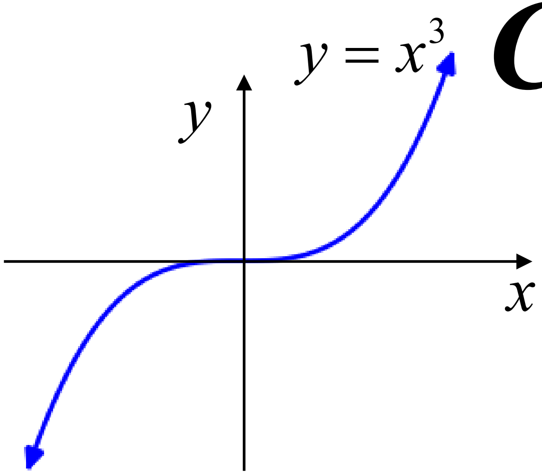
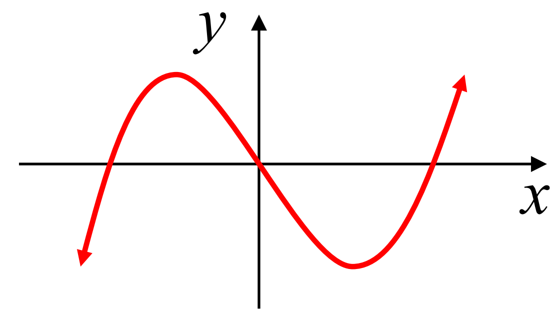
Cubic Function



The **cubic function** has two different basic shapes

The classic shape has a **horizontal point of inflection** and can be factorised into a perfect cube $y = k(x-a)^3$



Otherwise it will be a continuous curve with two **turning points**

Similar to the linear and quadratic functions, all cubic functions can be transformed from the two basic shapes using translations, rotations, reflections or a combination of all three.

Recognising the cubic function

$$y = ax^3 + bx^2 + cx + d$$

power '1' (the y) power '3' (the x^3)

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

Polynomials

The **polynomial function** has many different basic shapes

even

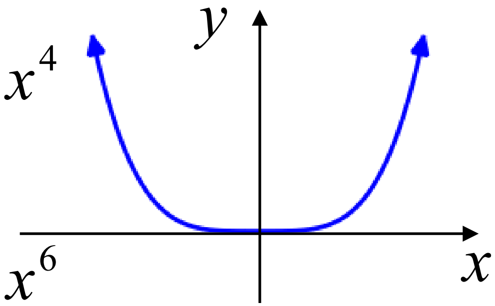
$y = x^4$

⋮

$y = x^6$

⋮

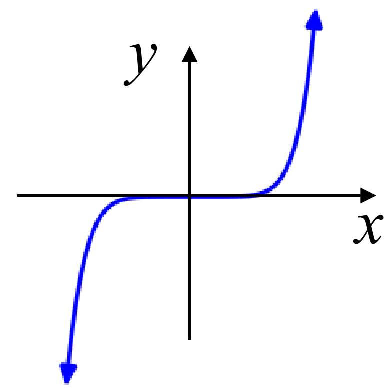
etc



Polynomials that can be factorised down to a single perfect factor

$$y = k(x - a)^n$$

will take on the common basic shape



odd

$y = x^5$

⋮

$y = x^7$

⋮

etc

As power gets bigger, curve gets; - flatter at base

- steeper at the sides

Recognising the polynomial function

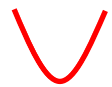
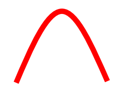
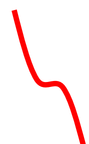
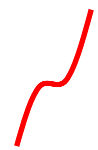
power '1' → powers are + integers

