

## Percentage

$\frac{N}{100} \Rightarrow 100$  equal parts  
 $\downarrow$   
1 part +  $1\%$  of  $N$

$[P\% + C\%]$  means for every  $\underline{\underline{100}}$

$\frac{500}{100} = 5$        $1\% \text{ of } 500$   
 $+ 20\% \text{ of } 500 = \frac{5 \times 20}{100}$   
 $= \underline{\underline{100}}$



$\leftarrow$  Exam  
Kapil  $\rightarrow$  50 M

$\leftarrow$  Aseet  $\rightarrow$  75 M

$\leftarrow$  Exam

Max

$$200 \Rightarrow 25\% \checkmark$$
$$400 \Rightarrow \frac{75}{4} = 18.75\% \underline{\underline{}}$$



Fraction to percentage:-

Let multiply with 100

$$\frac{1}{5} \rightarrow \frac{1}{5} \times 100\% = 20\%$$

$$\frac{1}{3} \rightarrow \frac{1}{3} \times 100 = 33\frac{1}{3}\%$$



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$\frac{1}{2} = 50\%$   
 $\frac{1}{3} = 33\frac{1}{3}\%$   
 $\frac{1}{4} = 25\%$   
 $\frac{1}{5} = 20\%$   
 $\frac{1}{6} = 16.\underline{67}\%$   
 $\frac{1}{8} = 12.5\%$   
 $\frac{1}{9} = 11.\underline{11}\%$   
 $\frac{1}{10} = 10\%$   
 $\frac{1}{11} = 9.\underline{90}\%$   
 $\frac{1}{12} = 8.\underline{33}\%$   
 $\frac{1}{12} = \frac{1}{4} \times \frac{1}{3} = (\frac{1}{4}) \times \frac{1}{3}$   
 $= 25 \times \frac{1}{3}\%$   
 $= \frac{25}{3}\%$   
 $= 8.33\%$   
 $\frac{3}{4} = \underline{\underline{75\%}}$



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Percentage to Fraction:-

→ Divide by 100

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

$$20\% \rightarrow \frac{20}{100} = \frac{1}{5}$$

$$70\% \rightarrow \frac{70}{100} = \frac{7}{10}$$

$$75\% \rightarrow \frac{75}{100} = \frac{3}{4}$$



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$\# \quad 30\% \text{ of } 700$ $= \left(\frac{30}{100}\right) \times 700 = \underline{\underline{210}}$ $\text{or } 1\% \text{ of } 700$	$700\% \text{ of } 30$ $= \left(\frac{700}{100}\right) \times 30 = \underline{210}$ $\text{or } 1\% \text{ of } 30$
---	---

$a\% \text{ of } b = b\% \text{ of } a$

+



### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage(Lec-1)



1)  $5\% \text{ of } a = b$ , then  $b\% \text{ of } 20$  is the same as \_\_\_\_\_.

- A)  $20\% \text{ of } \frac{a}{2}$       B)  $50\% \text{ of } \frac{a}{20}$       C)  $50\% \text{ of } \frac{a}{2}$       D)  $20\% \text{ of } \frac{a}{20}$

$$\begin{aligned} (n-2) \quad 5\% \text{ of } a &= b \Rightarrow \frac{5}{100} \times a = b \\ b\% \text{ of } 20 &= \frac{b}{100} \times 20 = \frac{b}{5} = \frac{a}{20} \times 5 = \frac{a}{100} \end{aligned}$$

$$\frac{q}{100} = \left(\frac{q}{2}\right) \times \frac{1}{50}$$

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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage(Lec-1)

Percentage - 1 | Basic Concept | General Aptitude | Lec 37 | GATE CE



1)  $5\% \text{ of } a = b$ , then  $b\% \text{ of } 20$  is the same as \_\_\_\_\_.

A)  $20\% \text{ of } \frac{a}{2}$   
 $\cancel{\frac{20}{100} \times \frac{a}{2}} = 10$   
 $a = 100$

$b = 5$

$5\% \text{ of } 20 = \cancel{1}$

B)  $50\% \text{ of } \frac{a}{20}$   
 $\cancel{5 \times \cancel{a} \times 5} = 25$

C)  $50\% \text{ of } \frac{a}{2}$   
 $\cancel{5 \times \cancel{a} \times 5} = 25$

D)  $20\% \text{ of } \frac{a}{20}$   
 $\cancel{2 \times \cancel{a} \times 5} = \cancel{5} \times 20 = 100$

$5\% \text{ of } a = b \Rightarrow \frac{a}{100} \times 5 = b$   
 $b\% \text{ of } 20$

$\cancel{\frac{20}{100} \times b = \frac{b}{5}} = \frac{a}{20 \times 5} = \frac{a}{100}$

45:03 / 1:03:38

GATE 2021

37

GATE 2021

38

Ways

5M

### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage(Lec-1)



Q) (x % of y) + (y % of x) is equivalent to

A) 2 % of  $xy$

B) 2 % of  $\left(\frac{xy}{100}\right)$

[GATE 2016]

*Same opn*

$$100\% \text{ of } xy$$

$$= 2y = 100\%$$

C)  $xy \% \text{ of } 100$

D)  $100 \% \text{ of } xy$

$$2\% \text{ of } 100\% \\ = 200$$

$$2\% \text{ of } \frac{xy}{100}$$

$$100\% \text{ of } xy$$

$$100\%$$

$$x = 100, y = 100 \quad 2(x\% \text{ of } y) = 2(10\% \text{ of } 100) \\ = 2 \times 100 \\ = 200$$



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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage(Lec-1)

3) If 40% of a = b then b% of 40 is the same as

$$40\% \text{ of } a = b$$

$$\frac{9}{10} \times 40 = b$$

$$\frac{9}{6} = \frac{5}{2}$$

$$\therefore b = \frac{29}{5}$$

$$b\% \text{ of } 40 =$$

$$= \frac{40}{100} \times b$$

$$= \left( \frac{2}{5} \right) b$$

$$\therefore = \frac{2}{5} \times \frac{29}{5} = \frac{49}{25}$$



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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage(Lec-1)

Percentage - 1 | Basic Concept | General Aptitude | Lec 37 | GATE CE  
Q) If 40% of  $(a + b)$  = 60% of  $(a - b)$ . Find the value of  $(2a - 3b)/(a + b)$

