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Chapter 1: Percentage

Percentage:

A decimal fraction is one in which the denominator of the fraction is a power of 10 i.e. 10, 100, and 1000 etc. That decimal fraction which has 100 as its denominator is known as Percentage. The numerator of such a fraction is known as Rate Per Cent.

Alternatively, X % of a number Y is e.g. 20% of 300 = 300 * 20/100 = 60.

1.1 Basic Percentage Terms

(i) ***Conversion from a Fraction to Percent and vice versa***

1. ***Fraction to Percent:*** Multiply the fraction by 100 to convert it into a percent.

e.g. 0.2 = 0.2 × 100 = 20 %

3/8 = (3/8)* 100 = 37.5 %

2. ***Percent to Fraction:*** Reversing the earlier operation will convert a percent to a fraction - i.e. divide the number by 100.

e.g. 40 % **= 40/100 =** 0.4,

55 % **= 55/100 =** 0.55

(ii) ***Percentage Increase or Decrease of a Quantity***:

Here, one point is to be noted, that the increase or the decrease is always on the original quantity. If the increase or decrease is given in absolute and the %age increase or decrease is to be calculated, then the following formula is applied to do so.

%increase/decrease = 100*Increase or decrease/Original Quantity

The point worth remembering is that the denominator is the **ORIGINAL QUANTITY.**

Illustration: The salary of a man goes up from Rs 100 to Rs 125. What is the percentage increase in his salary?

Sol: Increase = 125 – 100 = Rs. 25.

$\therefore$ % increase = 100 * 25/100 = 25 %

Alternatively, if the salary of the same man had been reduced from Rs. 125 to Rs 100, what is the percentage decrease in his salary?

Decrease = 125 – 100 = Rs. 25

∴% decrease = 100 *25/125 = 20 %.

Note that for the same quantity of increase or decrease the % increase and % decrease have two different answers. The change in the denominator – which is the original value changes in the above two situations and hence the difference.

(iii) To Increase a Number by x %:

If a number is increased by 10 %, then it becomes 1.1 times of itself.

If a number is increased by 20 %, then it becomes 1.2 times of itself.

If a number is increased by 30 %, then it becomes 1.3 times of itself.

If a number is increased by 40 %, then it becomes 1.4 times of itself.

(iv) To Decrease a Number by x %:

If a number is decreased by 10 %, then it becomes 0.90 times of itself.

If a number is decreased by 20 %, then it becomes 0.80 times of itself.

If a number is decreased by 30 %, then it becomes 0.70 times of itself.

If a number is decreased by 40 %, then it becomes 0.60 times of itself.

(v) Equivalent Percentages of some commonly used Fractions:

$\frac{1}{2}$	50 %	$\frac{3}{4}$	75 %	$\frac{2}{9}$	$22\frac{2}{9}\%$
$\frac{1}{3}$	$33\frac{1}{3}\%$	$\frac{4}{5}$	80 %	$\frac{1}{15}$	$6\frac{1}{3}\%$
$\frac{1}{4}$	25 %	$\frac{1}{8}$	$12\frac{1}{2}\%$	$\frac{1}{20}$	5 %
$\frac{1}{5}$	20 %	$\frac{1}{12}$	$8\frac{1}{3}\%$	$\frac{1}{25}$	4 %
$\frac{1}{6}$	$16\frac{2}{3}\%$	$\frac{3}{8}$	$37\frac{1}{2}\%$	$\frac{1}{50}$	2 %
$\frac{2}{5}$	40 %	$\frac{5}{8}$	$62\frac{1}{2}\%$	$\frac{4}{3}$	133 1/3 %
$\frac{3}{5}$	60 %	$\frac{7}{8}$	$87\frac{1}{2}\%$	$\frac{5}{4}$	125 %
$\frac{2}{3}$	$66\frac{2}{3}\%$	$\frac{1}{9}$	11.11 %	$\frac{6}{5}$	120 %

1.2 Percentage Basic Solved Examples

1. What is 25 % of Rs 50?

Sol. $\frac{25}{100} \times 50$ = Rs 12.5

2. What percentage is Rs 13 out of a total sum of Rs 65?

Sol.: 100 * 13/65 = 20 %

3. A student obtained 82.5 % marks in a certain examination. If the maximum marks is 600 find the total marks obtained by her.

