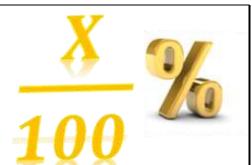# PERCENTAGES

- **Percentage means per one hundred.**

- **X % means X / 100**

- **10 % means 10 / 100 , which is 1 / 10.**

- **10% increase means $\frac{110}{100}$ ➔ $\frac{11}{10}$**

- **10% decrease means $\frac{90}{100}$ ➔ $\frac{9}{10}$**

- **To convert a ratio into percentage multiply it with 100.**

- **Eg: 1 / 2 (ratio) into percentage(%) ➔ (1 /2)*100 = 50%**

- **10 % of (50) is same as 50% of (10) . Ans 5**

- ❖ **If A is R% more than B, then B is less than A by**

  (or)

- ❖ **If price of a product increases by R% ,then Percentage of consumption to decrease to make no change in expenditure.**

$$\left[\frac{R}{(100+R)} \times 100 \right] \%$$

❖ **If A is R % less than B, then B is more than A by**

(or)

❖ **If price of a product decreases by R% ,then the Percentage of consumption to increase to make no change in expenditure.**

$$\left[\frac{R}{(100-R)} \times 100\right]\%$$

❖ **If Population(P) increases by R% per annum, then the Population after 'N' years will be**

(or)

❖ **If price of an item increases by R% per annum, then the price of an item after 'N' years will be**

$$P \times \left[\frac{100+R}{100}\right]^{N}$$

❖ **If population(P) increases by R% per annum, then the Population before 'N' years will be**

(or)

❖ **If price of an item (P) increases by R% per annum, then the price of an item before 'N' years will be**

$$\frac{P}{\left[\frac{100+R}{100}\right]^{N}}$$

❖ **If Population(P) decreases by R% per annum, then the Population after 'N' years will be**

(or)

❖ **If price of an item decreases by R% per annum, then the price of an item after 'N' years will be**

$$P \times \left[\frac{100-R}{100}\right]^{N}$$

❖ **If population(P) decreases by R% per annum, then the Population before 'N' years will be**

(or)

❖ **If price of an item (P) decreases by R% per annum, then the price of an item before 'N' years will be**

$$\frac{P}{\left[\frac{100-R}{100}\right]^{N}}$$

Basic Problems:

1)

i. Let the cost price of an item is 500, if seller increased It by 10% and sell it then what is the selling price. **Ans: 550**

ii. Let the cost price of an item is 800, if seller sold it at a loss 25% then what is the selling price. **Ans: 600**

iii. Let the cost price of an item is 1100, if seller sold it at a profit of 9.09% then what is the selling price. **Ans: 1200**

2) In a family, there are four brothers named A, B, C, and D. Initially, brother A has 500 rupees.

- A increases this amount by 20% and then gives the entire amount to B.
- B decreases the amount received by 25% and gives the remaining amount to C.
- C decreases the amount received by 11.11% and gives the remaining amount to D.
- What is the difference between the initial amount that A had and the final amount that D received ?

   a) 200   **b) 100**   **c) 500**   **d) 350**

3) A fruit seller had some oranges, he sells 40% of them and he still got 420 oranges. How many oranges he had earlier ?

   a) 500   **b) 600**   **c) 700**   **d) 640**

Model : 1

1) The salary of a person was reduced by 10%. By what percent should his reduced salary be raised so as to bring it at par with his original salary ?

   a) 10 %   **b) 16 2/3 %**   **c) 11 1/9 %**   **d) 20 %**

2) The salary of a person was Increased by 20% . By what percent should his increased salary be reduced so as to bring it at par with his original salary ?

   a) 33 1/3 %   **b) 16 2/3 %**   **c) 20 %**   **d) 10%**

3) If A earns 33 1/3% more than B, then by how much percent does B earn less than A ?

a) 20 %　　　**b) 25 %**　　　**c) 42 %**　　　**d) 16 %**

4) A's salary is 20% less than B's salary, by how much percent is B's salary more than A ?

a) 25%　　　**b) 20%**　　　**c) 12%**　　　**d) 6.55 %**

5) In the new budget, the price of **Petrol** is increased by 25%. By how much percent must a person reduce his consumption so that his expenditure on it does not increase ?

a) 20%　　　**b) 25%**　　　**c) 30%**　　　**d) 42%**

6) If the price of **tomatoes** drops by 15% due to deflation, by what percentage must a person increase his consumption so that his expenditure on tomatoes does not change ?

