

## Chapter 8

# PROFIT AND LOSS

In the previous class, you have learnt about cost price, selling price, profit, loss, profit and loss percentage, marked price, discount and discount percentage. We also solved some real life problems involving these concepts. In this chapter, we shall review and strengthen these basic ideas and solve a few tougher problems.

## PROFIT AND LOSS

**Cost price.** The price at which an article is purchased by a dealer is called its **cost price** (C.P.).

**Selling price.** The price at which an article is sold by a dealer is called its **selling price** (S.P.).

**Profit.** If the selling price of an article is more than its cost price, then the dealer makes a profit and

$$\text{profit} = \text{selling price} - \text{cost price}$$

**Loss.** If the selling price of an article is less than its cost price, then the dealer suffers a loss and

$$\text{loss} = \text{cost price} - \text{selling price}$$

In solving problems on profit and loss, remember the following :

□ Profit = S.P. - C.P.

□ Loss = C.P. - S.P.

□ Profit percentage =  $\left( \frac{\text{profit}}{\text{cost price}} \times 100 \right) \%$

□ Loss percentage =  $\left( \frac{\text{loss}}{\text{cost price}} \times 100 \right) \%$

□ If there is a profit of  $p\%$ , then

$$\text{S.P.} = \text{C.P.} + \text{profit} = \text{C.P.} + p\% \text{ of C.P.}$$

$$= \text{C.P.} + \frac{p}{100} \text{ of C.P.} = \left( 1 + \frac{p}{100} \right) \text{ of C.P.}$$

$$\text{Thus, S.P.} = \left( 1 + \frac{p}{100} \right) \text{ of C.P.}$$

□ If there is a loss of  $l\%$ , then

$$\text{S.P.} = \text{C.P.} - \text{loss} = \text{C.P.} - l\% \text{ of C.P.}$$

$$= \text{C.P.} - \frac{l}{100} \text{ of C.P.} = \left( 1 - \frac{l}{100} \right) \text{ of C.P.}$$

$$\text{Thus, S.P.} = \left( 1 - \frac{l}{100} \right) \text{ of C.P.}$$

□ If C.P. and S.P. are given for different number of articles, first find C.P. and S.P. of equal number of articles and then calculate profit or loss percentage.

*Formulae*  
*Explain them how to derive*



### Overheads

If an article is purchased for some amount and there are some additional expenses on transportation, labour, commission etc., these are to be included in the cost price. Such expenses are called **overhead expenses** or **overheads**.

#### For example :

If an article is purchased for ₹ 570 and ₹ 30 are spent on its transportation, then the total cost of the article = ₹ 570 + ₹ 30 = ₹ 600. If the dealer sells it for ₹ 645, then his profit = ₹ 645 - ₹ 600 = ₹ 45.

$$\therefore \text{Profit percentage} = \left( \frac{45}{600} \times 100 \right) \% = \frac{15}{2} \% = 7.5\%$$

Thus, overheads (if any) are always added to the original cost to get the total cost, and the profit or loss percentage is calculated on the total cost price.

**Example 1.** John bought a watch for ₹ 540 and sold it for ₹ 585. Find his profit and profit percentage.

#### Solution.

C.P. of the watch = ₹ 540, S.P. of the watch = ₹ 585

Profit = S.P. - C.P. = ₹ 585 - ₹ 540 = ₹ 45

$$\begin{aligned} \text{Profit percentage} &= \left( \frac{\text{profit}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{45}{540} \times 100 \right) \% \\ &= \frac{100}{12} \% = \frac{25}{3} \% = 8\frac{1}{3} \% \end{aligned}$$

**Example 2.** By selling a bike for ₹ 22464, Ansari incurs a loss of ₹ 1536. Find his loss percentage.

#### Solution.

S.P. of the bike = ₹ 22464, loss = ₹ 1536

$\therefore$  C.P. of the bike = S.P. + loss = ₹ 22464 + ₹ 1536 = ₹ 24000

$$\begin{aligned} \text{Loss percentage} &= \left( \frac{\text{loss}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{1536}{24000} \times 100 \right) \% \\ &= \frac{1536}{240} \% = \frac{64}{10} \% = 6.4\% \end{aligned}$$

**Example 3.** Bijoy bought bananas at the rate of 5 for ₹ 4 and sold them at the rate of 4 for ₹ 5. Calculate

(i) his gain percent.

(ii) the number of bananas he should sell to earn a profit of ₹ 90.

#### Solution.

(i) C.P. of 5 bananas = ₹ 4

$$\text{C.P. of 1 banana} = ₹ \frac{4}{5} = ₹ 0.80$$

S.P. of 4 bananas = ₹ 5

$$\text{S.P. of 1 banana} = ₹ \frac{5}{4} = ₹ 1.25$$

$\therefore$  Gain on the sale of one banana

$$= \text{S.P.} - \text{C.P.} = ₹ 1.25 - ₹ 0.80 = ₹ 0.45$$

$$\therefore \text{Gain percentage} = \left( \frac{\text{profit}}{\text{C.P.}} \times 100 \right) \%$$

$$= \left( \frac{0.45}{0.80} \times 100 \right) \% = \left( \frac{45}{80} \times 100 \right) \%$$

$$= \frac{225}{4} \% = 56.25\%$$



$$\begin{aligned}
 \text{(ii) Number of bananas to be sold} &= \frac{\text{total profit}}{\text{profit on one banana}} \\
 &= \frac{\text{₹ } 90}{\text{₹ } 0.45} = \frac{90}{0.45} = 200.
 \end{aligned}$$

**Example 4.**

A fruit-vendor buys certain number of oranges. If the selling price of 6 oranges is equal to the cost price of 5 oranges, find his profit or loss percentage.

