PERCENTAGES

→ Percentage means for every 100.

eg :- $x\% = \frac{x}{100}$; $13\% = \frac{13}{100}$

→ 13% of x can be written as $\frac{13}{100} \times x$

Out of 100 parts 13 parts of x can be selected.

→ $\frac{1}{4}$ can be written as $\frac{1}{4} \times \frac{25}{25} = \frac{25}{100}$

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

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

→ Rate percent ⟹ multiply with 100

→ is (=)

what (?)

of (×)

what percent $\left(\frac{?}{100}\right)$

→ 5 is what percent of 125

$$5 = \frac{?}{100} \times 125$$

$$? = \frac{5 \times 100^{4}}{125_{5}} = 4$$

→ standard percentage values

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

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

$$25\% = \frac{25}{100} = \frac{1}{4}$$

$$12\frac{1}{2}\% = \frac{25}{2}\% = \frac{25}{2 \times 100} = \frac{1}{8}$$

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

$37\frac{1}{2}\% = \frac{75}{2\times100} = \frac{3}{8}$

$6\frac{1}{4}\% = \frac{25}{4\times100} = \frac{1}{16}$

$8\frac{1}{3}\% = \frac{25}{3\times100} = \frac{1}{12}$

$12\frac{1}{2}\% = \frac{25}{2\times100} = \frac{1}{8}$

$66\frac{2}{3}\% = \frac{200}{3\times100} = \frac{2}{3}$

$16\frac{2}{3}\% = \frac{50}{3\times100} = \frac{1}{6}$

$\approx \frac{1}{3}$

1) Find 33.33 percent of the following values

a) 240 b) 156 c) 105 d) 126

(a) $240 \times \frac{1}{3} = 80$

(b) $156 \times \frac{1}{3} = 52$

(c) $105 \times \frac{1}{3} = 35$

(d) $126 \times \frac{1}{3} = 42$

2) Express each of the following as rate percent $\times 100$

a) 23/36 b) 27/4 c) 0.004

(a) $\frac{23}{36} \times \frac{25}{100} = \frac{575}{9} = 63\frac{8}{9}$

(b) $\frac{27}{4} \times \frac{25}{100} = 675$

(c) $0.004 \times 100 = 0.4$

→ Find 11%, 16%, 19%, 49% of '1100' and '36'

