

# RATIO AND PROPORTION

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(23)

## 3.1: Ratio Introduction

What is the ratio?

Dhoni purchased dozen apples worth ₹ 100

Lohit " " " lemons worth ₹ 20

Compare the costs.

$$\frac{\text{Cost of Apples}}{\text{Cost of Lemons}} = \frac{100}{20} = \frac{5}{1}$$

Cost of apples is 5 times the cost of lemon.

**E** Ratio is comparison of two or more numbers in terms of 'how many times.'

Ratio is denoted as ':

$a:b$  (or)  $\frac{a}{b}$  (or)  $a$  to  $b$   
↑  
terms

$a$  = 1<sup>st</sup> term = numerator

$b$  = 2<sup>nd</sup> term = denominator

### Properties

1) If we multiply or divide the numerator and denominator of a ratio by the same number, the ratio does not change

$$\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{6}{8}$$

↓  
0.75

$$\left| \begin{array}{l} \frac{16}{24} = \frac{16/4}{24/4} = \frac{4}{6} \\ \downarrow \\ 0.67 \end{array} \right. \quad \downarrow \quad 0.67$$

$\alpha)$  If  $\frac{a}{b} = \frac{c}{d} = \frac{e}{f} = \frac{k}{l}$  then the value of  $\frac{a+c+e}{b+d+f} = \frac{k}{l}$

Eg If  $p:q = r:s : t:u = 2:3$  then the value of  $\frac{p+r+t}{q+s+u} = ?$

$$\frac{p}{q} = \frac{r}{s} = \frac{t}{u} = \frac{2}{3}$$

$$\frac{p}{q} = \frac{2}{3} \Rightarrow p = \frac{2q}{3}$$

$$\frac{r}{s} = \frac{2}{3} \Rightarrow r = \frac{2s}{3}$$

$$\frac{t}{u} = \frac{2}{3} \Rightarrow t = \frac{2u}{3}$$

$$\frac{p+r+t}{q+s+u} = ?$$

$$\frac{\frac{2q}{3} + \frac{2s}{3} + \frac{2u}{3}}{q+s+u} = \frac{\frac{2}{3}(q+s+u)}{(q+s+u)} \\ \Rightarrow \frac{2}{3}$$

(Trick)

$$\frac{p}{q} = \frac{r}{s} = \frac{t}{u} = \frac{2}{3}$$

$$\frac{p+r+t}{q+s+u} = \frac{2}{3}$$

### Types of Ratio

A ratio can be expressed as  $a:b$ .

- 1) Duplicate Ratio =  $a^2 : b^2$
- 2) Sub-Duplicate Ratio =  $\sqrt{a} : \sqrt{b}$
- 3) Triplicate Ratio =  $a^3 : b^3$
- 4) Sub-Triplicate Ratio =  $\sqrt[3]{a} : \sqrt[3]{b}$