NAT

$$\frac{a+b}{100} \times 40\% = \frac{a-b}{100} \times 60\%$$

$$2(a+b) = 3(a-b)$$

5b = 4

$$\frac{2a-3b}{a+b} = \frac{10b-3b}{5b+b}$$
$$= \frac{7}{6}$$

58:16 / 1:03:38

GATE 2021

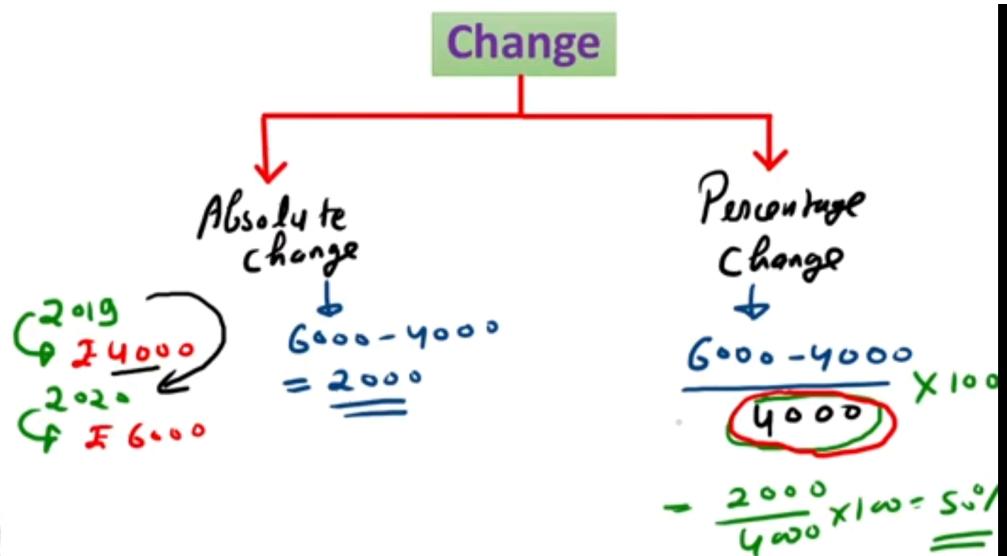
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GATE 2021

38

Ways

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To increase & Decrease a given number by given percent



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## To increase & Decrease a given number by given percent

$$\begin{aligned}x \uparrow \text{by } 20\% &= x + \frac{x}{100} \times 20 \\&= x + \frac{x}{5} = \frac{6x}{5} \\&= \underline{1.2x}\end{aligned}$$

$$\begin{aligned}x \uparrow \text{by } 30\% &= 1.3x \\x \uparrow \text{by } 80\% &= 1.8x \\x \uparrow \text{by } 5\% &= 1.05x \\x \uparrow \text{by } 100\% &= \underline{\underline{2x}}\end{aligned}$$

$$\begin{aligned}x \uparrow \text{by } 30\% &= 4x \\" &\quad " 50\% = 6x\end{aligned}$$

x  
 $x \xrightarrow{400\% \uparrow} 5x$   
 $x \xrightarrow{140\% \uparrow} 15x$   
 $x \xrightarrow{9900\% \uparrow} 100x$



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To increase & Decrease a given number by given percent

$$x \text{ by } 20\% = x - \frac{x}{100} + 20$$
$$= x - \frac{x}{5} = \frac{4x}{5} = \underline{\underline{.8x}}$$

$$x \text{ by } 100\% = 0$$
~~$$x - \frac{x}{100} = 40\%$$~~

$$x \text{ by } 10\% = .9x$$
$$\text{, , } 50\% = .5x$$
$$\text{, , } 90\% = .1x$$



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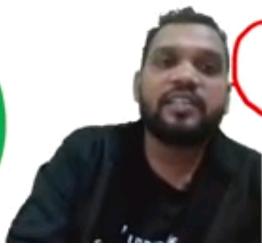
## Shortcut in percentage calculation:-

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Easy to calculate any value of 1%, 10%, 20%,  
25%, 33.3%, 50% & 100%

$$\begin{aligned} 1\% \text{ of } 300 &= 3 \\ 10\%, " &= 30 \\ 20\%, " &= 60 \quad \times 2 \\ 25\%, " &= 75 \\ 33.3\%, " &= 100 \\ 50\%, " &= 150 \\ 100\%, " &= 300 \end{aligned}$$

$$\begin{aligned} 12.5\% \text{ of } 300 &= \cancel{\left(\frac{300}{100}\right) \times 12.5} \\ 12.5\% &= 10\% + 2.5 \\ &= 30 + 7.5 \\ &= 37.5 \end{aligned}$$



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$$\textcircled{1} \quad 72\% \text{ of } \underline{300} \Rightarrow \begin{array}{l} 70\% + 2\% \\ (30 \times 7) + (3 \times 2) \\ \hookrightarrow 210 + 6 = \underline{\underline{216}} \end{array}$$

$$\textcircled{2} \quad 98\% \text{ of } 300 \Rightarrow \begin{array}{l} 100\% - 2\% \\ 300 - 6 = \underline{\underline{294}} \end{array}$$

$$\textcircled{3} \quad 45\% \text{ of } \underline{300} \Rightarrow \begin{array}{l} 50\% - 5\% \\ (150 - 15) \\ = \underline{\underline{135}} \end{array}$$



$$\underline{77\% \text{ of } 980} \Rightarrow \frac{80\%}{\cancel{5}} - \frac{3\%}{\cancel{4}} \text{ or } \frac{75\% + 2\%}{\cancel{4}}$$
$$\left( \frac{98 \times 8}{800} - 2 \right)$$
$$= 784 - 2$$
$$= \underline{\underline{755}}$$



$$\textcircled{1} \quad 19\% \text{ of } \frac{999}{\underline{\underline{1000}}} \Rightarrow \underline{\underline{19^{\circ}}}$$

$$\textcircled{2} \quad \begin{array}{c} \underline{\underline{39}}\% \text{ of } \cancel{798} \\ \downarrow \\ 4^{\circ} - 1^{\circ} = 3^{\circ} \\ 3^{\circ} - 8 = \underline{\underline{312}} \end{array}$$

$$\begin{array}{rcl} 320 & \xrightarrow[100\%]{+32} & 320 + 32 \\ \textcircled{320} & & \textcircled{352} \\ \textcircled{100\%} & & \textcircled{110\%} \\ \hline & & \end{array}$$
$$\begin{array}{rcl} 320 & \xrightarrow[100\%]{-32} & 320 - 32 \\ \textcircled{320} & & \textcircled{288} \\ \textcircled{100\%} & & \textcircled{90\%} \\ \hline & & \end{array}$$





## Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

✓ 1) If 18% of a number is 720, then what is 81% of the same number?

10:05

A) 2280

B) 1620

C) 3240 ✓

D) 3160

$$\begin{aligned} & \text{Given: } 18\% \text{ of a number} = 720 \\ & \text{Let the number be } x. \quad \text{So, } 18\% \text{ of } x = 720 \\ & \frac{18}{100} \times x = 720 \\ & x = \frac{720 \times 100}{18} \\ & x = 4000 \\ \\ & \text{Now, we need to find } 81\% \text{ of } x. \\ & 81\% \text{ of } x = \frac{81}{100} \times 4000 \\ & = 3240 \end{aligned}$$



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✓ 2) A number is increased by 84, it becomes 107% of itself. What is the number?

