

OLYMPIAD · EVERYDAY MATHEMATICS · OLYMPIAD PREPARATION · SHORT NOTES

Chapter 10: Percentage

Topic-wise short notes with solved examples

Percent as a fraction of 100, finding a percentage of a quantity, percentage increase and decrease, and successive changes.

1 Percent as a fraction

- **Percent** means "out of 100". 25% means $\frac{25}{100}$.
- To change a fraction to a percent, multiply by 100: $\frac{3}{8} \times 100 = 37.5\%$.
- To change a percent to a fraction or decimal, divide by 100: $40\% = \frac{40}{100} = 0.4$.
- To find $p\%$ of a quantity, multiply: $p\%$ of $N = \frac{p}{100} \times N$.

Fraction	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{4}$	$\frac{1}{5}$	$\frac{1}{6}$	$\frac{1}{8}$	$\frac{1}{10}$
Percent	50%	$33\frac{1}{3}\%$	25%	20%	$16\frac{2}{3}\%$	12.5%	10%

Example 1.1 Find 15% of 240.

SOLUTION

$$\frac{15}{100} \times 240 = 36.$$

36

Example 1.2 A student scores 360 marks out of 450. What is the percentage?

SOLUTION

$$\frac{360}{450} \times 100 = 80.$$

80%

2 Increase and decrease

- **Percentage change** = $\frac{\text{change}}{\text{original value}} \times 100$. Always divide by the **original** value.
- After an increase of $p\%$, the new value is $\left(1 + \frac{p}{100}\right)$ times the old value. After a decrease of $p\%$, it is $\left(1 - \frac{p}{100}\right)$ times.

Example 2.1 The price of a book rises from Rs 50 to Rs 65. Find the percentage increase.

SOLUTION

Change = $65 - 50 = 15$. Percentage = $\frac{15}{50} \times 100$.

30%

Example 2.2 After a 20% decrease, a price is Rs 400. What was the original price?

SOLUTION

The new price is 0.8 times the original. Original = $\frac{400}{0.8}$.

Rs 500

3 Successive changes

- A change of $a\%$ followed by a change of $b\%$ is **not** $(a + b)\%$. Multiply the factors instead.
- The net change is $\left(a + b + \frac{ab}{100}\right)\%$, using a minus sign for a decrease.

Example 3.1 A price is increased by 25% and then decreased by 20%. Find the net change.

SOLUTION

The factors are 1.25 and 0.8, and $1.25 \times 0.8 = 1$.

No change at all

Example 3.2 A population of 20 000 grows by 10% each year. Find the population after 2 years.

SOLUTION

$20\,000 \times 1.1 \times 1.1 = 24\,200$.

24 200

REMEMBER

A 10% increase and then a 10% decrease does not return to the start. $1.1 \times 0.9 = 0.99$, a 1% fall.