

Percentage

→ % change

→ Successive % change
+
application.

Per cent

⇒ Every hundred

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

* $\frac{a}{b} = \frac{a}{b} \times 100\% \quad (\text{circled})$

* $1 = 100\%$.

* $\frac{1}{2} = 50\%$.

* $\frac{1}{3} = 33\cdot33\%$.

* $\frac{1}{4} = 25\%$.

* $\frac{1}{5} = 20\%$.

* $\frac{1}{6} = 16\cdot66\%$.

* $\frac{1}{7} = 14\cdot28\%$.

* $\frac{1}{8} = 12\cdot5\%$.

* $\frac{1}{9} = 11\cdot11\%$.

* $\frac{1}{10} = 10\%$.

$$\text{Ex: } ① \frac{80}{100} = 80 \times \frac{1}{100} \\ = 80\%$$

$$② \frac{4}{5} = \frac{4}{5} \times \frac{100}{100} \\ = \frac{4 \times 100}{5} \times \frac{1}{100} \\ = 80\%$$

* $\frac{1}{11} = 9\cdot09\%$.

* $\frac{1}{12} = 8\cdot33\%$.

* $\frac{1}{13} = 7\cdot7\%$.

* $\frac{1}{14} = 7\cdot14\%$.

* $\frac{1}{15} = 6\cdot66\%$.

* $\frac{1}{16} = 6\cdot25\%$.

* $\frac{1}{17} = 5\cdot88\%$.

* $\frac{1}{18} = 5\cdot55\%$.

* $\frac{1}{19} = 5\cdot28\%$.

* $\frac{1}{20} = 5\%$.

$$\frac{19}{34} = \frac{17+2}{34} \Rightarrow 50\% + 5.88\% \quad \text{negative!}$$

$$\Rightarrow 55.88\%.$$

$$\Rightarrow 0.5588$$

Overall % Change

* $a \xrightarrow{\frac{b-a}{a} \times 100\%} b$

Ex1 $1,20,000 \xrightarrow{\hspace{1cm}} 1,30,000$

$$\frac{1,30,000 - 1,20,000}{1,20,000} \times 100\%$$

$$\Rightarrow \frac{130-120}{120} \Rightarrow \frac{10}{120} \times 100\%$$

$$\Rightarrow 8.33\%$$

Ex2 $110 \xrightarrow{\hspace{1cm}} 130$

$$\Rightarrow \frac{20}{110}$$

$$\frac{130-110}{110} \times 100\%$$

$$\Rightarrow \frac{2}{11}$$

$$\frac{20}{110} \times 100\%$$

$$\Rightarrow 2 \times \frac{1}{11}$$

$$\frac{2}{11} \times 100\%$$

$$\Rightarrow 2 \times 9.09\%$$

$$\Rightarrow 18.18\%$$

Single % Change

initial x $\xrightarrow{+r\%}$ final $x + r\% \text{ of } x$
 $= x + r \times \frac{1}{100} \times x$
 $= x \left[1 + \frac{r}{100} \right]$
 $= x \left[\frac{100+r}{100} \right]$

$x \xrightarrow{+a\%} x \left(\frac{100+a}{100} \right)$

$x \xrightarrow{-b\%} x \left(\frac{100-b}{100} \right)$

$\underline{\underline{x}} \quad ① \quad x \xrightarrow{+12\%} x \left(\frac{100+12}{100} \right) = \frac{112}{100} x$
 $= 1.12 x$

$② \quad x \xrightarrow{+17\%} 1.17 x$

$③ \quad x \xrightarrow{+7\%} 1.07 x$

$④ \quad x \xrightarrow{-12\%} x \left(\frac{100-12}{100} \right) = x (1 - 0.12) = \boxed{0.88x}$

Q3 Population of town has increased up to 2%. If new population is 15,600. What is the original population?

$$\textcircled{2} \xrightarrow{+12\%} x \left(\frac{100+12}{100} \right) = 15600$$

$$1.12x = 15600$$

$$x = \frac{15600}{1.12}$$

$$x = 13928.57$$

Q4 Salary of Ram has grown up by 30%.

