



SSC - CGL

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COMBINED GRADUATE LEVEL

STAFF SELECTION COMMISSION

VOLUME - V

Arithmetic

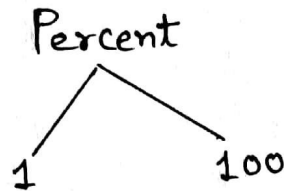


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PERCENTAGE

Percent word is formed by two words "Per" and "Cent."



$$1\% = \frac{1}{100} \quad , \quad x\% = \frac{x}{100}$$

One by hundredth part of anything is percent. It is represented by sign '%'. and to put the % in the end of any number. We multiply the number by 100.

$$16\% = \frac{16}{100}$$

$$18\% = \frac{18}{100}$$

$$20\% = \frac{20}{100}$$

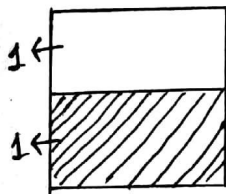
$$16 = 16 \times 100\% = 1600\%$$

$$18 = 18 \times 100\% = 1800\%$$

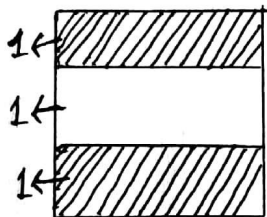
$$\frac{2}{5} = \frac{2}{5} \times 100\% = 40\%$$

Fraction:

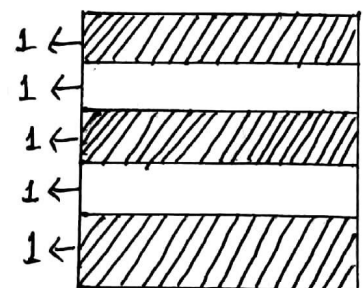
Any small or tiny part or proportion of something is represented in fraction.



White part = $\frac{1}{2}$



White part = $\frac{1}{3}$



White part = $\frac{2}{5}$

All diagram above are divided in equal parts and fraction that white part is what fraction of whole diagram.

\Rightarrow Numerator \longrightarrow Small part of whole number
Denominator \longrightarrow Whole number

\longrightarrow To make our questions easier, we keep remember few converts, percentage to fraction and fraction to percentage.

$$1 = 1 \times 100\% = 100\%$$

$$\frac{1}{9} = 11\frac{1}{9}\% = 11.11\%$$

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

$$\frac{2}{9} = 22.22\%, \frac{3}{9} = 33.33\%, \frac{5}{9} = 55.55\%$$

$$\frac{1}{3} = 33\frac{1}{3}\%$$

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

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

$$\frac{1}{11} = 9\frac{1}{11}\% = 9.09\%, \frac{4}{11} = 36.36\%$$

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

$$\frac{1}{12} = 8\frac{1}{3}\%$$

$$\frac{1}{6} = 16\frac{2}{3}\%$$

$$\frac{1}{13} = 7\frac{6}{13}\%$$

$$\frac{1}{7} = 14\frac{2}{7}\%$$

$$\frac{1}{14} = 7\frac{1}{7}\% = 7.14\%$$

$$\frac{1}{8} = 12.5\%$$

$$\frac{1}{15} = 6\frac{2}{3}\%$$

$$\frac{1}{16} = 6\frac{1}{4}\%$$

→ Formulas of percentage:

$$\% \text{ Change} = \frac{\text{Final Value} - \text{Initial Value}}{\text{Initial Value}} \times 100$$

$$\text{Increased Value / Final Value} = \frac{\text{Initial Value} \times \left\{ \frac{100 + \text{Increase}\%}{100} \right\}}{100}$$

$$\text{Increased Value / Final Value} = \frac{\text{Initial Value} \times \left\{ \frac{100 - \text{Decrease}\%}{100} \right\}}{100}$$

$$\text{Initial Value} = \text{Final Value} \times \left(\frac{100}{100 - \text{decrease}\%} \right)$$

$$\text{Resultant percentage change} = \left(x + y \right) + \frac{x + y}{100}$$

For increase we take percent "+", for decrease we take percent "-".

PRACTICE EXAMPLES

Q.1 If a fruit seller sells 40% of his total apples then he is now left with 480 apples. How many apples had he originally?

