1.2 CHAPTER

Percentage

The term 'percent' indicates the value out of hundred. This concept of percentage is developed to make the comparison of ratio easier by taking the denominator value as 100.

The concept of percentage is very useful in reasoning & aptitude and specially for data interpretation section, where every logic that has to be used, is based on percentage.

Calculation of Percentage

As we know that percent value is the value out of hundred. The percent value is calculated as

$$\frac{\text{Value}}{\text{Total Value}} \times 100$$

The basic thing that has to be kept in mind is that the value in the base must be taken care of.

Percentage & Fraction

The value percentage can be represented in three different form each form is important for making calculation similar. Here are some percentage values given to understand different form.

% form	Fraction form	Decimal form
100%	1	1
50%	$\frac{1}{2}$	0.5
$33.\overline{33}\%$	$\frac{1}{3}$	$0.\overline{33}$
25%	$\frac{1}{4}$	0.25
20%	$\frac{1}{5}$	0.20
$16.\overline{66}\%$	$\frac{1}{6}$	$0.1\overline{6}$

Multiplication factor

Multiplication factor is the value by which a particular quantity has to be multiplied to show the final changed value. It is nothing but fractional or decimal form of percentage.

It has to be understood in this manner, that a quantity is 200. Its 60% value will be $\frac{60}{100}, \frac{3}{5}, 0.6$ times of 200. Here all these values are the multiplication factor for the quantity 200.

Multiplication factors are very important when we talk about the percenrage increment or decrement of a quantity. Let us understand with some examples.

Example 1.

A quantity 200 is increased by 75% then what will be the new quantity?

Solution.

One thing we can do is to find out 75% of 200 i.e.

$$\frac{75}{100} \times 200 = 150$$

and then the new quantity will be 200 + 150 = 350

But we can move in other way as the quantity initially was 100% i.e. 1 as a multiplying factor. Now it is increased by 75% i.e. 3/4 or 0.75 as a multiplying factor.

So the new quantity becomes

$$\left(1+\frac{3}{4}\right) \times 200 = 350$$

or $(1 + 0.75) \times 200 = 350$

These $\left(1+\frac{3}{4}\right)$ and $(1 + 0.75)$ are the multiplying factors. Let us see one more example to understand it clearly.

Example 2.

A quantity 300 when increased by some percenrage becomes 360. Find out by what percentage it has increased?

Solution.

Now we know that

300 × Multiplying Factor (MF) = 360

So MF $= \frac{360}{300} = 1.2$ or $\frac{6}{5}$

This shows that the multiplying factor 1 is increased by 0.2 or $\frac{1}{5}$ .Which is equal to 20%.

so net increment percentage is 20%.

Successive Percentage Change

Successive percentage change is one percentage change over and above another percentage change. Let us take one example to understand it.

Example 1.

A quantity 300 is increased by 20%. Then it was decreased by 10%. Find out the new quantity is how much percentage more/less than 300?

Solution.

300 when increased by 20% becomes 300(1.2) or $300\left(1+\frac{1}{5}\right)$. Now this new quantity is decreased by 10%. So the final quantity will be

$[300(1.2)](1-0.1)$

or $\left[300\left(\frac{6}{5}\right)\left(1-\frac{1}{10}\right)\right]$

$= 300(1.08)$

or $300\left(1+\frac{4}{50}\right)$

So we can understand the net result is 0.08 or $\frac{4}{50}$ increment in MF. Which is equal to net 8% increment in the quantity 300.

So it will be very clearly understood from the example that **in successive percentage changes, the multiplying factors are multiplied directly**. So the point that has to be understood is "In case of successive percentage changes the net multiplying factor is the product of all the corresponding multiplying factors.

Let us take another examples as:

Comparison Leading to the Base Change

Sometimes whenever the percentage comparison occurs between two different values. The base change occurs. Multiplying factors are again very useful here. Let us understand with some examples.

Example 1.

The salary of Ram was increased by 40%. But Ram's performance kept on declining. Because of which his employer decreased his salary to the salary before the increment. Find out what percentage deduction was provided by his employer?

Solution.

Let us assume in starting salary of Ram was x and after the increment it became y.

Now his salary was again decreased from y to x and we need to find out this percentage change, we can say it as

$$y = \left(1+\frac{40}{100}\right)x$$

$$\Rightarrow y = \left(1+\frac{2}{5}\right)x$$

$$\Rightarrow y = \frac{7}{5}x$$

$$\text{So } x = \frac{5}{7}y$$

$$\text{or } x = \left(1-\frac{2}{7}\right)y$$

So we can say the % decrement in the salary of Ram is the percenrage equivalent of $\frac{2}{7}$ which is $\frac{2}{7}\times 100\%$ i.e. 28.56%.

Example 2.

Rama uses rice as his daily meal. But because of inflation the price on rice were increased by 10%. Find out by what percentage he has to decrease his consumption to keep the expenditure same as previous?

Solution.

Let us assume initial price was P and the expenditure was 'x' then,

Price x consumption = Expenditure

$$\Rightarrow \text{ initial consumption} = \frac{x}{P}$$

Now price became $\left(1+\frac{10}{100}\right)P = \frac{11}{10}P$

$$\text{Then final consumption} = \frac{x}{\frac{11}{10}P} = \frac{10}{11}\left(\frac{x}{P}\right)$$

So final consumption = $\frac{10}{11}$ (initial consumption)

or we can say the net percent decrement in consumption will be $\left(1-\frac{10}{11}\right)$ i.e. $\frac{1}{11}$ part.

