPTS



The  **$x$ -intercepts** are values of  $x$  where the graph meets the  $x$ -axis.

The  **$y$ -intercept** is the value of  $y$  where the graph meets the  $y$ -axis.

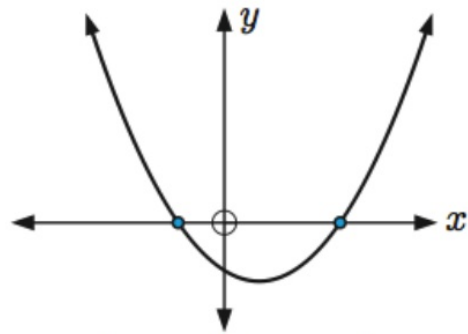
## THE $y$ -INTERCEPT

You will have noticed that for a quadratic function of the form  $y = ax^2 + bx + c$ , the  $y$ -intercept is the constant term  $c$ . This is because any curve cuts the  $y$ -axis when  $x = 0$ .

## FINDING $x$ -INTERCEPTS FROM THE FACTORISED FORM

The  $x$ -intercepts of  $y = a(x - \alpha)(x - \beta)$  are  $\alpha$  and  $\beta$ .

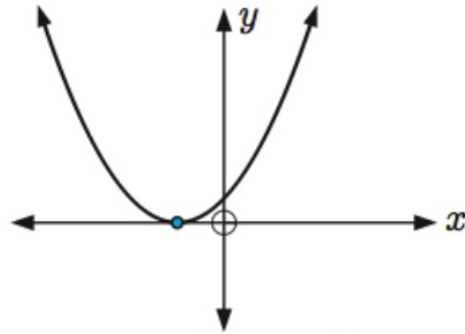




two  $x$ -intercepts

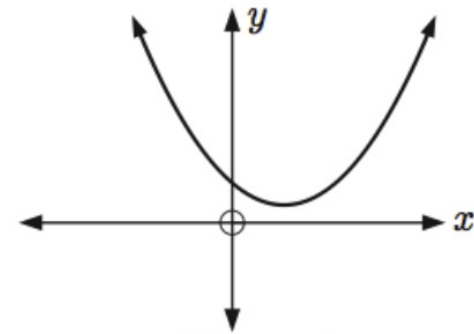
$$y = (x - a)(x - b)$$

$$x\text{-int} = a, b$$



one  $x$ -intercept

$$y = (x + 1)^2$$



no  $x$ -intercepts

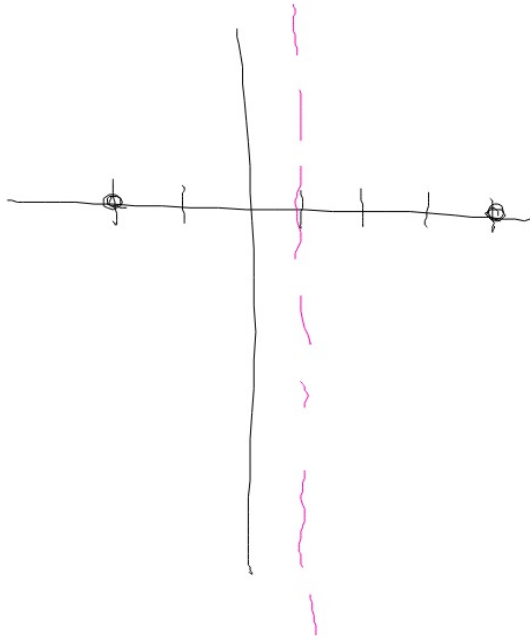


Find the  $x$ -intercepts of:

**a**  $y = 3(x - 4)(x + 2)$

$$x = 4 \quad x = -2$$

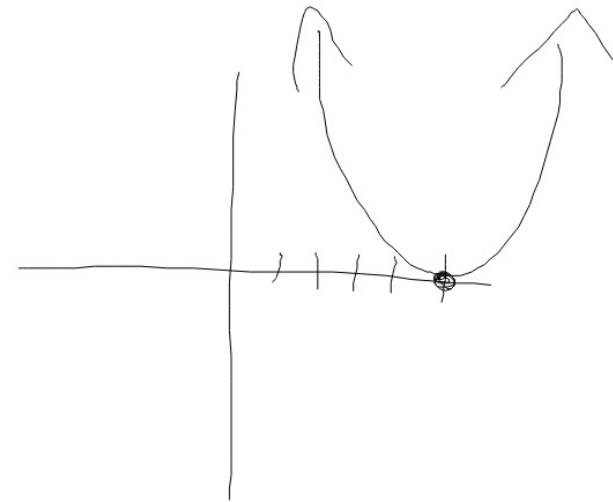
$x$ -value of vertex  $x: \frac{4 + (-2)}{2}$   
 $= 1$



$$(x - 5)(x - 5)$$

**b**  $y = (x - 5)^2$

$$x = 5$$



## Assignment:

Exercise 17    A # 6, 8  
                  B # 3  
                  C # 2, 3, 6 (*a-d for all*)