$$y = ax^n + bx^{n-1} + cx^{n-2} + \ldots + k$$

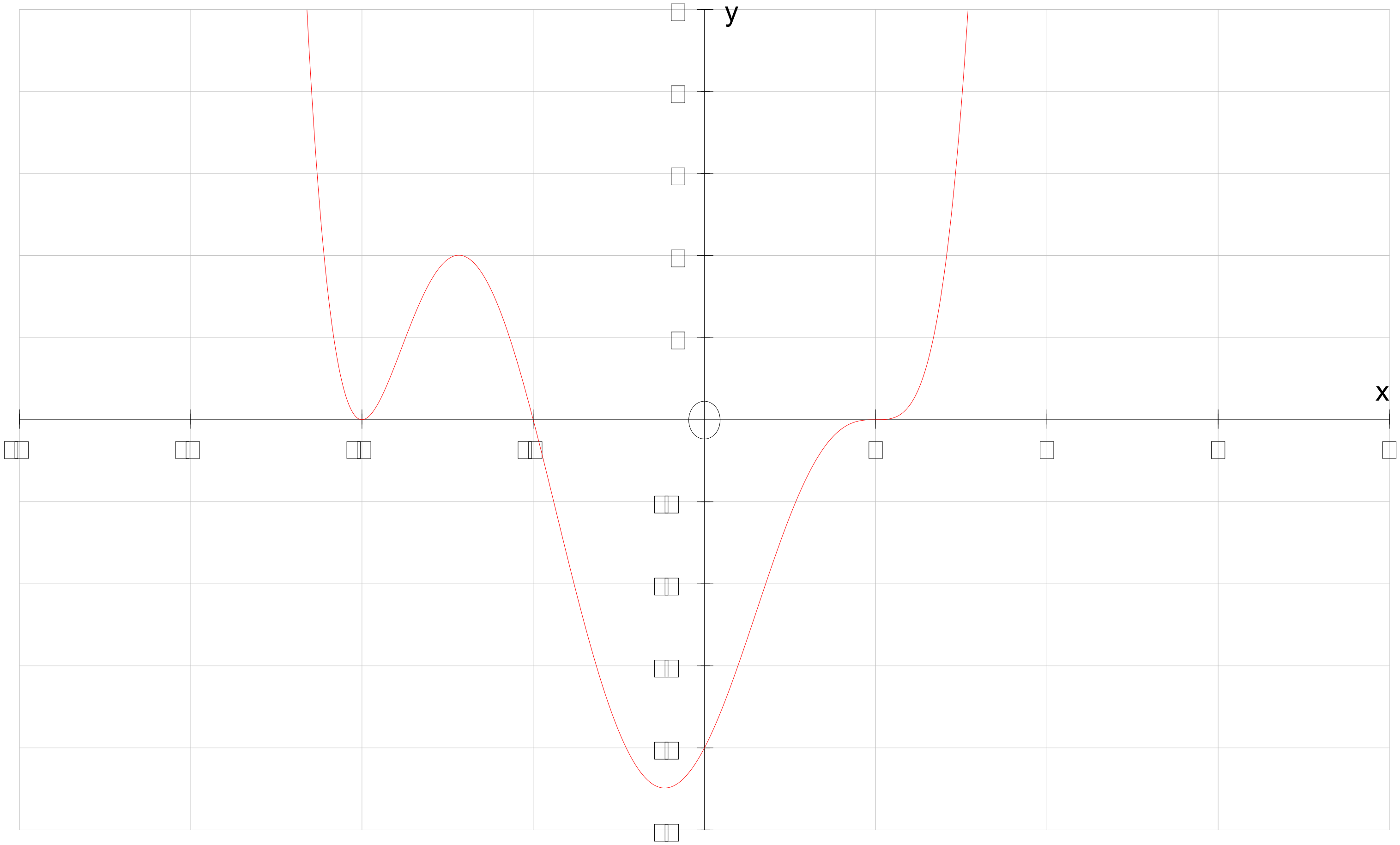
- terms contain at most one variable, one variable is to the power of one, the other variables have **positive integer powers**
- highest power is the **degree** of the polynomial

