

Variation

Direct Variation: **y varies directly as x** (y is directly proportional to x), if there is a nonzero constant k such that

$$y = kx.$$

The number k is called **the constant of variation** or the constant of proportionality

Verbal Phrase	Expression
<i>y varies directly with x</i>	$y = kx$
<i>s varies directly with the square of t</i>	$s = kt^2$
<i>y is directly prop. with the cube of z</i>	$y = kz^3$
<i>u is directly prop. with the sq. rt. of v</i>	$u = k\sqrt{v}$

Direct Variation Statements

1. y **varies directly** as x .
2. y is **directly proportional** to x .
3. $y = kx$ for some nonzero constant m .

NOTE: k is the **constant of variation** or the constant of proportionality.

Example: If $y = 3$ when $x = 2$, find k .

$y = kx$ yields $3 = m(2)$ or $m = 1.5$.

Thus, $y = 1.5x$.

Variation

Direct Variation

Suppose y varies directly as x . If y is 24 when x is 8, find the constant of variation (k) and the direct variation equation.

$$y = kx$$

$$24 = k(8)$$

direct variation equation

$$\frac{24}{8} = k$$

$$y = 3x$$

constant of variation

$$k = 3$$

x	3	5	9	13
y	9	15	27	39

Variation

Inverse Variation: **y varies inversely as x** (y is inversely proportional to x), if there is a nonzero constant k such that

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

The number k is called **the constant of variation** or the constant of proportionality.

Verbal Phrase	Expression
<i>y is inversely proportional with x</i>	$y = \frac{k}{x}$
<i>s varies inversely with the square of t</i>	$s = \frac{k}{t^2}$
<i>y is inversely proportional to z^4</i>	$y = \frac{k}{z^4}$
<i>u varies inversely with the cube.rt. of v</i>	$u = \frac{k}{\sqrt[3]{v}}$

Inverse Variation Statements

1. y **varies inversely** as x .
2. y is **inversely proportional** to x .
3. $y = k / x$ for some nonzero constant k .

NOTE: k is the **constant of variation** or the constant of proportionality.

Example: If $y = 3$ when $x = 2$, find k .

$y = k / x$ yields $3 = k / 2$ or $k = 6$.

Thus, $y = 6 / x$.

Variation

Inverse Variation

Suppose y varies inversely as x . If y is 6 when x is 3, find the constant of variation (k) and the inverse variation equation.

$$6 = \frac{k}{3}$$

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

direct variation equation

$$18 = k$$

$$y = \frac{18}{x}$$

constant of variation

x	3	9	10	18
y	6	2	1.8	1

DIRECT & INVERSE PROPORTION

LITERACY

$\propto$ is a symbol that is short for 'is proportional to'.

Write down the longer meanings to 5 other mathematical symbols.

RESEARCH

If the circumference of a circle is directly proportional to the diameter. What is the constant of proportionality?

Who were the first people to use this constant?

MEMORY

If a is directly proportional to b then

$$a \propto b$$

$$a = kb$$

For some constant k

If x is directly proportional to y then

$$x \propto 1/y$$

$$x = c/y$$

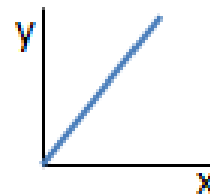
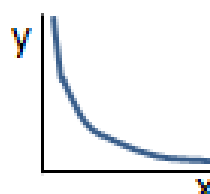
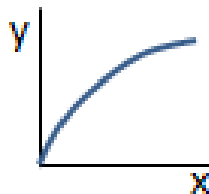
For some constant c

SKILLS PRACTICE

1. P is directly proportional to Q . When P is 5, Q is 15. Write a formula for P in terms of Q .
2. If P is 7, what is Q ?
3. If Q is 10, what is P ?
4. The number of friends (F) at a party, is inversely proportional to the number of slices of cake (S) each receives. 12 Friends are there and they get 4 slices each. Write a formula for F in terms of S .
5. If only 8 friends turn up, how many slices do they get each?
6. If 10 friends turn up, how many slices do they get each?

7. Match the proportions to the graphs..

- (i) $y \propto x$
- (ii) $y \propto 1/x^2$
- (iii) $y \propto \sqrt{x}$



STRETCH

In an experiment, the mass (m) of a mammal was taken after a time (t) that it was born: 1 week, 5 weeks and 15 weeks.

The results are shown in the table.

t	1	5	15
m	1.65	43	381

Which rule fits the best?

- a) $m \propto t$
- b) $m \propto t^2$
- c) $m \propto t^3$