A) 600

B) 900

C) 1500

D) 1200 ✓

$$\begin{array}{ccc} \text{100\%} & +84 & \text{107\%} \\ \downarrow & \nearrow & \downarrow \\ \end{array}$$

$7\% \rightarrow 84$   
 $1\% \rightarrow 12$   
 $100\% \rightarrow 1200$



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4 typ

Typo-I

$$\left\{ \begin{array}{l} 400 \xrightarrow[+120]{30\%} 520 \\ 940 \xrightarrow[+188]{20\%} 1128 \end{array} \right\}$$

$$\left\{ \begin{array}{l} 400 \xrightarrow[-100]{25\%} 300 \\ 720 \xrightarrow[-216]{30\%} 504 \end{array} \right\}$$

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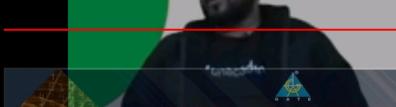
**Type-II**

$$\left\{ \begin{array}{l} 200 \xrightarrow[+100]{50\% +100} 300 \\ 320 \xrightarrow[+64]{20\% +64} 384 \end{array} \right.$$



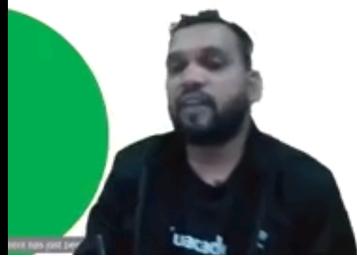
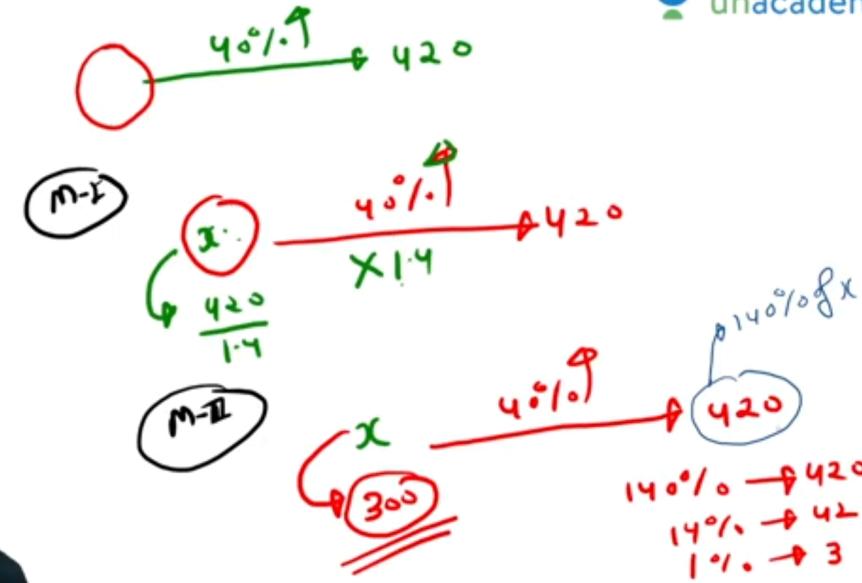
$$\left\{ \begin{array}{l} 200 \xrightarrow[-50]{25\% -50} 150 \\ 300 \xrightarrow[-50]{166.7\% -50} 250 \end{array} \right.$$

22:28 / 1:13:10

**WHICH LAPTOP DID AVI LIVE ON?** GATE 2021 TO GET INTO IITs & IISERs**THEORY OF**

Type III

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$$\begin{aligned}
 & \text{Original Value} \xrightarrow{20\% \text{ off}} 160 \\
 & \text{Marked Price} \xrightarrow{20\% \text{ off}} 160 \\
 & \quad \downarrow \frac{160}{x} \cdot 8 \\
 & \text{Original Price} \xrightarrow{20\% \text{ off}} 160 \\
 & \quad \downarrow \frac{160}{x} \cdot 8 \\
 & \quad \quad \quad \text{80% of } x \\
 & \quad \quad \quad 160 \\
 & \quad \quad \quad 80\% \rightarrow 160 \\
 & \quad \quad \quad 100\% \rightarrow 200 \\
 & \quad \quad \quad 100\% \rightarrow 200
 \end{aligned}$$



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**Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage**

1) Rajiv spends 40% of his salary on food, 20% on house rent, 10% on entertainment, 10% on conveyance. If his savings at the month end are ₹2,000, then his monthly salary is

[ESE 2017, 2 MARKS]

- A) ₹6,000      B) ₹8,000      C) ₹10,000      D) ₹12,000

$$\begin{array}{l} \cancel{80\%} \quad \cancel{20\%} \rightarrow 2000 \\ \cancel{\phantom{0}} \quad \cancel{\phantom{0}} \\ 10\% \rightarrow 100 \\ 10\% \rightarrow \cancel{10000} \end{array}$$



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21 A candidate appearing for an examination has to secure 40% marks to pass a paper. But he secured only 40 marks and failed by 20 marks. What are the maximum marks for the paper?

A) 100

B) 150

C) 180

D) 200

[VIZAG STEEL PLANT, 2015]

$$40 + 20 \rightarrow 40\%$$

$$40\% \rightarrow 60$$

$$2\% \rightarrow 3$$

$$10\% \rightarrow 150$$

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In a party, 60% of the invited guests are male and 40% are female. If 80% of the invited guests attended the party and if all the invited female guests attended, what would be the ratio of males to females among the attendees in the party?

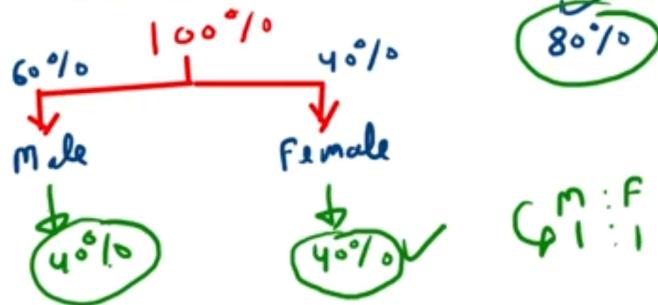
A) 2:3

B) 1:1

C) 3:2

D) 2:1

[GATE 2018, 2 MARKS (CS)]



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~~Q4.~~ The ratio of the number of boys and girls who participated in an examination is 4:3. The total percentage of candidates who passed the examination is 80 and the percentage of girls who passed is 90. The percentage of boys who passed is \_\_\_\_\_.