→ 1100

11%

10% → 110

1% → +11

121

16%

10% → 110

5% → 55

1% → 11

176

19%

10% → 110

20% → 220

1% → - 11

209

49%

100% → 1100

50% → 550

1% → - 11

539

→ 36

11%

10% → 3.6

1% → 0.36

3.96

16%

10% → 3.6

5% → 1.8

1% → 0.36

5.76

19%

10% → 3.6

20% → 7.20

1% → 0.36

6.84

→ 49%

100% → 36

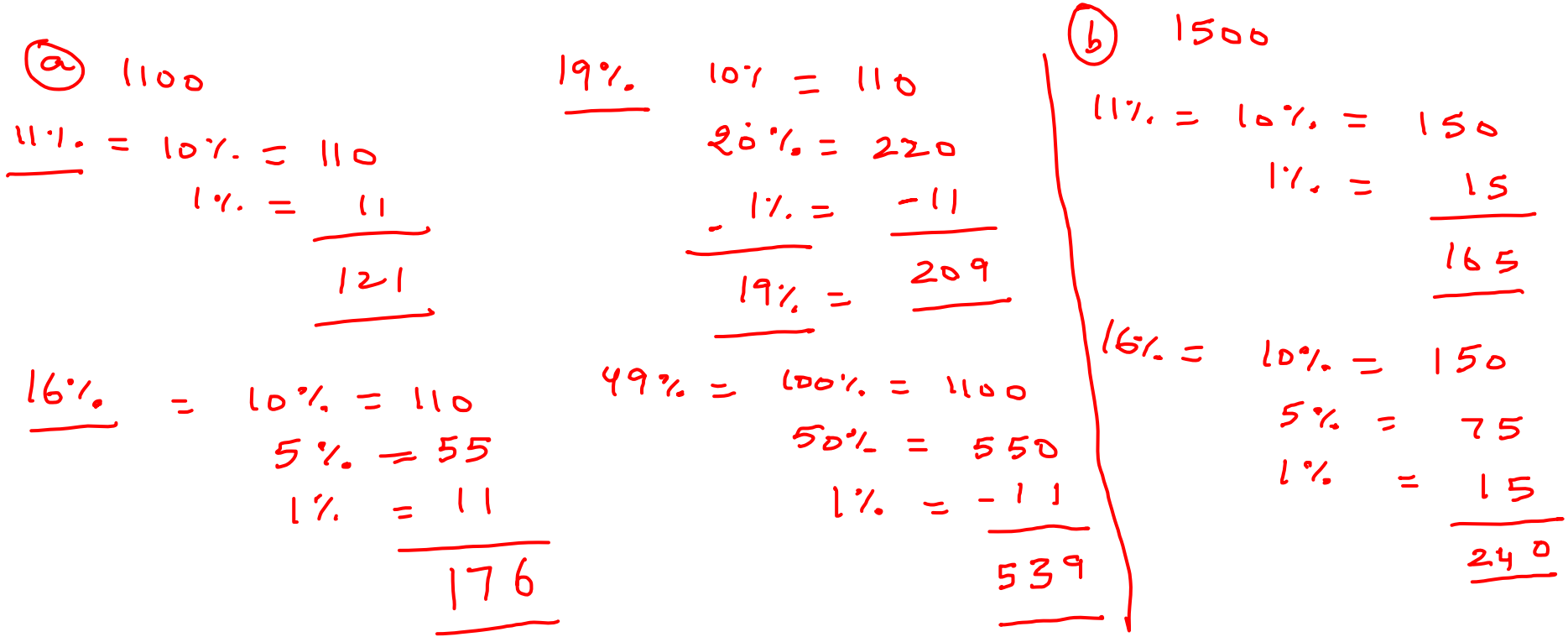
50% → 18.00

1% → 0.36

17.64

3) Find 11%, 16%, 19%, 49%of the following values

a) 1100 b) 1500 c) 600 d) 360



19% = 10% = 150

20% = 300

1% = 15

285

49% = 100% = 1500

50% = 750

1% = 15

735

(c) 600

→ 11% = 10% = 60

1% = 6

66

16% = 10% = 60

5% = 30

1% = 6

96

19% 10% = 60

20% = 120

1% = 6

114

49%

100% = 600

50% = 300

1% = 6

49% = 294

(d) 360

→ 11% = 10% = 36

1% = 3.6

39.6

16% = 10% = 36

5% = 18

1% = 3.6

57.6

19% = 10% = 36

20% = 72.0

1% = 3.6

68.4

4) Evaluate :

a) 28 % of 450 + 45% of 280

b) 16.66 % of 600 gm – 33.33 % of 180 gm

(a) $\frac{28}{100} \times 450 + \frac{45}{100} \times 280$

$= \frac{28}{100} \times [450 + 450]$

$= \frac{28}{100} \times 900 = 252$

(b) $= \frac{1}{6} \times 600 - \frac{1}{3} \times 180$

$= 100 - 60$

$= 40$ gm

(a) $2 = \frac{?}{100} \times 50 \Rightarrow ? = \frac{100 \times 2}{50} = 4$

(b) $1/2 = ?/100 \times 1/3 \Rightarrow ? = 300/2 = 150$

5) a) 2 is what percent of 50 ?

b) ½ is what percent of 1/3 ?

c) What percent of 7 is 84?

d) what percent of 2 metric tonnes is 40 quintals?

(c) $\frac{?}{100} \times 7 = 84$

$? = \frac{8400}{7} = 1200$

NOTE : 1 metric Tonne = 10 Quintals

(d) $\frac{?}{100} \times 2 \times 10 = 40$

$? = \frac{100 \times 40^{2}}{20} = 200\%$

$\frac{4}{5} \times \frac{20}{20} = \frac{80}{100}$ | $\frac{65}{100}$

6) Sixty percent of a number is 21 less than four – fifth of that number. What is the number?

a) 100

b) 120

c) ~~140~~

d) 160

(80 − 65) → 21

100 → ?

