



Complete Notes on Percentage (Concepts, Short Tricks, Questions, etc.)

Today, we will be covering a very important topic from the quantitative aptitude section viz. **Percentage**. These formulas and shortcuts will be helpful for your upcoming **SSC and Railway Exams**. If you like it let us know by giving it an upvote. You can also go through the **5 Most Critical Questions with Short Tricks on Boat & Stream for Upcoming SSC Exams 2021** we have covered earlier.

Percentage

The percentage is per-cent which means parts per hundred.

Percent sign

The percent sign is the symbol: %

It is written to the right side of the number: 50%

Percentage Definition

Percentage is a value that represents the proportion of one number to another number.

1 percent represents **1/100** fraction.

If we have to convert percentage into a fraction than it is divide by 100.

Example 1: if we write **45%** then its equal to **45/100** or in fraction **9/20** or in decimal **0.45**

If we have to convert a fraction into a percentage, we have to multiple with 100.

Example 2: if we write **3/5** in fraction it is equal to **60% = 3/5 × 100 = 60**.

Convert Percentage into Decimal:

$$20\% = 20/100 = 0.5$$

Convert Decimal into Percentage:

$$0.25 = (0.25 \times 100) \% = 25\%$$

$$1.50 = (1.50 \times 100) \% = 150\%$$

Here is a table of commonly used values shown in Percent, Decimal and Fraction:

| Percent | Decimal | Fraction |
|---------|----------|------------------|
| 1% | 0.01 | $\frac{1}{100}$ |
| 5% | 0.05 | $\frac{1}{20}$ |
| 10% | 0.1 | $\frac{1}{10}$ |
| 12½% | 0.125 | $\frac{1}{8}$ |
| 20% | 0.2 | $\frac{1}{5}$ |
| 25% | 0.25 | $\frac{1}{4}$ |
| 33⅓% | 0.333... | $\frac{1}{3}$ |
| 50% | 0.5 | $\frac{1}{2}$ |
| 75% | 0.75 | $\frac{3}{4}$ |
| 80% | 0.8 | $\frac{4}{5}$ |
| 90% | 0.9 | $\frac{9}{10}$ |
| 99% | 0.99 | $\frac{99}{100}$ |
| 100% | 1 | |
| 125% | 1.25 | $\frac{5}{4}$ |
| 150% | 1.5 | $\frac{3}{2}$ |
| 200% | 2 | |

Types of Formulas and Short Tricks

Type 1: Percentage Increase/Decrease:

If the price of a commodity increases by R%, then the reduction in consumption so as not to increase the expenditure is: $[\frac{R}{100 + R}] \times 100\%$

If the price of a commodity decreases by R%, then the increase in consumption so as not to decrease the expenditure is: $[\frac{R}{100 - R}] \times 100\%$

Type 2: Results on Population:

Let the population of a town be P now and suppose it increases at the rate of R% per annum, then:

1. Population after n years = $P (1 + \frac{R}{100})^n$

2. Population n years ago = $P / (1 + R/100)^n$

Type 3: Results on Depreciation:

Let the present value of a machine be P. Suppose it depreciates at the rate of R% per annum.

Then:

1. Value of the machine after n years = $P (1 - R/100)^n$
2. Value of the machine n years ago = $P / [(1 - R/100)^n]$
3. If A is R% more than B, then B is less than A by = $[R / (100 + R)] \times 100\%$
4. If A is R% less than B, then B is more than A by = $[R / (100 - R)] \times 100\%$

Note: For two successive changes of x% and y%, net change = $\{x + y + xy/100\}\%$

Other Important Concepts of Percentage

Concept 1

1. $A+B+AB/100$ When A and B both are the positive change
2. $A-B-AB/100$ When A is positive change and B is a negative change
3. $-A+B-AB/100$ When A is negative change and B is a positive change.
4. $-A-B+AB/100$ When A and B both are the negative change.

