Proportion: Proportion says that two ratios (or fractions) are equal.

Example:

$$\frac{1}{3} = \frac{2}{6}$$
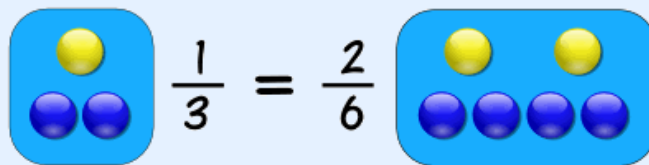
So **1-out-of-3** is equal to **2-out-of-6**

The ratios are the same, so they are in proportion.

Ratio: In mathematics, a ratio indicates how many times one number contains another.

For example, if there are eight oranges and six lemons in a bowl of fruit, then the ratio of oranges to lemons is eight to six (that is, 8:6, which is equivalent to the ratio 4:3).

Similarly, the ratio of lemons to oranges is 6:8 (or 3:4) and the ratio of oranges to the total amount of fruit is 8:14 (or 4:7)

We will discuss here about the different types of ratios:

Successive ratio : Suppose the ratio of ages of son and father $= 15 : 41$ (antecedent: subsequent) and the ratio of the ages of father and grandfather $= 41 : 65$. When two ratios are put together, we get son's age : father's age : grandfather's age $= 15 : 41 : 65$.

This type of ratio is called successive ratio

To convert two ratios into successive ratio, both the antecedent and the subsequent of second ratio are to be multiplied by the subsequent of first ratio and both antecedent and subsequent of first ratio are to be multiplied by antecedent of second ratio.

Example 1. 7 : 5 and 8 : 9 are two ratios. Express them as successive ratio.

Solution : First ratio = 7 : 5

$$= \frac{7}{5}$$

$$= \frac{7 \times \text{⑧}}{5 \times \text{⑧}} = \frac{56}{40}$$

$$= 56 : 40$$

Second ratio $= 8 : 9$

$$= \frac{8}{9}$$

$$= \frac{8 \times \text{⑤}}{9 \times \text{⑤}} = \frac{40}{45}$$

$$= 40 : 45$$

Alternative solution :

first ratio $= 7 : 5 = 7 \times \text{⑧} : 5 \times \text{⑧}$

$$= 56 : 40$$

second ratio $= 8 : 9 = 8 \times \text{⑤} : 9 \times \text{⑤}$

$$= 40 : 45$$

∴ Successive ratio of two ratios is 56 : 40 : 45

Practice work

Express the following ratios as successive ratio:

1. 12 : 17 and 5 : 12
2. 23 : 11 and 7 : 13
3. 19 : 25 and 9 : 17
4. 5 : 8 and 12 : 17

Note:

first quantity: second quantity = third quantity : fourth quantity.

$$\text{or} \quad \frac{\text{first quantity}}{\text{second quantity}} = \frac{\text{third quantity}}{\text{fourth quantity}}$$

or first quantity × fourth quantity = second quantity × third quantity

Example 2. Determine the fourth proportional of 3, 6, 7.

Solution : Here, the first quantity is 3, the second quantity is 6 and the third quantity is 7

We know that,

first quantity × fourth quantity = second quantity × third quantity

∴ 　　　3 × fourth quantity = 6 × 7

$$\text{or fourth quantity} = \frac{\overset{2}{\cancel{6}} \times 7}{\underset{1}{\cancel{3}}} \quad \text{or, } 14$$

The required fourth proportional is 14

Practice work

Determine the fourth proportional of the following quantities

1).7,5,10

2).15,25,33

3).16,24,32

4). 8,7,14

Compounded ratio: For two or more ratios, if we take antecedent as product of antecedents of the ratios and consequent as product of consequents of the ratios, then the ratio thus formed is called mixed or compound ratio. As, compound ratio of m: n and p: q is mp : nq.

In other words,

When two or more ratios are multiplying term wise; the ratio thus obtained is called compound ratio.

For example:

The compounded ratio of the two ratios a: b and c: d is the ratio ac: bd, and that of a: b, c: d.

Three quantities are said to be in continued proportion if the ratio of the first term and second term be equal to the ratio of the second term and third term.

Suppose, the three quantities x, y and z are said to be in continued proportion if x: y = y: z

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

Or, y^2 = x×z

This is, multiplication of first and third quantities is equal to the square of second quantity

Fill in the gaps

9:18::25:■

or, $\dfrac{9}{18} = \dfrac{25}{■}$

or, 9× ■=25× 18

or,■ $= \dfrac{25×18}{9}$

or,■ = 50(Answer)

Practice work

Fill in the gaps :

(a) 11 : 25 :: ☐ : 50   (b) 7 : ☐ :: 8 : 64   (c) 2·5 : 5·0 :: 7 : ☐

(d) $\dfrac{1}{3} : \dfrac{1}{5}$ :: ☐ : $\dfrac{7}{10}$ (e) ☐ : 12·5 :: 5 : 25