[GATE-2019]

- A) 90.00      B) 80.50

- C) 55.50      D) 72.50

$$\begin{aligned} \frac{B}{G} &= \frac{4}{3} \\ B &= 400 \\ G &= 300 \\ B+G &= 700 \end{aligned}$$

$$\begin{aligned} \text{Total} &= 80\% \quad 20\% \\ \text{Girls} &= 90\% \quad 270 \\ \text{Boys} &= 10\% \quad 70 \\ \text{Boys} &= 560 - 270 = 290 \\ &\Rightarrow \frac{290}{400} \times 100 = 72.5\% \end{aligned}$$

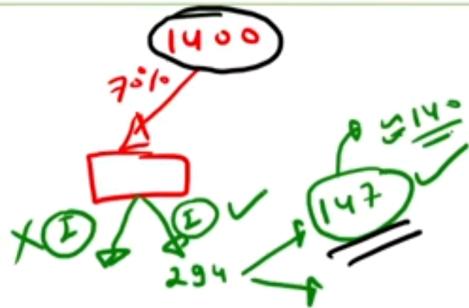
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**Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage**

5) In a country of 1400 million population, 70% own mobile phones. Among the mobile phone owners, only 294 million access the internet. Among these Internet users, only half buy goods from e-commerce portals. What is the percentage of these buyers in the country? [GATE 2019]

- A) 10.50      B) 14.70      C) 15.00      D) 50.00



$$\frac{147}{1400} \times 100$$

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## Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

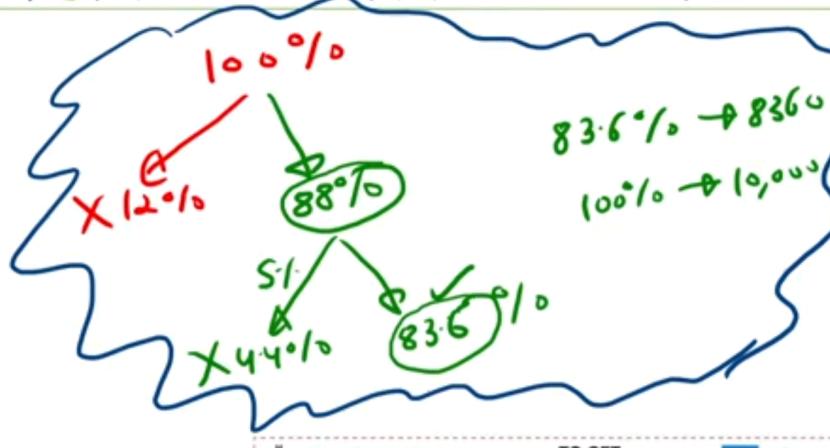
6) A village lost 12% of its goats in a flood and 5% of remainder died from diseases. If the number left now is 8360 what was the original number before the flood?

A) 1000

B) 10,000

C) 1,00,000

D) 8360



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 Home Work Question

The ratio of the number of boys and girls in a college is  $3 : 2$ . If 20% of boys and 25% of girls are adults, the percentage of those students who are not adults, is

A) 58%

B) 67.5%

C) 78%

D) 82.5%

$$\frac{B}{G} = \frac{3}{2}$$

$$\begin{aligned} B &= 300 \\ G &= 200 \\ B+G &= 500 \end{aligned}$$

$$\begin{aligned} 20\% \text{ of Boys} &= 60 \\ 25\% \text{ of Girls} &= 50 \end{aligned}$$

$$\begin{array}{r} 110 \\ \hline 390 \\ \hline 400 \end{array}$$

$$\frac{390}{500} \times 100$$



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- ①  $a$  is  $x\%$  of  $b$
- ②  $a$  is  $x\%$  greater than  $b$
- ③  $a$  is  $x\%$  less than  $b$



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① A is  $20\%$  of B

(M-I)

$$\left(\frac{B}{100}\right) \times 20 = A$$

$$\frac{B}{5} = A$$

$$\Rightarrow A : B = 1 : 5$$

(M-II)

$$B = 100$$

$$A = 20$$

$$\frac{A}{B} = \frac{20}{100}$$

$$A : B = 1 : 5$$

\*\*\*\*

(M-III)

$$20\% \rightarrow \frac{1}{5}$$

$$A : B$$

$$1 : 5$$



## Type-II

A is 20% more than B

P-II

A = 120% of B

$$A = B + \left(\frac{B}{100}\right) \times 20$$

$$A = B + \frac{B}{5}$$

$$A = \frac{6B}{5} \Rightarrow A:B \rightarrow 6:5$$

P-II

$$B = 100$$

$$A = 100 + 20$$

$$A = 120$$

$$A:B = 120:100$$

$$A:B = 6:5$$

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P-III

$$20\% \rightarrow \frac{1}{5}$$

$$A:B$$

$$(5+1):5$$

$$\hookrightarrow 6:5$$



1000+

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Type III

A is 20% less than B  
 $\hookrightarrow A = 80\% \text{ of } B$

M-3

$$A = B - \left(\frac{B}{100}\right) \times 20$$

$$= B - \frac{B}{5} = \frac{4B}{5}$$

$$A = \frac{4B}{5}$$

(A : B)  
4 : 5

M-11

$$B = 100\%$$

$$A = 100 - 20$$

$$A = 80$$

(A : B)  
4 : 5

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~~\*\*\*\*~~

M-IV

$$20\% \rightarrow \frac{1}{5}$$

$$A : B$$

$$(5-1) : 5$$

$$\hookrightarrow 4 : 5$$

$$5 \times \frac{1}{5} = 1$$



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1) If A is equal to 20% of B and B is equal to 25% of C; then what percent of C is equal to A?

A) 10

B) 15

C) 5

D) 20

A is equal to 20% of B | B is equal to 25% of C

$$20\% \rightarrow \frac{1}{5}$$

$$\begin{matrix} A & : & B \\ 1 & : & 5 \end{matrix}$$

$$25\% \rightarrow \frac{1}{4}$$

$$\begin{matrix} B & : & C \\ 1 & : & 4 \end{matrix}$$

$$\frac{A}{B} = \frac{1}{5} \quad \frac{B}{C} = \frac{1}{4}$$

$$\frac{A}{C} = \frac{1}{20}$$

$$\frac{1}{20} \times 100 = 5\%$$

$$\begin{aligned} \frac{A}{C} &= \frac{1}{20} \\ A &= 1 \text{ unit} \\ C &= 20 \text{ units} \end{aligned}$$

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Q) If 35% of A's income is equal to 25% of B's income, then the ratio of A's income to B's income is

A) 7 : 5

B) 5 : 7

C) 4 : 7

D) 4 : 3  
[SF]

$$35\% \text{ of } A = 25\% \text{ of } B$$

$$\frac{A}{100} \times 35 = \frac{B}{100} \times 25$$
$$\frac{A}{B} = \frac{25}{35} = \frac{5}{7}$$