a) 25.36%　　　**b) 12.68%**　　　**c) 17.64%**　　　**d) 35.22%**

Model: 2

1) The population of a town is 1,76,400. If it increases at the rate of 5% per annum,
   (i) what will be its population 2 years hence ? **ans: 1,76,400**
   (ii) What was it '2' years ago ? **ans : 1,60,000**

2) If the population of a town is increased by 20% in the first year and is again increased by 20% in the new year, what effect can be seen in the population of that town (in percentage) ?

a) 36%　　　**b) 42%**　　　**c) 50%**　　　**d) 75%**

3) The value of a machine 'depreciates at the rate of 10% per annum. If its present value is Rs. 162,000.

   (i)   what will be its worth after 2 years ?   **ans: 1,31,220**
   (ii)   What was the value of the machine 2 years ago ? **ans: 2,00000**

4) The value of a machine depreciates at the rate of 20% every year. It was purchased 3 years ago. If its present value is Rs.6400, its purchase price was.

   a) 15200   **b) 10000**   **c) 17500**   **d)12500**

5) If the side of the square is increased by 30% then its area is increased by (in%) ?

   a) 5%↑   **b) 30%**↑   **c) 69%**↑   **d) 58%**↑

6) If the length of rectangle is increased by 20% and breadth is decreased by 10% then what will be the impact on area?

   a) 5%↑   **b)10%**↑   **c) 20%**↓   **d) 8%**↑

Model: 3

1) 40% of the greater number is equal to 60% of the smaller. If their sum is 250, then the smaller number is ?

   a) 150   **b) 100**   **c) 120**   **d) 200**

2) The sum of 15% of a positive number and 20% of the same number is 126. What is one-third of that number ?

   a) 150   **b) 126**   **c) 120**   **d) 380**

3) The product of one-third of a number and 150% of the another number is what percent of the product of the original numbers ?

a) 50%   **b) 20%**   **c) 70%**   **d) 35%**

4) If the numerator of certain fraction is increased by 200% and the denominator is increased by 150% the new fraction thus formed is 9/10 . What is the original fraction ?

a) $\frac{2}{3}$ **b)** $\frac{3}{4}$ **c)** $\frac{7}{9}$ **d)** $\frac{6}{5}$

5) A person multiplied a number by 3/5 instead of 5/3, what is the percentage error in calculation ?

a) 56%   **b) 32%**   **c) 64%**   **d) 77%**

6) A person gave 20% of his income to his elder son, 30% of the remaining to the younger son, and 10% of the balance he donated to a trust . He is left with Rs.10080. His income in rupees was ?

a) 20,000   **b) 30,000**   **c) 28,960**   **d) 42,000**

7) A man spends 75% of his income. His income increases by 25% and increased his expenditure by 20%. His savings are increased by what percentage ?

a) 15%   **b) 25%**   **c) 20%**   **d) 35%**

8) A man saves a certain part of his monthly income so that he can purchase a car in 16 months. Find the % increase in his saving so that he can purchase the same car in 14 months only ?

a) 24.23%   **b) 14.28%**   **c) 34.78%**   **d) 12.29%**

9) Fresh watermelon contains 80% water while dry watermelon contains 10% water by weights. What is the weight of dry watermelon from 25 kg fresh watermelon ?

a) 7.5 kg   **b) 5.55 kg**   **c) 3.5 kg**   **d) 18.5 kg**

10) In measuring sides of a square an error of 5% excess is made, Find the error % in its area.

a) 10.25%   **b) 15.78%**   **c) 25.46%**   **d) 33.33%**

11) Milk contains 5% water What quantity of pure milk should be added to 10 liters of milk to reduce this to 2%.

a)15 liters   **b) 5 liters**   **c) 7 liters**   **d)11 liters**

12) In a school with 4000 students, if 60 percent of the boys and 80 percent of the girls pass the exam, and the overall pass percentage is 65 percent, how many girls are there in the school ?

a) 1500   **b) 1000**   **c) 2000**   **d)3000**

Basic problems:-

1.) i) C.P = 500

$10\% \uparrow (increase) = \dfrac{110}{100}$

$\dfrac{110}{100} \times 500 = 550$ Ans: (550)

(or)

$10\% \text{ of } (500) = \dfrac{10}{100} \times 500 = 50$

$S.P = (500 + 50) = \underline{550}$

ii) C.P = 800, $25\% \downarrow = \dfrac{75}{100}$

$\dfrac{75}{100} \times 800 = 600$ (Ans)