$$\text{Ex: } 8:1$$

$$\rightarrow 64:1$$

$$\sqrt{8}:1 = 2\sqrt{2}:1$$

$$(8)^{\frac{3}{2}} : (1)^{\frac{3}{2}} = 512:1$$

$$\sqrt[3]{8} : \sqrt[3]{1} = 2:1$$

5) Inverse Ratio (or) Reciprocal Ratio

$$\text{Original Ratio} = a:b$$

$$\text{Inverse Ratio} = \frac{1}{a} : \frac{1}{b} = b:a$$

$$\begin{matrix} 8:1 \\ \text{IR} = 1:8 \end{matrix}$$

$$a:b:c$$

$$\text{IR} = \frac{1}{a} : \frac{1}{b} : \frac{1}{c}$$

$$= bc : ac : ab$$

$$2:3:4 \rightarrow \text{IR} = 4:3:2 \times$$

$$\text{IR} = \frac{1}{2} : \frac{1}{3} : \frac{1}{4} \Rightarrow 6:4:3$$

6) Compound Ratio = Product of Ratios

$$a:b = 2:3 \quad c:d = 4:6 \quad e:f = 7:9$$

$$\text{Compound Ratio} = \frac{2}{3} \times \frac{4}{6} \times \frac{7}{9}$$

$$= \frac{28}{81}$$

How to combine the Ratios



①  $a:b = N_1:D_1 \quad b:c = N_2:D_2$

$$a:b = N_1:D_1$$

$$b:c = N_2:D_2$$

$$\underline{a:b:c = N_1 \times N_2 : D_1 \times D_2}$$

$\Rightarrow a:b = 2:3, b:c = 5:6, a:b:c = ?$

$$\begin{array}{rcl} a:b & = & 2:3 \\ b:c & = & 5:6 \end{array}$$

$$\begin{array}{rcl} a:b:c & = & \underline{2 \times 5:3 \times 5:3 \times 2} \\ & & 10:15:18 \end{array}$$

Trick

$$\begin{array}{rcl}
 a:b & = & 2:3 \rightarrow 3 \\
 b:c & = & 5 \leftarrow 5:6 \\
 \hline
 a:b:c & = & 10:15:18
 \end{array}$$

Ex

$$a:b = 3:4, \quad b:c = 7:8$$

$$\begin{array}{rcl}
 a:b & = & 3:4 \rightarrow 4 \\
 b:c & = & 7 \leftarrow 7:8 \\
 \hline
 a:b:c & = & 21:28:32
 \end{array}$$

$\oplus \quad a:b = N_1:D_1 \quad b:c = N_2:D_2 \quad c:d = N_3:D_3 \quad a:b:c:d = ?$

$$\begin{array}{rcl}
 a:b & = & N_1 : D_1 \\
 b:c & = & N_2 : D_2 \\
 c:d & = & N_3 : D_3 \\
 \hline
 a:b:c:d & = & N_1 \times N_2 \times N_3 : D_1 \times D_2 \times D_3
 \end{array}$$

$$a:d = N_1 \times N_2 \times N_3 : D_1 \times D_2 \times D_3$$

Ex  
 $a:b = 3:4, b:c = 5:6, c:d = 2:3$  then  $a:b:c:d = ?$

$$\begin{array}{rcl} a:b & = & 3:4 \\ b:c & = & 5:6 \\ c:d & = & 2:3 \end{array}$$

$$\begin{array}{rcl} a:b:c:d & = & 3 \times 5 \times 2 : 4 \times 5 \times 2 : 4 \times 6 \times 2 : 4 \times 6 \times 3 \\ & = & 15:20:24:36 \end{array}$$

Trick

$$\begin{array}{rcl} a:b & = & 3:4 \rightarrow 4 \rightarrow 4 \\ b:c & = & 5 \leftarrow 5:6 \rightarrow 6 \\ c:d & = & 2 \leftarrow 2 \leftarrow 2:3 \end{array}$$

$$\begin{array}{rcl} a:b:c:d & = & 30:40:48:72 \\ & = & 15:20:24:36 \end{array}$$

## 3.2 : Introduction to Proportion

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Proportion

Ramu purchased 5 books for ₹ 100.

Somu purchased 3 pens for ₹ 60.

Amount paid by Ramu  $\frac{100}{5}$  (or)  $100:5$  } 20/-

Amount paid by Somu  $\frac{60}{3}$  or  $60:3$  } 20/-

$$\frac{100}{5} = \frac{60}{3} \quad (\text{or}) \quad 100:5 = 60:3$$

Ratios are equal.

100, 5, 60, 3 are in proportion.

\* When two ratios are equal is called proportion and we can say that the four numbers are in proportion.

i.e., if  $\frac{a}{b} = \frac{c}{d}$  then a, b, c, d are in proportion.  
 $a:b :: c:d$

Properties

If four numbers are in proportion, the product of extremes is equal to the product of means.

$$a:b :: c:d$$

a, d are called extremes

b, c are called Means

$$\therefore a \times d = b \times c$$

a = 1<sup>st</sup> proportional  
b = 2<sup>nd</sup> " "  
c = 3<sup>rd</sup> " "  
d = 4<sup>th</sup> "