3 : 7



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3) If A is 25% more than B.

a) Find A : B  $\rightarrow 5:4$

b) B is what percentage less than A?  $\rightarrow 20\%$

A is 25% more than B

$25\% \rightarrow \frac{1}{4}$

A  $\propto$  B

$$\begin{matrix} (4+1) & 4 \\ S & 4 \end{matrix}$$

$$\frac{A}{B} = \frac{5}{4}$$

A = 5 unit

B = 4 unit

$$A - B$$

$$\frac{5-4}{5} \times 100$$

$$B = \frac{1}{5} \times 100 = 20\% \quad \underline{\underline{}}$$

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4) If A is 50% less than B, then find

a) Find A : B  $\rightarrow 1 : 2$

b) B is what percentage more than A?  $\rightarrow 100\%$

A is 50% less than B

$$50\% \rightarrow \frac{1}{2}$$

$$A : B$$

$$(2-1) : 2 \\ \rightarrow 1 : 2$$

$$\frac{A}{B} = \frac{1}{2} \quad A = 1 \text{ unit} \quad B = 2 \text{ units}$$

$$\frac{B-A}{A} \times 100 = 100\%$$

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 Home Work Question

A's income is 25% more than B's income. How much per cent is B's income less than A's income?

[VIZAG STEEL PLANT, 2015]

- A) 30%      B) 25 %      C) 20%      D) 27.5%

$$\begin{array}{l} 25\% + 1 \\ \hline A : B \\ (4+1) : 4 \end{array} \left. \begin{array}{l} \{ \\ \} \end{array} \right\} \begin{array}{l} A : B \\ 5 : 4 \end{array} \quad \frac{A}{B} = \frac{5}{4} \quad 20\%$$



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 Home Work Question

A's income is 25% more than B's income. How much per cent is B's income less than A's income?

[VIZAG STEEL PLANT, 2015]

- A) 30%      B) 25 %      C) 20%      D) 27.5%

$$\frac{25+1}{4} \quad A : B \quad \left\{ \begin{array}{l} A:B \\ (4+1):4 \end{array} \right. \quad 4:5:4$$

$$\frac{A}{B} = \frac{5}{4}$$

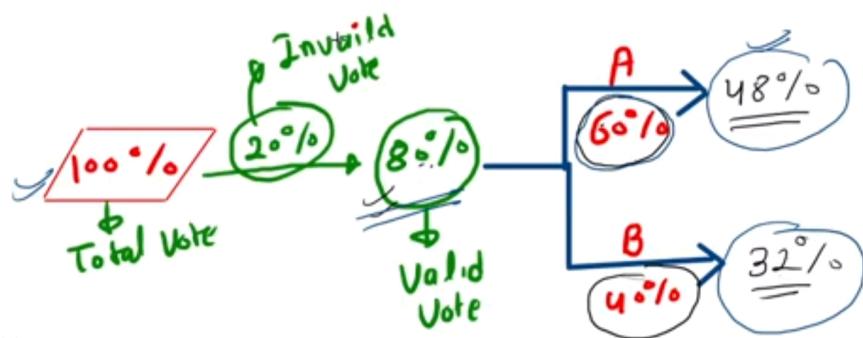
$$20\%$$

$$\frac{A-B}{A} \times 100 = 20\%$$



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## Election Based Question



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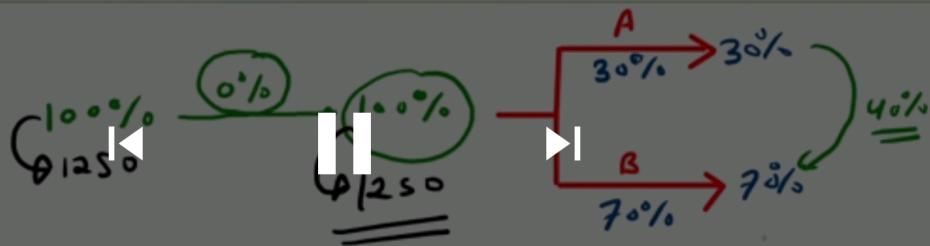
1) In a election contested by two candidates, one candidate got 30% of total votes and still lost by 500 votes, then find the total number of votes casted.

A) 1350

B) 1250

C) 1150

D) 1000



27:28 / 1:04:10

GATE 2021

41

GATE 2021

40

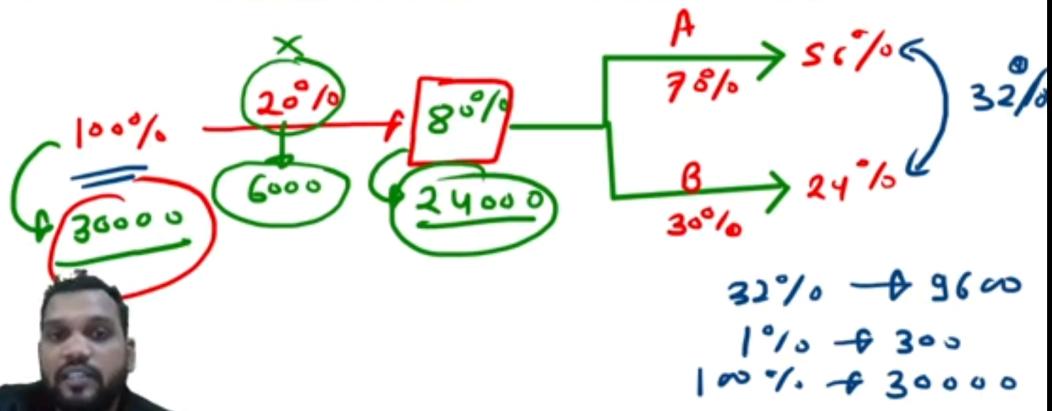
GATE 2021

49



### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

- 2) In a election 2 candidates participated 20% votes declare invalid & the winner gets 70% of the valid votes, & won by 9600 votes. Find the number of Voting list and valid votes
- A) 30000, 24000      B) 25000, 20000      C) 20000, 16000      D) 22000, 17600



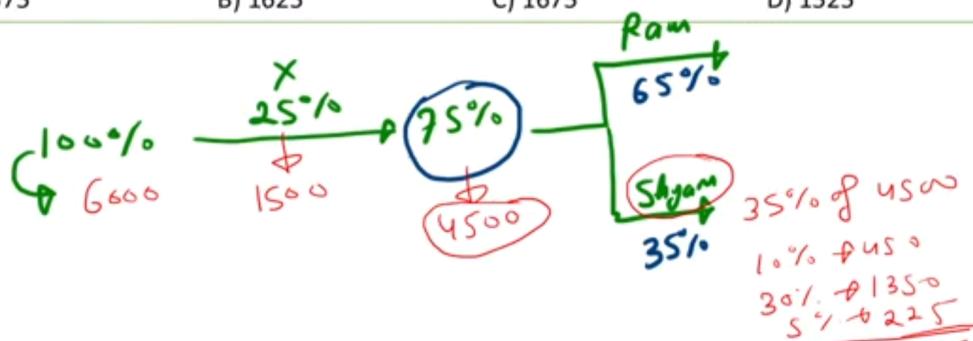
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**Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage**

3) There are two candidates Ram and Shyam for an election. Ram gets 65% of total valid votes. If total votes were 6000 what is the number of valid votes that the other candidate Shyam gets if 25% of total votes were declared invalid?