Sol.: 600 * 82.5/100= 495

4. The annual sales of company X were Rs 72,000 in fiscal year 94-95 and Rs 84,000 in fiscal 95-96. What was the % increase in turnover?

Sol.: Here Increase = 84,000 – 72,000 = 12,000
∴ % Increase =100 * 12000/72000= 16.67 %

1.3 Important Percentage Formulae

(i) Salary/Weight/Income More .

If *A*'s income is *R* % more than *B*, then *B* is income is less than that of *A* by 100 × R/(100+R)%. Given below are some of the important results in that context

(ii) Salary/Weight/Income Less .

If A's income is R% less than *B*, then *B*'s income is more than that of A by 100 × R/(100-R)%.

Given below are some important results in that context.

If *A* is 16.66% less than *B*, then *B* is 20 % more than *A*.
If *A* is 20 % less than *B*, then *B* is 25 % more than *A*.
If *A* is 25 % less than *B*, then *B* is 33.33%more than *A*.

Note: If the question is - the price of a commodity is increased by R %, by what percent its consumption should be decreased, so that the total expenditure remains the same. Then the way to solve such question is the same. I.e. if the price is increased then consumption should be decreased by 100 *R/(100+R) If

the price is decreased, then consumption should be increased by 100 * R/(100 – R)

(iii) ***Increase and Decrease by the same % age***.

If a number is increased by *R* %, then this number is decreased by *R* %, then in total there would be a decrease of $R^2/100\%$.

(iv) **Increase and Decrease by different% age**.

If a number is decreased by *X* %, then this is again increased by *Y* %. Then the total increase in the no. will be $X+Y+\frac{XY}{100}$.

The above-mentioned formula is very important. It has its application in so many other questions. In case instead of increase, there is a decrease, simply put a negative value in its place. You will get the right answer, even when both the decreases are given. What you will get after solving the formula, if it is positive, there is an increase, and if it is negative, there is a decrease.

1.4 More Solved Examples

5. The price of rice increases by 30 %. In order to keep the expenses on rice constant as before, by what percentage should a person cut down his consumption?

Sol.: Here apply the formula $\frac{100\times R}{(100+R)}$ ($\because$ the price has increased)

Consumption should be reduced by $\frac{100\times 30}{(100+130)} = 22\frac{1}{3}\%$

6. Tom's income is 20 % less than Jerry's. How much is Jerry's income more than Tom's?

Sol.: Apply the formula $\frac{100 \times R}{(100+R)}$ ($\because$ income is R% less)

Jerry's income is more by $\frac{100 \times 20}{(80)} = 25\ \%$

7. A traveling salesman carried 75 % of his money in traveler's cheque's and 25 % in cash. During one of his journeys, he lost his entire cash and spent from his traveler's cheques. On completion of the journey, he returned 30% of the traveler's cheques,

which amounted to Rs 180. What was the total money that he carried?

Sol.: 30 % of TC = Rs 180

$\therefore$ 100 % of TC s = $\frac{100}{30} \times 180$ = Rs 600

Since TC s accounted for 75% of the total money that he had carried, the total money that he carried is 600 * 100/75= Rs 800.

8. A number is increased by 20%, then it is decreased by 30%, what is the net change in the number?

Sol.: Using the formula $X + Y + \frac{XY}{100}$. $\Rightarrow 20 + (-30) + \frac{20 \times -30}{100}$ = -16.

This means there is a decrease of 16%.

Chapter 2: Profit & Loss

Profit & Loss

- ***Cost Price (CP):*** The price which is paid to acquire a product. *All overhead expenses such as transportation, taxes etc. are also included in the cost price.*
- ***Selling Price (SP)***: *The sum of money, which is finally received for the product.*
- ***Marked Price (MP)****: The price, which is listed or marked on the product, this is also known as printed price/quotation price/invoice price/catalogue price.*
- ***Profit:*** *There is gain in a transaction if the selling price is more than the cost price. The excess of the selling price to the cost price is the profit in the transaction.*

PROFIT = SELLING PRICE – COST PRICE

E.g. Let the cost price of a quintal of rice be Rs 1000 and the shopkeeper sells that for Rs 1250, then
∴ Profit = 1250 – 1000 = Rs 250 per quintal

- ***Loss:*** *When the selling price is less than the cost price there is loss in the transaction. The excess of cost price over the selling price is the loss in the transaction.*