Important: There is no need to remember the above formulas, you have to just remember $\pm A \pm B \pm AB/100$ and put the sign of change, if negative, then (-) and positive then, (+) but keep in mind that sign of AB is the product of signs of A and B.

Example1: The price of a book is reduced by 10% and the sale of the book is increased by 15%.

Find the net effect on revenue.

Solution: Let old price is 100 Rs. and old selling number of books are 100

So, old revenue = price \times selling number of books = $100 \times 100 = 10000$

New price = 90 Rs and New Selling number = 115

New revenue = $90 \times 115 = 10350$

$$\begin{aligned}\text{net effect\%} &= \frac{\text{new revenue} - \text{old revenue}}{\text{old revenue}} \times 100 \\ &= \frac{10350 - 10000}{10000} \times 100 \\ &= \frac{350}{100} \% = 3.5\%\end{aligned}$$

Using above trick: change in price is (-) and change in sale is (+)

$$\text{so net effect \%} = -10 + 15 - \frac{10 \times 15}{100} = 5 - 1.5 = 3.5\%$$

Example2: If the length and breadth of a rectangle are increased by 5% and 8% respectively. Find the % change in the area of the rectangle.

Solution: Let length and breadth of a rectangle is 100 and 50 respectively.

Old Area = $100 \times 50 = 5000$

New length = 105 and new breadth = 54

New Area = $105 \times 54 = 5670$

$$\begin{aligned}\% \text{ change in Area} &= \frac{\text{new area} - \text{old area}}{\text{old area}} \times 100 \\ &= \frac{670}{5000} \times 100 = 13.4\%\end{aligned}$$

Using above trick: change in length is (+) and change in breadth is (+)

$$\text{so, \% change in area} = 5 + 8 + \frac{5 \times 8}{100} = 13.4\%$$

Concept 2:

New solution \times new % = old solution \times old %

This formula is applicable to the commodity which is **constant** in the solution or mixture, its quantity doesn't change after mixing in solution.

Example3: A mixture of sand and water contains 20% sand by weight. Of it, 12 kg of water is evaporated and the mixture now contains 30% sand.

Solution: In this sand is constant in the mixture. So we will **apply this formula on the sand, not on the water.**

(a) Find the original mixture.

Let the original mixture is P kg, So new mixture = (P-12) kg

old% = 20 and new % = 30

new solution × new % = old solution × old %

$$(P-12) \times 30\% = P \times 20\%$$

$$3P - 36 = 2P$$

$$P = 36 \text{ Kg.}$$

(b) Find the quantity of sand and water in the original mixture.

Quantity of sand in original mixture = 20% of 36 = 7.2 Kg

Quantity of water in original mixture = 80% of 36 = 28.8 Kg

OR = Quantity of mixture – quantity of sand = 36 - 7.2 = 28.8 Kg

Example 4: 30 litres of a mixture of alcohol and water contains 20% alcohol. How many litres of water must be added to make the alcohol 15% in the new mixture?

Solution: only water is added to the mixture so, **there is no change in alcohol. We will apply the above formula on alcohol.** Let water added is P litres.

Old mixture = 30 litres, old % of alcohol = 20%

New mixture = 30+P litres, new % of alcohol = 15

using, new solution × new % = old solution × old %

$$(30+P) \times 15\% = 30 \times 20\%$$

P = 10 litres, hence 10 litres of water is added.

Concept 3:

If the price % of a commodity increases or decreases, then how much consumption % should decrease or increase, so the expenditure remains same.

$$\text{Decrease or increase in \% consumption} = \frac{r}{100 \pm r} \times 100$$

If price of a commodity increase then sign will be (+) and result will be decrease in consumption.

If price of a commodity decrease then sign will be (-) and result will be increase in consumption.

Example 5: If the price of milk increased by 25%, by how much percent must Rahul decrease his consumption, so as his expenditure remains the same.

Solution: Let the price of milk is 20 Rs/litre and Rahul consumes 1-litre milk.

