

# 6 | Percentage and its Applications

## INTRODUCTION

In class VII, you have learnt about percentage and its applications in simple problems.

In this chapter, we shall learn slightly advanced problems involving applications on percentages, profit and loss, overhead expenses, discount, taxes (sales tax and value added tax VAT).

## PERCENTAGE

The word **percent** means 'per hundred' or out of hundred.

*For example:*

Utkarsh got 95 marks out of hundred marks. It means he got 95 percent marks.

Percent is denoted by symbol % (read as percent).

Thus, 95% means 95 out of hundred =  $\frac{95}{100}$ .

Percentage is the numerator of a fraction with denominator 100.

### Converting a percentage into a fraction

To convert a percentage into a fraction, replace the % sign with  $\frac{1}{100}$  and reduce the fraction to simplest form.

*For example:*

$$(i) 20\% = \frac{20}{100} = \frac{1}{5}$$

$$(ii) 75\% = \frac{75}{100} = \frac{3}{4}$$

### Converting a fraction into a percentage

To convert a fraction into a percentage, multiply the fraction by 100 and put the % sign.

*For example:*

$$(i) \frac{3}{25} = \left(\frac{3}{25} \times 100\right)\% = 12\%$$

$$(ii) \frac{1}{3} = \left(\frac{1}{3} \times 100\right)\% = 33\frac{1}{3}\%$$

### Converting a percentage into a ratio

To convert a percentage into a ratio, first convert the given percentage into a fraction in simplest form and then to a ratio.

*For example:*

$$(i) 28\% = \frac{28}{100} = \frac{7}{25} = 7 : 25$$

$$(ii) 66\frac{2}{3}\% = \frac{200}{3}\% = \frac{200}{3} \times \frac{1}{100} = \frac{2}{3} = 2 : 3$$

## Converting a ratio into a percentage

To convert a ratio into a percentage, first convert the given ratio into a fraction and then to a percentage.

**For example:**

$$(i) 1 : 4 = \frac{1}{4} = \left(\frac{1}{4} \times 100\right)\% = 25\%$$

$$(ii) 3 : 8 = \frac{3}{8} = \left(\frac{3}{8} \times 100\right)\% = \frac{75}{2}\% = 37.5\%$$

## Converting a percentage into a decimal

To convert a percentage into a decimal, first convert the percentage into fraction by replacing % sign with  $\frac{1}{100}$ , then convert the fraction to decimal.

**For example:**

$$(i) 36\% = \frac{36}{100} = 0.36$$

$$(ii) 78.5\% = \frac{78.5}{100} = 0.785$$

## Converting a decimal into a percentage

To convert a decimal into a percentage, multiply the decimal by 100 and put % sign.

**For example:**

$$(i) 0.75 = (0.75 \times 100)\% = 75\%$$

$$(ii) 0.026 = (0.026 \times 100)\% = 2.6\%$$

## Finding a percentage of a given quantity

To find a percentage of a given quantity, change the percentage into fraction and multiply by the given quantity.

**For example:**

$$(i) 75\% \text{ of } 12 = \frac{75}{100} \times 12 = \frac{3}{4} \times 12 = 9$$

$$(ii) 14\% \text{ of ₹ } 75 = ₹ \left(\frac{14}{100} \times 75\right) = ₹ \frac{21}{2} = ₹ 10.50$$

■ **Example 1.** In class VIII of a school, girls are 60% of the total number of students. If there are 18 girls in class, find the total number of students and number of boys in the class.

**Solution.** Let the total number of students be  $x$ .

Given 60% of total number of students are girls,

$$\therefore 60\% \text{ of } x = 18$$

$$\Rightarrow \frac{60}{100} \times x = 18$$

$$\Rightarrow x = \frac{18 \times 100}{60} = 30.$$

$$\therefore \text{Total number of students in the class} = 30$$

$$\text{and number of boys in the class} = 30 - 18 = 12.$$

■ **Example 2.** 72% of 25 students are good in Mathematics. How many are not good in Mathematics?

**Solution.** Given, total number of students = 25

and 72% of total students are good in Mathematics.

$$\begin{aligned}\text{So, number of students who are good in Mathematics} &= 72\% \text{ of } 25 \\ &= \frac{72}{100} \times 25 = 18\end{aligned}$$

$$\therefore \text{Number of students who are not good in Mathematics} = 25 - 18 = 7$$

Hence, 7 students are not good in Mathematics.

