

# PERCENTAGE

## Percentage

'Per cent' means 'per hundred'. It is given by % symbol. Here  $x\%$  means  $x$  per hundred or  $\frac{x}{100}$ . Thus, any percentage can be converted into an equivalent fraction by dividing it by 100.

eg  $20\% = \frac{20}{100} = \frac{1}{5}$ ;  $150\% = \frac{150}{100} = \frac{3}{2}$

Also, any fraction or decimal can be converted into its equivalent percentage by multiplying with 100.

eg  $\frac{1}{5} = \frac{1}{5} \times 100 = 20\%$ ;  $\frac{3}{2} = \frac{3}{2} \times 100 = 150\%$ .

## Important Formulae

1. Percentage increase =  $\frac{\text{Increase}}{\text{Original value}} \times 100$

2. Percentage decrease =  $\frac{\text{Decrease}}{\text{Original value}} \times 100$

3. If the price of the commodity increases by  $r\%$  then the reduction in consumption so as not to increase the expenditure is  $\left[ \frac{r}{100+r} \times 100 \right] \%$

4. If the price of the commodity decreases by  $r\%$  then the reduction in consumption so as not to increase the expenditure is  $\left[ \frac{r}{100-r} \times 100 \right] \%$

5. If  $A$ 's income is  $r\%$  more than  $B$ 's income then  $B$ 's income is less than  $A$ 's income by  $\left[ \frac{r}{100+r} \times 100 \right] \%$ .

6. If  $A$ 's income is  $r\%$  less than  $B$ 's income then  $B$ 's income is more than  $A$ 's income by  $\left[\frac{r}{100-r} \times 100\right]\%$ .

7. Let the population of a town be  $P$  and it increases at the rate of  $r\%$  per annum, then

$$(a) \text{ Population after } n \text{ years} = P \left(1 + \frac{r}{100}\right)^n$$

$$(b) \text{ Population } n \text{ years ago} = \frac{P}{\left(1 + \frac{r}{100}\right)^n}$$

8. Let the present value of the machine be  $P$  and if it depreciates at the rate of  $r\%$  per annum.

$$(a) \text{ Value of machine after } n \text{ years} = P \left(1 - \frac{r}{100}\right)^n$$

$$(b) \text{ Value of machine } n \text{ years ago} = \frac{P}{\left(1 - \frac{r}{100}\right)^n}$$

**Example 1:** Express  $3/2$  as rate per cent.

**Solution.**  $\frac{3}{2} = \left(\frac{3}{2} \times 100\right)\% = 150\%$

**Example 2:** Find 25% of 1000.

**Solution.** 25% of 1000 =  $\frac{25}{100} \times 1000 = 250$

**Example 3.** What per cent of 6 is 144?

**Solution.** Required percentage =  $\left(\frac{144}{6} \times 100\right)\% = 2400\%$

**Example 4:** What per cent of 2.5 kg is 15 g?

**Solution.** Required percentage =  $\left(\frac{15}{2.5 \times 1000} \times 100\right)\% = 0.6\%$

**Example 5.** If the price of tea falls by 12%, by how much per cent must a house holder increase its consumption, so as not to decrease its expenditure on tea?

**Solution.** (Short cut method)

$$\begin{aligned} \text{Increase \% in consumption} &= \left\{ \frac{r}{100-r} \times 100 \right\} \% = \left\{ \frac{12}{100-12} \times 100 \right\} \% \\ &= \left( \frac{12}{88} \times 100 \right) \% = \frac{150}{11} \% = 13\frac{7}{11} \% \end{aligned}$$

**Example 6:** The value of a machine depreciates at the rate of 10% per annum. If its present value is 162000, what was the value of the machine 2 year ago?

$$\begin{aligned} \text{Solution. Value of machine 2 year ago} &= \left[ \frac{162000}{\left(1 - \frac{10}{100}\right)^2} \right] = \left( 162000 \times \frac{10}{9} \times \frac{10}{9} \right) \\ &= \text{` } 200000 \end{aligned}$$

**Example 7:** Due to a reduction of 5% in prices of sugar, a man is able to buy 1 kg more for ` 95. Find the original and reduced rate of sugar.

**Solution.** Let the original rate be `  $x$  per kg.

$$\text{Reduced rate} = \text{` } (100 - 5) \times \frac{1}{100} x = \text{` } \frac{95x}{100} \therefore \frac{95}{\frac{95x}{100}} - \frac{95}{x} = 1$$

$$\Rightarrow \frac{5}{x} = 1 \Rightarrow x = 5$$

$\therefore$  Original rate = ` 5 per kg

$$\text{Reduced rate} = \text{` } \left( \frac{19}{20} \times 5 \right) \text{ per kg} = \text{` } \frac{19}{4} = 4.75 \text{ er kg}$$

**Example 8:** If the price of 1 kg cornflakes is increased by 25%, the increase is ` 10. Find the new price of cornflakes per kg.

$$\text{Solution. Original price} = \frac{\text{Difference in price}}{\text{Difference in per cent}} \times 100 = \frac{10}{25} \times 100 = 40$$

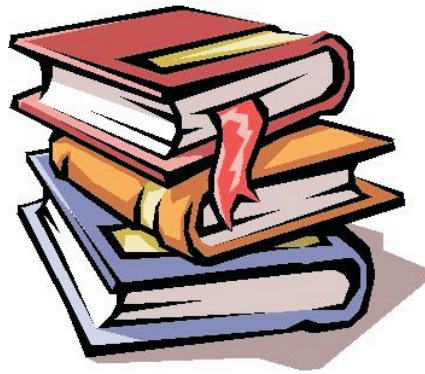
$$\therefore \text{New price} = 40 \times \frac{125}{100} = \text{` } 50$$

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