Q: Define ratio and give one example. (ALP)

A relation between two quantities of the same kind is called ratio. If a and b are two quantities of the same kind and b is not zero, then ratio of a and b is written as $a:b$ or in fraction $\frac{a}{b}$. For example, if a hockey team wins 4 games and loses 5, then the ratio of the games won to games lost is $4:5$.

OR We define ratio $a:b=\frac{a}{b}$ as the comparison of two alike quantities a and b called the terms of a ratio.

Q: Define proportion. (ALP)

A proportion is a statement, which is expressed as equivalence of two ratios. If two ratio $a:b$ and $c:d$ are equal, then we can write $a:b=c:d$.

OR The equality of two ratios is called proportion. $i.e$ if $a:b=c:d$, then a,b,c and d are said to be in proportion.

Q: Differentiate between antecedent and consequent.

In ratio $a:b$, the first term a is called antecedent and the second term b is called consequent.

Q: Define direct variation. (ALP)

If two quantities are related in such a way that when one quantity **increase** (decrease) the other will also **increase**(decrease), then this variation is called direct variation. If x and y two quantities, then mathematically

$$x \propto y$$
$$x = ky$$
$$\frac{x}{y} = k \qquad k \neq 0$$

For example,

(i) Faster the speed of a car, longer the distance it covers.

(ii) The smaller the radius of the circle, smaller the circumference is.

Q: Define inverse variation. (ALP)

If two quantities are related is such a way that when one quantity **increase**, the other **decrease** is called inverse variation. If x and y two quantities, then mathematically

$$x \propto \frac{1}{y}$$
$$x = \frac{k}{y}$$
$$xy = k \qquad k \neq 0$$

For example,

(i) More speed, less time is taken to cover the same distance.

(ii) Less speed, more time is taken to cover the same distance.

Q: Define joint variation.

A combination of direct and inverse variations of one or more than one variation forms joint variation. If a variable x varies directly as y and varies inversely as z, then $x \propto y$ and $x \propto \frac{1}{z}$. In joint variation, we can write it as

$$x \propto \frac{y}{z}$$

$$x = k\left(\frac{y}{z}\right)$$
$$\frac{xz}{y} = k \qquad k \neq 0$$

Where $k \neq 0$ is constant of variation.

Q: State the theorem of invertendo.

If $a:b = c:d$, then $b:a = d:c$ **OR** If $\frac{a}{b} = \frac{c}{d}$, then $\frac{b}{a} = \frac{d}{c}$

Q: State the theorem of alternando.

If $a:b = c:d$, then $a:c = b:d$ **OR** If $\frac{a}{b} = \frac{c}{d}$, then $\frac{a}{c} = \frac{b}{d}$

Q: State the theorem of componendo.

If $a:b = c:d$, then

(i) $a + b:b = c + d:d$

(ii) $a:a + b = c:c + d$

OR

If $\frac{a}{b} = \frac{c}{d}$, then

(i) $\frac{a+b}{b} = \frac{c+d}{d}$

(ii) $\frac{a}{a+b} = \frac{c}{c+d}$

Q: State the theorem of dividendo.

If $a:b = c:d$, then

(i) $a - b:b = c - d:d$

(ii) $a:a - b = c:c - d$

OR

If $\frac{a}{b} = \frac{c}{d}$, then

(i) $\frac{a-b}{b} = \frac{c-d}{d}$

(ii) $\frac{a}{a-b} = \frac{c}{c-d}$

Q: State the theorem of componendo-dividendo. (ALP)

If $a:b = c:d$, then

(i) $a + b:a - b = c + d:c - d$

(ii) $a - b:a + b = c - d:c + d$

OR

If $\frac{a}{b} = \frac{c}{d}$, then

(i) $\frac{a+b}{a-b} = \frac{c+d}{c-d}$

(ii) $\frac{a-b}{a+b} = \frac{c-d}{c+d}$

Q: State k-method.

If $a:b = c:d$ is a proportion, then each ratio equal to $k.\ i.e$

$$\frac{a}{b} = \frac{c}{d} = k$$

$$\Rightarrow a = bk \text{ and } c = dk$$