(or)

$\dfrac{1}{4} \times 800 = 200$

$S.P = (800 - 200) = \underline{600}$

iii) C.P = 1100

$9.09\% \Rightarrow \dfrac{1}{11}$ profit means $\dfrac{12}{11}$

$\dfrac{12}{11} \text{ of } (1100) = \underline{1200}$ (Ans)

2.) Brothers A, B, C, D

A = 500 Rs

$\left(20\% = \dfrac{1}{5}, \; 25\% = \dfrac{1}{4}, \; 11.11\% = \dfrac{1}{9}\right)$

| increases means $\to \dfrac{6}{5}$ | decreases means $\to \dfrac{3}{4}$ | decreases means $\dfrac{8}{9}$ |

$$500 \times \dfrac{\overset{100}{\cancel{6}}}{\cancel{5}} \times \dfrac{\overset{2}{\cancel{3}}}{\cancel{4}} \times \dfrac{\overset{2}{\cancel{8}}}{\cancel{9}_3}$$

$$\dfrac{100 \times 2 \times 2}{}$$

$\boxed{400}$; Now 'D' had 400 Rs.

Ans:- $\left[A - D = 500 - 400 = \underline{100} \right]$

3.) He sold 40%, So, He left with 60%.

$$60\% \rightarrow 420$$
$$6\% \rightarrow 42 \div 7$$
$$1\% \rightarrow 7$$

$$\boxed{100\% \rightarrow 700}$$

Ans: 700

Model : 1

1.) The salary reduced by 10%.

$$10\% \downarrow = \frac{1}{10} \downarrow \text{ (or) } \left(\frac{10}{100} \downarrow\right)$$

- Let initial salary be "100" if 10% decrease "90"

- Now, you have to increase 10% But on "90" not on "100".

$$\therefore \frac{10}{90} \times 100 \Rightarrow \frac{1}{9} \times 100 = 11.11\%$$
(or)

Ans: $11\frac{1}{9}\%$

2.) Salary increase by 20%.

which means $\frac{120}{100}$

- Let initial salary be '100' then after increase salary is "120".

- Now, we have to decrease '20' on "120" but not on 100.

$$\therefore \frac{20}{120} \times 100 = \frac{1}{6} \times 100$$
$$= 16.66\% \text{ (or) } 16\frac{2}{3}\%$$

Ans: $16\frac{2}{3}\%$

3.) $33\frac{1}{3}\% \rightarrow \frac{1}{3}$

If 'A' earns $33\frac{1}{3}\%$ more means $\frac{4}{3}$.

which means if 'A' earns '4 ₹', 'B' earns '3 ₹' only.

$$\therefore \text{'B' earns } \frac{1}{4} \times 100$$
$$= 25\%$$

Ans: 'B' earns 25% less than 'A'

4.) If A's salary is 20% less than 'B' means.

$\Rightarrow 20\% = \frac{1}{5} \Rightarrow$ less than means $\frac{4}{5}$

if 'A' = 4, then 'B' = 5

$$\therefore \text{'B's salary is } \frac{1}{4} \times 100 = 25\%$$
25% more than 'A'.

Ans: 25%

(or)

you can use formula.,

$$\frac{R}{100-R} \times 100 \Rightarrow \frac{20}{100-20} \times 100$$

$$\Rightarrow \frac{20}{80} \times 100$$

Ans: 25%

5.) Price of petrol is increased by 25%.

means $\frac{125}{100}$

__Earlier__
For 100₹ you consume 100%.

__Now__
For 125₹ youconsume ?(x%)

$$100₹ \rightarrow 100\%.$$
$$125₹ \rightarrow x\%.$$

Indirect relation so, direct multiplication.

$$x\% = \frac{100 \times 100}{125} = \frac{100 \times \overset{4}{\cancel{100}}}{\underset{5}{\cancel{125}}}$$

$$x\% = 80\%$$

So, you have to reduce
(100₹80%) = 20% Consumption

Ans: 20%

6.) Price of tomato's drop by 15%.

• Earlier for 100₹ → 100%.
• Now for 85₹

$$100 \rightarrow 100\%.$$
$$85 \rightarrow x\%.$$

• Indirect relation, So, direct multiplication.

$$x\% = \frac{100 \times \overset{20}{\cancel{100}}}{\cancel{85}17} = \frac{20}{17} \times 100$$

$$x\% = 117.64\%.$$

So, you have to increase

$$(117.64\% - 100\%) = 17.64\%.$$

Ans: 17.64%.