LOSS = COST PRICE – SELLING PRICE
E.g. The cost price of a score of mangoes is Rs. 220. The fruit vendor retails each mango for Rs. 10, then
Cost price = Rs. 220 / score = Rs. 11 / mango

(1 score = 20 nos.)
Selling price = Rs. 10 / mango
∴ Loss = Rs. 11 – Rs. 10 = Re. 1 per mango

Note: *Profit and loss percentage is always calculated on cost price, unless otherwise specified.*

2.1 Important Profit & Loss Formulae

- ***% Profit: 100 * profit/Cost Price***

- ***% Loss: = 100 * Loss/Cost Price***

- ***Equal % profit & loss on the same selling price of two articles:***

  If two items are sold each at Rs *X*, one at a gain of *p* % and the other at a loss of *p* %, then the two transactions have resulted in an overall loss of $\frac{p^2}{100}$ %

  The absolute value of the loss = Rs $\frac{2 \cdot p^2 \cdot X}{100^2 - p^2}$

- ***Equal % profit & loss on the same cost price of two articles:***

  If the cost price of two items are *X*, and one is sold at a profit of *p* % and the other at a loss of *p* %, then the two transactions have resulted in no gain or no loss.

Note: *The discount is always taken as a % of the marked price only unless specified otherwise. .*

E.g. suppose the list price of an article be Rs. 450. A discount of 5 % on its list price is announced.
Therefore, the new selling price = 450 * 95/100 = Rs 422.5

- ***Cash Discount:***

  In addition to trade discount, the manufacturer may offer an additional discount called the Cash Discount if the buyer makes full payment within a certain specified time.

  Cash Discount is usually offered on the net price (the price after subtracting discount from the marked price).

  Therefore, Cash Price = Net Price - Cash Discount

Note: *Cash discount is always calculated on net price, unless otherwise specified.*

- ***Wrong Weight****: When a tradesman professes to sell at cost price, but uses a false weight, then the percentage profit earned*

  $$= \frac{100 \times \text{Error}}{\text{True Weight - Error}}$$

- ***Successive Discounts****: When a tradesman offers more than one discount to the customer, then sometimes you need to calculate the single discount, which is equal to the two discounts given. There you can apply*

the method of decimals learned in the concepts of percentages.

e.g. a tradesman offers two successive discounts of 20 % and 10 %, which single discount is equal to these two successive discounts.

You can apply the principle, that after the first discount of 20 % the remaining price is 0.8 and after the second discount of 10 %, the remaining part is 0.9.

Net the remaining part is $0.8 \times 0.9 = 0.72$

$\Rightarrow$ The discount is $1 - 0.72 = 0.28$ i.e. 28 %.

- *Or a straight method can be applied for two discounts.*

Single discount, which is equal to two successive discounts of *m* % and *n* % = [m + n – (mn/100)]

2.2 Solved Examples

1. A cloth merchant bought 20 shirts, each at a price of Rs 180. He paid Rs 100 as octroi charges for bringing them into Pune. He sold each of them for Rs 203.50. Find his percentage profit.

Sol: Total cost = cost of 20 shirts + Rs 100 (Octroi)
= 20 × 180 + 100 = 3700
∴ Cost / Shirt = 3700/20= 185.
Selling price = 203.50. ∴ Profit = 203.5 – 185 = 18.50
∴ % Profit = 100 * 18.5/185 = 10 %

2. Raj purchased two watches at the same price and sold one at a profit of 10 % and the other at a profit of 12.5%. If the difference between the two selling price is Rs 15, what is the cost price of each of the watches?

Sol: Let the cost price of the watches = 100
The selling price of the first watch = 110 and
The selling price of the second watch = 112.5.
The difference in the selling price = 2.5 if the cost price = 100
∴ If the difference in selling price = 15, the cost price = 100 * 15/2.5 = 600

3. A retail fruit vendor buys pineapples at a score for Rs 240, and retails them at a dozen for Rs 180. Did he gain or lose in the transaction and what % was his gain or loss?

Sol: C.P = Rs. 240/score
$\therefore$ C.P/Pineapple = 240/20 = 12 (Note: 1 score = 20 nos.)
S.P = Rs.180/dozen
$\therefore$ S.P/Pineapple = 180/12 = 15
Profit = 15 – 12 = 3.
$\therefore$ % Profit = 100 * 3/12 = 25%

4. A man sells two tables at the same price. On one he makes a profit of 10 % and on the other he makes a loss of 10 %. Find his total loss / gain in these two transactions. If the selling price of the tables was Rs 1000 each, what was the profit / loss in Rs and what was the cost price of each of the tables?