Sol:

Basic: Let total no. of apples are x
 Seller Sells = $x \times \frac{40}{100}$ apples
 Remaining apples = $x - \frac{x \times 40}{100}$

$$\frac{100x - 40x}{100} = 480 \text{ (Given in question)}$$

$$\frac{60x}{100} = 480$$

$$x = 800 \text{ apples.}$$

Trick:

Everything is 100% in itself. So after selling 40% a man is left with only 60%.

$$60\% = 480$$

$$1\% = 8$$

$$100\% = 800$$

Q.2 A book seller has total 6300 books and he sells 90% of all. How many books are still unsold?

Sol:

$100\% = 6300$
 $1\% = 63$
 He is now left with only $(100\% - 90\%) = 10\%$.
 So $10\% = 630$

Q.3 If monthly salary of an employee is increased by $\frac{8}{3}\%$, he gets 72 rupee more. His monthly salary is?

Sol:

Basic: Let his salary is x
 Salary after increment $x \times \left(100 + \frac{8}{3}\right)\%$

$$= x \times \frac{308}{300}$$

Trick:

% increase is equal to increase in number.

$$\frac{8}{3}\% = 72$$

$$1\% = 27$$

$$100\% = 2700$$

$$\text{Difference} = \left(x \times \frac{308}{300} - x\right) = 72$$

$$= \frac{8x}{300} = 72$$

$$= x = 2700 \text{ ₹}$$

Q. 4 The population of town in 2019 is 2100. In the next year it increases by 21%, what is the increased population of village in 2020?

sol:

$$\begin{aligned}
 \text{Increased Value} &= \text{initial Value} \times \frac{(100 + \text{Increase})}{100} \\
 &= 2100 \times \frac{21}{100} \\
 &= 2541
 \end{aligned}$$

Trick:

Initial	Increased value
100	121
↓ ×21	↓ ×21
2100	2541

Q. 5 If the numerator of the fraction is increased by 20% and denominator is decreased by 5%, the value of the new fraction becomes $\frac{5}{2}$. What is the original fraction?

sol:

Let the no. is $\frac{x}{y}$

$$\Rightarrow \frac{x \times \left(\frac{100+20}{100}\right)}{y \times \left(\frac{100-5}{100}\right)} = \frac{x \times 120}{y \times 95}$$

$$\Rightarrow \frac{x \times 120}{y \times 95} = \frac{5}{2} \quad \Rightarrow \frac{x}{y} = \frac{5 \times 95}{2 \times 120} = \frac{95}{48}$$

Q. 6 When a number is increased by 24, it becomes 104% of itself. What is the number?

sol:

Basic: Let number is x

then

$$x + 24 = \frac{104}{100} \times x$$

$$24 = \frac{104}{100} x - x$$

$$24 = \frac{4x}{100}$$

$$x = 600$$

Trick:

Every no. is 100% in itself.
So increase is 4%.

$$4\% = 24$$

$$1\% = 6$$

$$100\% = 600$$

Q.7 5 is what percent of 25?

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

Q.8 A number is increased from 21 to 84. what is the percentage change in the number?

sol: 300 %

Q.9 If $\frac{1}{5}$ th of the soldiers in a battalion are equal to 500 then what is total number of soldiers in the battalion.

sol: 2500

Q.10 If the numerator of the fraction is increased by 35% and denominator is also increased by 20%, the value of the new fraction becomes $\frac{9}{6}$. what is the original fraction?

sol: $\frac{4}{3}$

Q.11 When a number is increased by 39, it becomes 113% of itself. what is the number?

sol: 300

Q.12 When 40 is subtracted from 40% of a number, the result is 80. The number is?

sol: 300

INCREASE/DECREASE TO DECREASED/ INCREASED NO:

Q.13 If A's income is 25% less than B, how much percent B's income more than that of A?

sol: Let B's income x .