The percentage equivalent will be $\frac{1}{11}\times 100 = 9.09\%$

Alternately: The net percent change

$$= \frac{100\times 10}{100+10}\% = 9.09\%$$

Example 3.

The price of a toy was increased by 20% & then it was sold at 20% discount. Find out the net change in the price of the toy.

Solution.

The net multiplying factor

$$= \left(1+\frac{20}{100}\right)\left(1-\frac{20}{100}\right)$$

$= 1.2 \times 0.8 = 0.96$

$= (1 - 0.04)$

So net percentage change

$= 0.04 \times 100 = 4\%$ decrease.

Example 4.

The price of a ball pen & a gel pen is same. Now the price of ball pen is decreased by 30%. While of gel pen is increased by 20%. Find out the net percentage change in the net total price of both pens.

Solution.

Let the price of individual pens be x

Total price = $2x$

New price of ball pen = $(1 - 0.3)x = 0.7x$

New price of gel pen = $1.2x$

New total is = $1.9x = 0.95(2x)$

So change = 5% decrement

Example 5.

A shop provides flat 50% discount on one shirt. While another shop provides the successive discount of 30% and 30%. If the difference of the bills is Rs. 43. Find out the net cost of shirt.

Solution.

Let the price of shirt be x

For the first shop the bill is

$= (1 - 0.5)x = 0.5x$

For the second shop the bill is

$= 0.7 \times 0.7x = 0.49x$

The difference in the bills

$= 0.01x = 43$

$\Rightarrow$ x = Rs. 4300

Example 6.

Radius of a sphere is increased by 10%. Find out the net percentage increment in the volume.

Solution.

Net percentage increment in radius = 10%

New radius = 1.1 r

So the new volume = $\frac{4}{3}\pi(1.1r)^3$

$= (1.1)^3$ (original volume)

$= 1.331$ (original volume)

So net percent increment = 33.1%

Example 7.

In an office 40% of the employee are males while 70% of the employees are married if 80% of male are married find out the net percent of unmarried female in the office.

Solution.

Let us assume total employees as 100 then

	Married	Unmarried	Total
Male	80% of 40 = 32	8	40
Female	70 – 32 = 38	60 – 38 = 22	60
Total	70% of 100 = 70		100

So net percent $\frac{22}{100}\times 100 = 22\%$

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Solved Examples

1. Which of the following is the largest number?
(a) 20% of 200 (b) 7% of 500
(c) 1300% of 3 (d) 600% of 7

Ans. (d)

20% of 200 = 40
7% of 500 = 35
1300% of 3 = 39
600% of 7 = 42

2. Mr. Rajesh is worried about the balance of his monthly budget. The price of petrol has increased by 40%. By what percent should he reduce the consumption of petrol so that he is able to balance his budget?
(a) 33.33 (b) 28.56
(c) 25 (d) None of these

Ans. (b)

We know that % reduction required is

$$= \frac{x}{100+x} \times 100 \quad \text{here } x=40$$

$$= \frac{40}{140} \times 100 = 28.56\%$$

3. In an election between 2 candidates, Ravikant gets 65% of the total valid votes. If the total votes were 6000, what is the number of valid votes that the other candidate Shailendra gets if 25% of the total votes were declared invalid?
(a) 1625 (b) 1575
(c) 1675 (d) 1525

Ans. (b)

Total votes 6000
Invalid votes = 25% of 6000 = 1500
Total valid votes = 4500
Ravikant gets 65%
So other candidate gets 35%
35% of 4500 = 1575

4. 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.
(a) 20 (b) 28.56
(c) 25 (d) None of these

Ans. (a)

Height increased =25%
here x = 25 to reduce to normal % correction required is

$$= \frac{25}{100+25} \times 100 = 20\%$$

5. A number is mistakenly divided by 5 instead of being multiplied by 5. Find the percentage change in the result due to this mistake.
(a) 96% (b) 95%
(c) 2400% (d) None of these

Ans. (a)

Let number is 100
It is divided by 5 we get 20
Now actual result should be $5 \times 100 = 500$
So % change is result

$$= \frac{500-20}{500} \times 100 = 96\%$$

6. In a mixture of 80 litres of milk and water, 25% of the mixture is milk. How much water should be added to the mixture so that milk becomes 20% of the mixture?
(a) 20 litres (b) 15 litres
(c) 25 litres (d) None of these

Ans. (a)

Total mixture 80 litre

Milk is 25% i.e. $\frac{25}{100} \times 80 = 20$ litre

to make it 20% amount of water required to add

$$= \frac{60+x}{80+x} \times 100 = 80\%$$

$6000 + 100x = 6400 + 80x$
$20x = 400, x = 20$

7. A landowner increased the length and the breadth of a rectangular plot by 10% and 20% respectively. Find the percentage change in the cost of the plot assuming land prices are uniform throughout his plot.
(a) 33% (b) 35%
(c) 22.22% (d) None of these

Ans. (d)

here x =10 or y = 20

$$\% \text{ change in area} = \left(x + y + \frac{xy}{100}\right)$$

$$= 10 + 20 + \frac{10 \times 20}{100} = 32$$

8. The length, breadth and height of a room in the shape of a cuboid are increased by 10%, 20% and 50% respectively. Find the percentage change in the volume of the cuboid.

(a) 77% (b) 75%

(c) 88% (d) 98%

Ans. (d)

Let l, b, h be length, breadth and height of the cuboid

Volume v = l.b.h

Now, l, b, h are increased by 10%, 20% 50% respectively

$$v = l\left[1+\frac{10}{100}\right]\times b\left[1+\frac{20}{100}\right]+h\left[1+\frac{50}{100}\right]$$

$= 1.98\ l.b.h$

% change = 98%

9. The price of sugar is reduced by 25% but inspite of the decrease, Aayush ends up increasing his expenditure on sugar by 20%. What is the percentage change in his monthly consumption of sugar?