Q) If three numbers say  $a, b, c$  are in continued proportion, then

$$(i) \text{ Mean Proportional} = \sqrt{ac}$$

$$(ii) \text{ Third Proportional} = \frac{b^2}{a}$$

$$a:b :: b:c$$

$$\frac{a}{b} = \frac{b}{c}$$

$a$  = 1<sup>st</sup> proportional

$b$  = mean proportional

$c$  = 3<sup>rd</sup> proportional

$$b^2 = ac$$

$$b = \sqrt{ac}$$

$$c = \frac{b^2}{a}$$

Ex

Mean proportional between 5 and 45 is

$$a = 5$$

$$c = 45$$

$$a:b :: b:c$$

$$5:b :: b:45$$

$$\frac{5}{b} = \frac{b}{45}$$

$$b^2 = 5 \times 45$$

$$b = 15$$

(or)

$$\begin{aligned} b &= \sqrt{ac} \\ &= \sqrt{5 \times 45} \\ &= 15 \end{aligned}$$

### Variation

If the price of milk has increased.

Then cost of related milk products increases.

If salary increases then expenditure/savings increases.

If speed increases then travel time decreases.

If speed decreases then travel time increases.

Direct Variation

Indirect Variation

- ④ When two or more quantities dependent on each other and if one of them changes, other item also changes.

### Direct Variation

If A increases      B increases  
A decreases      B decreases

A is directly proportional to B  
Varies

$$A \propto B \Rightarrow A = KB$$

K is constant

### Indirect Variation

If A increases      B decreases  
A decreases      B increases

A is indirectly proportional to B  
Varies

$$A \propto \frac{1}{B} \Rightarrow A = \frac{K}{B}, K \text{ is constant}$$

Ex A varies directly as B. A is 12 when B is 6. What is the value of A when B is 12.

$$A \propto B \Rightarrow A = KB$$

$$12 = K(6)$$

$$K = 2.$$

$$A = KB$$

$$A = 2 \times 12$$

$$A = 24$$

(OR)

$$\begin{array}{rcl} \frac{B}{6} & \xrightarrow{x^2} & \frac{A}{12} \\ 12 & \xrightarrow{x^2} & ? \\ & & 24 \end{array}$$

Ex 'y' is inversely proportional to 'x' and that  $y = 0.4$  when  $x = 5$ . Find y. when  $x = 4$ .

$$y \propto \frac{1}{x} \Rightarrow y = \frac{k}{x}$$

$$0.4 = \frac{k}{5}$$

$$k = 2$$

$$y = \frac{2}{x} \quad [\text{when } x=4]$$

$$y = \frac{1}{2}.$$

### 3.4 ! Solved Problems 9-10

**Q.1** An amount of ₹100 is being divided among two persons in the ratio  $\frac{1}{10} : \frac{1}{15}$ . How much money does each get?

$$\text{L.C.M.}(10, 15) = 30$$

$$\begin{array}{c} 100 \\ \diagup \quad \diagdown \\ A \qquad B \\ \frac{1}{10} : \frac{1}{15} \end{array}$$

$$\frac{1}{10} : \frac{1}{15} = 3 : 2$$

$$\begin{array}{c} 100 \\ \diagup \quad \diagdown \\ 3 \qquad 2 \\ 3/5 \qquad 2/5 \\ 3/5 \times 100 = 60 \qquad 2/5 \times 100 = 40 \end{array}$$

(Q.)  
 $3x + 2x = 100$   
 $5x = 100$   
 $x = 20$

$$\begin{array}{l} A = 60 \\ B = 40 \end{array}$$

**Q.2** If  $\frac{x}{y} = \frac{7}{8}$ , then find the value of the expression  $\frac{3x - 5y}{2x + 7y}$  ?

$$\frac{x}{y} = \frac{7}{8} \Rightarrow x:y = 7:8$$

$$x = 7/15; y = 8/15$$

$$\begin{aligned} \frac{3x - 5y}{2x + 7y} &= \frac{3(7) - 5(8)}{2(7) + 7(8)} = \frac{21 - 40}{14 + 56} \\ &= \frac{-19}{70}. \end{aligned}$$