Sol: Net loss = $10^2/100$ = 1 % loss
If the selling price = S.P, the amount of loss = $\frac{2 \cdot p^2 \cdot S.P}{100^2 - p^2}$
$\therefore$ As the selling price = 1000,

Loss = $\frac{2 \cdot 10^2 \cdot 1000}{100^2 - 10^2}$ = 2000/99 = 20 20/99.

Cost price of the item sold on profit

C.P (1 + 0.1) = 1000.
C.P = 1000/1.1 = 909 1/11
Cost price of the item sold on loss
C.P (1 – 0.1) = 1000.
∴ C.P = 1000/0.9 = 1111.11

5. A floppy disc drive is sold for Rs 935 at a profit of 10 %. What would have been the actual profit or loss if it had been sold at Rs 807.50?

Sol: C.P (1.1) = 935. ∴C.P = 935/1.1 = 850
If selling price = Rs.807.50, then loss = 850 – 807.50 = 42.50
% Loss = 100 * 42.5/850 = 5 %

6. Profit obtained by selling a wristwatch at Rs 160 is equal to $7/5^{th}$ of the profit obtained by selling the same wristwatch at Rs 150. What is the cost price of the watch?

Sol: Let the cost of a watch be x ∴ (160 - x) = (150 - x)* 7/5 => 800 – 5x = 1050 – 7x. ⇒2x = 250 ⇒x = Rs.125

7. 2000 copies of a book are printed at Rs 8000. What should be the list price if the publisher wishes to make a 50 % profit after giving a 20 % discount on the list price to the retailer?

Sol: C.P per book = 4
Profit to be made = 50 % $\Rightarrow$ S.P = 1.5 $\times$ 4 = 6
Rs. 6 should be the net price to the publisher after a 20 % discount on the list price.
I.e. List price $\times$ 0.8 = 6 $\Rightarrow$ List price = 6/0.8 = Rs. 7.5

8. What should each of the sixty Shirts be sold at, the cost of each of which is Rs.25, so as to get a profit equal to the selling price of 10 of them?

Sol: S.P. of 10 Shirts = S.P of 60 Shirts – C.P. of 60 Shirts
10 S.P. = 60 S.P – 60 $\times$ 25
50 S.P = 1500 $\Rightarrow$ S.P = Rs. 30

9. If an article is sold at a loss of 20%, what is the loss in terms of the selling price?

Sol: Let the C. P. = 100. $\therefore$ Amount loss = 20
$\Rightarrow$ S. P. = 100 – 20 = 80

$\therefore$ Loss expressed in terms of S. P. = 100*20/80 = 25%.%

10. A package tour operator allows a 25 % discount on his advertised price and then makes a profit of 20 %. What is the advertised price on which he gains Rs.60?

Sol: Profit = Net price – Cost Price = 60
Net price = 1.2 (C. P.) $\Rightarrow$ 1.2 C.P – C. P. = 60
$\Rightarrow$ 0.2 C. P. = 60 $\Rightarrow$ C. P. = 300 and Net price = 360.
List price or advertised price $\times$ (0.75) = Net price
$\therefore$ List price = Net Price/0.75 = 360/0.75 = 480.

11. One tradesman calculates % profit on the buying price and the other on the selling price. Find the difference between their profits if both of them claim to make 20 % on their goods sold at Rs.1500

Sol: **Case I:** C. P. (1.2) = 1500.
$\therefore$ C. P. = 1250 $\Rightarrow$ Profit = 1500 – 1250 = Rs. 250
Case II: Profit = 0.2 (S.P) = 0.2 $\times$ 1500 = Rs. 300
$\Rightarrow$ The difference in profit made by each of the tradesmen = Rs. 50.

12. A man sold Pentium computers at a profit of 6 %. Had he made a loss of 5 % instead due to a price crash, he would have sold it for Rs 3,850 less. What was his cost price ?

Sol: C. P. (1.06) = S. $P._1$

C. P. (0.95) = S. $P._2$

S. $P._1$ - S. $P._2$ = 3850

$\Rightarrow$ C. P. (1.06 – 0.95) = 3850

$\Rightarrow$ 0.11 C. P. = 3850

$\Rightarrow$C. P. = 35,000