# Percentage, Profit and Loss

## NOTES

### FUNDAMENTALS

- Gain = Selling price (S.P.) - Cost Price (C.P.)
- Loss $= C.P. - S.P.$
- $Gain\% = \frac{Gain}{C.P.} \times 100\%;\ S.P.$

  $= C.P. + Gain = C.P. + C.P. \times \frac{Gain(in\%)}{100}$

  $= C.P.\left[1 + \frac{gain(in\%)}{100}\right].$
- In case of loss, $S.P. = C.P.\left[1 - \frac{loss\%}{100}\right]$
- $CP = \left(\frac{100}{100 + gain\%}\right) \times S.P. = \left(\frac{100}{100 - loss\%}\right) \times S.P.$

**Elementary Question:**

**Q.** Price of a book was decreased by 10% and then increased by 10%. If the original price of book is Rs. 100, what is its current price?

1. Decreased by 10%

**Ans.** $Rs.100 \xrightarrow{decreased\ by\ 10\%} 10\%\ Rs.100\ means\ \ 100 - 100 \times \frac{10}{100} = 100 - 10 = 90$

2. $Increased\ by\ 10\%\ Rs.90 \xrightarrow{Increased\ by\ 10\%}$

$= 90 + 90 \times \frac{10}{100} = 90 + 9 = 99$

**Example:** Gurpreet sells two watches forRs.1980/- each, gaining 10% on one and losing 10% on the other. Find her gain or loss per cent in the whole transaction.

**Solution:**

SP of the first watch = Rs 1980/-; Gain = 10%

$\therefore$ CP of the first watch

$= \left\{\frac{100}{(100 + gain\%)} \times SP\right\} = \left\{\frac{100}{(100 + 10)} \times 1980\right\} = Rs\left(\frac{100}{110} \times 1980\right) = Rs1800/-$

SP of the second watch = Rs 1980/-; Loss% = 10%; CP of the second watch

Total CP of the two watches

$= Rs(1800 + 2200) = Rs4000/-$

$\therefore$ Total SP of the two watches

$= Rs(1980 \times 20) = Rs\,3960/-$

Since $(SP) < (CP)$, there is less in the whole transaction.

Loss $= Rs(3960 - 4000) = Rs40/-;$

$\therefore Loss\% = \frac{40}{4000} \times 100\% = 1\% loss$

Hence, Gurpreet loses 1 % in the whole transaction.

**Further concepts on percentage:**

- A number can be split into two parts such that one part is P% of the other. Then the two parts are:

  $\frac{100}{100+p} \times number \ and \times number.$

- If the circumference of a circle is increased (or) decreased by P%, then the radius of a circle increases (or) decreases by P%.

**Elementary question 1:** The circumference of a circle is 88 cm, if the circumference is increased by 50%, find percentage increase in radius.

Answer: $C_1 = 88cm C_2 = C_1 + \frac{50}{100} \times C_1 = 88 + 44 = 132 \ \ r_1 = \frac{88}{2\pi} = 14 \ and \ r_2 = \frac{132}{2\pi} = 21$

$\therefore$ % age increase in radius

$\frac{r_2 - r_1}{r_1} \times 100\% = \frac{21-14}{14} \times 100\% = 50\%$

**OVERHEADS:** Suppose you go to market and purchase a bed set and a TV. Naturally, you need to pay transportation charges and also labour cost and sometimes repairing charges, if there is damage. These extra expenses are called overheads. For calculating the total cost price, we add overheads to the purchase price.

**Elementary question 2:** Mohan Kumar purchased and old bike for Rs.20000 and spent Rs. 4000 on its overhauling. Then, he sold it to his friend Jatin for Rs. 21000. Find his loss/gain percentage.

**Solution:** Cost price = Rs. 20000, overheads = Rs. 21000;

Total cost price

$= Rs(20000 + 4000) = 24000;$

Selling price = Rs. 21000.

Since $(SP) < (CP)$, Mohan Kumar makes a loss.

$\text{Loss} = Rs(24000 - 21000) = Rs.3000;$

$\text{Loss}\% = \frac{3000}{24000} \times 100\% = 12\frac{1}{2}\%$

**Elementary question 3:** By selling 36 m of cloth, a cloth-maker loses an amount equal to the selling price of 4m of cloth. Find her gain or loss percent.

