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## Unit 3 -: Ratio & Praportion , Problems on ages and Percentage

### 3.1 Ratio

- The comparision between two quantities in terms of magnitude is called Ratio.
- If a and b are two numbers, the ratio of a to b is  $A/B$  or  $a \div b$  and is denoted by  $a:b$ . The numerator 'a' is called the antecedent and denominator 'b' is called as consequent.

#### 3.1.1 Types of Ratio :

1. **Duplicate ratio** :— The ratio of the squares of two Numbers is called the duplicate ratio of the two numbers. For example,  $\frac{3}{4^2}$  or  $\frac{9}{16}$  is called the duplicate ratio of  $\frac{3}{4}$ .
2. **Triplicate Ratio**: The ratio of the cubes of two Numbers is called the triplicate ratio of the two numbers. For example,  $\frac{3}{4^3}$  or  $\frac{27}{64}$  is triplicate ratio of  $\frac{3}{4}$ .
3. **Sub-duplicate Ratio**: The ratio of the square roots of two numbers is called the sub-duplicate ratio of two numbers. For example,  $\frac{3}{4}$  Is the sub-duplicate ratio of  $\frac{9}{16}$ .
4. **Sub-triplicate Ratio**: The ratio of the cube roots Of two numbers is called the sub-triplicate ratio of two numbers. For example,  $\frac{2}{3}$  is sub-triplicate ratio of  $\frac{8}{27}$ .
5. **Inverse Ratio or Reciprocal Ratio**: If the antecedent And consequent of a ratio interchange their places, The new ratio is called the inverse ratio of the first. Thus, if  $a:b$  be the given ratio, then  $1/a:1/b$  or  $b:a$  is Its inverse ratio. For example,  $\frac{3}{4}$  is the inverse ratio of  $\frac{4}{3}$ .
6. **Compound Ratio**: The ratio of the product of the Antecedents to that of the consequents of two or more Given ratios is called the compound ratio. Thus, if  $a:b$  and  $c:d$  are two given ratios, then  $ac : bd$  is the Compound ratio of the given ratios. For example, if  $\frac{3}{4}$ ,  $\frac{4}{5}$  and  $\frac{5}{7}$  be the given ratios, then their compound ratio is  $\frac{3}{7}$ .

• **Notes :**

- The comparison of two quantities is meaningless if they are not of the same kind or in the same units .
- A ratio does not change, if both of its terms are Multiplied or divided by the same number.

### **3.2 Proportion**

- The equality of two ratios is called proportion.
- If  $a:b = c:d$  then  $a, b, c$  and  $d$  is said to be in proportion and we write  $a:b :: c:d$  . This is read as “a to b as c to d”.
- **Fourth proportional :** If  $a:b = c:d$  then  $d$  is called the fourth proportional .  
To find fourth proportional ( Multiply first and last digit = Multiply middle digit )  
i.e  $d = \frac{b \times c}{a}$  .
- **Third proportional :** If  $a:b = b:c$  then  $c$  is called third proportional.  
To find the third proportional ( Middle digit )<sup>2</sup> = multiplication of last digit  
i.e  $b^2 = a \times c$  .
- **Mean proportional :** If  $a:x :: x:b$ , then  $x$  is called The mean or second proportional of  $a, b$ .

$$\frac{a}{x} = \frac{b}{x} \text{ or, } x^2 = ab \text{ or, } x = \sqrt{ab} .$$

**NOTE: )** If  $a:b = n_1: d_1$  and  $b:c = n_2: d_2$ , then  $a:b:c = (n_1 \times n_2):(d_1 \times n_2):(d_1 \times d_2)$ .

If  $a:b = n_1: d_1$ ,  $b:c = n_2: d_2$  And  $c:d = n_3: d_3$ ,

then  $a:b:c:d = (n_1 \times n_2 \times n_3):(d_1 \times n_2 \times n_3):(d_1 \times d_2 \times n_3):(d_1 \times d_2 \times d_3)$ .