$\frac{\cancel{100}^{20} \times \cancel{21}^{7}}{\cancel{15}_{\cancel{5}_{1}}} = 140$

$3\frac{1}{2}\% = \frac{7}{2\times100} = \frac{8400}{42} \times \frac{7}{200} = Rs\ 294$

7) If the sales tax be reduced from 3(1/2) % to 3(1/3) %, then what difference does it make to a person who purchases an article with marked price of Rs 8400?

a) 10

b) 12

c) 14

d) 16

$3\frac{1}{3}\% = \frac{10}{3\times100} = \frac{10}{300} \times 8400 = Rs\ 280$

$Diff = 294 - 280 = Rs\ 14$

$x - y = 1660$

$\frac{7.5}{100} x = \frac{12.5}{100} y$

8) Difference of two numbers is 1660. If 7.5 % of one number is 12.5 % of the other number, find the two numbers. $\frac{x}{y} = \frac{5}{3}$

a) 2400, 4150

b) 2490, 4200

c) 2490, 4150

d) None of these

$x : y = 5 : 3$

$2p \rightarrow 1660$

$1p \rightarrow 830$

$x \rightarrow 5 \times 830 = 4150$

$y \rightarrow 3 \times 830 = 2490$

→ Increment / Decrement

→ When $x \longrightarrow x+a$

$$\text{Increase} = x+a-x = a$$

$$\text{Increase \%} = \frac{a}{x} \times 100$$

→ When $y \longrightarrow y-b$

$$\text{Decrease} = y-(y-b) = y-y+b = b$$

$$\text{Decrease \%} = \frac{b}{y} \times 100.$$

(c) $I\% = \frac{160}{80} \times 100 = 200\%$

9) Find the percentage increase and decrease of the following values?

a) 300 – 400 b) 1500 – 1250 c) 80 -240

(a) $I\% = \frac{100}{300} \times 100$

$= 33\frac{1}{3}\%$ (↑) increase

(b) $D\% = \frac{250}{1500} \times 100 = \frac{50}{3} = 16\frac{2}{3}\%$ (↓) decrease

10) The price of an article was increased from Rs 200 to 250. What is the percentage increase in its price?

a) 10

b) 15

c) 20

d) 25

$200 \longrightarrow 250$

$I\% = \frac{50}{200} \times 100 = 25\%$ (↑) increase

Number = 100 (Let)

+30 (30% of 100)

130

11) If a number is increased by 30% it becomes 390. Find the number?

a) 100

b) 200

c) 300

d) None of these

130% → 390

100% → ?

$$\frac{100 \times 390}{130} = 300$$

B's salary = Rs 100 (Let)

A's Salary = Rs 100

+ 25 (25% of 100)

125

12) If A's salary is 25% more than B's salary then B's salary is how much percent less than that of A's salary?

$= \frac{25}{125} \times 100$

a) 10 %

b) 20 %

$= 20\%$

c) 30 %

d) None of these

$A_{Rectangle} = l \times b$

$l = 20m$ $\quad b = 10m$ (let)

13) The length and breadth of a rectangle are increased by 10 % and 20 % respectively. What is the percentage increase in its area?

a) 12 %

b) 22 %

c) 32 %

d) None of these

$A = l \times b$

$= 20 \times 10$

$= 200$

New $A_{rea} = 22 \times 12 = 264$

Increase in Area $= 264 - 200$

$= 64$

$200\ m^2 \rightarrow 64$

$100\ m^2 \rightarrow ?$

$\frac{100 \times 64}{200} = 32\%$

→ Restore model

$$\text{Increase \%} = \frac{\text{Decrease \%}}{100 - \text{Decrease \%}} \times 100$$

$$\text{Decrease \%} = \frac{\text{Increase \%}}{100 + \text{Increase \%}} \times 100$$

14) The price of an article is cut by 10%, to restore it to the former value, by what percent the new price must be increased?

a) 10 %

b) 11 %

c) 9 %

d) 11.11 %

$D\% = 10\%$

$$I\% = \frac{D\%}{100 - D\%} \times 100$$

$$= \frac{10}{100 - 10} \times 100$$

$$= \frac{10}{90} \times 100$$

$$= 11.11\%$$

15) The price of an article is increased by 25 %, to restore it to the former value, by what percent the new price must be decreased?

a) 20 %

b) 25 %

c) 33.33 %

d) 16.66 %

$$I\% = 25\%$$

$$D\% = \frac{I\%}{100 + I\%} \times 100$$

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

$$= \frac{25}{125} \times 100$$

$$= 20\%$$

16) The price of sugar is increased by 20 %. If the expenditure is not allowed to increase, what is the ratio between the reduction in consumption and the original consumption?