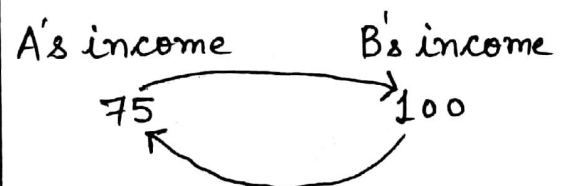
So A's income = $\frac{x \times 75}{100}$

So percent increase in B's income

$$= \frac{x - \frac{x \times 75}{100}}{\frac{x \times 75}{100}} \times 100$$

$$= \frac{25x}{\frac{x \times 75}{100}} \times 100 = 33\frac{1}{3}\%$$

Trick:



$$= \frac{25}{75} \times 100$$

$$= 33\frac{1}{3}\%$$

Q. 14 The price of sugar is increased by $\frac{100}{3}\%$. If the expenditure is not allowed to increase for a housewife, by what percent should she reduce consumption.

sol:

<u>Price</u>	<u>Quantity/Consumption</u>
$\frac{100}{3}\% = \frac{1}{3} (\uparrow)$	$\frac{1}{4} (\downarrow) = 25\%$

If there is increase or decrease in one side than to equal things, we use short trick;

<u>Numerator</u>	(↑)	→ then →	<u>Numerator</u>	(↓)
<u>Denominator</u>			<u>Numerator + Denominator</u>	
<u>Numerator</u>	(↓)	→ then →	<u>Numerator</u>	(↑)
<u>Denominator</u>			<u>Denominator - Numerator</u>	

Q. 15 If the length of a rectangle is increased by 60% then by what percent should breadth of that be reduced so area remains the same?

sol:

Length	Breadth.
$60\% = \frac{6}{10} \uparrow$	$\frac{6}{10+6} = \frac{6}{16} \downarrow = 37.5\%$

Q. 16 A number is increased by $Y\%$. to get back to the original number, it is to be reduced by?

sol: $Y\% = \frac{Y}{100} (\uparrow) = \frac{Y}{100+Y} \% (\downarrow)$

Q. 17 If the radius of the cylinder is decreased by 40% then by what percent the height of that should be increased so curved surface area remain the same?

sol: $66\frac{2}{3}\%$

Q. 18 The price of wine is increased by 25%. If the expenditure is not allowed to increase for a drunkard, by what percent should he reduce consumption?

sol: 20 %

RESULTANT CHANGE IN:

Q. 19 salary of a person is first increased by 10%, then it is again increased by 10%, then the percentage change in his salary is?

sol: Let salary is 100
 then first increase = $100 \times \frac{110}{100} = 110$
 Second increase = $110 \times \frac{110}{100} = 121$

$$\% \text{ Change} = \left(\frac{121-100}{100} \right) \times 100 = 21\%$$

Trick:

Use formula given in the introduction part of percentage

$$\begin{aligned}
 &= x + y + \frac{xy}{100} \\
 &= 10 + 10 + \frac{10 \times 10}{100}
 \end{aligned}$$

$$= 21\%$$

Q. 20 The price of sugar is increased by 20% and its consumption is decreased by 10% then what is the net affect on the expenditure?

sol:

$$\begin{aligned}
 &= x + y + \frac{xy}{100} \\
 &= +20\% - 10\% + \frac{20\% \times -10\%}{100}
 \end{aligned}$$

$$= 10\% - 2$$

$$= 8\% \text{ increase}$$

Q. 21 The price of an article is first decreased by 20% and then increased by 30%. If the resulting price is Rs 416, The original price of the article is?

sol:

$$x + y + \frac{xy}{100}$$

$$= -20 + 30 + \frac{-20 \times 30}{100}$$

$$= 10 - 6 = 4\% \text{ increase}$$

$$\text{Initial price} \times \left(\frac{100 + \text{increase}}{100} \right) = \text{Final result}$$

$$\text{Initial price} \times \left(\frac{104}{100} \right) = 416$$

$$\text{I. P} = 400 \text{ ₹}$$

Q. 22 A number is first decreased by 60% then 40%. What is the net change in the price of the sugar?

Sol: 76 % DECREASE

Q. 23 The price of an article was increased by R%. Later the new price was decreased by R%. If the latest price was Rs. 1, then the original price was?

Sol: $\frac{10000}{10000-R^2}$

Q. 24 The price of milk is increased by 20% and again by 30%. By what percent should we reduce the new price of milk so as to restore the original price?

Sol: $35\frac{35}{39}\%$

MARKS BASED QUESTIONS

Q. 25 Katrina required 33% marks to pass an examination but she got only 21% marks and was declared fail by 18 marks. Find out the total marks of the examination?