- A) 1575      B) 1625      C) 1675      D) 1525



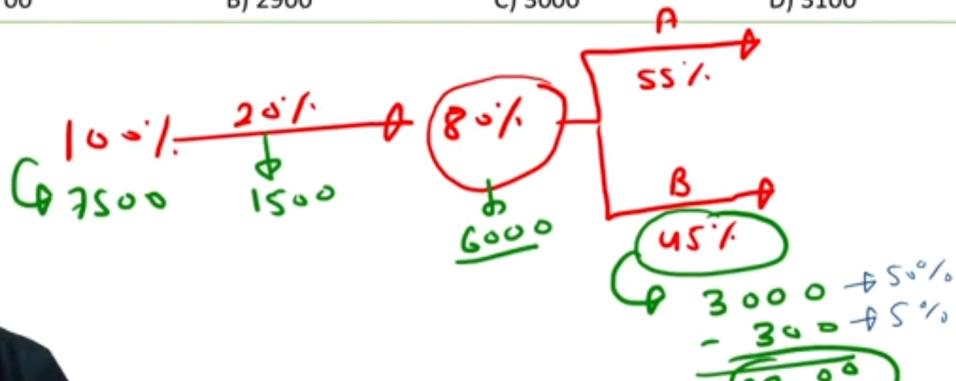
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Q) In an election between two candidates, one got 55% of the total valid votes, 20% of the votes were invalid. If the total number of votes was 7500, the number of valid votes that the other candidate got, was?

- A) 2700      B) 2900      C) 3000      D) 3100



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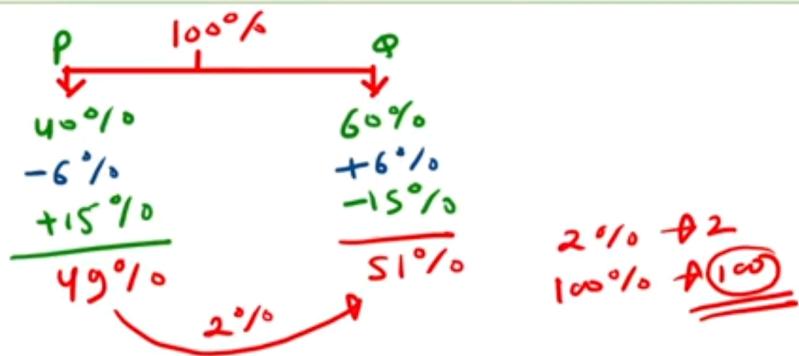
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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

Q) 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 voters went back on their promise to vote for P and instead voted for Q. 25% of the voter went back on their promise to vote for Q and instead voted for P. Suppose, P lost by 2 votes, then what was the total number for voters? [GATE 2014, 1 MARK]

- A) 100      B) 10      C) 90      D) 95



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## Home Work Question

A engineering student has to secure 25% marks to pass. He gets 47 and fails by 43 marks. What are the maximum marks of examination?

- A) 385      B) 410      C) 560      D) 235

$$\begin{aligned} & \text{47 + 43} \rightarrow \text{Passing Marks} \\ & 90 \rightarrow 25\% \\ & 360 \rightarrow 100\% \end{aligned}$$



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$$A \times B = C$$

CASE-1

One Parameter is constant  
and other two are variable

①  $A = \text{constant}$

$B \propto C$

②  $B = \text{constant}$

$A \propto C$

③  ~~$C = \text{constant}$~~

$A \propto \frac{1}{B}$

CASE-2

All parameter are variable

$$A \times B = C$$

↑ ↑ ↑

↓ ↓ ↓

↑ ↓ ①



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$$A \times B = C$$

**CASE-1** One Parameter is constant and other two are variable

① A = Constant

$$B \propto C$$

$$\begin{matrix} 10^1 & \uparrow & 10^1 \\ 10^2 & \not\propto & 10^1 \end{matrix}$$

② B = Constant

$$A \propto C$$

$$\begin{matrix} 10^1 & \uparrow & 10^1 \\ 10^2 & \not\propto & 10^1 \end{matrix}$$

③ C = Constant

$$A \propto \frac{1}{B}$$

$$\begin{matrix} 10^1 & \uparrow & 10^1 \\ 10^2 & \not\propto & 10^1 \end{matrix}$$



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$$A \times B = C$$
$$\times \quad \quad \quad \times \quad \quad \quad \times$$
$$5 \xrightarrow{\frac{1}{5} \downarrow} 6 \quad \quad \quad 6 \xrightarrow{\frac{1}{6} \downarrow} 5 = 30 = \text{constant}$$
$$16.67 \xrightarrow{\frac{1}{16.67} \downarrow} 1 = 30 = \text{constant}$$



$$\left\{ \begin{array}{l} A \times B = C = \text{constant} \\ A \propto \frac{1}{B} \\ \left( \frac{1}{x^{\alpha}} \frac{1}{x+1^{\beta}} \right) \\ \left( \frac{1}{x^{\alpha}} \frac{1}{x-1^{\beta}} \right) \end{array} \right.$$



A man with a beard and dark hair, wearing a black t-shirt with the 'unacademy' logo, is pointing towards a chalkboard. He is positioned on the left side of the frame. The chalkboard contains handwritten calculations related to a problem involving a horizontal beam.

Handwritten notes on the chalkboard:

- A horizontal line with a length of  $1\text{m}$  indicated above it.
- An equation  $\frac{1}{2} \times 1\text{m} = 60\text{mm}$  written below the line.
- A circled value  $1.5$  with a note  $\leftarrow S_{i/9}$  below it.
- A circled value  $40\text{mm} \cdot \text{m}$  with a note  $\leftarrow L_9$  below it.
- A circled value  $30\text{min}$ .
- A circled value  $\leftarrow 10^{\circ}/9$  with a note  $\leftarrow 2x$  above it.





### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

1) An architect is planning to increase of a rectangular room by 10% without increasing the area of the room. By what percentage must reduce the Length of the room?

