7. Variation

- Two quantities, x and y, are said to be in **direct proportion**, if they increase (or decrease) together in such a manner that the ratio of their corresponding values remains constant. That is, $\frac{x}{y} = k$ where k is a positive number. ,

  For example, price of wheat per kg and the weight of wheat that can be brought are in direct proportion as more the weight of wheat, more will be the cost.

- If y_1, y_2 are the values of y corresponding to the values x_1, x_2 of x respectively then $\frac{x_1}{y_1} = \frac{x_2}{y_2}$ is a case of direct proportion.
- Two variables x and y will be in direct proportion if $\frac{x}{y} = k$ or $x = ky$, where the constant k is known as constant of proportionality of the direct proportion. Thus, to check whether the variables x and y are in direct proportion, we need to find the ratio $\frac{x}{y}$ for their corresponding values. If this ratio remains constant, then the variables are in direct proportion, otherwise they are not.

- Two quantities, x and y, are said to be in **inverse proportion**, if an increase in x causes a proportional decrease in y (and vice-versa) in such a manner that the product of their corresponding values remains constant. That is, $xy = k$, where k is a positive number.
- Two variables x and y will be in inverse proportion if $xy = k$, where the constant k is known as constant of proportionality of the inverse proportion. Thus, to check whether the two variables x and y of a given situation are in inverse proportion or not, we have to calculate the product of the value of variable x with its corresponding value of the variable y. If all these products are equal, then we can say that the variables x and y are in inverse proportion, otherwise not.

  For example, $x = 1$, $y = 20$ and $x = 5$, $y = 4$ are in inverse proportion.

  Here, $1 \times 20 = 20$

  $5 \times 4 = 20$

  It can be seen that $x \times y = 20$, which is constant for both observations.

  Therefore, x and y are in inverse proportion.

- Speed of an object can be calculated using the formula:

  Speed=DistanceTime

- If an object covers equal distances in equal intervals of time, then its speed is said to be **uniform** (or constant), otherwise its speed is said to be **variable**.

- If the speed is given in terms of km/hour, then we can convert it into m/sec as:

  $$\textbf{1 km/hour} = \frac{5}{18}\textbf{m/sec}$$

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  Example:

  A car covers a distance of 3 km in 10 minutes. How much time will it take to travel 24 km?

  Solution:

  $$\text{Speed} = \frac{3\text{ km}}{10\text{ minute}} = \frac{3}{10}\text{km/min}$$

  Now, distance = 24 km

  $$\therefore \text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

  $$= \frac{24\text{ km}}{\frac{3}{10}\text{km/min}}$$

  $$= \frac{24 \times 10}{3}\text{min}$$

  = 80 minutes

  = 1 hour 20 minutes ($\because$ 1 hour = 60 minutes)

  Thus, the time taken by the car to travel 24 km is 1 hour 20 minutes.