Model : 2

1.) Population 'P' = 1,76,400
(i)
R% = 5%.
n = 2 years

Population after '2' years

$$= P \left[\frac{100 + R}{100} \right]^n$$

$$= 176,400 \times \left[\frac{105}{100} \right] \times \left[\frac{105}{100} \right]$$

$$= 176,400 \times \frac{21}{20} \times \frac{21}{20}$$

$$= 194,481 \ (Ans):-$$

(or)

$$5\% \Rightarrow \frac{1}{20} \Rightarrow \left(\frac{21}{20} \right)^n \Rightarrow \left(\frac{21}{20} \right)^2$$

$$\frac{441 \ (Future\ value)}{400 \ (present\ value)}$$

400P → 176,400

1P → $\frac{1764}{4}$ = 441

then 441P → 441 × 441

$$(441)^2$$

$$\begin{array}{r} 1\ 6\ 1\ 6\ 0\ 1 \\ 3\ 2\ 0\ 8\ \times \\ 0\ 8\ \times\ \times \\ \hline \end{array}$$

Ans:- 194481

(ii) Population before '2' years.

$$V = P \left[\frac{100 + R}{100} \right]^n$$

$$= P \times \left[\frac{100}{100 + R} \right]^n$$

$$= 176,400 \times \left[\frac{100}{105} \right]^2$$

$$= 176,400 \times \frac{20}{21} \times \frac{20}{21}$$

$$= 160,000 \ (Ans):-$$

(or)

$$\frac{441 \ (Present\ value)}{400 \ (Past\ value)}$$

$$441 \rightarrow 176,400$$
$$400 \rightarrow ?$$

$$400 \times 400 \Rightarrow 160,000 \ (Ans):-$$

2.) $x + y + \frac{xy}{100}$

$$20\% + 20\% + \frac{20 \times 20}{100}$$

$$= 42\%$$

Ans: 42% increase in population.

3.) (i)

Present value = 1,62,000₹

depreciates at R% = 10%

∴ Value of machine after

'n' years is $= P\left[\dfrac{100-R}{100}\right]^N$

$= 162000\left[\dfrac{9}{10}\right]\left[\dfrac{9}{10}\right]$

$= 1,31,220$ (Ans)

(or)

$10\% \downarrow \Rightarrow 10\% = \dfrac{1}{10} \Rightarrow \left(\dfrac{9}{10}\right)^n$.

$\left(\dfrac{9}{10}\right)^2$

$\dfrac{81 \text{ (future value)}}{100 \text{ (present value)}}$

$100p \rightarrow 162,000$

$1p \rightarrow 1620$

$81p \rightarrow 81 \times 1620 = 131,220$

(ii)

Value of the machine

before 'n' years.

$= P\left/\left[\dfrac{100-R}{100}\right]^N\right.$

$$= P \times \left[\frac{100}{100-R}\right]^N$$

$$= 162,000 \left[\frac{10}{9}\right]\left[\frac{10}{9}\right]$$

$$= 2,00000 \text{ (Ans)}.$$

4.) $P = 6400$, $R\cdot l. = 20$, $N = 3$

Value of a machine 'N' years ago

$$= P \times \left[\frac{100}{100-R}\right]^{N=3}$$

$$= 6400 \times \left[\frac{100}{100-20}\right]^3$$

$$= 6400 \times \frac{10}{8} \times \frac{10}{8} \times \frac{10}{8}$$

$$= 12,500 \text{ (Ans)}.$$

5.) $x + y + \frac{xy}{100}$

$$30 + 30 + \frac{30 \times 30}{100}$$

$$60 + 9 = 69\%$$

Ans: 69% increase

6.) $x + y - \frac{xy}{100}$

$$+20 - 10 - \frac{20 \times 10}{100}$$

$$+8\%.$$

Ans: 8% increase

Model : 3

1.) Let the greater number is x & the smaller number is y.