a) 6:1

b) 1:6

c) 3:5

d) 5:3

$I\% = 20\%$

$D\% = \frac{I\%}{100 + I\%} \times 100$

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

$= \frac{20}{120} \times 100 = \frac{100}{6} = \frac{50}{3}$

Reduction : original $= \frac{50}{3} : \frac{100}{1} = \frac{50}{3} : \frac{300}{3} = 1 : 6$

17) The price of sugar increased by 12.5 %. To maintain previous budget, to what percent the consumption should be reduced?

a) 33.33 %

b) 16.66 %

c) 11.11 %

d) 12.5 %

$I\% = 12.5$

$D\% = \frac{I\%}{100 + I\%} \times 100$

$= \frac{12.5}{100 + 12.5} \times 100$

$= \frac{125}{1125} \times 100$

$= 11.11\ \%$

18) Rakesh credits 15 % of his salary in his fixed deposit account and spends 30 % of the remaining amount on groceries. If the cash in hand is Rs 2380. What is his salary?

a) Rs 42500

b) Rs 3000

c) Rs 3500

d) Rs 4000

Salary = Rs 100 (Let)

Fixed deposit = − 15 (15% of 100)

85

85.0

Groceries = − 25.5 (30% of 85)

59.5

59.5 → 2380

100 → ?

Salary = $\frac{100 \times 2380}{59.5}$ = Rs 4000

(or)

(18)

Sol

Salary = Rs x

$$x \times \frac{85}{100} \times \frac{70}{100} = 2380$$

$$x = \frac{2380 \times 100 \times 100}{85 \times 70}$$

Salary = x = Rs 4000

19) After spending 40 % on machinery, 25 % on building, 5 % on raw material and 5 % on furniture, Hari had a balance of Rs 1305. What amount he had originally?

a) Rs 5220

b) Rs 5000

c) Rs 1870

d) Rs 2900

Original Amount = Rs 100 (Let)

Machinery = Rs 40 (40% of 100)

Building = Rs 25 (25% of 100)

Raw material = Rs 5 (5% of 100)

Furniture = Rs 5 (5% of 100)

Rs 75

Left Amount = 100 − 75 = 25

Rs 25 → Rs 1305

Rs 100 → ?

$= \frac{100 \times 1305}{25} = Rs\ 5220$

(or)

original amount = Rs x

(19) Sol

$[100 - (40 + 25 + 5 + 5)]\% = (100 - 75)\% = 25\%$

$$x \times \frac{25}{100} = 1305$$

$$x = \frac{1305 \times 100}{4}$$

original Amount = x = Rs 5220

20) A fruit seller had some apples. He sells 40 % and still has 420 apples. How many apples he had originally?

a) 1000

b) 700

c) 630

d) 300

originally apples = 100 (Let)

sold = 40 [40% of 100]

left = 60

60 → 420

100 → ?

$$\text{Originally apples} = \frac{100 \times 420}{60} = 700$$

21) In a college election, a candidate secured 62 % of the votes and is elected by a majority of 144 votes. What is the total number of votes polled?

a) 362

b) 600

c) 400

d) 168

Total votes polled = 100

I	II
62	100 − 62 = 38

(62% of 100)

Majority = 62 − 38 = 24

24% → 144

100% → ?

$$\text{Total votes} = \frac{100 \times 144}{24} = 600$$

(on)

(21)

Sol

Total votes = x

$$x \times \frac{24}{100} = 144$$

I	II
62	38

24 (62 − 38)

$$\text{Total votes} = x = \frac{144 \times 100}{24} = 600$$

Total votes = 7500

Invalid = 1500 (20% of 7500)

Total valid votes = 6000

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

a) 2700

b) 6000

c) 4200

d) 5600

I	II
55%	(100 − 55)% = 45%

100% → 6000

45% → ?

