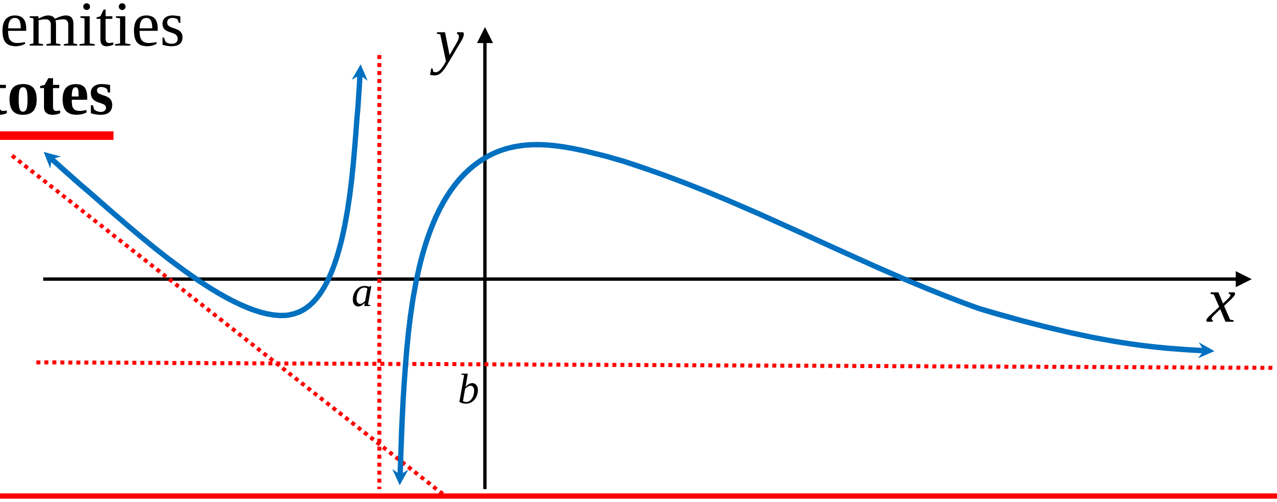
Graphs with Asymptotes

Asymptotes are a geometrical way of describing the behaviour of a function at its extremities

Types of Asymptotes



Vertical asymptotes occur if $\lim_{x \to a} f(x) = \pm\infty$

Functions **do not** touch/cut vertical asymptotes

Horizontal asymptotes occur if $\lim_{y \to \pm\infty} f(x) = b$

Oblique asymptotes occur if $\lim_{x \to \pm\infty} f(x) = \pm\infty$

Notes: oblique asymptotes are straight lines, asymptotes could be any function that approaches infinity

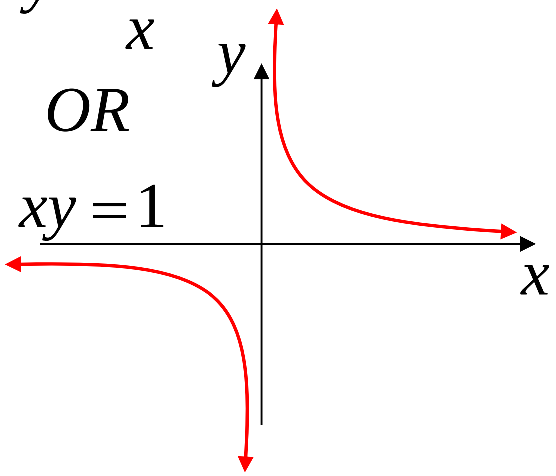
*functions **can** touch/cut horizontal and oblique asymptotes*

Rectangular Hyperbolic Function

$$y = \frac{1}{x}$$

OR

$$xy = 1$$

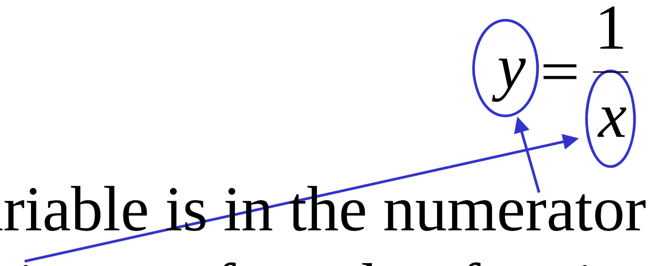


Any data that demonstrates **inverse variation** will lie on a rectangular hyperbola.

Rectangular hyperbolas have two asymptotes that are perpendicular

All rectangular hyperbolas can be transformed from the basic equation $y = \frac{1}{x}$ using translations, rotations, reflections or a combination of all three.

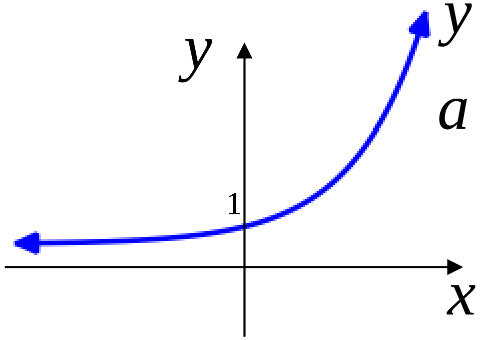
Recognising the hyperbolic function



- one variable is in the numerator of a fraction, the other is in the denominator of another fraction

Exponential Functions

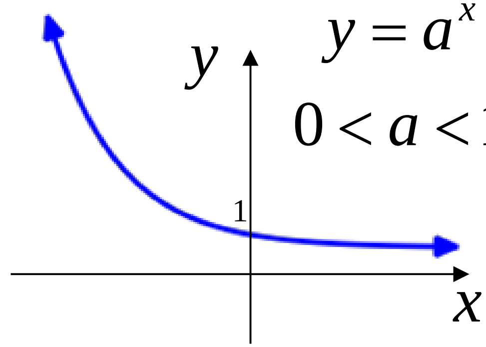
The orientation of the basic **exponential function** is determined by the base



$y = a^x$

$a > 1$

exponentials with a base > 1 start shallow and increase more rapidly as the dependent variable increases



$y = a^x$

$0 < a < 1$

exponentials with a base < 1 start steep and decrease less rapidly as the dependent variable increases

<u>Recognising the exponential function</u>

$$y = a^x$$

- one variable is in the power (or **exponent**)
- the base is positive (not equal to 1)

Exercise 3H; 1, 3, 4, 6, 11, 12, 15b, 16a, 17, 18