(a) +60% (b) −10%

(c) +33.33% (d) 50%

Ans. (a)

Let price of sugar be x & expenditure E

Now it is reduced by 25%. So it is $\frac{3}{4}x$ now expenditure of sugar is also increased by 20% i.e.

1.2 E or $\frac{6}{5}$E

So quantity of sugar that can be purchased

$$=\frac{\frac{6}{5}E}{3/4\,x}=\frac{8}{5}\frac{E}{x}=160\%\ \text{of}\frac{E}{x}$$

Hence consumption increased by 60%.

10. 30% of a number when subtracted from 91, gives the number itself. Find the number.

(a) 60 (b) 65

(c) 70 (d) None of these

Ans. (c)

$$\frac{30}{100}x = 30\%\ \text{of number}\ x$$

$$\text{Now}\ 91-\frac{30}{100}x = x$$

$$91=\frac{130}{100}x,\ x = 70$$

11. The population of the village of Rampur is 10,000 at this moment. It increases by 10% in the first year. However, in the second year, due to immigration, the population drops by 5%. Find the population at the end of the third year if in the third the population increases by 20%.

(a) 12,340 (b) 12,540

(c) 1,27,540 (d) 12,440

Ans. (b)

P =10000, x = +10%, y = −5%, z = 20%

Population at the end of third year

$$=P\left(1+\frac{x}{100}\right)\left(1+\frac{y}{100}\right)\left(1+\frac{2}{100}\right)$$

$$=10000\left(1+\frac{10}{100}\right)\left(1-\frac{5}{100}\right)\left(1+\frac{20}{100}\right)$$

$= 12540$

12. In an examination, Mohit obtained 20% more marks than Sushant but 10% less than Rajesh. If the marks obtained by Sushant is 1080, find the percentage marks obtained by Rajesh if the full marks is 2000.

(a) 86.66% (b) 72%

(c) 78.33% (d) None of these

Ans. (b)

Marks obtained by Shushant is 1080

$$\text{Mohit's marks} = \frac{120}{100}\times 1080 = 1296$$

$$\text{Rajesh Marks, R} \Rightarrow \frac{90}{100}\times R = 1296$$

$R = 1440$

$$\%\ \text{of Rajesh Marks} = \frac{1440}{2000}\times 100 = 72\%$$

13. The population of a village is 5500. If the number of males increases by 11% and the number of females increases by 20%, then the population becomes 6330. Find the population of females in the town.

(a) 2500 (b) 3000

(c) 2000 (d) 3500

Ans.(a)

x is population of male

$\therefore$ $(5500-x)$ is female population

$$\frac{x\times 111}{100}+\frac{(5500-x)\times 120}{100}=6330$$

On calculating we get $x = 3000$

So female population = 2500.

14. Vicky's salary is 75% more than Ashu's. Vicky got a raise of 40% on his salary while Ashu got a raise of 25% on his salary. By what percent is Vicky's salary more than Ashu's now?

(a) 96% (b) 51.1%
(c) 90% (d) 52.1%

Ans. (a)

Lets Ashu's salary = Rs. 100

Vicky's salary = Rs. 175

Vicky's salary increased by 40% i.e.

$$= \frac{140}{100} \times 175 = \text{Rs. } 245$$

Ashu's salary increased by 25% ie 125

Vicky's Salary is 120 more that Ashu's in % term

$$\frac{120}{125} \times 100 = 96\%$$

15. During winters, an athlete can run 'x' metres on one bottle of Glucose. But in the summer, he can only run $0.5x$ metres on one bottle of Glucose. How many bottles of Glucose are required to run 400 metres during summer?

(a) $800/x$ (b) $890/x$
(c) 96 (d) $454/x$

Ans. (a)

During summer to run $-5x$ one bottle of glucose is required

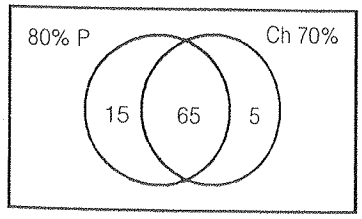
then to run 1 km $\frac{1}{0.5x}$ bottles

$\therefore$ to run 400m $\frac{1}{0.5x} \times 400 = \frac{800}{x}$ bottle

16. In an examination, 80% students passed in Physics, 70% in Chemistry while 15% failed in both the subjects. If 325 students passed in both the subjects. Find the total number of students who appeared in the examination.

(a) 500 (b) 400
(c) 300 (d) 600

Ans. (a)



15% student failed in both subjects

So total passed = 85%

$80 + 70 = 85 + x$, $x = 65\%$

65% of total = 325

total = 500.

17. 40% of 20% + 30% of 25% + 50% of 28% is equivalent to

(a) 29.5% (b) 28.5%
(c) 30.5% (d) None of these

Ans. (a)

$$40\% \text{ of } 20\% = \frac{40}{100} \times \frac{20}{100} = \frac{8}{100} = 8\%$$

$$30\% \text{ of } 25\% = \frac{30}{100} \times \frac{25}{100} = \frac{75}{100} = 7.5\%$$

$$\text{and, } 50\% \text{ of } 28\% = \frac{50}{100} \times \frac{28}{100}$$

$$= \frac{14}{100} = 14\%$$

$\therefore$ (40% of 20%+ 30% of 25% + 50% of 28%)

= 8% + 7.5% + 14% = 29.5%.