Q.37 If the ratio of  $x$  to  $y$  is  $6:5$  and the ratio of  $z$  to  $y$  is  $3:4$ , then the ratio of  $x$  to  $z$  is

$$\frac{x}{y} = \frac{6}{5} \Rightarrow x:y = 6:5$$

$$\frac{z}{y} = \frac{3}{4} \Rightarrow z:y = 3:4$$

$$\left. \begin{array}{l} x:y = 6:5 \\ y:z = 4:3 \end{array} \right\} x:y:z = 24:20:15$$

$$\begin{matrix} x:y &= 6:5 \rightarrow 5 \\ y:z &= 4:3 \end{matrix}$$

$$x:y:z = 24:20:15$$

$$\begin{aligned} x:z &= 24:15 \\ &= 8:5 \end{aligned}$$

(OR)

$$\begin{aligned} \frac{x}{y} \times \frac{y}{z} &= \frac{6}{5} \times \frac{4}{3} \\ \frac{x}{z} &= \frac{8}{5} \\ x:z &= 8:5 \end{aligned}$$

Q.4) The ratio between two numbers is 3:4. If each number be increased by 4, the ratio becomes 5:6. Find the numbers.

- (a) 6, 8      (b) 12, 16      (c) 18, 24      (d) 24, 32

Let the numbers be  $x$  and  $y$

$$\text{Then } x:y = 3:4$$

$$\Rightarrow \frac{x}{y} = \frac{3}{4}$$

Now the numbers be  $3p$  and  $4p$ .

$$\text{Then } \frac{3p+4}{4p+4} = \frac{5}{6}$$

$$18p+24 = 20p+20$$

$$2p = 4$$

$$p = 2$$

$$3(2) = 6$$

$$4(2) = 8$$

OR

$$(a) \frac{6}{8} = \frac{3}{4} \Rightarrow \frac{6+4}{8+4} = \frac{10}{12} = \frac{5}{6} \quad (\text{Ans})$$

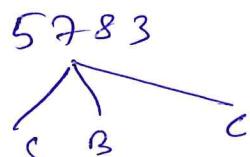
$$(b) \frac{12}{16} = \frac{3}{4}$$

$$(c) \frac{18}{24} = \frac{3}{4}$$

$$(d) \frac{24}{32} = \frac{3}{4}$$

(Q.5) ₹ 5783 is divided among Sherry, Berry and Cherry in such a way that if ₹ 28, ₹ 37 and ₹ 18 be deducted from their respective shares, they have money in the ratio 4:6:9. Find Sherry's share?

- (a) ₹ 1286      (b) ₹ 1228      (c) ₹ 1456      (d) ₹ 1084



$$S+B+C = 5783$$

$$\begin{array}{l} \{ \\ \{ \\ \{ \\ \end{array} \left. \begin{array}{l} S-28 \\ B-37 \\ C-18 \end{array} \right\} 4:6:9$$

Reduced shares =  $4n, 6n, 9n$

$$4n+28+6n+37+9n+18 = 5783$$

$$19n+83 = 5783$$

$$19n = 5700$$

$$n = 300$$

$$\therefore 4n+28 = 8$$

$$8 \Rightarrow 4(300)+28$$

$$= ₹ 1228$$

Q.6) Income of A and B are in the ratio of 4:3 and their savings are in the ratio 3:2. If the expenditure of each will be ₹600, then the income of A is:

(A) 1800

(B) 2400

(C) 3000

(D) 4800

$$\text{Income} = \text{Savings} + \text{Expenditure} \quad | \quad \text{Savings} = I - E$$

$\frac{A}{4x}$	$\frac{B}{3x}$
$\frac{\text{Income}}{600}$	$\frac{600}{3x - 600}$
$\frac{\text{Expenditure}}{600}$	$\frac{600}{3x - 600}$
$\frac{4x - 600}{3x - 600}$	
$\frac{\text{Savings}}{600}$	

$$\text{Savings} = \frac{3}{2}$$

$$\frac{4x - 600}{3x - 600} = \frac{3}{2}$$

$$8x - 1200 = 9x - 1800$$

$$x = 600.$$

$$\text{Income of A} = 4x600 \\ = 2400$$

Q.7) Third proportional to 15 and 20 is

$$a:b :: b:c \quad a=15, b=20$$

$$c = \frac{b^2}{a} = \frac{20^2}{15} \Rightarrow \frac{400}{15} = \frac{80}{3}$$