**Solution.**

Let the cost price of one orange be ₹  $x$ , then

$$\text{C.P. of 5 oranges} = ₹ 5x$$

It is given that S.P. of 6 oranges = C.P. of 5 oranges

$$\therefore \text{S.P. of 6 oranges} = ₹ 5x$$

$$\therefore \text{S.P. of one orange} = ₹ \frac{5x}{6}$$

As the cost price of one orange is ₹  $x$  and the selling price of one orange is ₹  $\frac{5x}{6}$ , the fruit-vendor suffers a loss.

$$\text{His loss on selling one orange} = ₹ x - ₹ \frac{5x}{6} = ₹ \frac{6x - 5x}{6} = ₹ \frac{x}{6}$$

$$\begin{aligned}
 \therefore \text{Loss percentage} &= \left( \frac{\text{loss}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{\frac{x}{6}}{x} \times 100 \right) \% \\
 &= \frac{100}{6} \% = \frac{50}{3} \% = 16\frac{2}{3} \%.
 \end{aligned}$$

**Example 5.**

A cloth merchant on selling 33 metres of cloth obtains a profit equal to the selling price of 11 metres of the same cloth. Find his profit percentage.

**Solution.**

Let the S.P. of 1 metre cloth be ₹  $x$ , then

$$\text{S.P. of 33 m cloth} = ₹ 33x$$

It is given that profit on selling 33 m cloth = S.P. of 11 m cloth = ₹  $11x$

$$\begin{aligned}
 \therefore \text{C.P. of 33 m cloth} &= \text{S.P. of 33 m cloth} - \text{profit on selling 33 m cloth} \\
 &= ₹ 33x - ₹ 11x = ₹ 22x
 \end{aligned}$$

$$\text{Profit percentage} = \left( \frac{\text{profit}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{11x}{22x} \times 100 \right) \% = 50\%.$$

**Example 6.**

Harpal bought a camera for ₹ 1280. Find its selling price if it is sold at

(i) 15% profit

(ii) 10% loss.

**Solution.**

C.P. of the camera = ₹ 1280

(i) If the camera is sold at 15% profit, then

$$\begin{aligned}
 \text{S.P.} &= \left( 1 + \frac{15}{100} \right) \text{ of ₹ } 1280 & \left| \text{S.P.} = \left( 1 + \frac{p}{100} \right) \text{ of C.P.} \right. \\
 &= ₹ \left( \frac{115}{100} \times 1280 \right) = ₹ 1472.
 \end{aligned}$$

(ii) If the camera is sold at 10% loss, then

$$\begin{aligned}
 \text{S.P.} &= \left( 1 - \frac{10}{100} \right) \text{ of ₹ } 1280 & \left| \text{S.P.} = \left( 1 - \frac{l}{100} \right) \text{ of C.P.} \right. \\
 &= ₹ \left( \frac{90}{100} \times 1280 \right) = ₹ 1152.
 \end{aligned}$$



**Example 7.**

Kirpal bought a certain number of apples at ₹ 75 per score and sold them at a profit of 40%. Find the selling price per apple.

**Solution.**

C.P. of one score *i.e.* 20 apples = ₹ 75, profit = 40%

$$\therefore \text{S.P. of 20 apples} = \left(1 + \frac{40}{100}\right) \text{ of } ₹ 75 \quad \left| \text{S.P.} = \left(1 + \frac{p}{100}\right) \text{ of C.P.} \right.$$

$$= ₹ \left(\frac{140}{100} \times 75\right) = ₹ 105$$

$$\therefore \text{S.P. of one apple} = ₹ \frac{105}{20} = ₹ \frac{21}{4} = ₹ 5.25.$$

**Example 8.**

By selling a fan for ₹ 649, Anil earns a profit of 18%. Find its cost price.

**Solution.**

S.P. of the fan = ₹ 649, profit = 18%, C.P. = ?

$$\therefore ₹ 649 = \left(1 + \frac{18}{100}\right) \text{ of C.P.} \quad \left| \text{S.P.} = \left(1 + \frac{p}{100}\right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ 649 = \frac{118}{100} \text{ of C.P.}$$

$$\Rightarrow \text{C.P.} = ₹ \left(649 \times \frac{100}{118}\right) = ₹ 550$$

Hence, the cost price of the fan = ₹ 550.

**Example 9.**

By selling a chair for ₹ 391, Ali suffers a loss of 15%. Find its cost price.

**Solution.**

S.P. of the chair = ₹ 391, loss = 15%

$$\therefore ₹ 391 = \left(1 - \frac{15}{100}\right) \text{ of C.P.} \quad \left| \text{S.P.} = \left(1 - \frac{l}{100}\right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ 391 = \frac{85}{100} \text{ of C.P.}$$

$$\Rightarrow \text{C.P.} = ₹ \left(391 \times \frac{100}{85}\right) = ₹ (23 \times 20) = ₹ 460$$

Hence, the cost price of the chair = ₹ 460.

**Example 10.**

David sells two calculators for ₹ 1500 each. He earns a profit of 25% on one and suffers a loss of 25% on the other. Find his total profit or loss on the whole deal. Also calculate it as a percentage.