IInd candidate gets = $\frac{45 \times 6000}{100}$ = 2700

(OR)

(22)

Sol

$$\text{II}^{\text{nd}} \text{ candidate votes} = 7500 \times \frac{\overbrace{(100-20)}^{\text{valid votes}}}{100} \times \frac{\overbrace{(100-55)}^{\%\text{ of II}^{\text{nd}}\text{ candidate votes}}}{100}$$

$$= 7500 \times \frac{80}{100} \times \frac{45}{100}$$

$$= 2700$$

23) In an examination, it is required to get 36 % of maximum marks to pass. A student got 113 marks and declared failed by 85 marks. What were the maximum marks?

a) 550

b) 297

c) 198

d) 239

Maximum marks = 100 %

Pass % = 36%

pass marks = 113 + 85 = 198

36% → 198

100% → ?

$$\text{Max marks} = \frac{100 \times 198}{36} = 550$$

pass % = 20 + 5 = 25 %.

24) A student who secures 20 % marks in an examination fails by 30 marks. Another student who secures 32 % marks gets 42 marks more than those required to pass. What is the percentage of marks required to pass?

a) 20

b) 15

c) 25

d) None of these

pass marks = x

$20\% \longrightarrow x - 30$

$32\% \longrightarrow x + 42$

$(32 - 20)\% \longrightarrow (x + 42) - (x - 30)$

$12\% \longrightarrow 72$

$6\% \longrightarrow 36$

$1\% \longrightarrow 6$

$(6 - 1)\% \longrightarrow (36 - 6)$

$5\% \longrightarrow 30$

Max marks = 100

pass % = 35 %

pass marks = 96 + 16 = 112

25) A candidate needs 35 % marks to pass. If he get 96 marks and fails by 16 marks, then what is the maximum marks?

35 % → 112

100 % → ?

$$\text{Max marks} = \frac{100 \times 112}{35} = 320$$

a) 112

b) 320

c) 208

d) 328

1 litre = 1000 ml

26) One litre of water is evaporated from 6 litres of a solution containing 5 % salt. What is the percentage of salt in the remaining solution?

a) 6 %

b) 4 %

c) 8 %

d) 5 %

		Salt	% salt
6 lit	6000 ml	300	5 %
5 lit	5000 ml	300	6 %

(6 - 5) litre evaporated

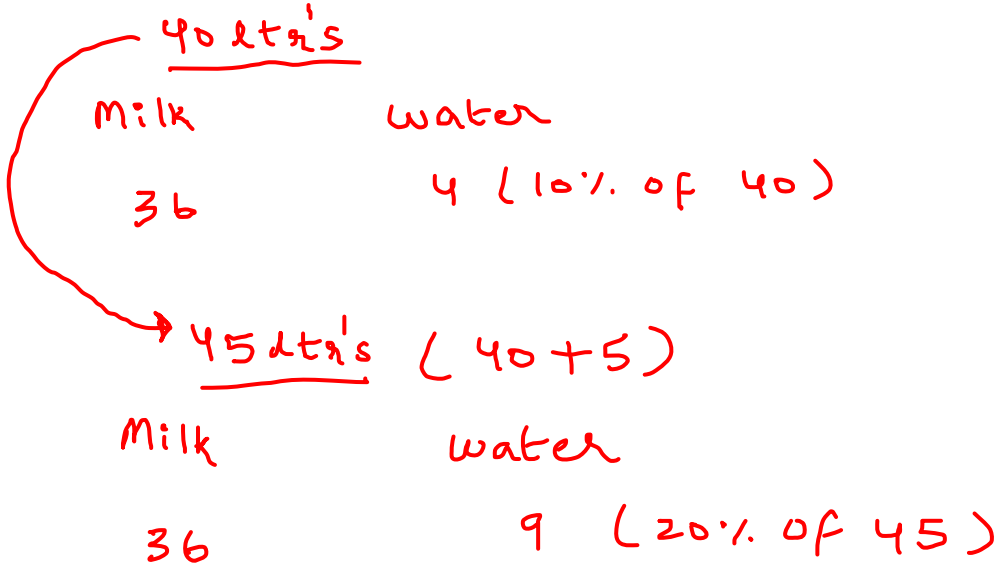
27) A mixture of 40 litres of milk and water contains 10 % of water. How much water should be added to this so that water may be 20 % in the new mixture?

a) 2.5 ltrs

b) 4 ltrs

c) 3.5 ltrs

d) 5 ltrs



28) A mixture contains alcohol and water in the ratio 4:3. If 7 litres of water is added to the mixture, the ratio of the alcohol and water 3:4. What is the quantity of alcohol in the new mixture?