Expenditure of Rahul = price × consumption

Now price of milk is increased by 25%, so the new price is $(125/100) \times 20 = 25$ Rs.

but his expenditure remains the same

So, new consumption × new price = old price × old consumption

$$\text{new consumption} \times 25 = 20 \times \text{old consumption}$$

$$\text{new consumption} = (20/25) \times \text{old consumption}$$

$$\text{new consumption\%} = (20/25) \times \text{old consumption} \times 100$$

$$\text{new consumption\%} = 80\% \text{ of old consumption}$$

decrease in consumption = 20 %

Using the above trick: Given, price % is increased so the sign will be (+) and consumption % will decrease.

$$\text{Decrease in consumption} = (25/125) \times 100 = 20\%$$

Example 6: If the price of milk decreases by 25%, by how much percent must Rahul increase his consumption, so as his expenditure remains the same.

Solution: Let the price of milk is 20 Rs/litre and Rahul consumes 1-litre milk.

Expenditure of Rahul = price × consumption

Now the price of milk is decreased by 25%, so the new price is $\times 20 = 15$ Rs.

but his expenditure remains the same

So, new consumption × new price = old price × old consumption

$$\text{new consumption} \times 15 = 20 \times \text{old consumption}$$

$$\text{new consumption} = (20/15) \times \text{old consumption}$$

$$\text{new consumption\%} = (20/15) \times \text{old consumption} \times 100$$

$$\text{new consumption\%} = 133(1/3)\% \text{ of old consumption}$$

$$\text{increase in consumption} = 33(1/3) \%$$

Using the above trick: given price % is decreased so the sign will be (-) and consumption % will increase.

$$\text{Increase in consumption} = (25/75) \times 100 = 33(1/3)\%$$

Concept 4:

If there is successively increase or decrease or both in any value we can represent it in the given form:

Let price of a TV is P Rs. and in its price is increased by X% in 1st year, decreased by Y% in 2nd year and again it is increased by Z% in 3rd Year, then its new price will be

$$\begin{aligned} \text{New Price} &= \text{old price} \times \frac{(100+X)(100-Y)(100+Z)}{100 \times 100 \times 100} \\ &= P \times \frac{(100+X)(100-Y)(100+Z)}{100 \times 100 \times 100} \end{aligned}$$

Example 7: The population of a town is 6000. It increases 10% during the 1st year, increases 25% during the 2nd year and then again decreases by 10% during the 3rd year. What is the population after 3 years?

$$\begin{aligned} \text{Solution : Population after 3 years} &= 6000 \times \frac{(100+10)(100+25)(100-10)}{100 \times 100 \times 100} \\ &= 6000 \times \frac{110 \times 125 \times 90}{100 \times 100 \times 100} \\ &= 7425 \end{aligned}$$

Hence, population after 3 years is 7425.

Example 8: The population of a village increases by 10% during the first year, decreased by 12% during the 2nd year and again decreased by 15% during the 3rd year. If the population at the end

of the 3rd year is 2057.

8.(a) Find the population of village at the beginning of the 1st year?

Solution: Let population of village at the beginning of the first year is P.

$$\text{Population after 3 years} = P \times \frac{(100+10)(100-12)(100-15)}{100 \times 100 \times 100}$$

$$2057 = P \times \frac{110 \times 88 \times 85}{100 \times 100 \times 100}$$

$$2057 = P \times \frac{11 \times 22 \times 17}{10 \times 25 \times 20}$$

$$P = 2500.$$

8.(b) Find the population at the end of 1st year?