**Solution.**

*For the first calculator :*

S.P. = ₹ 1500, profit = 25%, C.P. = ?

$$\therefore ₹ 1500 = \left(1 + \frac{25}{100}\right) \text{ of C.P.} \quad \left| \text{S.P.} = \left(1 + \frac{p}{100}\right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ 1500 = \frac{125}{100} \text{ of C.P.}$$

$$\Rightarrow \text{C.P.} = ₹ \left(1500 \times \frac{100}{125}\right) = ₹ 1200.$$

*For the second calculator :*

S.P. = ₹ 1500, loss = 25%, C.P. = ?

$$₹ 1500 = \left(1 - \frac{25}{100}\right) \text{ of C.P.} \quad \left| \text{S.P.} = \left(1 - \frac{l}{100}\right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ 1500 = \frac{75}{100} \text{ of C.P.}$$



$$\Rightarrow \text{C.P.} = ₹ \left( 1500 \times \frac{100}{75} \right) = ₹ 2000$$

Thus, total cost price = ₹ 1200 + ₹ 2000 = ₹ 3200

Total selling price = ₹ 1500 + ₹ 1500 = ₹ 3000

$\therefore$  Loss = C.P. - S.P. = ₹ 3200 - ₹ 3000 = ₹ 200

Hence, David suffers a loss of ₹ 200 on the whole deal.

$$\text{Loss percentage} = \left( \frac{\text{loss}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{200}{3200} \times 100 \right) \% = \frac{25}{4} \% = 6.25\%$$

**Example 11.**

On selling a bag for ₹ 704, a shopkeeper suffers a loss of 12%. At what price should he sell it to gain 7.5%?

**Solution.**

S.P. = ₹ 704, loss = 12%, C.P. = ?

$$₹ 704 = \left( 1 - \frac{12}{100} \right) \text{ of C.P.} \quad \left| \text{S.P.} = \left( 1 - \frac{l}{100} \right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ 704 = \frac{88}{100} \text{ of C.P.}$$

$$\Rightarrow \text{C.P.} = ₹ \left( 704 \times \frac{100}{88} \right) = ₹ 800$$

Now C.P. = ₹ 800, gain = 7.5%, New S.P. = ?

$$\text{New S.P.} = \left( 1 + \frac{7.5}{100} \right) \text{ of ₹ 800} \quad \left| \text{S.P.} = \left( 1 + \frac{p}{100} \right) \text{ of C.P.} \right.$$

$$= \left( 1 + \frac{15}{200} \right) \text{ of ₹ 800} = ₹ \left( \frac{215}{200} \times 800 \right) = ₹ 860.$$

**Example 12.**

By selling a table for ₹ 517.50, a shopkeeper gains 12.5%. For how much should he sell it to gain 30%?

**Solution.**

S.P. = ₹ 517.50, gain 12.5%, C.P. = ?

$$₹ 517.50 = \left( 1 + \frac{12.5}{100} \right) \text{ of C.P.} \quad \left| \text{S.P.} = \left( 1 + \frac{p}{100} \right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ 517.50 = \left( 1 + \frac{25}{200} \right) \text{ of C.P.} = \frac{225}{200} \text{ of C.P.}$$

$$\Rightarrow \text{C.P.} = ₹ \left( 517.50 \times \frac{200}{225} \right) = ₹ \left( 517.50 \times \frac{8}{9} \right) = ₹ 460$$

Now C.P. = ₹ 460, gain = 30%, S.P. = ?

$$\text{S.P.} = \left( 1 + \frac{30}{100} \right) \text{ of ₹ 460} \quad \left| \text{S.P.} = \left( 1 + \frac{p}{100} \right) \text{ of C.P.} \right.$$

$$= ₹ \left( 460 \times \frac{130}{100} \right) = ₹ 598.$$

**Example 13.**

A shopkeeper purchased 60 articles at ₹ 150 each. He sold one-third of them at a loss of 6%. At what price each must he sell the remaining articles so as to gain 10% on the whole deal?

**Solution.**

C.P. of each article is ₹ 150

$\therefore$  C.P. of all i.e. 60 articles = ₹ (150 × 60) = ₹ 9000

Desired gain on the whole deal = 10%

$$\text{S.P. of all articles} = \left( 1 + \frac{10}{100} \right) \text{ of ₹ 9000} = ₹ \left( \frac{110}{100} \times 9000 \right) = ₹ 9900$$



$$\text{One-third of all articles} = \frac{1}{3} \times 60 = 20$$

$$\text{C.P. of 20 articles} = ₹(150 \times 20) = ₹3000$$

As these articles are sold at a loss of 6%,

$$\text{S.P. of these articles} = \left(1 - \frac{6}{100}\right) \text{ of } ₹3000 = ₹\left(\frac{94}{100} \times 3000\right) = ₹2820$$

$$\therefore \text{S.P. of the remaining i.e. 40 articles} = ₹9900 - ₹2820 = ₹7080$$

$$\therefore \text{S.P. of each of the remaining articles} = ₹\frac{7080}{40} = ₹177.$$

**Example 14.**

Anu sold a saree to Manu at a gain of 15%. Manu sold it to Banu at a loss of 5%. If Banu paid ₹1311, how much did Anu pay for it?

**Solution.**

Let the amount paid for the saree by Anu be ₹ $x$ .

Since Anu sold the saree to Manu at a gain of 15%,

$$\text{the amount paid by Manu} = \left(1 + \frac{15}{100}\right) \text{ of } ₹x \quad \left| \text{S.P.} = \left(1 + \frac{p}{100}\right) \text{ of C.P.} \right.$$

$$= ₹\frac{115}{100}x = ₹\frac{23}{20}x$$

Since Manu sold the saree to Banu at a loss of 5%,

$$\text{the amount paid by Banu} = \left(1 - \frac{5}{100}\right) \text{ of } ₹\frac{23}{20}x \quad \left| \text{S.P.} = \left(1 - \frac{l}{100}\right) \text{ of C.P.} \right.$$

$$= ₹\left(\frac{95}{100} \times \frac{23}{20}x\right) = ₹\left(\frac{19}{20} \times \frac{23}{20}x\right)$$

$$\text{According to the given condition, } \frac{19}{20} \times \frac{23}{20}x = 1311$$

$$\Rightarrow x = \frac{1311 \times 400}{19 \times 23} = 1200.$$

Hence, the amount paid by Anu for the saree = ₹1200.

**Remark**

At each stage, the selling price of one becomes the cost (buying) price for the other.