**Example 1:** If  $A:B = 3:4$  and  $B:C = 8:9$ , find  $A:B:C$ .

**Solution:** Here,  $n_1 = 3$ ,  $n_2 = 8$ ,  $d_1 = 4$  and  $d_2 = 9$ .

$\therefore A:B:C = (n_1 \times n_2):(d_1 \times n_2):(d_1 \times d_2) = (3 \times 8):(4 \times 8):(4 \times 9) = 24:32:36$  or,  $6:8:9$ .

**Example 2:** If  $A:B = 2:3$ ,  $B:C = 4:5$  and  $C:D = 6:7$ , find  $A:D$ .

**Solution:** Here,  $n_1 = 2$ ,  $n_2 = 4$ ,  $n_3 = 6$ ,  $d_1 = 3$ ,  $d_2 = 5$  and  $d_3 = 7$ .

$\therefore A:B:C:D = (n_1 \times n_2 \times n_3):(d_1 \times n_2 \times n_3):(d_1 \times d_2 \times n_3):(d_1 \times d_2 \times d_3)$   
 $= (2 \times 4 \times 6):(3 \times 4 \times 6):(3 \times 5 \times 6):(3 \times 5 \times 7)$   
 $= 48:72:90:105$  or,  $16:24:30:35$ .

Thus,  $A:D = 16:35$ .

**Example 3 :** Two numbers are in the ratio of 4:5 and The sum of these numbers is 27. Find the two numbers.

**Solution :** ( If two numbers are in the ratio of a:b and the sum of these numbers is x, then these numbers will be  $\frac{ax}{a+b}$  and  $\frac{bx}{a+b}$  respectively.)

Here, a = 4, b = 5 and x = 27.

$$\therefore \text{The first number} = \frac{ax}{a+b} = \frac{4 \times 27}{4+5} = 12$$

$$\therefore \text{The second number} = \frac{bx}{a+b} = \frac{5 \times 27}{4+5} = 15$$

**Example 4 :** Given two numbers which are in the Ratio of 3:4. If 8 is added to each of them, their ratio Is changed to 5:6. Find the two numbers.

**Solution :** ( **NOTE :** The ratio between two numbers is a:b. If x is Added to each of these numbers, the ratio Becomes c:d. The two numbers are given as:

$$\frac{ax(c-d)}{ad-bc} \text{ and } \frac{bx(c-d)}{ad-bc}.$$

we have, a:b = 3:4, c:d = 5:6 and x = 8

$$\begin{aligned} \therefore \text{The first number} &= \frac{ax(c-d)}{ad-bc} & \text{and, the second number} &= \frac{bx(c-d)}{ad-bc} \\ &= \frac{3 \times 8 \times (5-6)}{(3 \times 6 - 4 \times 5)} = 12 & &= \frac{4 \times 8 \times (5-6)}{(3 \times 6 - 4 \times 5)} = 16. \end{aligned}$$

**Example 5 :** The ratio of two numbers is 5:9. If Each number is decreased by 5, the ratio becomes 5:11 find the numbers.

**Solution :** ( **NOTE :** The ratio between two numbers is a:b. If x is Subtracted from each of these numbers, the ratio Becomes c:d. The two numbers are given as:

$$\frac{ax(d-c)}{ad-bc} \text{ and } \frac{bx(d-c)}{ad-bc}$$

we have, a:b = 5:9, c:d = 5:11 and x = 5

$$\begin{aligned} \therefore \text{The first number} &= \frac{ax(d-c)}{ad-bc} & \text{and, the second number} &= \frac{bx(d-c)}{ad-bc} \\ &= \frac{5 \times 5 \times (11-5)}{(5 \times 11 - 9 \times 5)} = 15 & &= \frac{9 \times 5 \times (11-5)}{(5 \times 11 - 9 \times 5)} = 27. \end{aligned}$$

## **EXERCISE**

1. A sum of Rs. 53 is divided among Rohit, Mohit and Shobhit in such a way that Rohit gets Rs.7 more than what Mohit gets and Mohit gets Rs. 8 more than what Shobhit gets. Find the ratio of their shares .