a) 10 ltrs

b) 15 ltrs

c) 12 ltrs

d) 5 ltrs

Alcohol : water

$4 : 3$

$$\frac{4x}{3x+7} = \frac{3}{4}$$

$16x = 9x + 21$

$7x = 21$

$x = 3$

Alcohol $= 4x = 4 \times 3 = 12$ ltrs

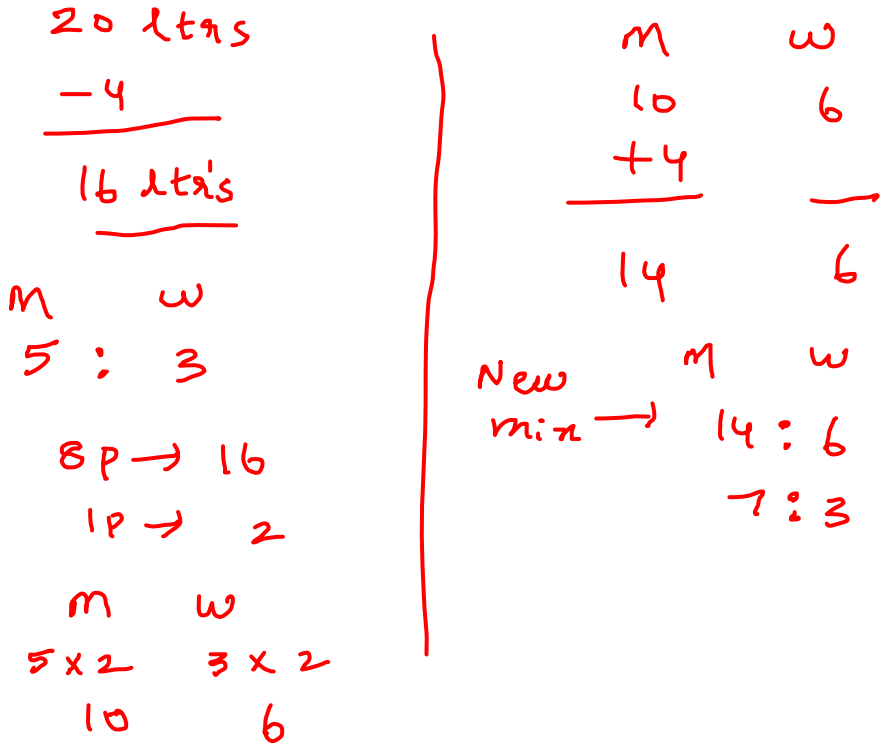
29) 20 ltrs of a mixture contain milk and water in the ratio 5:3. If 4 ltrs if this mixture are replaced by 4 ltrs of milk. What is the ratio of milk and water in the new mixture?

a) 3:7

b) 7:3

c) 2:7

d) 7:2



30) The population of a town is 176400. It increases annually at the rate of 5 % per annum. What will be its population after 2 years ?

a) 194040

b) 194400

c) 194481

d) 200000

Population after 2 years $= 176400 \times \frac{105}{100} \times \frac{105}{100} = 194481$

(or)

(30)

Sol

Present population = 176400

$$= \begin{array}{r} 8820 \\ \hline 185220 \end{array}$$ [5% of 176400]

Population after 1st year = 185220

$$= \begin{array}{r} 185220 \\ 9261 \\ \hline 194481 \end{array}$$ [5% of 185220]

Population after 2nd year = 194481

31) The population of the town is 8000. It increases by 10 %, during the first year and by 20 % during the second year. What is its population after 2 years?

a) 10560

b) 10750

c) 10340

d) 10900

Population after 2 years $= 8000 \times \frac{110}{100} \times \frac{120}{100} = 10560$

(or)

(31) Sol

Present population = 8000

$+\ 800$ [10% of 8000]

Population after 1st year = 8800

8800

$+\ 1760$ [20% of 8800]

Population after 2nd year = 10560

Purchased price = Rs x

Present value = 44000

32) The value of a machine depreciates at the rate of 20 % every six months. It was purchased 1 year ago. What was its purchased price, if its present value is Rs 44000?

a) 61600

b) 68750

c) 69850

d) 70000

$$x \times \frac{80}{100} \times \frac{80}{100} = 44000$$

$$x = \frac{44000 \times 10_0 \times 100}{80 \times 80} = 68750$$

Venn diagrams

Total = 100 Students

33) In an examination, 42 % students failed in Hindi and 52 % failed in English. If 17 % failed in both the subjects. What is the percentage of those who passed in both the subjects?