18. A man's wages were decreased by 50%. The reduced wages were increased by 50%. He had a loss of

(a) 35% (b) 25%
(c) 20% (d) None of these

Ans. (b)

Here, $x = -50$ and $y = 50$.

$\therefore$ The net % change in wages

$$= \left(x + y + \frac{xy}{100}\right)\%$$

$$= \left(-50 + 50 - \frac{50 \times 50}{100}\right)\% \text{ or } -25\%.$$

Since the sign is –ve, he has a loss of 25%.

19. The radius of a sphere is increased 10%. The surface area increases by

(a) 21% (b) 31%
(c) 41% (d) None of these

Ans. (a)

Since $4\pi \times$ radius $\times$ radius = surface area

$\therefore$ Net % change in area

$$= \left(x + y + \frac{xy}{100}\right)\%$$

$$= \left(10 + 10 + \frac{10 \times 10}{100}\right)\% = 21\%.$$

Percentage

Practice Exercise: I

1. If a number is 20% more than the other, how much percent is the second number less than the first?

   (a) $12\frac{1}{3}\%$ (b) $16\frac{2}{3}\%$

   (c) $16\frac{1}{3}\%$ (d) None of these

2. If the given two numbers are respectively 7% and 28% of a third number, then what percentage is the first of the second?

   (a) 20% (b) 25%

   (c) 18% (d) None of these

3. The price cooking oil has increased by 15%. The percentage of reduction that a family should effect in the use of cooking oil so as not to increase the expenditure on this account is

   (a) $15\frac{2}{23}\%$ (b) $13\frac{1}{23}\%$

   (c) $17\frac{1}{23}\%$ (d) None of these

4. The difference between a discount of 35% and two successive discounts of 20% and 20% on a certain bill was Rs. 22. Find the amount of the bill.

   (a) Rs. 3200 (b) Rs. 2200

   (c) Rs. 1800 (d) None of these

5. Two shopkeepers sell a radio of similar brand and type at the same list price of Rs. 1000. The first allows two successive discount of 20% and 10% and the second allows the successive discount of 15% and 15%. Find the difference in discounts offered by the two shopkeepers.

   (a) Rs. 3.50 (b) Rs. 1.50

   (c) Rs. 2.50 (d) None of these

6. The tax on a commodity is diminished by 10% and its consumption increases by 10%. Find the effects on revenue.

   (a) 1% increase (b) 2% increase

   (c) 3% decrease (d) None of these

7. If the side of a square is increased by 30%, its area is increased by

   (a) 49% (b) 69%

   (c) 79% (d) None of these

8. In measuring the sides of a rectangle, one side is taken 10% in excess and the other 20% in deficit. Find the error percent in area calculated from the measurement.

   (a) 12% deficit (b) 10% deficit

   (c) 12% excess (d) None of these

9. Water tax is increased by 20% but its consumption is decreased by 20%. The increase or decrease in the expenditure is

   (a) 4% decrease (b) 4% increase

   (c) 8% decrease (d) 8% increase

10. The population of a city increases at the rate of 10% annually. Its present population is 90.51 lacs. The population 3 years ago was nearly.

    (a) 72 lacs (b) 68 lacs

    (c) 80 lacs (d) None of these

11. The value of a machine is Rs. 6250. It decreases by 10% during the first year, 20% during the second year and 30% during the third year. What will be the value of the machine after 3 years?

    (a) Rs. 2650 (b) Rs. 3050

    (c) Rs. 3150 (d) None of these

12. An army lost 10% its men in war, 10% of the remaining due to diseases and 10% of the rest were disabled. Thus, the strength was reduced to 729000 active men. Find the original strength.

    (a) 1000000 (b) 1200000

    (c) 1500000 (d) None of these

13. In an examination, 30% and 35% students respectively failed in History and Geography while 27% students failed in both the subjects. If the number of students passing the examination is 248, find the total number of students who appeared in the examination.

    (a) 425 (b) 380

    (c) 400 (d) None of these

14. In an examination, there were 2000 candidates, out of which 900 candidates were boys and rest were girls. If 32% of the boys 38% of the girls passed, then the total percentage of failed candidates is

(a) 35.3% (b) 64.7%
(c) 68.5% (d) 70%

15. If the price of gold increases by 30%, find by how much the quantity of ornaments must be reduced so that the expenditure may remain same as before?

(a) $27\frac{2}{3}\%$ (b) $23\frac{1}{13}\%$
(c) 30% (d) 19%

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

(a) 20% (b) 22.5%
(c) 25% (d) 40%

17. In a fraction, numerator is increased by 25% and the denominator is diminished by 10%. The new fraction obtained is $\frac{5}{9}$. The original fraction is

(a) $\frac{2}{5}$ (b) $\frac{5}{9}$

(c) $\frac{3}{5}$ (d) None of these

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Solutions

1. Ans.(b)
Here, $x = 20$

$\therefore$ Required answer $= \left(\frac{x}{100+x}\times 100\right)\%$

$= \left(\frac{20}{100+20}\times 100\right)\% = 16\frac{2}{3}\%.$

2. Ans. (b)
Here, $l = 7$, and $m = 28$.
$\therefore$ First number

$= \frac{l}{m}\times 100\%$ of second number

$= \frac{7}{28}\times 100\%$ of second number

Or 25% of second number.

3. Ans. (b)
Reduction in consumption

$= \left(\frac{P}{100+P}\times 100\right)\%$

$= \left(\frac{15}{100+15}\times 100\right)\%$ or $13\frac{1}{23}\%$.