- (a) 16:9:18
- (b) 25:18:10
- (c) 18:25:10
- (d) 15:8:30

**Answer :** (b) 25:18:10

Suppose Shobhit gets Rs.X, then Mohit gets Rs.(x+8) and Rohit gets Rs.(x+15) then,

$$x+x+8+x+15 = 53$$

$$\text{so, } x = 10$$

Therefore, Rohit : Mohit : Shobhit = 25:18:10

2. The ratio of two numbers is 4:5 . if both numbers are increased by 4, the ratio becomes 5:6. What is the sum of the two numbers ?

- (a) 9
- (b) 18
- (c) 27
- (d) 36

**Answer :** (d) 36

$$\frac{4x+4}{5x+4} = \frac{5}{6} \Rightarrow x = 4$$

$$\text{So, sum of no.} = 9x = 9 \times 4 = 36$$

3. Find two numbers such that their mean proportional is 6 and third proportional is 20.25.

- (a) 4,5
- (b) 5,9
- (c) 4,9
- (d) 2,4

**Answer :** (c) 4,9

$$\begin{aligned} \text{Here, } \sqrt{xy} &= 6 \text{ and } y^2 = 20.25x \\ \Rightarrow x &= 4 \text{ and } y = 9 \end{aligned}$$

4. If the ratio of time period of investment of P and Q is 4:5 , profit at the end of the year is 75000 and P's share is Rs . 15000 , then what is the ratio of Q's and P's investment ?

- (a) 5:16
- (b) 6:7
- (c) 12:13
- (d) 16:5

**Answer :** (d) 16:5

Let ratio of P's investment and Q's investment be x:y

Therefore, profit will be shared in the ratio 4x:5y

$$\text{Given , } \frac{4x}{4x+5y} \times 75000 = 15000$$

$$\frac{4x}{4x+5y} = \frac{1}{5}$$

$$20x = 4x+5y$$

$$16x = 5y$$

$$y:x = 16:5$$

5. Salaries of Ravi and Sumit are in the ratio 2:3. If the salary of each is increased by Rs. 4000, the new ratio becomes 40:57. What is Sumit's salary?

- (a) 38000
- (b) 46800
- (c) 36700
- (d) 50000

**Answer:** a) 38000

Let the original salaries of Ravi and Sumit be Rs. 2x and Rs. 3x respectively.

Then,

$$(2x+4000) / (3x+4000) = 40 / 57$$

$$\Rightarrow 57 \times (2x + 4000) = 40 \times (3x+4000)$$

$$\Rightarrow 6x = 68,000$$

$$\Rightarrow 3x = 34,000$$

$$\text{Sumit's present salary} = (3x + 4000) = \text{Rs.}(34000 + 4000) = \text{Rs. } 38,000$$

6. A mixture contains alcohol and water in the ratio 4 : 3. If 5 liters of water is added to the mixture, the ratio becomes 4: 5. Find the quantity of alcohol in the given mixture.

- (a) 10
- (b) 12
- (c) 15
- (d) 18

Answer: A) 10

Let the quantity of alcohol and water be  $4x$  litres and  $3x$  litres respectively

$$4x/(3x+5) = 4/5$$

$$20x = 4(3x+5)$$

$$8x = 20$$

$$x = 2.5$$

Quantity of alcohol =  $(4 \times 2.5)$  litres = 10 litres.

7. A bag contains 50 P, 25 P and 10 P coins in the ratio 5: 9: 4, amounting to Rs. 206.  
Find the number of coins of each type respectively.

(a) 360, 160, 200

(b) 160, 360, 200

(c) 200, 360, 160

(d) 200, 160, 300

**Answer:** C) 200, 360, 160

let ratio be  $x$ .