New salary = 15,600

old salary = ?

$$x \xrightarrow{+30\%} 1.3x = 15600$$

$$x = \frac{15600}{1.3}$$

$$x = 12000$$

Q1 A is 20% more than B
30% more than C

then ① what % $\frac{B}{C} = ?$

② what % $\frac{C}{B} = ?$

$$\textcircled{B} + 20\% \cdot B = \textcircled{A}$$

$$A = 1.2B$$

$$\textcircled{B} \xrightarrow{\uparrow 20\%} \textcircled{A} \quad \textcircled{1}$$

$$C + 30\% \cdot C = \textcircled{A}$$

$$\textcircled{C} \xrightarrow{\uparrow 30\%} \textcircled{A}$$

$$1.3C = A \quad \textcircled{2}$$

$$A = [1.2B = 1.3C]$$

$$\frac{B}{C} = \frac{13}{12} = \frac{12+1}{12}$$

$$\Rightarrow 1 + \frac{1}{12}$$

$$\Rightarrow 100\% + 8.33\%$$

$$\Rightarrow 108.33\%$$

$$\frac{C}{B} = \frac{12}{13} = 1 - \frac{1}{13}$$

$$= 100\% - 7.7\%$$

$$= 92.3\%$$

Successive % Change

More than
1 change

- ① change
- ② change
- ③ change
- ④ change

2. change



final

$$x \left(\frac{100+a}{100} \right) \times \left(\frac{100+b}{100} \right)$$

$$\begin{aligned} x &\xrightarrow{a\%} x \left(\frac{100+a}{100} \right) \\ &= y \xrightarrow{b\%} y \left(\frac{100+b}{100} \right) \end{aligned}$$

$$\Rightarrow x \left(\frac{100+a}{100} \right) \times \left(\frac{100+b}{100} \right)$$

$$\begin{aligned} \text{Expt} \quad x &\xrightarrow{20\%} \xrightarrow{30\%} x \times \left(\frac{100+20}{100} \right) \left(\frac{100+30}{100} \right) \\ &x \times 1.2 \times 1.3 \end{aligned}$$

$$x \xrightarrow{\text{Overall 1. change}} \quad$$

$$1.56x$$

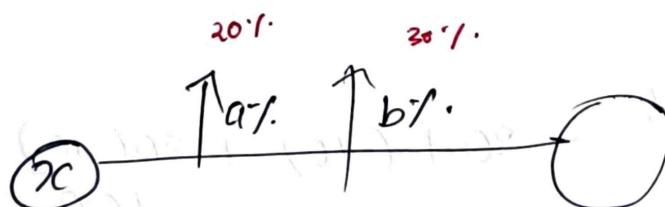
1.56x

56%

$$\frac{1.56 - x}{x} \times 100$$

$$56\%$$

$$\begin{aligned}
 \textcircled{X} \quad & \xrightarrow{\uparrow a\%} \xrightarrow{\uparrow b\%} \Rightarrow x \left(\frac{100+a}{100} \right) \times \left(\frac{100+b}{100} \right) \\
 & \Rightarrow \frac{x}{100^2} [100^2 + 100a + 100b + ab] \\
 & = x \times \frac{100^2}{100} + \frac{x}{100} \times \left(\frac{100a + 100b + ab}{100} \right) \\
 & \Rightarrow x + \left(a + b + \frac{ab}{100} \right) x = x + \frac{1}{100} \\
 & \Rightarrow x + \left[a + b + \frac{ab}{100} \right] \% \text{ of } x
 \end{aligned}$$

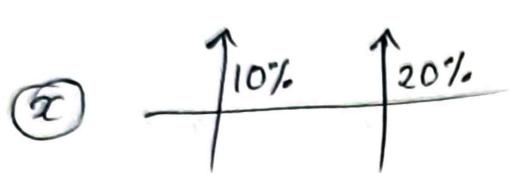


$$\text{Overall \% change} = a + b + \frac{ab}{100}$$

$$\Rightarrow 20 + 30 + \frac{20 \times 30}{100}$$

$$\Rightarrow 56\%$$

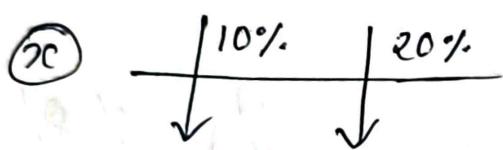
Find out overall % change.