- A) 10%      B) 11%      C) 9.09%      D) 11.11%

$$\text{Length} \times \text{Width} = \text{Area}$$

Diagram illustrating the relationship between length, width, and area:

Length  $\times$  Width = Area

10% increase in width leads to a 9.09% decrease in length to maintain the same area.

10% increase in width leads to a 11.11% increase in length to maintain the same area.



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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

- 2) The price of sugar has increased by 20%. The percentage of reduction that a family should effect in the use of sugar so as not increase the expenditure on this account is
- A) 25%      B) 30%      C) 16.7%      D) 15%

$$\frac{A}{(Price)} \times \frac{B}{(Consumption/Quantity)} = C \quad (= Expenditure)$$

$$\frac{2.19}{\cancel{5}} \quad \cancel{\frac{1}{6}} \quad \text{↳ Constant}$$



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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

3) Due to decrease in price per kg of sugar by 25% by how much percent a housewife should increase quantity so that total expenditure remains same?

- A) 25      B) 33.33      C) 20      D) NOTA

$$\underline{\text{(Price)} \times \text{(Consumption/Quantity)}} = \text{Expenditure}$$

$$\frac{25}{100} \quad \frac{33.33}{100} \quad \text{constant}$$

$\downarrow \frac{1}{4} \uparrow \quad \uparrow \frac{1}{3} \uparrow \quad \downarrow 2(+)x-1$

$$\left[ \frac{1}{10} \frac{1}{11} \right] \left[ \frac{1}{10} \frac{1}{11} \right]$$



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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

- 4) Due to decrease in the price of sugar by 20% Pooja can buy 6kg more for ₹120, then find the original price per kg in ₹?
- A) 5      B) 4      C) 3      D) 2

$$\frac{1}{x} \downarrow \frac{1}{x-1} \uparrow$$

(Price) × (Consumption/Quantity) = Expenditure

$$\begin{array}{c} 20\% \\ \downarrow \\ 1.6 \\ \downarrow \\ 5 \end{array}$$

$$\begin{array}{l} \text{Original Price} \rightarrow x \text{ kg} \\ \text{New Price} \rightarrow x - 1.6 \text{ kg} \\ \text{Expenditure} = 120 \\ \text{Original Price} \rightarrow \frac{120}{x} \\ \text{New Price} \rightarrow \frac{120}{x-1.6} \\ \frac{120}{x-1.6} = \frac{120}{x} + 6 \\ 120 = 6x \\ x = 20 \end{array}$$



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$$\left\{ \begin{array}{l} A \times B = C = \text{constant} \\ \frac{1}{x} \uparrow \quad \frac{1}{x+1} \downarrow \\ \frac{1}{x} \downarrow \quad \frac{1}{x-1} \uparrow \end{array} \right\} \left\{ \begin{array}{l} \frac{q}{x} \uparrow \quad \frac{q}{x+1} \downarrow \\ \frac{q}{x} \downarrow \quad \frac{q}{x-a} \uparrow \end{array} \right\}$$





### Home Work Question

Due to increase in the price of sugar by 30% a man can buy 6 kg less for ₹520, then find the original price per kg in ₹?

- A) 21      B) 20      C) 22      D) NOTA

$$\begin{aligned}
 & \text{Price} \times \text{Consumption} = \text{Expenditure} \\
 & \frac{3}{10}x = 3(1.9) \quad (\text{Let } x \text{ be the original price per kg}) \\
 & (x - 6) \text{ kg} \quad (\text{6 kg less}) \\
 & \frac{3}{10}x = \frac{3}{13}(x - 6) \\
 & x - \frac{3}{13}x = 6 \Rightarrow x = 26 \text{ kg}
 \end{aligned}$$

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## Consecutive or Successive Percentage Change

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The diagram illustrates two successive percentage increases. It starts with a value of 100, represented by a red circle. An arrow labeled  $+10$  points to a second red circle containing 110. Another arrow labeled  $+10\%$  points to a third red circle containing 121. A curved arrow labeled  $+21$  connects the first two circles, and another curved arrow labeled  $\underline{\underline{21\%}}$  connects the first and third circles. Below the circles, the formula  $a+b+\frac{ab}{100}$  is shown in a red box. Below that,  $a=+10\%$  and  $b=+10\%$  are given. At the bottom, the equation  $10+10+\frac{10 \times 10}{100}=10+10+1=\underline{\underline{21\%}}$  is written.

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## Consecutive or Successive Percentage Change

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The diagram illustrates a sequence of percentage changes starting from 100. It shows two steps: a decrease of  $10\%$  to 90, and another decrease of  $10\%$  to 81. A curved arrow points from the first step to the second, labeled with  $-19$ . A green circle encloses  $19\%$ , indicating a calculation error. A blue box contains the correct formula:  $q + b + \frac{qb}{100}$ .

$$100 \xrightarrow[10]{10\% \downarrow} 90 \xrightarrow[10]{10\% \downarrow} 81$$
$$q = -10\% \quad b = -10\%$$
$$-10 - 10 + \frac{(-10)(-10)}{100} = -20 + 1 = \underline{-19\%}$$



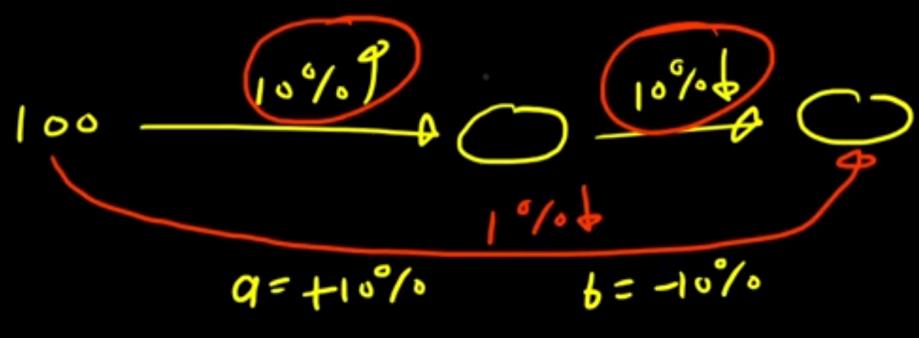
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$$a + b + \frac{ab}{1\omega} \Rightarrow \cancel{1^o - 1^o} + \frac{(-1^o)(1^o)}{1\omega}$$

$-1^o / \cancel{1^o}$

$\downarrow 1\% \downarrow$





- 1) A number is increased by 10% and then it is decreased by 10%. The net change in the number is
- A) no increase or decrease      B) 2% decrease    C) 1 % increase      D) 1% decrease

$$\textcircled{1} \xrightarrow[10\%]{\textcircled{2}} \textcircled{3} \xrightarrow[10\%]{\textcircled{4}}$$

$$\begin{aligned} & +10 - 10 + \frac{10(-10)}{100} \\ & = -10\% \quad \text{or} \quad 1\% \downarrow \end{aligned}$$