Hence no. of coins be  $5x$ ,  $9x$ ,  $4x$  respectively

Now given total amount = Rs. 206

$$\Rightarrow (0.50)(5x) + (0.25)(9x) + (0.10)(4x) = 206$$

we get  $x = 40$

$$\Rightarrow \text{No. of 50p coins} = 200$$

$$\Rightarrow \text{No. of 25p coins} = 360$$

$$\Rightarrow \text{No. of 10p coins} = 160$$

### 3.3 PROBLEMS ON AGES

**Problems based on ages generally consist of information of ages of two or more persons and a relation between their ages in present / future / past .**

Important Formulas on "Problems on Ages" :

1. If the current age is  $x$ , then  $n$  times the age is  $nx$ .
2. If the current age is  $x$ , then age  $n$  years later/hence  $= x + n$ .
3. If the current age is  $x$ , then age  $n$  years ago  $= x - n$ .
4. The ages in a ratio  $a : b$  will be  $ax$  and  $bx$ .
5. If the current age is  $x$ , then  $\frac{1}{n}$  of the age is  $\frac{x}{n}$ .

**Example 1:** Father is aged three times more than his son Ronit. After 8 years, he would be two and a half times of Ronit's age. After further 8 years, how many times would he be of Ronit's age?

- (a) 2 times
- (b)  $2\frac{1}{2}$  times
- (c)  $2\frac{3}{4}$  times
- (d) 3 times

**Answer:** (a) 2 times

Let Ronit's present age be  $x$  years. Then, father's present age  $= (x + 3x)$  years  $= 4x$  years.

$$(4x + 8) = \frac{5}{2}(x + 8)$$

$$\Rightarrow 8x + 16 = 5x + 40$$

$$\Rightarrow 3x = 24$$

$$\Rightarrow x = 8.$$

$$\text{Hence, required ratio} = \frac{4x+16}{x+16} = \frac{48}{24} = 2$$

**Example 2:** The sum of ages of 5 children born at the intervals of 3 years each is 50 years. What is the age of the youngest child?

- (a) 8 years
- (b) 4 years
- (c) 10 years
- (d) None of this

**Answer:** (b) 4 years

Let the ages of children be  $x$ ,  $(x + 3)$ ,  $(x + 6)$ ,  $(x + 9)$  and  $(x + 12)$  years.

Then,  $x + (x + 3) + (x + 6) + (x + 9) + (x + 12) = 50$

$$5x = 20$$

$$x = 4.$$

Age of the youngest child =  $x = 4$  years.

**Example 3:** A is two years older than B who is twice as old as C. If the total of the ages of A, B and C be 27, then how old is B?

- (a) 10
- (b) 8
- (c) 12
- (d) 16

**Answer :** (a) 10

Let C's age be  $x$  years. Then, B's age =  $2x$  years. A's age =  $(2x + 2)$  years.

$$(2x + 2) + 2x + x = 27$$

$$5x = 25$$

$$x = 5.$$

Hence, B's age =  $2x = 10$  years.

**Example 4:** Present ages of Sameer and Anand are in the ratio of 5 : 4 respectively. Three years hence, the ratio of their ages will become 11 : 9 respectively. What is Anand's present age in years?

- (a) 40
- (b) 27
- (c) 38
- (d) 24

**Answer :** (d) 24 years



Let the present ages of Sameer and Anand be  $5x$  years and  $4x$  years respectively.

$$\frac{5x+3}{4x+3} = \frac{11}{19}$$

$$\Rightarrow 9(5x + 3) = 11(4x + 3)$$

$$\Rightarrow 45x + 27 = 44x + 33$$

$$\Rightarrow 45x - 44x = 33 - 27$$

$$\Rightarrow x = 6.$$

Anand's present age =  $4x = 24$  years.

**Example 5:** Ayesha's father was 38 years of age when she was born while her mother was 36 years old when her brother four years younger to her was born. What is the difference between the ages of her parents?

