# Direct Inverse Proportional

## FUNDAMENTALS

Let 3 pens cost Rs. 9, then 6 pens will cost Rs. is

Clearly. More pens will cost more.

Again, if 2 women can do a piece of work in 7 hours, then 1 woman alone can do it in 14 hours.

Thus, less people at work, more will be the time taken to finish it.

Thus, change in one quantity brings a change in the other.

**Variation: If** two quantities depend upon each other in a way such that the change in one results in a corresponding change in the other, then the two quantities are said to be in variation. This variation may be **direct** (i.e. increase in one quantity leads to increase in other quantity) as illustrated in the example of "cost of pens" above. Variation may also be **indirect** (i.e. increase in one quantity leads to decrease in other quantity) as illustrated in the example of "work done by women" above.

There are many situations in our daily life where the variation in one quantity brings a variation in the other.

**ILLUSTRATIONS:**

(1) More no. of articles will cost more **(Direct Variation)**

(2) More is the number of workers at a work, less is the time taken to complete the work. **(Indirect Variation)**

(3) For a given amount of money deposited in a bank, more is the rate of interest, more is the interest earned upon it in a fixed time period. **(Direct Variation)**

(4) More is the distance covered by train, more will be electricity consumed by it. **(Direct Variation)**

(5) Faster is the speed of train, lesser will be the time taken to cover a given distance. **(Indirect Variation)**

**Direct Proportionality:** Two quantities x and y are said to be in direct proportion if increase / decrease in the value of one variable x, leads to increase / decrease in the value of y, in such a way that the ratio $\frac{x}{y}$ remains constant.

Hence, if x and y are directly proportional, then $\frac{x}{y} = k$, where k is a constant. As x takes the values $(x_1 = x_2 = x_3)$ and y. takes the values. $(y_1, y_2, y_3)$ then,

$$\frac{x_1}{y_1} = \frac{x_2}{y_2} = \frac{x_3}{y_3} = .... = K$$

**Examples (1), (3) and (4) given above are the cases of direct proportion.**

Consider a gas in a closed cylinder such that its volume (V) is kept constant. If you increase the temperature (T) of the gas, then its Pressure (P), which can be measured through a manometer, also increases.

If V= constant; $\frac{P}{T} = k$;

(in the example above, just try to understand $\frac{x_1}{y_1} = \frac{x_2}{y_2} = \frac{x_3}{y_3} = .... = k$ where the analogy for x is Pressure (P) and the analogy for y is temperature (T).

- ☐ See the table on the right side. Column II represent temperature (T) whereas Column III represents pressure (P).
- ☐ Divide each data in Column III by each data in Column II.
- ☐ Check whether you get a Constant, in each case.
- ☐ Report the result to your teacher.

| **Temperature** (°C) | **Temperature * (K)** | **Pressure (kPa)** |
|---|---|---|
| -150 | 173 | 36.0 |
| -100 | 223 | 46.4 |
| -50 | 273 | 56.7 |
| 0 | 323 | 67.1 |
| 50 | 373 | 77.5 |
| 100 | 423 | 88.0 |

***Temperature in Absolute scale** (Value in Column II = Value in Column I+273).

**Inverse Proportional:**

As we saw in examples (2) & (5) on previous page, more is the number of workers, less is the time taken to complete the work and faster is the speed of train, lesser will be the time taken to cover a given distance. **(Both** of **these are examples** of Indirect **Variation).These** are the cases wherein two variables are related in such a way that increasing one, deceases the other and vice versa.

**Inverse proportional:** Two quantities x and y are said to be in inverse proportion if xy = k, where k is a constant. Thus, $x_1y_1 = x_2y_2 = x_3y_3 = ..... = k$.

Consider the gas example again. This time, its temperature (T) is kept constant. Here, analogy for x is Pressure (P) and the analogy for y is Volume (V),

- ☐ If you increase the Pressure (P) of the gas by pressing the top piston, then its Volume (V) will decrease and vice-versa.
- ☐ Pressure, which can be measured though a manometer, also increases. Look at the data below:


**Sample Data from Pressure Volume Measurement**

| Pressure (torr ) | Volume (ml) |
|---|---|
| 760 | 29.0 |
| 960 | 23.0 |
| 1160 | 19.0 |
| 1360 | 16.2 |
| 1500 | 14.7 |
| 150 | 13.3 |

- ☐ Torr is a unit of pressure equivalent to 1 mm of mercury in a barometer.
- ☐ Multiply Pressure (P) and Volume (V);
- ☐ You will find that the product for each set of data is constant.
- ☐ Report and ask what it means from your teacher.