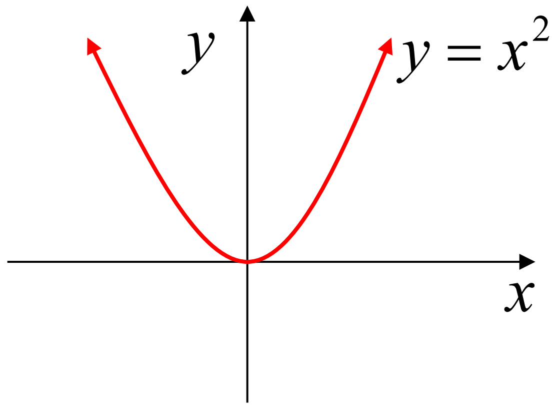
Quadratic Function



The linear function and the **quadratic function** are the building blocks of all polynomials

Every polynomial can be factorised down to a combination of linear and quadratic factors.

All quadratics can be transformed from the basic equation $y = x^2$ using transformations (translations, rotations, reflections) and/or dilations.

Recognising the quadratic function

$$y = ax^2 + bx + c$$

power '1' power '2'

- terms contain at most one variable, one variable is to the power of one, the other variable hs a term to the power of two

Quadratics and Completing the Square

a measures concavity

$$\boxed{y = a(x-h)^2 + k}$$

vertex is (h, k)

e.g. Sketch the parabola $y = x^2 + 8x + 12$

$$y = x^2 + 8x + 12$$
$$= (x+4)^2 - 4$$
$$\therefore \text{ vertex is } (-4, -4)$$

x intercepts

$$(x+4)^2 - 4 = 0$$
$$(x+4)^2 = 4$$
$$x + 4 = \pm 2$$
$$x = -4 \pm 2$$
$$x = -6 \text{ or } x = -2$$
$$\therefore \ x \text{ intercepts are}$$
$$(-6, 0) \text{ and } (-2, 0)$$

(ii) Write down the quadratic with roots 2 and 8 and vertex $(5,3)$

$$y = k\left\{(x-5)^2\right\} + 3$$
$$(2,0): \ 0 = k\left\{(2-5)^2\right\} + 3$$
$$9k = -3$$
$$k = -\frac{1}{3}$$
$$y = -\frac{1}{3}\left\{(x-5)^2\right\} + 3$$
$$y = -\frac{1}{3}\left(x^2 - 10x + 16\right)$$

Quadratics and the Discriminant

$$\boxed{\Delta = b^2 - 4ac}$$

$$\text{vertex} = \left(\frac{-b}{2a}, \frac{-\Delta}{4a}\right)$$

$$\text{zeroes} = \frac{-b \pm \sqrt{\Delta}}{2a}$$

Note: if $\Delta < 0$, no x intercepts

$\Delta = 0$, one x intercept

$\Delta > 0$, two x intercepts

e.g. Sketch the parabola $y = x^2 + 8x + 12$

$$\Delta = 8^2 - 4(1)(12)$$
$$= 16$$
$$\therefore \text{ vertex} = \left(-\frac{8}{2}, -\frac{16}{4}\right)$$
$$= (-4, -4)$$

Exercise 3E;1, 2c, 3ace, 4b, 5ac, 6bc, 7c, 8, 9b, 10be, 11a, 12ace, 13ac, 14ac, 15bdf, 16bc, 17, 19

Exercise 3F; 1a, 2adf, 5a, 6, 7, 8, 9ace, 10a, 12, 13b, 15