(a) 2 years

(b) 4 years

(c) 6 years

(d) 8 years

**Answer :** (c) 6 years

Mother's age when Ayesha's brother was born = 36 years.

Father's age when Ayesha's brother was born =  $(38 + 4)$  years = 42 years.

Required difference =  $(42 - 36)$  years = 6 years.

## **EXERCISE**

1. Four year ago average age of P,Q and R is 33 years . At present, age of R is three years less than Q and P is three year older than Q. Then find the age of P one year hence ?

(a) 36 years

(b) 38 years

(c) 41 years

(d) 46 years

**Answer :** (c) 41 years

Let present age of Q be X

Present age of P =  $x+3$

Present age of R =  $x-3$

$$\text{So, } (x+3+x+x-3) - 4 \times 3 / 3 = 33$$

$$3x - 12 = 99$$

$$3x = 111$$

$$x = 37 \text{ years}$$

$$\text{Age of P after one year} = 37 + 3 + 1 = 41 \text{ years}$$

2. Ratio of age of A and B, 6 year ago was 3:4. Sum of the present age of B and C is 80 years. C is 12 years elder to A. Find the difference of B and C's age five years later?

- (a) 3 years
- (b) 4 years
- (c) 5 years
- (d) 7 years

Answer :

3. If 2 members of a family are in a ratio  $3:\frac{1}{2}$  and the average of their ages is 35.

Find the total of their ages after 11 years.

- (a) 81 years
- (b) 92 years
- (c) 102 years
- (d) 89 years

**Answer:** (b) 92 years

The average ages of 2 members = 35

The total of their ages =  $35 \times 2 = 70$  years

The ratio of their ages =  $3:\frac{1}{2} = 6:1$  (multiplying both sides by 2, to make the ratio in natural numbers)

$$6x + x = 70$$

$$7x = 70$$

$$x = 10, 6x = 60$$

$$\text{The total of their ages after 11 years} = (10 + 11) + (60 + 11) = 21 + 71 = 92 \text{ years.}$$

4. The ages of 3 brothers are in a ratio 3:5:11. If the difference between the ages of the youngest and the eldest brother is 24 years, find the total of their ages.

- a) 49 years    c) 51 years
- b) 50 years    d) 52 years

**Answer : c) 51 years**

Let their ages be in relation to a constant term  $x$ .

The ages of the brother =  $3x$ ,  $5x$  and  $11x$  respectively.

The difference between the ages of the youngest and the eldest brother =  $11x - 3x$   
 $= 8x$

The difference = 24 years (given)

$8x = 24$  years

$x = 24 / 8 = 3$  years

The sum of their ages =  $3x + 5x + 11x = 19x$

$19x = 19 * 3 = 51$  years

5. Out of 3 students a, b and c, a is 18 years old if the ages of the b and c are in a ratio 2 : 3 and the ratio of age of a and b is 6 : 5, find the average age of all the 3 students.

a) 16.5 years

b) 17.5 years

c) 18.5 years

d) 19.5 years

**Answer : c) 18.5 years**

The ratio of ages of a and b is 6 : 5.

The ratio of ages of b and c is 2 : 3.

The age of a is 18 (given).

Age of b =  $18 / 6 * 5 = 15$  years

Age of c =  $15 / 2 * 3 = 22.5$  years

The total of their ages =  $15 + 18 + 22.5 = 55.5$  years

Average of their age =  $55.5 / 3 = 18.5$  years.

## **3.4 Percentage**

### **3.4.1 Concept of Percentage:**

By a certain percent, we mean that many hundredths.

Thus,  $x$  percent means  $x$  hundredths, written as  $x\%$ .