**Solution:** Let C. P. of 1 m cloth $= x \Rightarrow CP$ of 36 m cloth = 36x

Let her sell at p% loss $\Rightarrow SP = 36x\left(1 - \frac{p}{1000}\right)$

$\therefore Loss = \frac{36xp}{100}$ But this equal S. P. of 4m cloth

$\Rightarrow \frac{36xp}{100} = 4x\left(1 - \frac{p}{100}\right) \Rightarrow \frac{9p}{100} = 1 - \frac{p}{100}$

$\Rightarrow \frac{10p}{100} = 1 \Rightarrow p = 10\%$

**MARKED PRICE:** In shops and departmental stores, on every article there is a price written on it. This is called the marked price of that article.

For e.g., you would see a price written on the inside leather of your shoe. This is the marked price.

**DISCOUNT:** At certain times, like during Diwali, in order to increase the sale or clear the old stock, the shopkeepers offer a certain percentage of rebate on the marked price. This is called as discount.

Alternatively, there is a price called list price which is marked by the manufacturing company on the items produced by it this is called list price.

An important fact: The discount is to be calculated on marked price.

Selling price = (marked price) - (discount).

**Example:** If the S. P. of a refrigerator is Rs.12000 & the discount offered by the shopkeeper is 15%, then what is price written on the tag of the refrigerator.

Ans.: Let the price on tag (marked price) be x,

$S.P. = x - discount = x - 15\% of\ x = x - 0.15 = 0.85x \Rightarrow SP = 12000\,Rs = 0.85$

$\Rightarrow x = \frac{12000}{85} \times 100 = \frac{2400}{17} = Rs14117\frac{11}{17}$

**SUCCUESSIVE DISCOUNTS (i.e. Discount on Discount):** Suppose a discount of 20% is given on an article. Then, further on the reduced price a discount of 10% is given.

In such a case, we say that successive discounts of 20% and 10% have been given. It would be interesting to find equivalent discount for two succession discount.

**Example.** Find the single discount equivalent to two successive discount of 40% and 20%.

**Solution:** Without loss of generality, we can denote printed price as x or as 100

Let the marked price of an article be Rs100. (Actually, printed price is same as marked price)

Then, first discount on it $100 \times \frac{40}{110} = 40\ Rs$

Price after the first discount

$= Rs(100 - 40) = Rs60.$

Second discount on it

$= 20\%\ of\ Rs.60 = \frac{20}{100} \times 60 = 12\,Rs$

Price after the second discount

$= Rs(60 - 12) = Rs48.$

$\therefore$ selling price = Rs 48

$\therefore$ Equivalent discount $= (100 - 48)\% = 52\%$

**Sales Tax (ST)/ Value Added Tax (VAT)**

You may have marked (printed) price as S.P. or if there is discount, S.P. = M.P. - discount.

**SALES TAX** (ST) ST is charged by the shopkeeper from the customer on selling price of an item and is added to the value of the bill.

Sales tax is paid in a state to the respective state government.

**VALUE ADDED TAX (VAT) Since 1997,** the prices of the articles include one more tax, called Value Added Tax.

Different items carry VAT at different rates.

**Solved Examples**

**Example:** The cost of an almirah set was Rs 10000. If the sales tax charged was 5%, find the billing amount.

**Solution:** Sales tax

$= 5\%\ of\ Rs10000 = Rs500$

$\therefore$ bill amount $= Rs(10000 + 500) = Rs10500$

**Simple Interest:**

- When we deposit money in banks, banks give interest on money. Interest may be simple interest (called S.I.)
- $S.I. = \frac{P.t.r}{100}$

  S. I. =Simple Interest; P=Principal; t = Time; r =Rate percent per annum
- Amount (a) $= \text{Principal} + \text{Interest}$

$$= P + \frac{ptr}{100} = P\left[1 + \frac{rt}{100}\right]$$

- $r \times t = 100(n-1)$
- Where r = rate percent t = time

  n = The number of times the sum gets multiplied (i.e. doubled, tripled.....etc.)
- S.I. is calculated uniformly on the original principal throughout the time period.

**Compound Interest**

$$C.I. = P\left[1 + \frac{r}{100}\right]^t - p$$

Where P = principal; t = time (usually taken in years, unless mentioned); r = rate of interest