Q.8) Fourth proportional to the numbers 6, 8 and 15 is

$$a:b :: c:d$$

$$a=6, b=8, d=15$$

$$6:8 :: 15:d$$

$$\therefore \frac{6}{8} = \frac{15}{d}$$

$$6d = 15 \times 8$$

$$d = \frac{15 \times 8}{6}$$

$$= 20.$$

Q.9) What is the least possible number which must be subtracted from 16, 19 and 23 so that the resulting numbers are in continued proportion?

- (a) 2    (b) 4    (c) 6    (d) 7

$$a, b, c \\ a:b :: b:c$$

Let the numbers to be deducted be  $x$ .

$(16-x), (19-x), (23-x)$  are in continued proportion.

$$\frac{16-x}{19-x} = \frac{19-x}{23-x} \Rightarrow (16-x)(23-x) = (19-x)^2$$

Check with options

$$(a) \frac{2}{14} \neq \frac{17}{21}$$

(b) 4

$$\frac{12}{15} \neq \frac{15}{19}$$

$$(c) \frac{6}{10} \neq \frac{10}{13}$$

$$(d) \frac{7}{12} = \frac{12}{16} \\ \Rightarrow \frac{3}{4} = \frac{3}{4}$$

Q.10) Ramu has coins of the denomination of ₹ 1, 50p and 25p in his ratio 12:10:7. The total worth of the coins he has is ₹ 75. Find the number of 25p coins?

$$\text{Value} = \text{coins} \times \text{denomination}$$

Denomination	₹ 1	0.50	0.25
Coins	12x	10x	7x
Value	$12x$	$5x$	$\frac{7}{4}x$

$$12x + 5x + \frac{7}{4}x = 75$$

$$\frac{75x}{4} = 75 \Rightarrow x = 4$$

$$7(4) = 28$$

3 & 5 : Solved Problems 11 - 13

Q.11) The ratio of ages of Rakesh and Kamlesh is 3:5. 10 years later, this ratio becomes 5:7. What is the present age of Kamlesh?

Rakesh	Kamlesh
Present ages	$3x$
After 10 years	$3x+10$

$$\frac{3x+10}{5x+10} = \frac{5}{7}$$

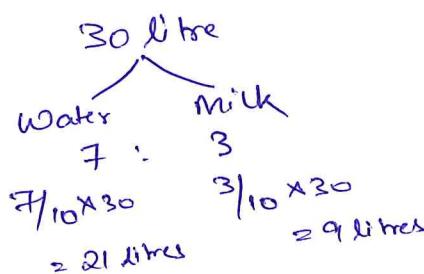
$$21x+70 = 25x+50$$

$$4x = 20$$

$$x = 5$$

$$\text{Kamlesh Present Age} = 5 \times 5 = 25$$

Q.12) The ratio of water and milk in a 30 litre mixture is 7:3. Find the quantity of water to be added to the mixture in order to make this ratio 6:1.



$$\frac{\text{Water}}{\text{Milk}} = \frac{21}{9}$$

Let quantity of water added be  $x$  litres.

$$\therefore \frac{21+x}{9} = \frac{6}{1}$$

$$21+x = 54  
x = 33 \text{ litres.}$$

Q.13) A factory employs skilled workers, unskilled workers and clerks in the ratio 8:5:1, and the wages of a skilled worker, an unskilled worker and a clerk are in the ratio 5:2:3. When 20 unskilled workers are employed, the total daily wages of all amount to ₹ 318. The wages paid to clerks is:

	Skilled	Unskilled	Clerks
No. of Persons	8	5	1
Wages	5	2	3
Total Wages	$32 \times 5x$	$+ 20 \times 2x$	$4 \times 3x = 318$

$$212x = 318$$

$$x = \frac{318}{212}$$

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

$$\text{Clerks} = 4 \times 3x$$

$$= 4 \times 3 \times \frac{3}{2}$$

$$= ₹ 18.$$

3.6 : Previous Year Gate Questions

Q.1) The current erection cost of a structure is ₹ 13,200/- . If the labour wages per day increases by  $\frac{1}{5}$  of the current wages and the working hours decreased by  $\frac{1}{24}$  of the current period, then the cost of new erection is :

(GATE 2013)

- (a) ₹ 16,500      (b) ₹ 11,000      (c) ₹ 11,100      (d) ₹ 10,120.

Solution

$$\text{Original cost of erection} = 13200$$

$$\text{Cost} = \text{wages} \times \text{hours}$$

$$\text{Wages} \uparrow \frac{1}{5}$$

$$\text{Let current wages} = 5$$

$$\text{increased wages} = 5 + 5 \times \frac{1}{5} = 6$$

$$\text{Hours} \downarrow \frac{1}{24}$$

$$\text{Let current hours} = 24$$

$$\text{decreased hours} = 24 - 24 \times \frac{1}{24} \\ = 23$$

$$\begin{array}{ccc} \text{Wages} & \text{hours} & \text{Cost} \\ 5 & \times & 24 \\ & & = 120 \end{array}$$

$$6 \times 23 = 138$$

$$120 — 13200$$

$$138 — \frac{13200}{120} \times 138 = ₹ 15,180/-$$

Q.27 S, M, E and F are working in shifts in a team to finish a project. M works with twice the efficiency of others but for half as many days as E worked. S and M have 6 hour shifts in a day, whereas E and F have 12 hours shifts. What is the ratio of contribution of M to contribution of E in the project?

- (a) 1:1      (b) 1:2      (c) 1:4      (d) 2:1

Solution

	S	M	E	F
No. of hours	6	6	12	12
No. of days	d	d	2d	
Efficiency	2e	e	e	

$$M:E = ?$$

$$\text{Work} = \frac{\text{units} \times \text{No. of hours} \times \text{No. of days}}{(\text{efficiency})}$$

$$M \text{ work} = 2e \times 6 \times d = 12ed$$

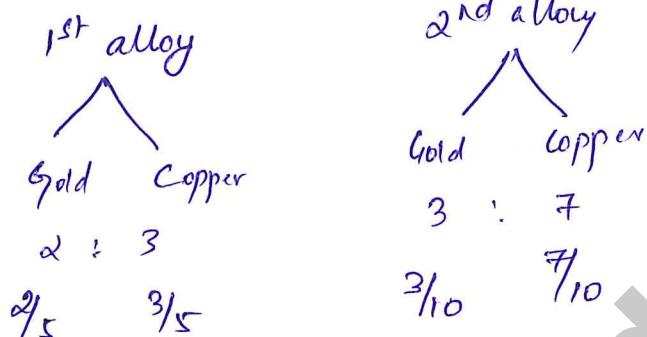
$$E \text{ work} = e \times 12 \times 2d = 24ed$$

$$M:E = 12ed : 24ed \\ = 1:2$$

Q.37 Two alloys A and B contain gold and copper in the ratios 2:3 and 3:7 by mass, respectively. Equal masses of alloys A and B are melted to make an alloy C, the ratio of gold to copper in alloy C is \_\_\_\_.

(GATE 2018)

- (a) 5:10      (b) 7:13      (c) 6:11      (d) 9:13

Solution

$$\begin{aligned} \text{Gold:Copper} &= \frac{2}{5} + \frac{3}{10} : \frac{3}{5} + \frac{7}{10} \\ &= \frac{7}{10} : \frac{13}{10} \\ &= 7:13 \end{aligned}$$

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Q.4) In manufacturing industries, loss is usually taken to be proportional to the square of the deviation from a target. If the loss is ₹ 4900 for a deviation of 7 units, what would be the loss in rupees for a deviation of 4 units from the target? (GATE 2018)

- (a) 400      (b) 1200      (c) 1600      (d) 2800

## Solution

$$\text{Loss} \propto (\text{Deviation})^2$$

$$I = K \cdot D^2$$

$$4900 = k \cdot (7)^2$$

K = 100

L = 9

$$D=4, K=100$$

$$I \propto K \cdot D^2$$

$$L = 100 \cdot (4)^2$$

- 1600

Q.5) The price of a wire made of a superalloy materials is proportional to the square of its length. The price of 10m length of the wire is ₹ 1600. What would be the total price (in ₹) of two wires of length 4m and 6m?