Sol:

Basic:

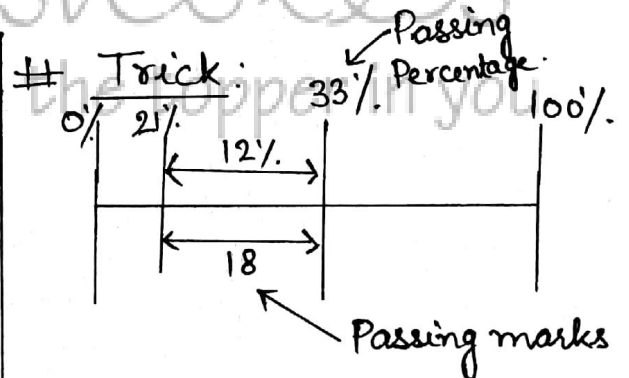
Let total marks are x

$$x \times 21\% + 18 = x \times 33\%$$

$$x \times 33\% - x \times 21\% = 18$$

$$x \times 12\% = 18$$

$$x = \frac{18}{12} \times 100 = 150$$



$$12\% = 18$$

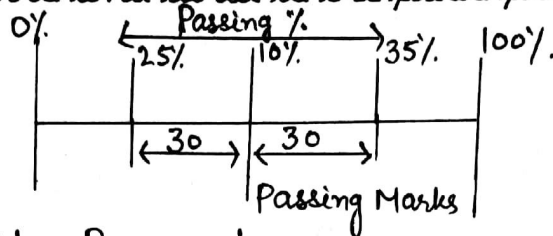
$$1\% = \frac{18}{12}$$

$$100\% = \frac{18}{12} \times 100$$

$$= 150 \text{ Marks.}$$

Q. 26 In a test a student got 25% marks and failed by 30 marks. In the same test another student got 35% and secured 30 more marks than passing marks. What are the maximum pass marks and what is the pass percentage of the exam?

Sol:



$$10\% = 60$$

$$1\% = 6$$

$$100\% = 600 = \text{Max Pass marks}$$

$$\text{Pass Marks} = 600 \times 25\% + 30$$

$$= 600 \times \frac{1}{4} + 30$$

$$= 180$$

$$\text{Pass percentage} = \frac{180}{600} \times 100 = 30\%$$

Q. 27 In an examination a candidate must secure 35% marks to pass. A candidate, who gets 100 marks, fails by 5 marks. Find the maximum marks for the examination?

Sol: 300

Q. 28 In a test a student got 35% marks and failed by 25 marks. In the same test another student got 48% marks and secured 20% marks more than the essential minimum pass marks. The maximum pass marks for the test were?

Sol: 500

INCREASED OR DECREASED PRICE:

Q. 29 Due to an increase of 20% in the price of apples, a man can buy 5 kg apples less for Rs. 600. Find out the difference between present price and original price?

Sol:

Basic: Present price = 600 ₹

Increased price for same qty = $\frac{600 \times 120}{100} = 720$

5 kg apples rate = $120 \text{ ₹} - 600 \text{ ₹} = 120 \text{ ₹}$

Present rate = 1 kg apple rate = $\frac{120}{5} = 24 \text{ ₹}$

Initial price = 20 ₹

Difference b/w present price and initial price = $24 - 20 = 4 \text{ ₹}$

Trick:

Price	Quantity
20% = $\frac{1}{5}$	5 ← $\frac{1}{5}$ change in qty.
	30 ← 6 initial qty.

Present qty = $30 - 5 = 25$

Initial price = $\frac{600 \text{ ₹}}{30} = 20 \text{ ₹}$

Present price = $\frac{600 \text{ ₹}}{25} = 24 \text{ ₹}$

Difference = $24 - 20 = 4 \text{ ₹}$

Q. 30 A reduction of 25% in the price of rice enables Rampyari to buy two kg more rice for Rs. 240. The reduced per kg price of rice is?

Sol:

Price.
 $25\% = \frac{1}{4} (\downarrow)$

quantity
 $2 \text{ kg} \leftarrow \frac{1}{3} (\uparrow) \text{ change in quantity}$
 $6 \text{ kg} \leftarrow \text{initial quantity}$

Present quantity = $6 \text{ kg} + 2 \text{ kg} = 8 \text{ kg}$.

Reduced price / Present price = $\frac{240}{8} = 30 \text{ ₹}$

Q. 31 The government reduced the price of rice of sugar by 10%. By this a consumer can buy 6.2 kg more sugar for Rs. 837. The reduced price per kg and original price per kg of sugar separately are?