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2) A number is first increased by 10% and then it is further increased by 20%. The original number is increased altogether by

A) 30%

B) 15%

C) 32%

D) 36%

$$\textcircled{O} \xrightarrow[9=+10]{10\% \uparrow} \textcircled{O} \xrightarrow[6=+20]{20\% \uparrow}$$

$$a+b+\frac{ab}{100} = 10+20+\frac{10 \times 2}{100} \\ = 32\%$$



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3) Salary of a person is first increased by 20%, then it is decreased by 20%. Percentage change in his salary is:

- A) 4% decrease      B) 4% increased      C) 8% decrease      D) 20% increased

$$\text{Initial} \xrightarrow{+20\%} \text{After Increase} \xrightarrow{-20\%} \text{Final}$$

$$+20 - 20 + \frac{20 \times (-20)}{100} = -40 \Rightarrow \underline{\underline{4\% \text{ decrease}}}$$



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**Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage**

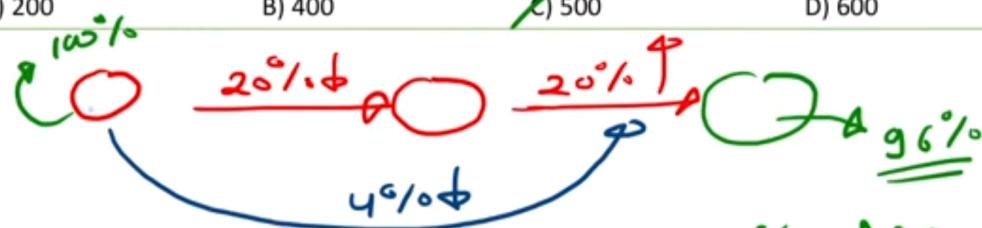
4) A number is first decreased by 20%. The decreased number is then increased by 20%. The resulting number is less than the original number by 20. Then the original number is

A) 200

B) 400

C) 500

D) 600



$$\begin{aligned} & a + b + \frac{ab}{100} \\ & -2a + 2b + \frac{2a(-2b)}{100} \\ & -4\% = 4\% \end{aligned}$$

$$4\% \rightarrow 20$$

$$1\% \rightarrow 5$$

$$100\% \rightarrow 500$$

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$$A \times B = C$$

CASE-2 All parameter are variable

$$\begin{array}{ccc} A & \times & B = C \\ 10\% & & 10\% \\ 10\% & & 10\% \\ 10\% & & 10\% \end{array}$$

~~20%~~ ~~20%~~ ~~20%~~

~~20%~~ ~~10%~~ ~~10%~~

~~10%~~ ~~10%~~ ~~9.1%~~

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$$\begin{aligned} -10-10 + \frac{(-1)(-1)}{100} \\ -20+1 = -19 \\ 19.1 \\ +16-16 + \frac{(1)(-1)}{100} \\ -10.1 \end{aligned}$$



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$$\left\{ \begin{array}{ccc}
 A & \times & B = C \\
 \begin{matrix} 10\% \\ 20\% \\ 15\% \\ 10\% \end{matrix} & \begin{matrix} 10\% \\ 20\% \\ 10\% \\ 10\% \end{matrix} & \begin{matrix} 21\% \\ 44\% \\ 19\% \\ 10\% \end{matrix} \\
 \end{array} \right\} \quad a+b+\frac{ab}{100}$$





## Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

5) Length and width of a rectangle are increased by 20% and 30% respectively. What will be the percentage change in area?

A) 50

B) 10

C) 56

D) NOTA

$$\text{Length} \times \text{Width} = \text{Area}$$

$$20\% \uparrow \quad 30\% \uparrow$$

$$+20 + 30 + \frac{20 \times 30}{100}$$
$$= 50 + 6 = \underline{\underline{56\%}}$$

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### Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

6) Due to increase in the price of sugar by  $\textcircled{20\%}$ , the consumption reduces by  $\textcircled{30\%}$ . Then find the percentage effect on total expenditure from it?

- A) 10% decrease    B) 10% increase    C)  $\textcircled{16\%}$  decrease    D) 16% increase

$$\begin{array}{c} A \quad X \quad B \\ \text{(Price)} \times \text{(Consumption/Quantity)} = \text{Expenditure} \end{array}$$

$$20\% \quad 30\% \quad$$

$$+20 -30 + \frac{(-30)(20)}{100} = -10 -6 = \textcircled{-16\%} \quad \textcircled{16\%}$$

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7) If side of a square is increased by 10% then the percentage change in its area will be?

- A) 21%      B) 20%      C) 10%      D) NOTA

$$\text{Area} = a^2 = a \times a$$

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

21.1%      10%.P      10%.P  
 $a+10\%$



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Q) If the radius of a circle is increased by 20%, the area of the circle will be increased by

- A) 30%      B) 40%      C) 44%      D) NOTA

$$\text{Area} = \pi r^2$$

$$\text{Area} \propto r \times r$$

40%      20%      20%



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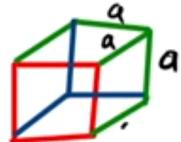




## Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

9) If side of a cube is increased by 10% then the percentage change in its volume will be?

- A) 21%      B) 20%      C) 10%      D) NOTA



$$\text{Volume} = a^3$$

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

$$101.9 \quad 101.9 \quad 101.9$$

$$21.1\% \uparrow \quad 33.1\% \uparrow$$

$$10 + 21 + \frac{10 \times 21}{100}$$

$$33.1\%$$

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

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

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$$\left[ \begin{array}{l} 10\% 10\% \rightarrow 20\% \\ 10\% 10\% \rightarrow 19\% \\ 20\% 20\% \rightarrow 44\% \\ 20\% 20\% \rightarrow 36\% \\ 20\% 20\% \rightarrow 4\% \\ 10\% 10\% \rightarrow 1\% \\ 10\% 10\% 10\% \rightarrow 33.1\% \end{array} \right]$$





## Aptitude for GATE/ESE/PSUs/AE/JE/College Placement, Topic- Percentage

10) The radius as well as the height of a circular cone increased by 10%. The percentage increase in its volume is \_\_\_\_\_. [GATE 2019]

A) 17.1

B) 21.0

C) 33.1

D) 72.8

$$V = \left(\frac{1}{3}\pi\right) r^2 h$$

$r \times r \times h$

$$\begin{matrix} 10\% & 10\% & 10\% \\ \curvearrowright & \curvearrowright & \curvearrowright \\ 21 & 33.1\% & \Phi \end{matrix}$$

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