4. Ans. (b)
The equivalent discount of two successive discounts of 20% and 20%.

$= \left(x+y+\frac{xy}{100}\right)\%$

$= \left(-20-20+\frac{20\times 20}{100}\right)\%$ or -36%.

Given: 36% – 35% = Rs. 22.
$\therefore$ Amount of the bill = 22 × 100 = Rs. 2200.

5. Ans. (c)
The equivalent discount of two successive discounts of 20% and 10%

$= \left(x+y+\frac{xy}{100}\right)\%$

$= \left(-20-10+\frac{20\times 10}{100}\right)\%$ or 28%

$\therefore$ Discount on the list price of radio offered by the first shopkeeper

$= 28\%$ of $1000 = \frac{28}{100}\times 1000 =$ Rs. 280.

Also, the equivalent discount of two successive discounts of 15% and 15%

$= \left(x+y+\frac{xy}{100}\right)\%$

$= \left(-15-15+\frac{15\times 15}{100}\right)\%$ or $27\frac{3}{4}\%$

$\therefore$ Discount on the list price of radio offered by the second shopkeeper.

$= 27\frac{3}{4}\%$ of $1000 = \frac{111}{400}\times 1000$

= Rs. 277.50

$\therefore$ Difference in discounts offered by the two shopkeepers = Rs. 280 – Rs. 277.50 = Rs. 2.50.

6. Ans. (d)

Since tax × consumption = revenue

∴ Net % change in revenue

$$=\left(x+y+\frac{xy}{100}\right)\%$$

$$=\left(-10+10+\frac{10\times10}{100}\right)\%$$

(here $x = -10$ and $y = 10$) $= -1\%$

∴ The revenue decreases by 1%.

7. Ans. (b)

Since side × side = area

∴ Net % change in area

$$=\left(x+y+\frac{xy}{100}\right)\%$$

$$=\left(30+30+\frac{30\times30}{100}\right)\% = 69\%.$$

∴ The area is increased by 69%.

8. Ans. (a)

Since $side_1 \times side_2$ = area

∴ Error % in area $=\left(x+y+\frac{xy}{100}\right)\%$

$$=\left(10-20-\frac{10\times20}{100}\right)\%$$

(Here, $x = 10$ and $y = -20$)

$= -12\%$, i.e. 12% deficit.

9. Ans. (a)

Since tax × consumption = expenditure

∴ Net % change in expenditure

$$=\left(x+y+\frac{xy}{100}\right)\%$$

$$=\left(20-20-\frac{20\times20}{100}\right)\% \quad [x = 20 \,\&\, y = -20]$$

$= -4\%$.

∴ Expenditure decreases by 4%.

10. Ans. (b)

We have, P = 90.51, r = 10 and n = 3.

∴ The population 3 years ago

$$=\frac{P}{\left(1+\frac{r}{100}\right)^n}=\frac{90.51}{\left(1+\frac{10}{100}\right)^3}$$

$$=\frac{9051}{100}\times\frac{100}{110}\times\frac{100}{110}\times\frac{100}{110} = 68 \text{ lacs.}$$

11. Ans. (c)

Here, A = 6250, $x = -10$, $y = -20$ & $z = -30$.

∴ Value of the machine after 3 years

$$=A\left(1+\frac{x}{100}\right)\left(1+\frac{y}{100}\right)\left(1+\frac{z}{100}\right)$$

$$=6250\left(1-\frac{10}{100}\right)\left(1-\frac{20}{100}\right)\left(1-\frac{30}{100}\right)$$

$$=\frac{6250\times90\times80\times70}{100\times100\times100} = \text{Rs. } 3150.$$

12. Ans. (a)

Let A be the original strength.

Then, $A\left(1+\frac{x}{100}\right)\left(1+\frac{y}{100}\right)\left(1+\frac{z}{100}\right)$

= 729000 (Given)

Here, $x = -10$, $y = -10$ and $z = -10$.

$$\therefore \quad A\left(1-\frac{10}{100}\right)\left(1-\frac{10}{100}\right)\left(1-\frac{10}{100}\right)$$

$$= 729000$$

$$\Rightarrow \quad A=\frac{729000\times100\times100\times100}{90\times90\times90}$$

= 1000000 men.

13. Ans. (c)

Percentage of students passing the examination

= (100 – (30 + 35 – 27))%

[here, $x = 30$, $y = 35$ and $z = 27$]

= (100 – 38)% = 62%.

Let the total number of students appearing in the examination x.

Given : 62% of $x = 248$

$$\text{or, } \frac{62}{100}\times x = 248 \text{ or } x=\frac{248\times100}{62} = 400.$$

Therefore, 400 students appeared in the examination.

14. Ans. (b)

Boys = 900, Girls = 1100

Passed = (32 % of 900) + (38% of 1100)

= 288 + 418 = 706

Failed = 2000 – 706 = 1294

$$\text{Failed \%} =\left(\frac{1294}{2000}\times100\right)\% = 64.7\%$$

15. Ans. (b)

$$\text{Reduction} = \frac{30}{100+30} \times 100\% = 23\frac{1}{13}\%$$

16. Ans. (c)

New price must be increased by

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

17. Ans. (a)

Let the fraction be $\frac{x}{y}$

Then, $\frac{x+0.25x}{y-0.10y} = \frac{5}{9}$, $\frac{x(1.25)}{y(0.9)} = \frac{5}{9}$

$$\frac{x}{y} = \frac{5}{9} \times \frac{90}{125}, \Rightarrow \frac{x}{y} = \frac{2}{5}$$

