DIRECT AND INVERSE PROPORTIONS

DIRECT VARIATION

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Consider the following table which shows various numbers of books (each of same cost)

denoted by x and the corresponding cost denoted by y.

x (No. of Books)	2	3	5	10	15
y (Cost in Rupees)	15	75	125	250	375

Here, we note that there is an increase in cost corresponding to the increase in the number of books. Hence, it is a case of direct variation.

In this case, if we compare the ratio of different number of books to the corresponding costs, then we have :

	$\frac{2}{50}$,	$\frac{3}{75}$,	$\frac{5}{125}$,	$\frac{10}{250}$,	$\frac{15}{375}$
	\downarrow	\downarrow	\downarrow	\downarrow	\downarrow
or	$\frac{1}{25}$,	$\frac{1}{25}$,	$\frac{1}{25}$,	$\frac{1}{25}$,	$\frac{1}{25}$,

Thus is, each ratio reduces to $\frac{1}{25}$ which is constant. We may express is in a general form as:

$$\frac{x}{y} = k$$
 (constant)

Thus, we conclude that,

When two quantities x and y vary such that the ratio $\frac{x}{y}$ remains constant and positive, then we say that x and y vary directly and the variation is called a Direct Variation. In Mathematical language, it may be written as,

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

or x = ky

Let us consider any two values of x, say x_1 and x_2 with their corresponding values of y as

 y_1 and y_2 . We have

and $x_1 = ky_1$ $x_2 = ky_2$ $\therefore \qquad \frac{x_1}{x_2} = \frac{ky_1}{ky_2}$

or $\frac{x_1}{x_2} = \frac{y_1}{y_2}$,

(i)

which helps us to find the value of any one of x_1 , x_2 , y_1 and y_2 , when other three are known.

Ex.1 If the cost of 15 pens of the same value is \models 600, find the cost of -

(i) 20 pens (ii) 3 pens.

Sol. Let us denote the required cost by x. Now, writing the like terms together, we have :

No. of Pens	Cost in rupees
15	600
20	Х

Ratio of pens = $\frac{15}{20} = \frac{3}{4}$

Ratio of rupees $=\frac{600}{x}$

Since, more pens cost more money, so this is a case of direct variation.

Therefore,
$$\frac{3}{4} = \frac{600}{x}$$

or $3 \times x = 600 \times 4$
or $x = \frac{600 \times 4}{3}$

- or $x = 200 \times 4 = 800$
- \therefore The cost of 20 pens is \neq 800.
- (ii) Again, ratio of pens = $\frac{15}{3} = \frac{5}{1}$

ratio of rupees =
$$\frac{600}{r}$$

$$\therefore \quad \frac{5}{1} = \frac{600}{x}$$

or $5 \times x = 600 \times 1$

or
$$x = \frac{600}{5} = 120$$

- \therefore The cost of 3 pens is $\neq 120$.
- Ex.2 Reema types 540 words during half an hour. How many words would she type in 6 minutes?
- **Sol.** Suppose she types x words in 6 minutes. Then, the given information can be represented in the following tabular form:

Number of words	540	Х
Time (in minutes)	30	6

Since in more time more words can be typed,

it is case of direct variation.

- \therefore Ratio of number of words
- = Ratio of number of minutes

 $\Rightarrow \frac{540}{x} = \frac{30}{6} \qquad \Rightarrow x = \frac{6 \times 540}{30} \qquad \Rightarrow x = 108.$

Hence, she types 108 words in 6 minutes.