To express  $x\%$  as a fraction: We have,  $x\% = \frac{x}{100}$

$$\text{Thus, } 20\% = \frac{20}{100} = \frac{1}{5}$$

To express  $\frac{a}{b}$  as a percent: We have,  $\frac{a}{b} = (\frac{a}{b} \times 100)\%$

$$\text{Thus, } \frac{1}{4} = (\frac{1}{4} \times 100)\% = 25\%$$

### **3.4.2 Percentage Increase/Decrease:**

⇒ If the price of a commodity increases by  $R\%$ , then the reduction in consumption so as not to increase the expenditure is:  $[\frac{R}{(100+R)} \times 100]\%$

⇒ If the price of a commodity decreases by  $R\%$ , then the increase in consumption so as not to decrease the expenditure is:  $[\frac{R}{(100-R)} \times 100]\%$

### **3.4.3 Results on Population:**

Let the population of a town be  $P$  now and suppose it increases at the rate of  $R\%$  per annum, then:

1. Population after  $n$  years  $= P (1 + \frac{R}{100})^n$
2. Population  $n$  years ago  $= \frac{P}{(1 + \frac{R}{100})^n}$

### **3.4.4 Results on Depreciation:**

Let the present value of a machine be  $P$ . Suppose it depreciates at the rate of  $R\%$  per annum. Then:

1. Value of the machine after  $n$  years  $= P (1 - \frac{R}{100})^n$
2. Value of the machine  $n$  years ago  $= \frac{P}{(1 - \frac{R}{100})^n}$
3. If  $A$  is  $R\%$  more than  $B$ , then  $B$  is less than  $A$  by:  $[\frac{R}{(100+R)} \times 100]\%$
4. If  $A$  is  $R\%$  less than  $B$ , then  $B$  is more than  $A$  by:  $[\frac{R}{(100-R)} \times 100]\%$

**Example 1:** A batsman scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score did he make by running between the wickets?

- (a) 45 %
- (b)  $45\frac{5}{11}$  %
- (c)  $54\frac{6}{11}$  %
- (d) 55%

Answer : (b)

$$\begin{aligned}\text{Number of runs made by running} &= 110 - (3 \times 4 + 8 \times 6) \\ &= 110 - (60) \\ &= 50.\end{aligned}$$

$$\text{Required percentage} = \left(\frac{50}{110} \times 100\right) \% = 45\frac{5}{11} \%$$

**Example 2:** Two students appeared at an examination. One of them secured 9 marks more than the other and his marks was 56% of the sum of their marks. The marks obtained by them are:

- (a) 39, 30
- (b) 41, 32
- (c) 42, 33
- (d) 43, 34

Answer : (c) 42, 33

Let their marks be  $(x + 9)$  and  $x$ .

$$\text{Then, } x + 9 = \frac{56}{100} (x + 9 + x)$$

$$25(x + 9) = 14(2x + 9)$$

$$3x = 99$$

$$x = 33$$

So, their marks are 42 and 33.

**Example 3:** What percentage of numbers from 1 to 70 have 1 or 9 in the unit's digit?

- (a) 1
- (b) 14
- (c) 20
- (d) 21

Answer : (c) 20

Clearly, the numbers which have 1 or 9 in the unit's digit, have squares that end in the digit 1. Such numbers from 1 to 70 are 1, 9, 11, 19, 21, 29, 31, 39, 41, 49, 51, 59, 61, 69.

Number of such number = 14

$$\text{Required percentage} = \left(\frac{14}{70} \times 100\right) \% = 20\%$$

**Example 4:** Two numbers A and B are such that the sum of 5% of A and 4% of B is two-third of the sum of 6% of A and 8% of B. Find the ratio of A : B.

(a) 2:3

(b) 1:1

(c) 4:3

(d) 3:4

Answer : (c) 4:3

$$5\% \text{ of } A + 4\% \text{ of } B = \frac{2}{3} (6\% \text{ of } A + 8\% \text{ of } B)$$

$$\Rightarrow \frac{5}{100}A + \frac{4}{100}B = \frac{2}{3} \left( \frac{6}{100}A + \frac{8}{100}B \right)$$

$$\Rightarrow \frac{1}{20}A + \frac{1}{25}B = \frac{1}{25}A + \frac{4}{75}B$$

$$\Rightarrow \left( \frac{1}{20} - \frac{1}{25} \right) A = \left( \frac{4}{75} - \frac{1}{25} \right) B$$

$$\Rightarrow \frac{1}{100}A = \frac{1}{75}B$$

$$\frac{A}{B} = \frac{100}{75} = \frac{4}{3}$$

Required ratio = 4 : 3

**Example 5:** 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

Answer : (a) 2700

Number of valid votes = 80% of 7500 = 6000.