$$40\% (x) = 60\% (y)$$

$$4x = 6y$$

$$2x = 3y$$

$$x + y = 250$$

$$x + \frac{2x}{3} = 250 \Rightarrow \frac{5x}{3} = 250$$

$$\boxed{x = 150} \quad \boxed{y = 100}$$

Ans: $y = 100$

2.) $15x + 20x = 126$

$$35x = 126$$

$$x = \frac{126}{35} \frac{18}{5} \Rightarrow \frac{18}{5}$$

$$100x = \frac{\overset{20}{100} \times 18}{5} \Rightarrow 360$$

$$\therefore \frac{1}{3}(360) = 120 \text{ (Ans)}$$

3.) Let the numbers be x & y

$$\frac{\frac{1}{3} x \times \frac{150}{100} y}{xy} \times 100$$

$$\frac{\frac{1}{3} x \times \frac{3}{2} y}{xy} \times 100$$

$$\frac{1}{2} \times 100 = 50\%$$

Ans: 50%

4.)
$$\frac{\dfrac{300}{100} \times x}{\dfrac{250}{100} \times y} = \frac{9}{10}$$

$$\frac{30}{25} \times \frac{x}{y} = \frac{9}{10}$$

$$\frac{x}{y} = \frac{\cancel{9}^3}{\cancel{10}_2} \times \frac{\cancel{25}^5}{30\cancel{62}}$$

Ans:

$$\boxed{\frac{x}{y} = \frac{3}{4}}$$

5.) Multiplied by $\frac{3}{5}$ instead of $\frac{5}{3}$.

- $\left(\dfrac{3}{5}\right)$ Multiply the numerator & denominator by '3'

$$\Rightarrow \frac{9}{15}$$

- $\left(\dfrac{5}{3}\right)$ Multiply the numerator & denominator by '5'

$$\Rightarrow \frac{25}{15}$$

$\%$ error in calculation $= \dfrac{(25-9)}{25} \times 100$

$$= \frac{\cancel{16}^4}{\cancel{25}} \times \cancel{100}$$

$$= 64\% \text{ (Ans)}.$$

6.)
He gave 20% of income to elder son. So, he left with 80% of income.

$$\frac{80}{100} \times \frac{70}{100} \times \frac{90}{100} \times (x) = 10080$$

$$\frac{\cancel{80}}{\cancel{100}} \times \frac{\cancel{70}}{\cancel{100}} \times \frac{\cancel{90}}{100}(x) = 10080 \quad \frac{\cancel{160}}{1120}_{20}$$

$$\frac{8 \times 7 \times \cancel{9}}{1000}(x) = \cancel{10080}$$

$$\frac{x}{1000} = 20$$

Ans: $\boxed{x = 20{,}000}$

7.) Initial

I	Exp	Sav.
8550	5700	2850

7.) Initial

In	Expen	Saving
100%	75%	25%

New

In	Exp	Saving
125%	90%	35%

- Savings increased by $\dfrac{35-25}{25} \times 100$

$$\Rightarrow \frac{5}{25} \times 100 = 20\%$$

Ans: 20%.

8.) $16 \times x = 14 \times y$

$$\frac{x}{y} = \frac{14}{16} \Rightarrow \frac{7}{8}$$

% increase in savings $= \frac{2}{14} \times 100$

$= \frac{1}{7} \times 100$

$= 14.28\%$

9.) Fresh water melon

Water	Pulp
80%	20%

Dry water melon

Water	Pulp
10%	90%

NOTE:- The 20% pulp in Fresh watermelon becomes 90% in dry watermelon.

∴ In fresh 25kg melon the pulp is 20% which is 5kg.

→ Now, this 5kg becomes 90%

$90\% \rightarrow 5kg$
$10\% \rightarrow 0.55 kg$.

∗ Total wt is $5 + 0.55$
$= 5.55 kg$

10.) original $100 \times 100 = 10,000$
error $105 \times 105 = 11025$

% Error $= \frac{11025 - 10000}{10,000} \times 100$

Ans:- % Error $= 10.25\%$

11.) In 10 litres of Milk,

Pure milk	Water
95%	5%
9.5L	0.5L

• Now to make this 0.5L 2%.

$0.5L \rightarrow 2\%$
$? \rightarrow 100\%$

$\frac{100 \times 0.5}{2} = \frac{100 \times 5}{2 \times 10} = 25$

∴ The solution should be "25L".

Ans:- So, we have to add '15'L of puremilk

12.) Let boys be 'x'
then girls $= (4000 - x)$

$\frac{60}{100} x + \frac{80}{100} (4000 - x) = \frac{65}{100} (4000)$

$60x + 320000 - 80x$
$= 260000$

$60,000 = 20x$

$\boxed{3000 = x}$

Ans:- girls $= 4000 - 3000 = 1000$