Sketching Polynomials

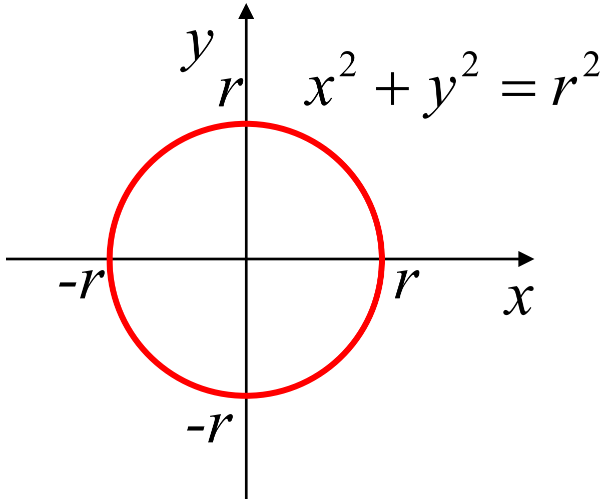
When drawing $y = P(x)$

- y intercept is the constant
- x intercepts are the roots, solve $P(x)=0$
- as $x \to \pm\infty$, $P(x)$ acts like the leading term
- even powered roots look like  or 
- odd powered roots look like  or 

e.g. $y=(x+1)(x-1)^3(x+2)^2$



Circles



Circles **must** be drawn with the **same** scale on both axes

Circles are **not** functions; they are a composite of **two semi-circular functions**

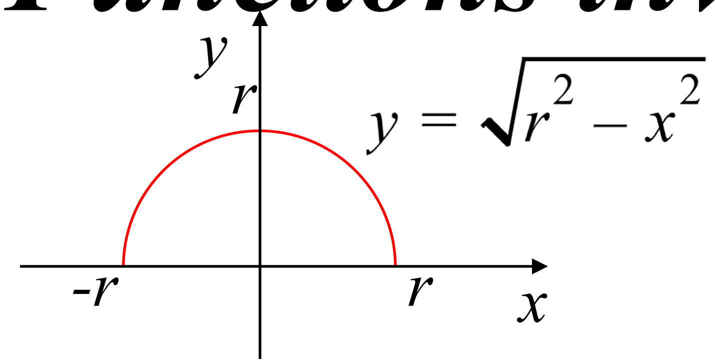
Recognising the circle

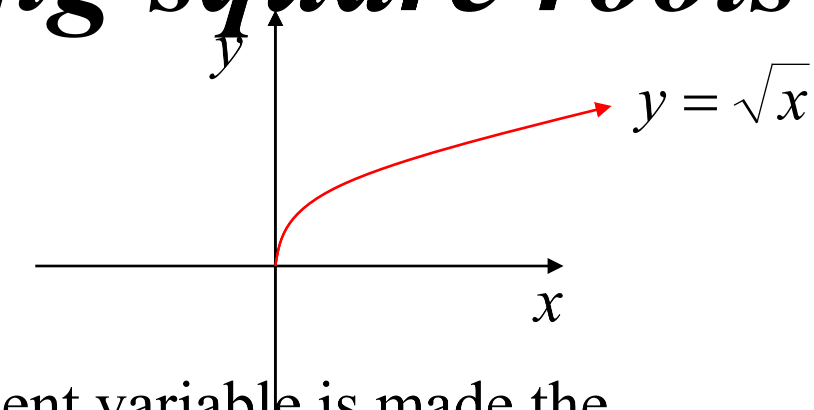
both powers are '2'

$$x^2 + y^2 = r^2$$

- both the independent and dependent variables have a term to the power of two
- the coefficients of the squared variables are the same

Functions involving square roots





Often created when the dependent variable is made the subject of the function

Recognising the shape of functions involving square roots

- if you are unsure, square both sides and the basic shape will be revealed

$$y = \sqrt{r^2 - x^2}$$
$$y^2 = r^2 - x^2$$
$$x^2 + y^2 = r^2$$
$\therefore$ circle

$+\sqrt{\quad}$ means top half

$-\sqrt{\quad}$ means bottom half

$$y = \sqrt{x}$$
$$y^2 = x$$
$\therefore$ parabola

Exercise 3G; 1bd, 2b, 5, 6, 7, 8, 9cd, 13ae, 14, 15, 16, 17ac, 18