□□□□

II Practice Exercise: II

1. Of the total amount received by Prerna, 20% was spent on purchases and 5% of the remaining on transportation. If he is left with Rs. 1520, the initial amount was:
   (a) Rs. 2800 (b) Rs. 2000
   (c) Rs. 2400 (d) Rs. 1600

2. The price of jute has been reduced by 20%. if the reduced price is Rs. 800 per quintal, the original price per quintal was
   (a) Rs. 900 (b) Rs. 640
   (c) Rs. 960 (d) Rs. 1000

3. 5/9 part of the population in a village are males. If 30% of the males are married, the percentage of unmarried females in the total population is:
   (a) 70% (b) 40%
   (c) $27\frac{7}{9}\%$ (d) 20%

4. A school has only three classes which contain 40, 50 and 60 students respectively. The pass percentages of these classes are 10, 20 and 10 respectively. The pass percentage of the school is:
   (a) $13\frac{1}{3}$ (b) 15
   (c) 20 (d) $16\frac{2}{3}$

5. If x% of a is the same as y% of b, then z% of b is
   (a) $\frac{yz}{x}$% of a (b) $\frac{xy}{z}$% of a
   (c) $\frac{xz}{y}$% of a (d) None of these

6. From a container having pure milk, 20% is replaced by water and the process is repeated thrice. At the end of the third operation, the milk is:
   (a) 40% pure (b) 50% pure
   (c) 51.2% pure (d) 58.8% pure

7. The salaries of A and B together amount to Rs. 2000. A spends 95% of his salary and B, 85% of his. If now, their savings are same, what is A's salary?
   (a) Rs. 1500 (b) Rs. 1250
   (c) Rs. 750 (d) Rs. 1600

8. 300 grams of sugar solution has 40% sugar in it. How much sugar should be added to make it 50% in the solution?
   (a) 10 gms (b) 40 gms
   (c) 60 gms (d) 80 gms

9. In an examination, there are 3 papers of Mathematics of 100 marks each. A boy secures 60% in the first paper and 70% in the second paper. In order to secure 70% in the aggregate the percentage of marks he should secure in third paper will be:
   (a) 90% (b) 80%
   (c) 75% (d) 70%

10. Two numbers are less than a third number by 30% and 37% respectively. How much percent is the second number less than the first?
    (a) 10% (b) 7%
    (c) 4% (d) 3%

11. In an examination, A got 10% marks less than B, B got 25% marks more than C and C got 20% less than D. If A got 360 marks out of 500, the percentage of marks obtained by D was
    (a) 70 (b) 75
    (c) 80 (d) 85

12. If the numerator of a fraction be increased by 15% and its denominator be dimimished by 8%, the value of the fraction $\frac{15}{16}$. The original fraction is

(a) $\frac{3}{5}$ (b) $\frac{3}{4}$

(c) $\frac{3}{7}$ (d) $\frac{2}{3}$

13. In an examination, 35% candidates failed in one subject and 42% failed in another subject while 15% failed in both the subjects. If 2500 candidates appeared at the examiniation, how many passed in either subject but not in both?

(a) 325 (b) 1175

(c) 2125 (d) None of these

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

(a) 58% (b) 67.5%

(c) 78% (d) 82.5%

15. The price of sugar is increased by 20%. As a result, a family decreases its consumption by 25%. The expenditure of the family on sugar will be decreased by:

(a) 10% (b) 5%

(c) 14% (d) 15%

16. A building worth Rs. 133,100 is constructed on land worth Rs. 72,900. After how many years will the value of both be the same if land appreciates at 10% p.a. and building depreciates at 10% p.a.?

(a) 2.5 (b) 2

(c) 1.5 (d) 3

17. A reduction of 21% in the price of wheat enables a person to buy 10.5 kg more for Rs. 100. What is the reduced price per kg?

(a) Rs. 2 (b) Rs. 2.25

(c) Rs. 2.30 (d) Rs. 2.50

18. The length of a rectangle is increased by 60%. By what percent would the width have to be decreased to maintain the same area?

(a) $37\frac{1}{2}\%$ (b) 60%

(c) 75 % (d) None

19. Ram sells his goods 25% cheaper than Shyam and 25% dearer than Bram. How much percentage is Bram's goods cheaper than Shyam's?

(a) 33.33% (b) 50%

(c) 66.66% (d) 40%

20. Rajiv wanted to subtract 5 from a number Unfortunately, he added 5 instead of subtracting Find the percentage change in the result.

(a) 300%

(b) 66.66%

(c) 50%

(d) Cannot be determined

21. The salary of Amit is 30% more than that of Varun Find by what percentage is the salary of Varun les than that of Amit?

(a) 26.12% (b) 23.07%

(c) 21.23% (d) None of these

22. Ram spends 20% of his monthly income on his hous hold expenditure, 15% of the rest of books, 30% o the rest on clothes and saves the rest. On counting he comes to know that he has finally saved Rs. 952(Find his monthly income.

(a) 10000 (b) 15000

(c) 20000 (d) None of these

23. An ore contains 25% of an alloy that has 90% iror Other than this, in the remaining 75% of the or there is no iron. How many kilograms of the ore ar needed to obtain 60 kg of pure iron?

(a) 250 kg (b) 275 kg

(c) 300 kg (d) 266.66 kg

24. Ram sells his goods 20% cheaper than Bobby an 20 dearer than Chandilya. How much percentage Chandilya's goods cheaper/dearer than Bobby's.