## Expressing one quantity as percentage of other quantity

$$\text{Percentage} = \left( \frac{\text{one quantity}}{\text{other quantity}} \times 100 \right) \%$$

Note that both quantities must be of same kind (in same units).

■ **Example 3.** Express

- (i) 150 g as a percentage of 6 kg.
- (ii) 20 paise as a percentage of 4 rupees.
- (iii) 36 seconds as a percentage of 8 minutes.

**Solution.**

$$(i) \text{ 6 kg} = (6 \times 1000) \text{ g} = 6000 \text{ g}$$

$$\therefore \text{Required percentage} = \left( \frac{150}{6000} \times 100 \right) \% = \frac{15}{6} \% = \frac{5}{2} \% = 2.5\%$$

$$(ii) \text{ 4 rupees} = (4 \times 100) \text{ paise} = 400 \text{ paise}$$

$$\therefore \text{Required percentage} = \left( \frac{20}{400} \times 100 \right) \% = 5\%$$

$$(iii) \text{ 8 minutes} = (8 \times 60) \text{ seconds} = 480 \text{ seconds}$$

$$\therefore \text{Required percentage} = \left( \frac{36}{480} \times 100 \right) \% = \frac{15}{2} \% = 7.5\%$$

## Finding increase/decrease percentage

$$\text{Percentage increase} = \left( \frac{\text{increase in value}}{\text{original value}} \times 100 \right) \%$$

$$\text{Percentage decrease} = \left( \frac{\text{decrease in value}}{\text{original value}} \times 100 \right) \%$$

■ **Example 4.** The price of a scooter was ₹ 34000 last year. This year its price is ₹ 40800. Find the percentage increase or decrease in price.

**Solution.** The price has increased from ₹ 34000 to ₹ 40800

$$\text{Original price} = ₹ 34000$$

$$\text{Increase in price} = ₹ 40800 - ₹ 34000 = ₹ 6800$$

$$\begin{aligned}\therefore \text{Percentage increase} &= \left( \frac{\text{increase in price}}{\text{original price}} \times 100 \right) \% \\ &= \left( \frac{6800}{34000} \times 100 \right) \% = 20\%\end{aligned}$$

## Finding a quantity whose percentage is given

If certain percent of a quantity is given, then to find the quantity:

Let  $x\%$  of a quantity be  $y$ , then

$$\frac{x}{100} \text{ of the quantity} = y \Rightarrow \text{required quantity} = \frac{y}{x} \times 100$$

$$\text{Thus, if } x\% \text{ of a quantity is } y, \text{ then quantity} = \frac{y}{x} \times 100$$

## Finding increased/decreased quantity

If a quantity increases by  $x\%$ , then

$$\begin{aligned} \text{new quantity} &= \text{original quantity} + \text{increase in the quantity} \\ &= \text{original quantity} + x\% \text{ of original quantity} \\ &= \text{original quantity} + \frac{x}{100} \text{ of original quantity} \\ &= \left(1 + \frac{x}{100}\right) \text{ of original quantity} \end{aligned}$$

*Thus, if a quantity increases by  $x\%$ , then new quantity =  $\left(1 + \frac{x}{100}\right)$  of original quantity.*

If a quantity decreases by  $x\%$ , then

$$\begin{aligned} \text{new quantity} &= \text{original quantity} - \text{decrease in the quantity} \\ &= \text{original quantity} - x\% \text{ of original quantity} \\ &= \text{original quantity} - \frac{x}{100} \text{ of original quantity} \\ &= \left(1 - \frac{x}{100}\right) \text{ of original quantity} \end{aligned}$$

*Thus, if a quantity decreases by  $x\%$ , then new quantity =  $\left(1 - \frac{x}{100}\right)$  of original quantity.*

### ■ Example 5.

- (i) If 9.5% of a number is 76, find the number.  
 (ii) Increase the number 240 by 15%.  
 (iii) Decrease the number 275 by 8%.

### Solution.

- (i) Let the required number be  $x$ .