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

32%

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



$$(-10) + (-20) + \frac{(-10)(-20)}{100}$$

$$-30 + 2$$

-28%

28% ↓



$$30 + (-10) + \frac{30(-10)}{100}$$

$$20 - 3$$

17%



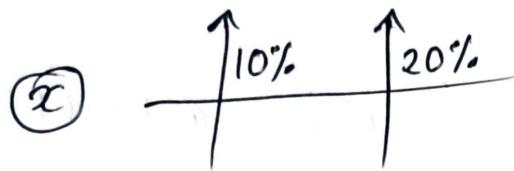
$$(-50) + (-50) + \frac{(-50)(-50)}{100}$$

$$-100 + 25$$

-75%

75% ↓

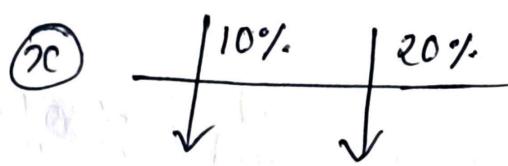
Q) Find out overall % change.



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

32%

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

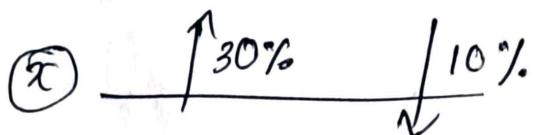


$$(-10) + (-20) + \frac{(-10)(-20)}{100}$$

$$-30 + 2$$

-28%

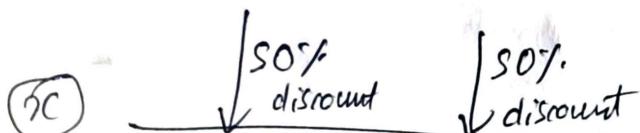
28% ↓



$$30 + (-10) + \frac{30(-10)}{100}$$

$$20 - 3$$

17%



$$(-50) + (-50) + \frac{(-50)(-50)}{100}$$

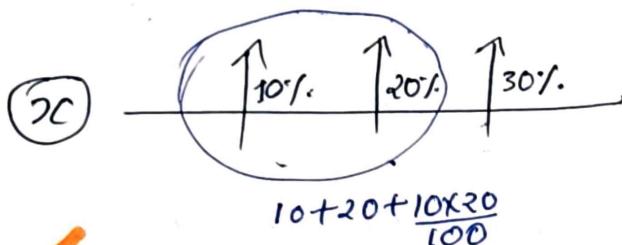
$$-100 + 25$$

-75%

75% ↓

3 change

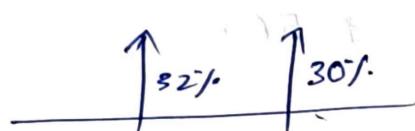
2 KO Pakode
ek formula
fir solve karao



$$x \left(\frac{100+10}{100} \right) \times \left(\frac{100+20}{100} \right) \times \left(\frac{100+30}{100} \right)$$