**Example 15.**

Manish sold a bicycle at a profit of 10%. Had it been sold for ₹75 more, the profit would have been 16%. Find the cost price of the bicycle.

**Solution.**

Let the cost price of the bicycle be ₹ $x$ . Profit = 10%

$$\text{S.P.} = \left(1 + \frac{10}{100}\right) \text{ of } ₹x \quad \left| \text{S.P.} = \left(1 + \frac{p}{100}\right) \text{ of C.P.} \right.$$

$$= \frac{110}{100} \text{ of } ₹x = ₹\frac{11}{10}x$$

To obtain 16% profit,

$$\text{S.P.} = \left(1 + \frac{16}{100}\right) \text{ of } ₹x = \frac{116}{100} \text{ of } ₹x = ₹\frac{29}{25}x$$

$$\text{According to given information, } \frac{29}{25}x = \frac{11}{10}x + 75$$



$$\Rightarrow \frac{29}{25}x - \frac{11}{10}x = 75 \quad (\text{Multiply both sides by } 50)$$

$$\Rightarrow 58x - 55x = 75 \times 50$$

$$\Rightarrow 3x = 75 \times 50 \quad \Rightarrow x = 25 \times 50 = ₹ 1250$$

Hence, the cost price of the bicycle = ₹ 1250.

**Example 16.** Arbindo sold his watch at 10% loss. If he had sold it for ₹ 54 more, he would have made 8% profit. Find the selling price of the watch.

**Solution.**

Let the selling price of the watch be ₹  $x$ . Loss = 10%

$$\therefore ₹ x = \left(1 - \frac{10}{100}\right) \text{ of C.P.} \quad \left| \text{S.P.} = \left(1 - \frac{l}{100}\right) \text{ of C.P.} \right.$$

$$\Rightarrow ₹ x = \frac{90}{100} \text{ of C.P.} = \frac{9}{10} \text{ of C.P.}$$

$$\Rightarrow \text{C.P.} = ₹ \frac{10}{9}x$$

To make 8% profit,

$$\text{S.P.} = \left(1 + \frac{8}{100}\right) \text{ of C.P.} = \frac{108}{100} \text{ of } ₹ \frac{10}{9}x = ₹ \left(\frac{108}{100} \times \frac{10}{9}x\right) = ₹ \frac{6}{5}x$$

According to given information,  $\frac{6}{5}x = x + 54$

$$\Rightarrow \frac{6}{5}x - x = 54$$

$$\Rightarrow 6x - 5x = 270 \quad \Rightarrow x = 270 \quad (\text{Multiply both sides by } 5)$$

Hence, the selling price of the watch = ₹ 270.

### Exercise 8.1

1. Find the profit or loss percentage, when :

(i) C.P. = ₹ 400, S.P. = ₹ 468

(ii) C.P. = ₹ 580, S.P. = ₹ 536.50

(iii) C.P. = ₹ 13600, S.P. = ₹ 12104

(iv) C.P. = ₹ 1560, S.P. = ₹ 1690

2. By selling an article for ₹ 1636.25, a dealer gains ₹ 96.25. Find his gain percentage.

3. By selling an article for ₹ 770, a man incurs a loss of ₹ 110. Find his loss percentage.

4. Rashida bought 25 dozen eggs at the rate of ₹ 9.60 per dozen. 30 eggs were broken in the transaction and she sold the remaining eggs at one rupee each. Find her gain or loss percentage.

5. A shopkeeper buys 200 bicycles at ₹ 1200 per bicycle. He spends ₹ 30 per bicycle on transportation. He also spends ₹ 4000 on advertising. Then he sells all the bicycles at ₹ 1350 per piece. Find his profit or loss. Also calculate it as a percentage.

6. The cost price of an article is 90% of its selling price. Find his profit percentage.

[Hint. Let S.P. be ₹  $x$ , then C.P. = 90% of ₹  $x = ₹ \frac{9}{10}x$ , Profit = ₹  $\left(x - \frac{9}{10}x\right)$ .]

7. Rao bought notebooks at the rate of 4 for ₹ 35 and sold them at the rate of 5 for ₹ 58. Calculate

(i) his gain percentage.

(ii) the number of notebooks he should sell to earn a profit of ₹ 171.

8. A vendor buys bananas at 4 for a rupee and sells at 3 for a rupee. Find his profit or loss percentage.



9. A vendor buys bananas at 3 for a rupee and sells at 4 for a rupee. Find his profit or loss percentage.
10. A shopkeeper buys a certain number of pens. If the selling price of 5 pens is equal to the cost price of 7 pens, find his profit or loss percentage.
11. Find the selling price, when :
- (i) cost price = ₹ 2360, profit = 8%      (ii) cost price = ₹ 380, loss = 7.5%
- (iii) cost price = ₹ 1440, profit =  $16\frac{2}{3}\%$       (iv) cost price = ₹ 360, loss =  $8\frac{3}{4}\%$ .
12. A dealer bought a number of eggs at ₹ 18 a dozen and sold them at 50% profit. Find the selling price per egg.
13. Mr. Ghosh purchased wrist watches worth ₹ 60000. He sold one-third of them at a profit of 30%, one-third at a profit of 20% and the remaining at a loss of 5%. Calculate his overall profit or loss percentage.
14. Kaliya purchased a cow for ₹ 6000 and a buffalo for ₹ 12000. He sold the buffalo at a profit of 15% and the cow at a loss of 10%. Calculate his overall profit or loss percentage.
15. Salman bought 40 chairs at ₹ 175 each. He sold one-fourth of them at a loss of 8%. At what price each must he sell the remaining chairs so as to gain 10% on the whole deal?
16. The manufacturing price of a T.V. set is ₹ 12000. The company sold it to a dealer at 20% profit and the dealer sold it to a customer at 12.5% profit. Find the price the customer has to pay.
17. Find the cost price, when :
- (i) selling price = ₹ 450, loss = 10%      (ii) selling price = ₹ 690, profit = 15%
- (iii) selling price = ₹ 444, loss = 7.5%      (iv) selling price = ₹ 6077.50, profit =  $6\frac{1}{4}\%$ .
18. Amiya sold two transistors at ₹ 600 each. He made a profit of 50% on one and suffered a loss of 50% on the other. Find his total profit or loss on the whole deal. Also calculate it as a percentage.
19. By selling an almirah for ₹ 3920, a shopkeeper would gain 12%. If it is sold for ₹ 4375, find his gain or loss percentage.
20. When an article is sold for ₹ 30, the profit is 20%. Find the profit percent if the selling price is lowered to ₹ 28.
21. By selling a bicycle at ₹ 1334, a shopkeeper would suffer a loss of 8%. At how much amount should he sell it to make a profit of  $12\frac{1}{2}\%$ ?
22. By selling a tie for ₹ 252, a shopkeeper gains 5%. At what price should he sell the tie to gain 35%?
23. By selling 8 bananas for ₹ 12, a fruit-seller gains 25%. How many bananas did he buy for ₹ 12?
24. A shopkeeper buys some toffees at the rate of 11 for ₹ 10 and also same number of toffees of another brand at the rate of 9 for ₹ 10. If he sells the whole lot at the rate of one rupee per toffee, find his gain or loss on the whole transaction.