Solution: Let the population of village at the end of 1st year is P.

$$2057 = P \times \frac{(100-12)(100-15)}{100 \times 100}$$

$$2057 = P \times \frac{88 \times 85}{100 \times 100}$$

$$P = 2750.$$

Important Questions with Short Tricks on Percentage

Question 1: If the radius of a circle is increased by 50%, its area is increased by

- (1) 125%
- (2) 100%
- (3) 75%
- (4) 50%

Solution:

Let the old area to be 100

50% increase means 150%

So, $100 \times 150\% \times 150\%$ because of 2 dimensional

$$100 \times \frac{3}{2} \times \frac{3}{2} = 225$$

$$\text{Increase} = 225 - 100 = 125\%$$

Short Trick:

Formula:- $a + b + \frac{(a \times b)}{100}$

50% + 50% + 50% of 50%

100% + 25% = **125%**

Question 2: The price of an article is reduced by 25% but the daily sale of the article is increased by 30%. The net effect on the daily sale receipt is

(1) $2\frac{1}{2}\%$ increase

(2) $2\frac{1}{2}\%$ decrease

(3) 2% increase

(4) 2% decrease

Solution:

Let the price of the article be Rs 100 and the daily sale be 100 units

Revenue per day = $100 \times 100 = \text{Rs } 10000$

Case II:

New receipts = $75 \times 130 = \text{Rs } 9750$

Decrease = $(10000 - 9750) = 250$

% decrease = $\frac{250}{10000} \times 100 = 2\frac{1}{2}\%$

Short Trick 1:

Let the daily sale is 100

So, $100 \times \frac{75}{100} \times \frac{130}{100} = 97.5$

Means: $100 - 97.5 = 2.5\%$ decrease

Decreases by 2.5%

Short Trick: 2:

$-25\% + 30\% + (-25\%) \text{ of } (30\%)$

= 2.5% decrease

Question 3: In a test consisting of 80 questions carrying one mark each, Arpita answer 65% of the first 40 questions correctly. What percent of the other 40 questions does she need to answer correctly to score 75% on the entire test?

- (1) 60
- (2) 80
- (3) 75
- (4) 85

Solution:

According to question = (x% of remaining 40 ques.) + (65% of already done 40 question) = 75% of total 80 questions

$$\frac{x}{100} \times 40 + \frac{65}{100} \times 40 = \frac{75}{100} \times 80$$

$$\frac{40x + 2600}{100} = \frac{6000}{100}$$

$$40x + 2600 = 6000$$

$$40x = 3400$$

$$x = 85 \%$$

Simple Way:

$$65\% \text{ of } 40 \text{ questions} = \frac{65}{100} \times 40 = 26 \text{ questions}$$

Thus, she gets 26 marks

But she needs to score 75% of 80

$$= \frac{75}{100} \times 80 = 60 \text{ marks}$$

$$\text{Req. marks} = 60 - 26 = 34 \text{ marks}$$

$$\text{Now, } x\% \text{ of } 40 = 34$$

$$\Rightarrow x = \frac{34 \times 100}{40} = 85\%$$

Question 4: If Ravi's salary is 25% more than Raju's salary, then the percentage by which Raju's salary is less than Ravi's salary is _____

- (1) 15
- (2) 20
- (3) 25
- (4) 32

Solution:

$$\text{Ravi's} = \frac{125}{100} \times \text{Raju's} = \frac{5}{4} \times \text{Raju's}$$

This means if Raju's salary is Rs 4 then Ravi's salary is Rs 5.

$$\text{They Req\%} = \frac{5-4}{5} \times 100 = 20\%$$

Short Trick:

$$\begin{array}{r} \text{Raju} \\ 100 \\ + 25 \\ \hline \text{Ravi} \\ 125 \end{array}$$

$$\therefore \frac{25}{125} \times 100 = 20\%$$

Question 5: In a village, each of the 60% of families has a cow; each of the 30% of families has buffalo and each of the 15% of families has both a cow and a buffalo. In all there are 96 families in the village. How many families do not have a cow or a buffalo?

- (1) 20
- (2) 24
- (3) 26
- (4) 28

Solution:

Families have cow = + 60%

Families have buffalo = + 30%

Families have both = - 15%

$$= 75\%$$

Don't have any = 25% of 96 = 24



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