$\boxed{x \times 1.1 \times 1.2 \times 1.3}$

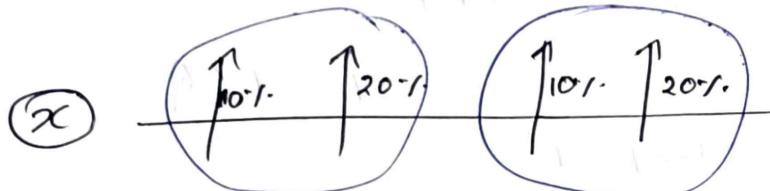
~~$a+b+c+\frac{abc}{100}$~~



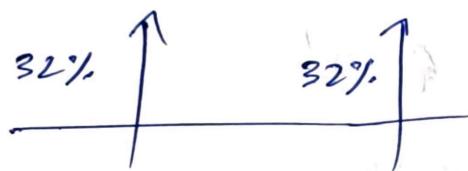
$$32 + 30 + \frac{32 \times 30}{100}$$

$$\begin{aligned} & 62 + 9.6 \\ & = \boxed{71.6\%} \end{aligned}$$

4 change



$$x \times 1.1 \times 1.2 \times 1.1 \times 1.2$$



$$\Rightarrow 32 + 32 + \frac{32 \times 32}{100}$$

$$\Rightarrow 64 + 10.24$$

$$\Rightarrow \boxed{74.24\%}$$

Successive % Change

Applications

$$x \xrightarrow[20\%]{30\%} x \times 1.2 \times 1.3 = 1.56x$$

$$\frac{20+30+20 \times 30}{100} = 56\%$$

Exp = Price \times Qty

$$\text{?} = P \uparrow_{20\%} \quad Q \uparrow_{30\%}$$

~~20 + 30 +~~

$$\frac{20+30+20 \times 30}{100} \quad | \quad 1.2 \times 1.3 \times x$$

↑ 56%.

↑ 56% ↑

$$E = P \times Q$$

$$P \uparrow_{20\%} \rightarrow 1.2P = P'$$

$$1.56$$

$$1.00$$

$$1.56$$

$$Q \uparrow_{30\%} \rightarrow 1.3Q = Q'$$

$$\begin{aligned} E' &= P' \times Q' \\ &= 1.2P \times 1.3Q \\ &= 1.56PQ \end{aligned}$$

$$P \left(\frac{100+20}{100} \right)$$

$$\frac{1.2q}{1.00}$$

$$1.2P$$

$$E' = 1.56 E$$

$$E' \xrightarrow{56\%} E$$

Q1 Sales = Price \times Qty

$$? \quad \uparrow 30\% \quad \downarrow 10\%$$

$$\frac{30 + (-10) + \cancel{30(-10)}}{100} \quad / \quad 1.3 \times 0.9 \times x \\ = 1.17 \rightarrow 17\% \uparrow$$

Q2 $A = l \times b$

$$\uparrow 10\% \quad \uparrow 20\%$$

$$1.1l \times 1.2b$$

$$\frac{10 + 20 + \cancel{10 \times 20}}{100} \quad / \quad 1.1 \times 1.2 \times x \\ = 1.32 \rightarrow 32\% \uparrow$$

for the given purpose

$$\% \text{ reduction} = \left(\frac{x}{100+x} \times 100 \right) \%$$

Q1

In a medical certificate, by mistake a candidate gave his height as 25% more than normal. In the interview panel, he clarified that his height was 5 feet 5 inches. Find the percentage correction made by the candidate from his stated height to his actual height.

Height increased = 25%,

here $x = 25$ to reduce to normal % correction required is $= \frac{25}{100+25} \times 100\% = 20\%$.

Q2

The price of an article is cut by 20%. To restore it to its original price, the new price must be increased by.

New price must be increased by

$$\left(\frac{20}{100-20} \times 100 \right) \% = 25\%$$

$$\text{Ex} \quad 100 - \frac{20}{100} = 80 - \frac{10}{80} = 72$$

$$② 100 \times \frac{80}{100} \times \frac{90}{80} = 72$$

Fraction

100 रुपये का चाला गया
 20% खर्च
 बचा रहा
 $\frac{1}{5}$

$$100 \times \frac{4}{5} \times \frac{9}{10} = 72$$

Question: 1

A man spends 20% of his salary on food items, 25% of the remaining on house rent, 33.33% of the remaining on entertainment and 10% of the remaining on children's education. After this he pays Rs 900 as income tax and still have Rs 2340. How many Rs he spends on entertainment?