[Hint. Let the number of toffees bought of each kind be  $x$ . Then,

$$\text{C.P. of 1st kind of toffees} = ₹ \frac{10x}{11},$$

$$\text{C.P. of 2nd kind of toffees} = ₹ \frac{10x}{9}.$$

$$\text{S.P. of whole lot} = ₹ (1 \times 2x) = ₹ 2x.]$$



25. A shopkeeper sells a sweater at a loss of 5%. If he had sold it for ₹ 260 more, he would have made a profit of 15%. Calculate the purchase price of the sweater.
26. A shopkeeper sells a bag at 12% profit. If he had sold it for ₹ 39 more, he would have made 18% profit. Find the cost price of the bag for the shopkeeper.
27. Janki sold her leather purse at 8% loss. If she had sold it for ₹ 150 more, she would have made 12% profit. Find the selling price of the purse.

## DISCOUNT

Sometimes in order to dispose off old (or damaged) goods or to increase the sales or to attract customers to buy their products, shopkeeper offer goods at reduced prices. You must have seen banners like "Special offer, Huge sale, Discount upto 50%. Rush to avail of lifetime opportunity".

**Discount** means reduction in prices.

**Marked price.** The price printed on an article or written on a slip attached to it is called its **marked price** (abbreviated **M.P.**).

The marked price of an article is also called its **listed** (catalogued or advertised) price.

**Discount.** The amount deducted from the marked price of an article is called **discount** (or **trade discount**).

Usually discount is given as a percentage on the marked price. Thus, by a discount of 12.5%, we mean that the price of the article is to be reduced by 12.5% of the marked price.

**Selling price.** The price of an article after deducting discount from the marked price is called **selling price** or **net price**. It is the price of the article paid by a customer.

Thus,

$$\text{selling price} = \text{marked price} - \text{discount}$$

**In solving problems on discount, remember the following :**

- ❑ Discount is always given on the marked price.
- ❑ Selling price = marked price - discount
- ❑ Discount = marked price - selling price
- ❑ Discount percentage =  $\left( \frac{\text{discount}}{\text{marked price}} \times 100 \right) \%$

- ❑ If the discount is  $d\%$ , then

$$\text{S.P.} = \text{M.P.} - \text{discount} = \text{M.P.} - d\% \text{ of M.P.}$$

$$= \text{M.P.} - \frac{d}{100} \text{ of M.P.} = \left( 1 - \frac{d}{100} \right) \text{ of M.P.}$$

$$\text{Thus, S.P.} = \left( 1 - \frac{d}{100} \right) \text{ of M.P.}$$

- ❑ **Successive discounts.** Suppose a discount of 15% is given on the marked price of an article and further a discount of 5% is given on the reduced price, then we say that two successive discounts are given.

If two successive discounts are  $d_1\%$  and  $d_2\%$ , then

$$\text{S.P.} = \left( 1 - \frac{d_1}{100} \right) \left( 1 - \frac{d_2}{100} \right) \text{ of M.P.}$$



**Example 1.**

A dinner set is marked at ₹ 2600. The shopkeeper offers 10% discount on it. Find the discount and the net price the customer pays.

**Solution.**

Marked price = ₹ 2600, discount = 10%

$$\therefore \text{Amount of discount} = 10\% \text{ of ₹ 2600} = ₹ \left( \frac{10}{100} \times 2600 \right) = ₹ 260$$

$$\text{Net sale price} = \text{M.P.} - \text{discount} = ₹ 2600 - ₹ 260 = ₹ 2340$$

Hence, the customer pays ₹ 2340.

**Example 2.**

A chair is marked at ₹ 480 and is sold for ₹ 440. Find the discount percentage given.

**Solution.**

M.P. of the chair = ₹ 480, S.P. of the chair = ₹ 440

$$\therefore \text{Discount} = \text{M.P.} - \text{S.P.} = ₹ 480 - ₹ 440 = ₹ 40$$

$$\begin{aligned} \text{Discount percentage} &= \left( \frac{\text{discount}}{\text{M.P.}} \times 100 \right) \% = \left( \frac{40}{480} \times 100 \right) \% \\ &= \frac{25}{3} \% = 8\frac{1}{3} \% \end{aligned}$$

**Example 3.**

A dealer is selling an article at a discount of 10% which is marked at ₹ 600, and still he makes 25% profit. Find :

- (i) the selling price (ii) the cost price

**Solution.**

- (i) M.P. = ₹ 600, discount = 10%, S.P. = ?

$$\begin{aligned} \text{S.P.} &= \left( 1 - \frac{10}{100} \right) \text{ of ₹ 600} & \left| \text{S.P.} &= \left( 1 - \frac{d}{100} \right) \text{ of M.P.} \\ &= ₹ \left( \frac{90}{100} \times 600 \right) = ₹ 540 \end{aligned}$$

Hence, the selling price = ₹ 540.