Valid votes polled by other candidate = 45% of 6000

$$\left( \frac{45}{100} \times 6000 \right) = 2700$$

## **EXERCISE**

1. The population of a town increased from 1,75,000 to 2,62,500 in a decade. The average percent increase of population per year is:

- (a) 4.37%
- (b) 5%
- (c) 5.35%
- (d) 8.75%

Answer : (b) 5%

Increase in 10 years =  $(262500 - 175000) = 87500$ .

$$\text{Increase\%} = \left( \frac{87500}{175000} \times 100 \right) \% = 50\%$$

$$\text{Required average} = \left( \frac{50}{10} \right) \% = 5\%$$

2. The population of a town is 352800. If it increases at the rate of 5% per annum , then what will be its population 2 years hence. Also , find the population 2 years ago.

- (a) 320000
- (b) 230000
- (c) 450000
- (d) 360000

Answer : (a) 320000

Here, P = 352800 , R = 5% , n = 2

$$\begin{aligned} \text{Population after 2 years} &= P \left( 1 + \frac{R}{100} \right)^n \\ &= 352800 \times \left( 1 + \frac{5}{100} \right)^2 \\ &= 352800 \times \frac{21}{20} \times \frac{21}{20} \\ &= 388962 \end{aligned}$$

$$\begin{aligned} \text{Population 2 years ago} &= \frac{P}{\left( 1 + \frac{R}{100} \right)^n} \\ &= \frac{352800}{\left( 1 + \frac{5}{100} \right)^2} \\ &= 352800 \times \frac{20}{21} \times \frac{20}{21} = 320000 \end{aligned}$$

3. 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) 2500
- (b) 2700
- (c) 3100
- (d) 2900

Answer : (b) 2700

Total number of votes = 7500

Given that 20% of Percentage votes were invalid

⇒ Valid votes = 80%

Total valid votes =  $7500 \times (80/100)$

1st candidate got 55% of the total valid votes.

Hence the 2nd candidate should have got 45% of the total valid votes

⇒ Valid votes that 2nd candidate got = total valid votes  $\times (45/100)$

$$7500 \times (80/100) \times (45/100) = 2700$$

4. A student has to obtain 33% of the total marks to pass. He got 125 marks and failed by 40 marks. The maximum marks are :

- (a) 500
- (b) 600
- (c) 800
- (d) 1000

Answer : (a) 500

Given that the student got 125 marks and still he failed by 40 marks

⇒ The minimum pass mark =  $125 + 40 = 165$

Given that minimum pass mark = 33% of the total mark

$$\Rightarrow \text{total mark} = 33/100 = 165 \Rightarrow \text{total mark} = 16500/33 = 500$$



5. if the price of a book is first decreased by 25% and then increased by 20%, then the net change in the price will be :

- (a) 10
- (b) 20
- (c) 30
- (d) 40

**Answer:** a) 10

Let the original price be Rs. 100.

New final price = 120 % of (75 % of Rs. 100) = Rs.  $[(120/100) * (75/100) * 100] =$  Rs.90.

Decrease = 10%

6. The value of a machine depreciates at the rate of 10% every year. It was purchased 3 years ago. If its present value is Rs. 8748, its purchase price was :

- (a) 10000
- (b) 12000
- (c) 14000
- (d) 16000

Answer : (b) 12000

Purchase price = Rs  $\left[ \frac{8748}{\left(1 - \frac{10}{100}\right)^3} \right] =$  Rs. 12000