1. Basic Method

$$\begin{aligned}
 & 100 \\
 & | - 20 = F.I. \\
 & 80 \\
 & | \quad \frac{1}{4} = - 20 = H.R. \\
 & 60 \\
 & | \quad \frac{1}{3} = - 20 = E. \\
 & 40 \\
 & | \quad - 4 = Education \\
 & \boxed{36} = 900 + 2340 \\
 & \quad = 3240
 \end{aligned}$$

2. Alli Method

$$\begin{aligned}
 & 100 \times \frac{80}{100} \times \frac{3}{4} \times \frac{2}{3} \times \frac{9}{10} \\
 & 36 = 3240 \\
 & I = \frac{3240}{36} = \boxed{90}
 \end{aligned}$$

Question: 2

Priyanka bought a box of chocolates. She has eaten $\frac{1}{4}$ th of them. 33.33% of the remaining chocolates she gave to her friends. She gave 20% of the remaining chocolates to some kids. If she is left with 48 chocolates, how many chocolates were there in the box?

basis

$$100 \times \frac{1}{4} =$$

$$\begin{aligned}
 & X \times \frac{3}{4} \times \frac{2}{3} \times \frac{4}{5} = 48 \\
 & X = 120
 \end{aligned}$$

Question:3

In a school, $\frac{4}{10}$ of the students did not appear for the annual exams. 10% of the students who appeared for the exams could not pass the exam. Out of the remaining students, 50% got distinction marks and 432 students passed the exam but could not get distinction marks. The total number of students in school is :

$$x \times \frac{96}{100} \times \frac{9}{10} \times \frac{1}{2} = 432$$

$x = 1000$

$\underbrace{x}_{\text{app}} + \underbrace{\text{Pass}}_{\text{in}}$

Question:4

A man spent 16.66% of his monthly earning on house rent. Out of the balance, he spent 12.5% on clothes, out of remaining 25% on travelling, out of the balance 22.22% on education, from remaining 27.27% on food. If he had a balance of Rs.1225 at the end of the month, the monthly earning of the man (in rupees) is

$$x \times \frac{5}{6} \times \frac{7}{8} \times \frac{3}{4} \times \frac{2}{9} \times \frac{8}{11} = 1225$$
$$\frac{1}{6} = 16.66\%, \quad \frac{2}{8} = 25\%, \quad \frac{1}{4} = 25\%, \quad \frac{2}{9} = 22.22\%, \quad \frac{3}{11} = 27.27\%$$

$$x = 3960$$

Question:5

In an election between two candidates, 75% of the voters cast their votes, out of which 2% votes were declared invalid. A candidate got 9261 votes which were 75% of the valid votes. The total number of voters enrolled in that election was $\frac{3}{4}$.

$$x \times \frac{3}{4} \times \frac{98}{100} \times \frac{3}{4} = 9261$$

Valid Votes

$x = 16800$

Question:6

There are two candidates P and Q in an election. During the campaign, 40% of the voters promised to vote for P, and rest for Q. However, on the day of election 15% of the voter went back on their promise to vote for P and instead voted for Q. 25% of the voters went back on their promise to vote for Q and instead voted for P. P lost by 300 votes, then what was the total no. of voters.

<u>100</u>	
<u>P</u>	<u>Q</u>
40	60
-6 ($40 \times 15\%$)	+6
+25	-15 ($60 \times 25\%$)
<u>49</u>	<u>51</u>
$2 = 300$	
<u>$2 = 150$</u>	

Question:7

If each edge of a cube is increased by 50%, find the percentage increase in its volume.

A. 125%

125

B. 237.5%

50 50 50

C. 37.5%

D. 225%

$a+b+\frac{ab}{100}$

$$\text{Vol} = a \times a \times a$$

$$2 \times 2 \times 2 = 8$$

$\hookrightarrow 3 \times 3 \times 3 = 27 \quad +19$

$$\frac{19}{8} \times 100$$

$$50+50+\frac{50 \times 50}{100} = 125$$

$$125+50+\frac{125 \times 50}{100}$$

$$237.5\% \quad \underline{\text{Ans}}$$

Ans

Question:8

The length, Breadth and height of a cuboid by 20%, 10% and 30% increases respectively. What is the percentage increases in the volume of that cuboid?