- (ii) S.P. = ₹ 540, profit = 25%, C.P.?

$$\begin{aligned} ₹ 540 &= \left( 1 + \frac{25}{100} \right) \text{ of C.P.} & \left| \text{S.P.} &= \left( 1 + \frac{p}{100} \right) \text{ of C.P.} \\ \Rightarrow ₹ 540 &= \frac{125}{100} \text{ of C.P.} \end{aligned}$$

$$\Rightarrow \text{C.P.} = ₹ \left( 540 \times \frac{100}{125} \right) = ₹ (108 \times 4) = ₹ 432$$

Hence, the cost price = ₹ 432.

**Example 4.**

A shopkeeper purchased a sewing machine for ₹ 1200. He sells it at a discount of 10% and still makes a profit of 8%. Find :

- (i) the selling price (ii) the marked price.

**Solution.**

- (i) C.P. = ₹ 1200, profit = 8%, S.P. = ?

$$\begin{aligned} \text{S.P.} &= \left( 1 + \frac{8}{100} \right) \text{ of ₹ 1200} & \left| \text{S.P.} &= \left( 1 + \frac{p}{100} \right) \text{ of C.P.} \\ &= ₹ \left( \frac{108}{100} \times 1200 \right) = ₹ 1296 \end{aligned}$$

Hence, the selling price of the machine = ₹ 1296.

- (ii) S.P. = ₹ 1296, discount = 10%, M.P. = ?

$$₹ 1296 = \left( 1 - \frac{10}{100} \right) \text{ of M.P.} \quad \left| \text{S.P.} = \left( 1 - \frac{d}{100} \right) \text{ of M.P.} \right.$$



$$\Rightarrow ₹ 1296 = \frac{90}{100} \text{ of M.P.} = \frac{9}{10} \text{ of M.P.}$$

$$\Rightarrow \text{M.P.} = ₹ \left( 1296 \times \frac{10}{9} \right) = ₹ (144 \times 10) = ₹ 1440$$

Hence, the marked price of the machine = ₹ 1440.

**Example 5.**

A dealer buys a bicycle for ₹ 1250 and marks it at 40% above its cost price. If he allows 8% discount, find :

- (i) the marked price      (ii) selling price      (iii) his profit percentage.

**Solution.**

(i) C.P. = ₹ 1250

Since the dealer marks the bicycle at 40% above the cost price,

$$\text{M.P.} = \text{C.P.} + 40\% \text{ of C.P.} = ₹ 1250 + ₹ \left( \frac{40}{100} \times 1250 \right)$$

$$= ₹ 1250 + ₹ 500 = ₹ 1750$$

Hence, the marked price of the bicycle = ₹ 1750.

(ii) M.P. = ₹ 1750, discount = 8%, S.P. = ?

$$\text{S.P.} = \left( 1 - \frac{8}{100} \right) \text{ of ₹ 1750} \quad \left| \text{S.P.} = \left( 1 - \frac{d}{100} \right) \text{ of M.P.} \right.$$

$$= ₹ \left( \frac{92}{100} \times 1750 \right) = ₹ (23 \times 70) = ₹ 1610.$$

(iii) Profit = S.P. - C.P. = ₹ 1610 - ₹ 1250 = ₹ 360

$$\text{Profit percentage} = \left( \frac{\text{profit}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{360}{1250} \times 100 \right) \%$$

$$= \frac{144}{5} \% = 28.8\%.$$

**Example 6.**

The cost price of an article is ₹ 600, which is 25% below the marked price. If the article is sold at a discount of 15%, find :

- (i) the marked price      (ii) the selling price      (iii) the profit percentage.

**Solution.**

(i) C.P. = ₹ 600

Since the cost price is 25% below the marked price,

$$\text{C.P.} = \text{M.P.} - 25\% \text{ of M.P.}$$

$$\therefore ₹ 600 = \text{M.P.} - \frac{25}{100} \text{ of M.P.} = \left( 1 - \frac{25}{100} \right) \text{ of M.P.}$$

$$\Rightarrow ₹ 600 = \frac{75}{100} \text{ of M.P.} = \frac{3}{4} \text{ of M.P.}$$

$$\Rightarrow \text{M.P.} = ₹ \left( 600 \times \frac{4}{3} \right) = ₹ 800.$$

Hence, the marked price of the article = ₹ 800

(ii) M.P. = 800, discount = 15%, S.P. = ?

$$\text{S.P.} = \left( 1 - \frac{15}{100} \right) \text{ of ₹ 800} \quad \left| \text{S.P.} = \left( 1 - \frac{d}{100} \right) \text{ of M.P.} \right.$$

$$= ₹ \left( \frac{85}{100} \times 800 \right) = ₹ 680$$

Hence, the selling price of the article = ₹ 680.

(iii) Profit = S.P. - C.P. = ₹ 680 - ₹ 600 = ₹ 80

$$\text{Profit percentage} = \left( \frac{\text{profit}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{80}{600} \times 100 \right) \% = \frac{40}{3} \% = 13 \frac{1}{3} \%$$



**Example 7.**

A dealer purchased an article at 20% discount on the marked price but sold it at the marked price. Find his profit percentage.

**Solution.**

Let the marked price of the article be ₹  $x$ .