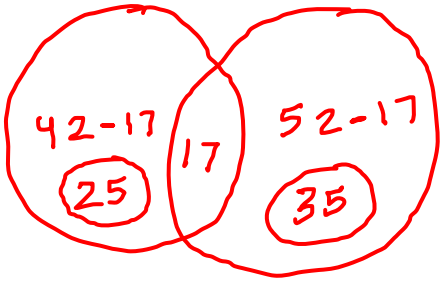
a) 11 %

b) 23 %

c) 15 %

d) 77 %

n(H) n(E)



pass = 100 − (25 + 35 + 17)

= 100 − 77

= 23 %

Total students = 100 $n(B \cup M)$

$n(B) = 72\%$

$n(M) = 44\%$

34) 72 % of the students of a certain class took biology and 44 % took Mathematics. If each student took biology or Mathematics and 40 students took both, what is the total number of students in the class?

a) 100

b) 150

c) 90

d) 250

$n(B \cup M) = n(B) + n(M) - n(B \cap M)$

$100 = 72 + 44 - n(B \cap M)$

$100 = 116 - n(B \cap M)$

$n(B \cap M) = 116 - 100 = 16$

$16\% \rightarrow 40$

$100\% \rightarrow ?$

Total No of students $= \frac{100 \times 40}{16} = 250$

(or)

(34) check through options

sol (d) Total No of Students = 250

No of students took Biology = 180 [72% of 250]

No of students took mathematics = 110 [44% of 250]

290 (250 + 40)

40 students took Biology and Mathematics

→ When $x \longrightarrow x^2$

$$\text{Increase \%} = 2x + \frac{x^2}{100}$$

$$\text{Decrease \%} = 2x - \frac{x^2}{100}$$

(or)

→ If the side of a square is increased by 30%. Then find the % change in its Area.

Sol Area of a Square = Side × side = x^2

NOTE: x^2 in this term x^2 the exponent is '2', so we have to repeat the % increase for 2 times

Area of a square = $100\ m^2$

100
+30 [30% of 100]
130

I st time increase → 130

130
39 [30% of 130]
169 → II nd time increase

Change in Area = 169 − 100 = 69% ↑

$A_{square} = x^2$

$x \longrightarrow x^2$

35) If the side of a square increased by 30 %. At what percent its area is increased?

a) 30

b) 39

c) 60

d) 69

$x = 30\% \uparrow$

$I\% = 2x + \frac{x^2}{100}$

$= 2(30) + \frac{30 \times 30}{100}$

$= 60 + 9$

$= 69$

$A_{circle} = \pi r^2$

$r \rightarrow r^2$

36) The radius of a circle is decreased by 1 %.
What is the decreased percent in its area?

a) 2.01

b) 0.21

c) 1.99

d) 2.00

$D\% = 2x - \frac{x^2}{100}$

$= 2(1) - \frac{(1)(1)}{100}$

$= 1.99$

Area of a Rectangle = $l \times b$

$200\ m^2$ = 10×20

(Let)

37) The length of a rectangle is decreased by 10 %. Then what is the decrease in the area of the rectangle?

a) 10 %

b) 11 %

c) 20 %

d) 21 %

$l = 10 - \frac{10}{100} \times 10 = 10 - 1 = 9$

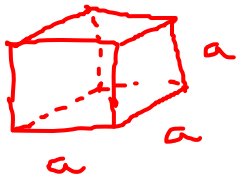
$180\ m^2 = 9 \times 20$

$200\ m^2 \rightarrow 100\%$

$180\ m^2 \rightarrow ?$

$\frac{180 \times 100}{200} = 90\%$

decreased by 10%



L.S.A = $4a^2$ cube

T.S.A cube = $6a^2$

Volume of a Cube = a^3

38) The side of a cube is increased by 20 %. Then find the change in its Volume?

a) 20

b) 21.2

c) 44

d) 72.8

a^3 in this variable exponent is '3' and repeat the increase | decrease for 3 times

Volume of a cube = $100\ m^3$

I st time → 100 + 20 (20% of 100) = 120

II nd time → 120 + 24 (20% of 120) = 144

III rd time → 144 + 28.8 [20% of 144] = 172.8

Change in volume = 172.8 − 100 = 72.8