(a) 33.33% (b) 50%

(c) 42.85% (d) None of these

25. Out of the total production of iron from hematite, a ore of iron, 20% of the ore gets wasted, and out o the remaining ore, only 25% is pure iron. If the pur iron obtained in a year from a mine of hematite wa 80,000 kg, then the quantity of hematite mined fro that mine in the year is

(a) 5,00,000 kg (b) 4,00,000 kg

(c) 4,50,000 kg (d) None of these

26. Ram spends 30% of his salary on house rent, 30 of the rest he spends on his children's educatio

and 24% of the rest salary he spends on clothes. After his expenditure, he is left with Rs. 2500. What is Ram's salary?

(a) Rs. 6713.2 (b) Rs. 20,000

(c) Rs. 10,000 (d) Rs. 15,000

□□□□

Solutions

1. Ans. (b)

Purchases = 20% of $x = \frac{x}{5}$.

Balance $= x - \frac{x}{5} = \frac{4x}{5}$.

Transportation = 5% of

$\frac{4x}{5} = \frac{5}{100} \times \frac{4x}{5} = \frac{x}{25}$.

Balance $= \frac{4x}{5} - \frac{x}{25} = \frac{19x}{25}$.

$\therefore \frac{19x}{25} = 1520 \Rightarrow x = \frac{1520 \times 25}{19} = 2000.$

2. Ans. (d)

80% of $x = 800 \Rightarrow \frac{80}{100}x = 800$

$\Rightarrow x = 800 \times \frac{100}{80} = 1000.$

3. Ans. (c)

Let, total population = x. Males = $\frac{5}{9}x$.

Married males = 30% of

$\frac{5}{9}x = \frac{30}{100} \times \frac{5}{9}x = \frac{x}{6}$.

Married females = $\frac{x}{6}$.

Total females $= \left(x - \frac{5}{9}x\right) = \frac{4x}{9}$.

Unmarried females $= \left(\frac{4x}{9} - \frac{x}{6}\right) = \frac{5x}{18}$.

$\therefore$ Required percentage

$= \left(\frac{5x}{18} \times \frac{1}{x} \times 100\right)\% = 27\frac{7}{9}\%.$

4. Ans. (a)

Number of passed candidates

$= \left(\frac{10}{100} \times 40 + \frac{20}{100} \times 50 + \frac{10}{100} \times 60\right)$

$= (4 + 10 + 6) = 20$

Passed percentage $= \frac{20}{(40 + 50 + 60)} \times 100$

$= \left(\frac{20}{150} \times 100\right)\% = 13\frac{1}{3}\%.$

5. Ans. (c)

$x\%$ of a = y% of b $\Rightarrow \frac{x}{100}a = \frac{y}{100}b \Rightarrow b$

$= \left(\frac{x}{100} \times \frac{100}{y}\right)a = \left(\frac{x}{y}\right)a$

$\therefore$ z% of b $= \left(z\% \text{ of} \frac{x}{y}\right)a$

$= \left(\frac{xz}{y \times 100}\right)a = \left(\frac{xz}{y}\right)\%$ of a.

6. Ans. (c)

Let total quantity of original milk=1000 gm.

Milk after first operation

= 80% of 1000 = 800 gm.

Milk after second operation

= 80% of 800 = 640 gm.

Milk after third operation

= 80% of 640 = 512 gm.

$\therefore$ Strength of final mixture = 51.2%.

7. Ans. (a)

Let A's salary = x, Then, B's = $(2000 - x)$

5% of A =15% of B, i.e.

$\frac{5}{100}x = \frac{15}{100}(2000 - x)$ or $x = 1500.$

8. Ans. (c)

Sugar $= \left(\frac{40}{100} \times 300\right)$gms =120 gms,

water =180 gms.

Let x gm sugar may be added.

Then, $\frac{120 + x}{300 + x} \times 100 = 50 \Rightarrow 240 + 2x$

$= 300 + x \Rightarrow x = 60$

9. Ans. (b)

$$60+70+x=\frac{70}{100}\times 300 \text{ or } x=80\%.$$

10. Ans. (a)

Let, third number be x. Then,

$$\text{First number} = 70\% \text{ of } x=\frac{7x}{10},$$

$$\text{Second number} = 63\% \text{ of } x=\frac{63x}{100}.$$

Required Percentage

$$=\left(\frac{7x}{100}\times\frac{10}{7x}\times 100\right)\%=10\%.$$

11. Ans. (c)

$$A=\frac{90}{100}B,\ B=\frac{125}{100}C \text{ and } C=\frac{80}{100}D.$$

$$\therefore\quad B=\frac{10}{9}A, C=\frac{4}{5}B \text{ and } D=\frac{5}{4}C.$$

$$B=\frac{10}{9}\times 360=400,\ C=\frac{4}{5}\times 400=320$$

$$\text{and } D=\frac{5}{4}\times 320=400.$$

$$\text{Percentage of D}=\left(\frac{400}{500}\times 100\right)\%=80\%.$$

12. Ans. (b)

Let the given fraction be x/y.

$$\text{Then, } \frac{115\% \text{ of } x}{92\% \text{ of } y}=\frac{15}{16}\Rightarrow\frac{115x}{92y}=\frac{15}{16}$$

$$\Rightarrow\ \frac{x}{y}=\left(\frac{15}{16}\times\frac{92}{115}\right)=\frac{3}{4}.$$

13. Ans. (b)

$$\text{Failed in 1st subject} =\left(\frac{35}{100}\times 2500\right)=875.$$

$$\text{Failed in 2nd subject}=\left(\frac{42}{100}\times 2500\right)=1050.$$

$$\text{Failed in both} =\left(\frac{15}{100}\times 2500\right)=375.$$

Failed in 1st subject only =(875 – 375) = 500.