Since the dealer purchased the article at 20% discount,

$$\text{C.P.} = \text{M.P.} - 20\% \text{ of M.P.}$$

$$= ₹ x - \frac{20}{100} \text{ of } ₹ x = ₹ x - ₹ \frac{1}{5} x = ₹ \left( x - \frac{1}{5} x \right) = ₹ \frac{4x}{5}$$

As the article is sold at the marked price, S.P. = ₹  $x$

$$\therefore \text{Profit} = \text{S.P.} - \text{C.P.} = ₹ x - ₹ \frac{4x}{5} = ₹ \left( x - \frac{4x}{5} \right) = ₹ \frac{x}{5}$$

$$\begin{aligned} \therefore \text{Profit percentage} &= \left( \frac{\text{Profit}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{\frac{x}{5}}{\frac{4x}{5}} \times 100 \right) \% \\ &= \left( \frac{x}{5} \times \frac{5}{4x} \times 100 \right) \% = 25\%. \end{aligned}$$

**Example 8.**

A dealer marks his goods 40% above the cost price and allows a discount of 15%. Find his profit percentage.

**Solution.**

Let the cost price of an article be ₹  $x$ .

Since the dealer marks his goods 40% above the cost price,

$$\text{M.P.} = \text{C.P.} + 40\% \text{ of C.P.}$$

$$= ₹ x + \frac{40}{100} \text{ of } ₹ x = ₹ x + ₹ \frac{40}{100} x = ₹ \left( x + \frac{2}{5} x \right) = ₹ \frac{7}{5} x$$

$$\text{S.P.} = \left( 1 - \frac{15}{100} \right) \text{ of } ₹ \frac{7}{5} x \qquad \text{S.P.} = \left( 1 - \frac{d}{100} \right) \text{ of M.P.}$$

$$= ₹ \left( \frac{85}{100} \times \frac{7}{5} x \right) = ₹ \frac{119}{100} x$$

$$\text{Profit} = \text{S.P.} - \text{C.P.} = ₹ \frac{119}{100} x - ₹ x = ₹ \left( \frac{119}{100} x - x \right) = ₹ \frac{19}{100} x$$

$$\text{Profit percentage} = \left( \frac{\text{profit}}{\text{C.P.}} \times 100 \right) \% = \left( \frac{\frac{19}{100} x}{x} \times 100 \right) \% = 19\%.$$

**Example 9.**

The marked price of a washing machine is ₹ 24800. A shopkeeper allows two successive discounts of 15% and 5%. Find the price which a customer has to pay for the washing machine.

**Solution.**

The selling price of the washing machine

$$= \left( 1 - \frac{15}{100} \right) \left( 1 - \frac{5}{100} \right) \text{ of M.P.} \qquad \left| \text{S.P.} = \left( 1 - \frac{d_1}{100} \right) \left( 1 - \frac{d_2}{100} \right) \text{ of M.P.} \right.$$

$$= \left( \frac{85}{100} \times \frac{95}{100} \right) \text{ of } ₹ 24800 = ₹ \left( \frac{17}{20} \times \frac{19}{20} \times 24800 \right)$$

$$= ₹ (17 \times 19 \times 62) = ₹ 20026.$$

**Example 10.**

Find a single discount equivalent to two successive discounts of 25% and 8%.

**Solution.**

Let the marked price of an article be ₹  $x$  and a single discount of  $d\%$  be equivalent to two given successive discounts of 25% and 8%, then



$$\left(1 - \frac{d}{100}\right) \text{ of } ₹x = \left(1 - \frac{25}{100}\right) \left(1 - \frac{8}{100}\right) \text{ of } ₹x$$

Both S.P. must be equal

$$\left| \text{S.P.} = \left(1 - \frac{d_1}{100}\right) \left(1 - \frac{d_2}{100}\right) \text{ of M.P.} \right.$$

$$\Rightarrow 1 - \frac{d}{100} = \frac{75}{100} \times \frac{92}{100} \Rightarrow 1 - \frac{d}{100} = \frac{3}{4} \times \frac{92}{100} = \frac{69}{100}$$

$$\Rightarrow 100 - d = 69 \Rightarrow d = 100 - 69 = 31.$$

Hence, a single discount of 31% is equivalent to two given successive discounts.

### Exercise 8.2

1. Find the discount and the selling price, when :

(i) the marked price = ₹ 575, discount = 12%

(ii) the printed price = ₹ 12750, discount =  $8\frac{1}{3}\%$ .

2. Find the discount and the discount percentage, when :

(i) marked price = ₹ 780, selling price = ₹ 721.50

(ii) advertised price = ₹ 28500, selling price = ₹ 24510.

3. A notebook is marked at ₹ 30. Find the price a student pays for a dozen notebooks if he gets 15% discount.

4. A dealer gave 9% discount on an electric fan and charges ₹ 728 from the customer. Find the marked price of the fan.

5. The list price of an article is ₹ 800 and a dealer is selling it at a discount of 20%. Find :

(i) the selling price of the article.

(ii) the cost price of the article if he makes 25% profit on selling it.

6. A shopkeeper marks his goods at such a price that would give him a profit of 10% after allowing a discount of 12%. If an article is marked at ₹ 2250, find its :

(i) selling price

(ii) cost price.

7. A shopkeeper purchased a calculator for ₹ 650. He sells it at a discount of 20% and still makes a profit of 20%. Find :

(i) the selling price

(ii) marked price.

8. A shopkeeper buys a dinner set for ₹ 1200 and marks it 80% above the cost price. If he gives 15% discount on it, find :

(i) the marked price

(ii) the selling price

(iii) his profit percentage.

9. The cost price of an article is ₹ 1600, which is 20% below the marked price. If the article is sold at a discount of 16%, find :

(i) the marked price

(ii) the selling price

(iii) profit percentage.

10. A shopkeeper allows 20% discount on his goods and still earns a profit of 20%. If an article is sold for ₹ 360, find :

(i) the marked price

(ii) the cost price.