According to the given condition, 9.5% of  $x = 76$

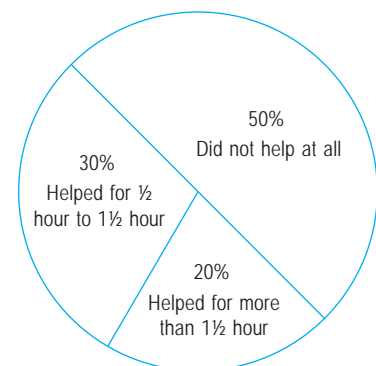
$$\Rightarrow \frac{9.5}{100} \times x = 76 \Rightarrow \frac{95}{1000} \times x = 76 \Rightarrow x = \frac{76 \times 1000}{95} = 800$$

Hence, the required number is 800.

$$\begin{aligned} \text{(ii) New number} &= \left(1 + \frac{15}{100}\right) \times 240 && \left[\left(1 + \frac{x}{100}\right) \text{ of original}\right] \\ &= \frac{115}{100} \times 240 = \frac{23}{20} \times 240 = 276 \end{aligned}$$

$$\begin{aligned} \text{(iii) New number} &= \left(1 - \frac{8}{100}\right) \times 275 && \left[\left(1 - \frac{x}{100}\right) \text{ of original}\right] \\ &= \frac{92}{100} \times 275 = \frac{23}{25} \times 275 = 253. \end{aligned}$$

■ **Example 6.** In a primary school, the parents were asked about the number of hours they spend per day in helping their children to do home work. There are 90 parents who helped for  $\frac{1}{2}$  hour to  $1\frac{1}{2}$  hours. The distribution of the number of parents who helped their children is given in the adjoining figure; 20% helped for more than  $1\frac{1}{2}$  hours per day; 30% helped for  $\frac{1}{2}$  hour to  $1\frac{1}{2}$  hours; 50% did not help at all.



## Exercise 6.1

- Express the following percentages as fractions :
  - 356%
  - $2\frac{1}{2}\%$
  - $16\frac{2}{3}\%$
  - 0.04%
- Express the following fractions as percentages :
  - $\frac{3}{2}$
  - $\frac{9}{20}$
  - $1\frac{1}{4}$
  - $2\frac{1}{3}$
- Express the following fractions as decimals. Then express the decimals as percentages :
  - $\frac{3}{4}$
  - $\frac{5}{8}$
  - $\frac{3}{16}$
  - $\frac{7}{80}$
- Express the following fractions as decimals correct to four decimal places. Then express the decimals as percentages :
  - $\frac{2}{3}$
  - $\frac{5}{6}$
  - $\frac{4}{7}$
  - $2\frac{2}{9}$
- Express the following ratios as percentages :
  - 17 : 20
  - 13 : 18
  - 93 : 80
- Express the following percentages as decimals :
  - 20%
  - 2%
  - $3\frac{1}{4}\%$
  - 0.07%
- Find the value of :
  - 27% of ₹ 50
  - $10\frac{2}{3}\%$  of 15 m
  - $6\frac{1}{4}\%$  of 25 kg
  - 0.8% of 390
- What percent is :
  - 10 of 40
  - 300 g of 2 kg
  - ₹ 7.50 of ₹ 6
  - $\frac{1}{3}$  of  $\frac{2}{9}$ ?
- What percent of :
  - 25 is 5
  - 50 kg is 65 kg
  - ₹ 9 is ₹ 4?
- If 6% of a number is 36, find the number.
  - If  $16\frac{2}{3}\%$  of a number is 25, find the number.
  - If 13.25% of a number is 159, find the number.
- Increase the number 60 by 30%.
  - Decrease the number 750 by 10%.
- What number when increased by 15% becomes 299?
  - On decreasing a number by 18%, it becomes 697. Find the number.
- Jaya saves 23% of her monthly salary. If her expenditure per month is ₹ 9702, find her salary.
- Mr. Khanna spent 83% of his salary and saved ₹ 1870. Calculate his monthly salary.
- In a school, 38% of the students are girls. If the number of boys is 1023, find the total strength of the school.
- The price of an article increases from ₹ 960 to ₹ 1080. Find the percentage increase in the price.
- Three candidates in a school election got 146, 294 and 360 votes each. What percentage of the votes did the winner receive?
- In a straight contest, the loser polled 42% votes and lost by 14400 votes. Find the total number of votes polled. If the total number of eligible voters was 1 lakh, find what percentage of voters did not vote.