

Variation

y varies directly as x (or y is directly proportional to x) $\Rightarrow y = kx$ for some constant k

y varies inversely as x (or y is inversely proportional to x) $\Rightarrow y = k\frac{1}{x}$ for some constant k

y varies jointly as x and z (or y is jointly proportional to both x and z) $\Rightarrow y = kxz$ for some k

y varies jointly as x^2 and z (or y is jointly proportional to both x^2 and z) $\Rightarrow y = kx^2z$ for some k

y is directly proportional to the square of x and inversely proportional to the cube of z

$$\Rightarrow y = k\frac{x^2}{z^3}$$

Examples:

The circumference of a circle is directly proportional to the radius. ($C = 2\pi r$)

The area of a circle is directly proportional to the square of the radius. ($A = \pi r^2$)

The area of a rectangle is jointly proportional to the length and the width. ($A = lw$)

The perimeter of a rectangle is directly proportional to the sum of the length and the width.

$$(P = 2(l + w))$$

The surface area of a cylinder is jointly proportional to the radius and the height. ($S = 2\pi rh$)

The volume of a cylinder is jointly proportional to the height and the square of the radius.

$$(V = \pi r^2 h)$$

The area of a square is directly proportional to the square of the side length. ($A = s^2$)

The perimeter of a square is directly proportional the side length. ($P = 4s$)

The volume of a sphere is directly proportional to the cube of the radius. ($V = \frac{4}{3}\pi r^3$)

The surface area of a sphere is directly proportional to the square of the radius. ($S = 4\pi r^2$)

The volume of a cube is directly proportional to the cube of the side length. ($V = s^3$)

The surface of a cube is directly proportional the square of the side length. ($S = 6s^2$)