11. If a shopkeeper marks his goods at 20% above the cost price and then gives 10% discount, find his gain percentage.

12. If a shopkeeper marks his goods at 20% above the cost price and then gives 20% discount, find his gain or loss percentage.



13. The printed price of a refrigerator is ₹ 28600. A dealer allows two successive discounts of 10% and 5%. Find the price which a customer has to pay for the refrigerator.
14. Two dealers have marked an article at the same price. The first dealer allows two successive discounts of 15% and 5%. The other allows a discount of 20%. Which is the better offer?
15. Find a single discount equivalent to two successive discounts of 30% and 10%.

## Summary

- ➔ The price at which an article is purchased by a dealer is called its cost price (C.P.).
- ➔ The price at which an article is sold by a dealer is called its selling price (S.P.).
- ➔ If the selling price is more than the cost price, then the dealer makes a profit and  

$$\text{profit} = \text{selling price} - \text{cost price}$$
- ➔ If the selling price is less than the cost price, then the dealer suffers a loss and  

$$\text{loss} = \text{cost price} - \text{selling price}$$
- ➔ Profit or loss percentage is always calculated on the cost price.

$$\text{Profit percentage} = \left( \frac{\text{profit}}{\text{cost price}} \times 100 \right) \%$$

$$\text{Loss percentage} = \left( \frac{\text{loss}}{\text{cost price}} \times 100 \right) \%$$

- ➔ If there is a profit of  $p$  %, then  $\text{S.P.} = \left( 1 + \frac{p}{100} \right)$  of C.P.
- ➔ If there is loss of  $l$  %, then  $\text{S.P.} = \left( 1 - \frac{l}{100} \right)$  of C.P.
- ➔ The price printed on an article or written on a slip attached to it is called its marked price (M.P.). It is also called listed (printed, catalogued or advertised) price.
- ➔ The amount deducted from the marked price of an article is called discount. Discount is always given on the marked price.
- ➔ The price of an article after deducting discount from the marked price is called selling (or net) price. It is the price of the article paid by a customer.

$$\text{Selling price} = \text{marked price} - \text{discount}$$

- ➔ Discount is always calculated on the marked price.

$$\text{Discount percentage} = \left( \frac{\text{discount}}{\text{marked price}} \times 100 \right) \%$$

- ➔ If there is discount of  $d$  %, then  $\text{S.P.} = \left( 1 - \frac{d}{100} \right)$  of M.P.
- ➔ If there are two successive discounts of  $d_1$  % and  $d_2$  %, then

$$\text{S.P.} = \left( 1 - \frac{d_1}{100} \right) \left( 1 - \frac{d_2}{100} \right) \text{ of M.P.}$$

## Check Your Progress

1. Ramu purchased 20 parrots at ₹ 30 each. Two parrots flew away and Ramu sold the rest of the parrots at ₹ 40 per parrot. Calculate the profit or loss percentage of Ramu.
2. A fruit-vendor purchased a certain number of oranges at 20 for ₹ 15 and sold them at 25 for ₹ 20. Find his profit or loss percentage.



3. A vegetable seller on selling 20 kg potatoes earns a profit equal to the cost price of 5 kg potatoes. Find his profit percentage.
4. A vegetable seller on selling 20 kg potatoes earns a profit equal to the selling price of 5 kg potatoes. Find his profit percentage.
5. Tanya bought three pigs for ₹ 250 each. She sold one at a loss of 10%. At what percent profit should she sell the remaining two pigs so as to gain 10% in the entire deal?
6. Find the selling price, when :
  - (i) cost price = ₹ 980, profit = 15%
  - (ii) cost price = ₹ 1530, loss =  $6\frac{2}{3}\%$ .
7. Ajit bought an old car for ₹ 78000. He spent ₹ 2000 on repairs and repainting the car. He sold the car to Anuj at a gain of 15%. Anuj sold it to Anthony at a loss of 5%. What did the car cost to Anthony?
8. The manufacturing price of a T.V. set was ₹ 5000. The company sold it to a distributor at 16% profit. The distributor sold it to a dealer at 10% profit. The dealer sold it to a customer at 20% profit. Find the price the customer paid.
9. Find the cost price, when :
  - (i) selling price = ₹ 6372, profit = 18%
  - (ii) selling price = ₹ 1296, loss = 4%.
10. Mahanta sold two cows at ₹ 12000 each. He made a profit of 20% on one cow and suffered a loss of 20% on the other. Find his total profit or loss on the whole deal. Also calculate it as a percentage.
11. A sells an article to B at a profit of 20% and B sells it to C at a loss of 6%. If C pays ₹ 846, find how much did A pay for it.
12. Gaurav sold an article at a profit of 12%. Had it been sold for ₹ 16 more, the profit would have been 20%. Find the cost price of the article.
13. Gaurav sold an article at a profit of 12%. Had it been sold for ₹ 16 more, the profit would have been 20%. Find the selling price of the article.
14. A shopkeeper allows 8% discount on his goods and still earns a profit of 15%. If an article is sold for ₹ 460, find :
  - (i) the marked price
  - (ii) the cost price.
15. If C.P. is ₹ 200, discount is 10% and profit is 17%, find
  - (i) S.P.
  - (ii) M.P.
16. A shopkeeper allows 10% discount to his customers and still gains 8%. Find the cost price of an article which is marked at ₹ 6000.
17. Find a single discount which is equivalent to two successive discounts of 10% and 5%.
18. A merchant imports an article at a cost of ₹ 150. Import duty and other taxes amount to 20% of the cost price. What is the final cost price of the article?  
He marks the article for sale 25% above this cost price, but accepts a 4% reduction of the marked price if a customer pays cash. What price such a customer pay for the article? Find also the percentage profit made by the merchant in that case.