- A. 30%
- B. 20%
- C. 71.6%
- D. 43%
- E. Can't say

$$V = l \times b \times h$$
$$5 \quad 10 \quad 10 = 500$$
$$6 \quad 11 \quad 13 = 858$$

$\downarrow \frac{(5+1)}{5} \quad \downarrow \frac{(10+1)}{10} \quad \downarrow \frac{(10+3)}{10}$

$$\frac{858 \times 100}{500}$$

21.61-

Question:09

In an examination of n questions, a student replied 15 out of the first 20 questions correctly. Of the remaining questions, he answered one-third correctly. All the questions have the same credit. If the student gets 50% marks, the value of n is (no negative marking)

$$n =$$
$$20 + (n-20)$$
$$25 + \frac{1}{3}(n-20) = \frac{n}{2}$$

$n = 50$ Ans

Question:10

Journalist Popatlal's income is 37.5% less than Dr. Iyyer's. Then Dr. Iyyer's income is how much % more than Popatlal's income?

Question:11

If the cost of coriander sold is increased by 33.33%. What should be the % decrease in consumption to keep expenditure same?

- 1) 29%
- ~~2) 25%~~
- 3) 30%
- 4) 25%
- 5) None of these

$$E = P \times C$$

Expenditure Price Consumption

~~4~~ 3 4 3

\rightarrow 3

$\therefore \frac{1}{4} = 25\%$

Question:12

A reduction of $\underline{20\%}$ in the rate of sugar enables Sudhir to get 6 kg more sugar for Rs 960. What is the reduced rate of sugar per kg?

$E = \text{constant}$

$$E = P \times C$$

5 $\cancel{P} \downarrow$ } E expenditure same because
4 $\cancel{(C)} \downarrow$ } C change

$$2 = 6 \text{ kg}$$

~~Rs.~~

24 kg } initial
consump

30 kg } final
consumption

~~960~~ ~~30~~
~~30~~

Question:13

The price of sugar reduced by 20%. Now a person can buy 500 gm more sugar for Rs. 36. The original price of sugar per kilogram was

Question:14 The arithmetic mean of scores of 25 students in an examination is 50. Five of these students top the examination with the same score. If the scores of the other students are distinct integers with the lowest being 30, then the maximum possible score of the toppers is :

Question:15 The monthly salary of a person was Rs 1,60,000. He used to spend on three heads Personal and family expenses (P), Taxes (T) and Education loan (E) and the rest were his savings. P was 50% of the income, E was 20% of P, and T was 15% of E. When his salary got raised by 30%, he maintained the percentage level of P, but E became 30% of P and T became 20% of E. The sum of the two savings (in Rs) is:

Question:16 The population of a town is 6000. If males are increased by 5% and female are increased by 9%. Then population will become 6500 after 1 year. Find the number of males and females Initially ?

Basic

$$\begin{array}{l} M+F=6000 \\ 6000 \\ 1.05M+1.09F=6500 \end{array} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\}$$

Asli Method

(rule)
→ Break Rule

$$\begin{array}{ccc} 6000 & \xrightarrow{+500} & 6500 \\ M & \swarrow & F \\ [5\%] & & [5\%] + 4\% \end{array}$$

$\frac{+300}{-200} \quad \frac{4}{100} \times F = 200$

$6000 \times 5\% = 300$

$F = 5000$

↓
Mahan 5%. Toh
badnege 2%

Question:17 The present population of a town is 6000, if the number of males increase by 8% and the number of females increase by 10%, the population will be 6500, Find the present number of females in the town -

$$\begin{array}{c}
 6000 \xrightarrow[20]{\frac{480}{8\%}} 6500 \\
 \text{M} \quad F \\
 \boxed{8\%} \quad \boxed{8\% + 2\%} \\
 \text{Males } \xrightarrow{\frac{2000}{\text{Female}}} \quad \text{F} = 1000
 \end{array}$$