Failed in 2nd subject only=(1050 – 375) = 675.

Passed in 2nd only + Passed in 1st only

= (675 + 500) = 1175.

14. Ans. (c)

Suppose boys = $3x$ and girls = $2x$.

$$\text{Not adults} =\left(\frac{80}{100}\times 3x\right)+\left(\frac{75}{100}\times 2x\right)$$

$$=\left(\frac{12x}{5}+\frac{3x}{2}\right)=\frac{39x}{10}.$$

Required percentage

$$=\left(\frac{39x}{10}\times\frac{1}{5x}\times 100\right)\%=78\%.$$

15. Ans. (a)

Let original consumption=100 units & original pric

= Rs. 100/unit.

Original expenditure = Rs. (100 × 100)

= Rs. 10000.

New expenditure= Rs. (120 × 75) = Rs. 9000.

∴ Decrease in expenditure

$$=\left(\frac{1000}{10000}\times 100\right)\%=10\%.$$

16. Ans. (d)

$$72900\left(1+\frac{10}{100}\right)^n=133100\times\left(1-\frac{10}{100}\right)^n$$

$$\therefore\quad\left(\frac{11}{10}\right)^n\times\left(\frac{10}{9}\right)^n=\frac{133100}{72900}=\frac{1331}{729}$$

$$\therefore\quad\left(\frac{11}{9}\right)^n=\left(\frac{11}{9}\right)^3\qquad\Rightarrow n=3.$$

17. Ans. (a)

Let original price = Rs. x/kg. Reduced price

$$=\left(\frac{79}{100}x\right)/\text{kg}.$$

$$\frac{\frac{100}{79x}}{100}-\frac{100}{x}=10.5\Rightarrow\frac{10000}{79x}-\frac{100}{x}=10.5$$

$$10000-7900=10.5\times 79x$$

$$\text{or}\quad x=\frac{2100}{10.5\times 79}$$

∴ Reduced price

$$=\text{Rs.}\left(\frac{79}{100}\times\frac{2100}{10.5\times 79}\right)/\text{kg}=\text{Rs. } 2/\text{kg}$$

18. Ans. (a)

Let length = l and breadth = b.

Let the required decrease in breadth be x%.

Then, $\frac{160}{100}l \times \frac{(100-x)}{100} \times b = lb$

$\Rightarrow 160(100-x) = 100 \times 100$

or $100 - x = \frac{10000}{160} = \frac{125}{2}$

$\Rightarrow x = \left(100 - \frac{125}{2}\right) = 37\frac{1}{2}.$

19. Ans. (d)

Let Shyam sells good at Rs. 100

So Ram sells good at Rs. 75

Now this Rs. 75 is 25% dearer than Bram i.e.

$\text{Bram} \times \frac{125}{100} = 75$

Bram's price = 60

Bram's good is Rs. 40 cheaper than Shyam in % term $\frac{40}{100} \times 100$ i.e. 40%

20. Ans. (d)

This cannot be determined because after adding or substracting 5 to different numbers variable results are obtained.

21. Ans. (b)

Let Varun's salary is 100

Amit salary = 30% more that Varun's Salary = 130 in % salary of Varun less than Amit

$= \frac{30}{130} \times 100 = 23.07\%$

22. Ans. (c)

Let he earns Rs. P

$x = -20$, $y = -15$, $z = -30$

$P\left[1+\frac{x}{100}\right]\left[1+\frac{y}{100}\right]\left[1+\frac{z}{100}\right] = 9520$

$P\left[\frac{80}{100}\right] \times \left[\frac{85}{100}\right]\left[\frac{70}{100}\right] = 9520$

$Px.\ 476 = 9520$, $P = 20000$

23. Ans. (d)

Let amount of ore is 100 kg

25% or 25 kg has 90% iron

$= \frac{25 \times 90}{100} = 22.5$ kg iron

75% or 75 kg has no iron = 0 kg

To obtain 22.5 kg 100 kg ore is required

So to obtain 60 kg

$\frac{100}{22.5} \times 60 = 266.66$ kg

24. Ans. (a)

Let Bobby's sale price is Rs. 100

Ram sale price = Rs. 80

Ram sale price is 20% dearer than chandilya So, Chandilya's price = CP

$CP \times \frac{120}{100} = 80$, $CP = 66.66$

Now Chandilya good is Rs. 33.33 cheaper than Bobby's i.e.

$= \frac{33.63}{100} \times 100 = 33.33\%$

25. Ans. (b)

Let x kg ore is there

20% washed away so remaining is

80% i.e. $4/5x$

out of $\frac{4}{5}x$, 25% is pure iron $\frac{25}{100} \times \frac{4}{5}x = \frac{1}{5}x$

i.e. $\frac{1}{5}x$ kg is obtained from x kg then 1 kg is obtained from 5 kg

$\therefore$ 80000 kg is obtained from

$5 \times 80000 = 400000$ kg

26. Ans. (a)

Let total salary is Rs. x

$P\left[1+\frac{x}{100}\right]\left[1+\frac{y}{100}\right]\left[1+\frac{z}{100}\right] = 2500$

$P\left[1-\frac{30}{100}\right]\left[1-\frac{30}{100}\right]\left[1-\frac{24}{100}\right] = 2500$

[(–)ve sign because of spending]

$P\left[\frac{70}{100}\right]\left[\frac{70}{100}\right]\frac{76}{100} = 2500$

P = Rs. 6713.21