Sol: 13.5 AND 15

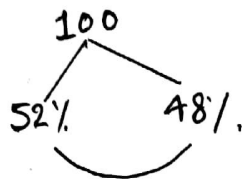
Q. 32 Due to an increase of 50% in the price of the eggs, 4 eggs less are available for Rs. 48. The present rate of eggs per dozen is?

Sol: 72

VOTER BASED QUESTION:

Q. 33 In an election, there are two candidates, one candidate gets 52% of the total votes and won the election by 2640. Tell the total no of votes and how many votes does loser get?

sol: Let total no. of votes are 100



Everything is 100% in itself. so if winner gets 52% then loser gets $(100 - 52) = 48\%$.

$4\% = 2640$

$1\% = 660$

Total Votes 100% = 66000

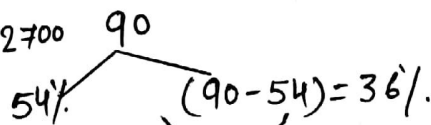
Votes of loser = $660 \times 48 = 31680$

Q. 34 In an election, there are two candidates, 10% votes are found invalid and winning candidate gets 54% of total votes and won the election by 900 votes. Then find the total no of votes casted and how many were the votes gotten by winning candidate?

sol: Let total votes are 100

Total votes - 100% = $50 \times 100 = 5000$ \downarrow - 10% - Invalid votes

Winners votes = $54 \times 50 = 2700$



$18\% = 900$ $1\% = 50$

Q. 35 In an election between two candidates, 75% of the voters cast their votes, out of which 2% votes have declared invalid. A candidate got 9261 votes which were 75% of the valid votes. The total no of voters enrolled in the election was?

sol: Let total votes are 100

$$\begin{aligned}
 &100 \\
 &\downarrow \\
 &75 - \text{valid + Invalid votes} \\
 &\downarrow \\
 &75 \times \frac{98}{100} = 73.5 - \text{Valid votes} \\
 \Rightarrow &73.5 \times \frac{75}{100} = 9261 \text{ (Given in question)} \\
 &1 = 168
 \end{aligned}$$

$$\begin{aligned}
 \text{Total no. of voters enrolled in} &= 168 \times 75 \\
 &= 12600
 \end{aligned}$$

Q. 36 In an election, there are two candidates, 20% votes are found invalid and winning candidate gets 54% of total votes and won the election by 560 votes. Then find the total no of votes casted. And how many were the votes gotten by winning candidate?

Sol: 2000, 1080

Q. 37 There are two candidates in an election, 20% voters didn't cast their votes while 500 votes were found invalid winning candidate got 60% of the total valid votes and he won by 8000 votes. Tell the total no of votes that voter casted?

Sol: 40500

DISTRIBUTED EXPENDITURE AND SAVING:

Q. 38 Anisha spends 40% of her salary on food, 20% on house rent, 10% on entertainment and 10% on conveyance. If her savings at the end of a month is Rs. 1500, then her salary per month is?

Sol:

Everything is 100% in itself.

$$\begin{aligned}
 \text{So total expenditure} &= 40\% + 20\% + 10\% + 10\% \\
 &= 80\%
 \end{aligned}$$

$$\text{Saving} = (100 - 80) = 20\%$$

$$20\% = 1500 \text{ (given in question)}$$

$$1\% = 75$$

$$\text{Salary} = 100\% = 7500$$

$$\left. \begin{aligned}
 &\text{Salary} = \\
 &\text{Saving} + \text{Expenditure}
 \end{aligned} \right\}$$

Q. 39 A man spends 12.5% of his salary on daily expenses, 30% of the rest on the house paint, this he is left with Rs. 2940 only. what is his total salary?

sol:

Basic: Let the salary is x ₹

$$\text{Daily expenditure} = x \times \frac{1}{8}$$

$$\text{Rest of Salary} = x - \frac{x}{8} = \frac{7x}{8}$$

$$\text{Expenditure on House paint} = \frac{7x}{8} \times \frac{3}{10}$$

$$\begin{aligned} \text{rest money} &= \frac{7x}{8} - \frac{21x}{80} \\ &= \frac{49x}{80} \end{aligned}$$

$$\Rightarrow \frac{49x}{80} = 2940 \text{ (Given in question)}$$

$$x = 4800 \text{ ₹}$$

Trick:

