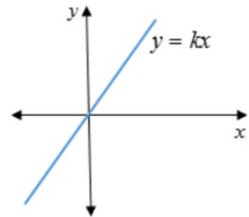## Direct proportion

If two quantities are in direct proportion, **as one increases**, the **other increases** at the **same rate**.

If y is directly proportional to x, this can be written as

$$y \propto x$$

An equation of the form y = kx represents direct proportion, where k **is the constant of proportionality**.

$y = kx$

E.g. p is directly proportional to q and when p = 12, q = 4.
Find p when q = 20.

Write a direct proportion equation: p = kq

Substitute the values given and solve it to find k: 12 = k x 4
so k = 3 and the equation is p = 3q

Now substitute in the value we are given: p = 3 x 20 = 60

What careers would use these skills?

Most jobs in banking and finance, distribution and production, architect, engineer, map maker, baker, nurse, web developer...

Inverse proportion

If two quantities are inversely proportional, **as one increases**, the **other decreases** at the **same rate**.
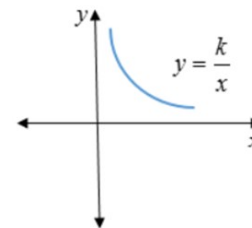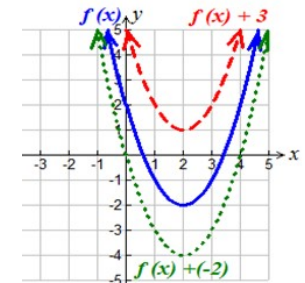
If y is inversely proportional to x, this can be written as

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

An equation of the form

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

represents inverse proportion.

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

Graph transformations

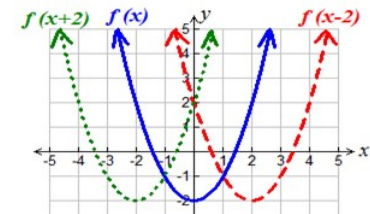$f(x) + a$

Vertical translation up a units.

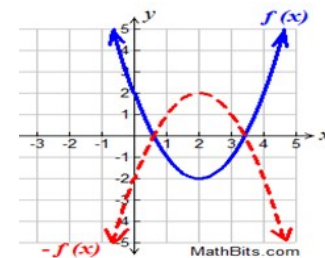$$\begin{pmatrix} 0 \\ a \end{pmatrix}$$

$f(x + a)$

Horizontal translation left a units.
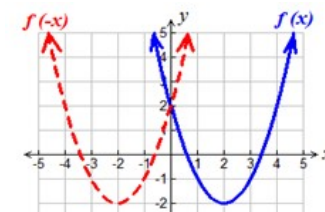
$$\begin{pmatrix} -a \\ 0 \end{pmatrix}$$
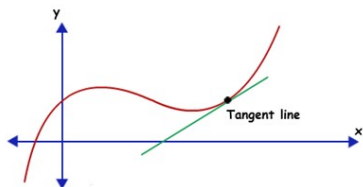

$-f(x)$

Reflection over the x-axis.

$f(-x)$
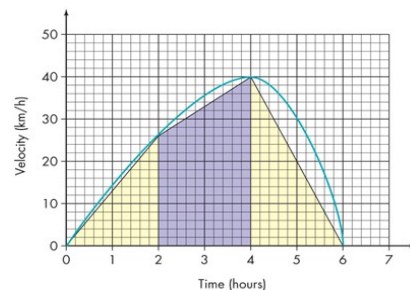
Reflection over the y-axis.

Calculate gradient of a tangent at a point

A tangent to a curve is a straight **line** that **touches** a curve at **exactly one point**.

Tangent line

$$Gradient = \frac{Change\ in\ y}{Change\ in\ x}$$

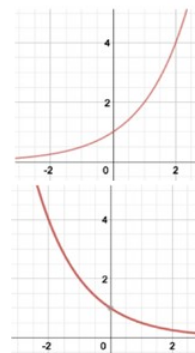## Estimate the area under a non-linear graph

To estimate the area under a curve, **split it up into simpler shapes**; rectangles, triangles and trapeziums.

Exponential graphs

The equation is of the form $y = a^x$, where a is a number called the **base**.

If a > 1, the graph **increases**.

If 0 < a < 1, the graph **decreases**.