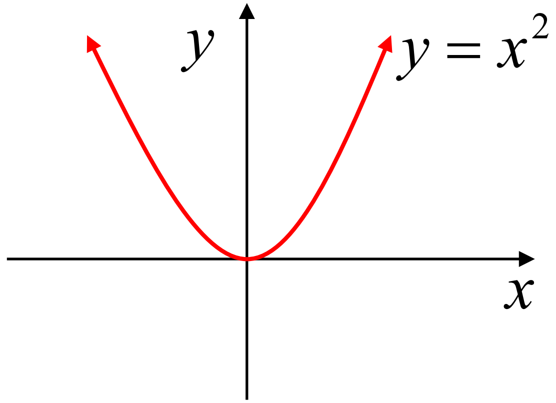
Quadratic Function

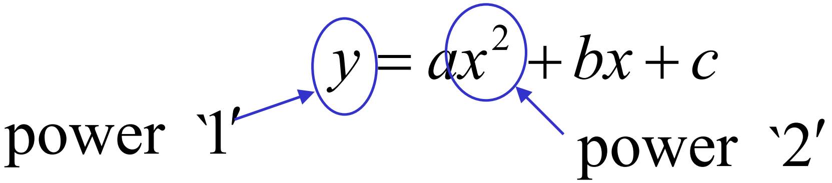


The linear function and the **quadratic function** are the building blocks of all polynomials

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 translations, rotations, reflections or a combination of all three.

Recognising the quadratic function



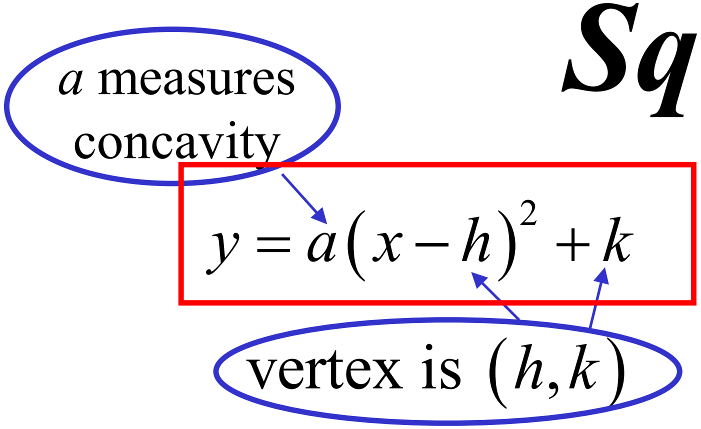
$$y = ax^2 + bx + c$$

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 $y=x^2+8x+12$

$$y=x^2+8x+12$$
$$=(x+4)^2-4$$

$\therefore$ vertex is $(-4,-4)$

x intercepts

$$(x+4)^2-4=0$$
$$(x+4)^2=4$$
$$x+4=\pm2$$
$$x=-4\pm2$$
$$x=-6 \text{ or } x=-2$$

$\therefore$ x intercepts are $(-6,0)$ 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 $y = x^2 + 8x + 12$

$$\Delta = 8^2 - 4(1)(12)$$

$$= 16$$

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

$$\underline{= (-4, -4)}$$

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

Exercise 3F; 1a, 2adf, 5a, 6, 7, 8, 9ace, 10a, 11, 12b, 14