Daily expenditure	Expenditure on House paint
$12.5\% = \frac{1}{8}$	$30\% = \frac{3}{10}$
So $1 - \frac{1}{8} = \frac{7}{8}$	So $1 - \frac{3}{10} = \frac{7}{10}$

Let Salary is x

$$\text{Saving} = x \times \frac{7}{8} \times \frac{7}{10} = 2940$$

$$x = 4800 \text{ ₹}$$

Q. 40 Rahul spends 30% of his income on entertainment, 20% at the rest income is spent on education of his child, 60% at the remaining money after child's education is spent on house expenses, 20% at the remaining after house expenses is spent on his girlfriend. Now he is left with only Rs. 448. what is the total income?

sol:

Entertainment	Education	House Expenses	Girl friend.
$30\% = \frac{3}{10}$	$20\% = \frac{1}{5}$	$60\% = \frac{3}{5}$	$20\% = \frac{1}{5}$
So $1 - \frac{3}{10} = \frac{7}{10}$	So $1 - \frac{1}{5} = \frac{4}{5}$	$= 1 - \frac{3}{5} = \frac{2}{5}$	$= 1 - \frac{1}{5} = \frac{4}{5}$

Let income is x

$$x \times \frac{7}{10} \times \frac{4}{5} \times \frac{2}{5} \times \frac{4}{5} = 448$$

$$x = 2500 \text{ ₹}$$

Q. 41 Mr. Pradeep spends 20% of his total income on house rent and 70% at the rest on house - hold expenses. if he saves Rs. 1,800. what is his total income?

Sol: 7500

Q. 42 Manisha spends 20% of her salary on her child's education, 30% on family, 25% on entertainment. if her savings at the end of a month is Rs. 1250, then what amount does she spends on entertainment?

Sol: 1250

VENN DIAGRAM BASED QUESTIONS:

Q. 43 in a village, each of the 60% families has a honda car, each of the 30% families has a Hyundai car and each or the families has both a honda and a hundai car. in all these are 96 families in the village. How many families do not have a honda or hundai car?

Sol: There is formula which is generally used in such kind of questions:

$$A \cup B = A + B - A \cap B$$

$A \cap B$ = It is called A intersection B. It means both things are possessed by someone.

$A \cup B$ = It is called A Union B. It means total no. of things which are calculated one thing only for once.

$$A \cup B = 60 + 30 - 15$$

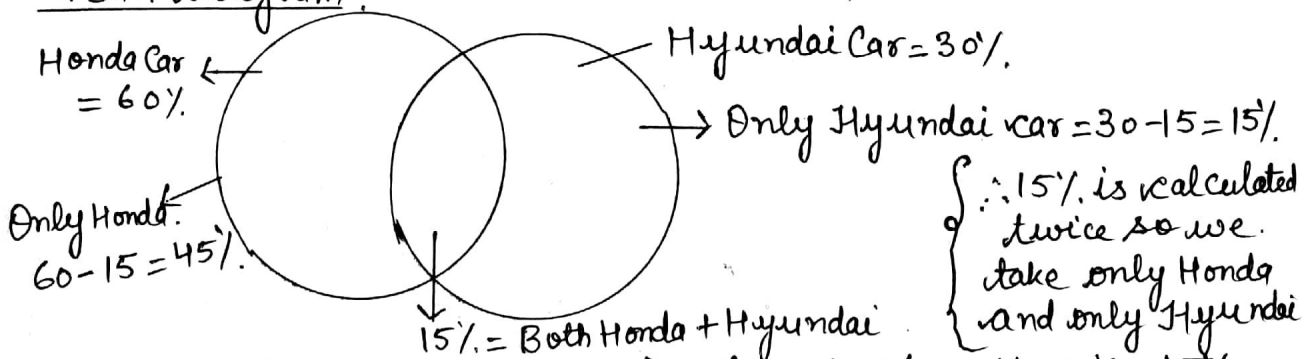
$$A \cup B = 75\% \rightarrow \text{people who have cars}$$

people who don't have any of these two cars = $100\% - 75\% = 25\%$

$$\text{So. Such families are} = 25\% \times 96$$

$$= \frac{1}{4} \times 96 = \underline{24}$$

Venn diagram:



Total Cars possessed by families = $45\% + 15\% + 15\% - 15\%$

$$\text{Families don't have Car} = 96 \times \frac{(100 - 75\%)}{100} = 24$$