- (a) 768      (b) 832      (c) 1440      (d) 1600

Solution

$$\text{Price} \propto (\text{length})^2$$

$$P = k \cdot l^2$$

$$1600 = k \cdot (10)^2$$

$$1600 = k \cdot 100$$

$$k = 16$$

$$P = ?$$

$$L_1 = 4 \text{ m}$$

$$L_2 = 6 \text{ m}$$

$$k = 16$$

$$\begin{aligned}\text{New Price} &= k \cdot L_1^2 + k \cdot L_2^2 \\ &= 16(4)^2 + 16(6)^2 \\ &= 16(16+36) \\ &= 16 \times 52 \\ &= 832.\end{aligned}$$

3.7: Solved Problems 14-15

Q.14} The price of a necklace varies directly as the no. of pearls in it. Also, it varies directly as the square root of radius of a pearl. The price of a necklace was ₹ 150, when it had 75 pearls each of radius 1 cm. Find the radius of the pearl of a necklace having 100 pearls whose cost is ₹ 600?

$$\text{Cost} \propto \text{No. of pearls} \propto \sqrt{\text{radius}}$$

$$C = k \times N \times \sqrt{R}$$

$$150 = k \times 75 \times \sqrt{1}$$

$$k = 2$$

$$R ?$$

$$N = 100, C = 600, k = 2$$

$$C = k \times N \times \sqrt{R}$$

$$600 = 2 \times 100 \times \sqrt{R}$$

$$\sqrt{R} = 3$$

$$R = 9.$$

Q.15) In two alloys the ratio of iron and copper is 4:3 and 6:1 respectively, if 14 kg of the first alloy and 42 kg of the second alloy are mixed together to form a new alloy, then what will be the ratio of copper to iron in the new alloy?

$$\text{Iron : Copper} \\ 14 \\ 4 : 3$$

$$\text{Iron : Copper} \\ 42 \\ 6 : 1$$

$$\text{Copper : Iron} = ?$$

$$14 \\ \begin{array}{c} / \\ 4 : 3 \\ \backslash \end{array} \\ \frac{4}{7} \times 14 \quad \frac{3}{7} \times 14 \\ 8 \quad 6 \\ \text{Iron} \quad \text{Copper}$$

$$42 \\ \begin{array}{c} / \\ 6 : 1 \\ \backslash \end{array} \\ \frac{6}{7} \times 42 \quad \frac{1}{7} \times 42 \\ 36 \quad 6 \\ \text{Iron} \quad \text{Copper}$$

$$\text{Copper : Iron} = \frac{6+6}{12+36} : \frac{8+36}{12+36} \\ = 12 : 44 \\ = 3 : 11.$$

3.8: Previous Year Questions

Q.6) Hema's age is 5 years more than twice Hari's age. Suresh's age is 13 years less than 10 times Hari's age. If Suresh is 3 times as old as Hema. How old is Hema? (GATE 2018)

- (a) 14      (b) 17      (c) 18      (d) 19

Solution

$$\text{Hema's age} = x$$

$$\text{Hari's age} = y$$

$$\text{Suresh's age} = z$$

$$x = 5 + 2y \Rightarrow x - 2y = 5$$

$$z = 10y - 13 \Rightarrow 3x - 10y = -13$$

$$z = 3x$$

$$\begin{array}{rcl} (x - 2y = 5) \times -5 \\ 3x - 10y = -13 \\ \hline \end{array}$$

$$-5x + 10y = -25$$

$$3x - 10y = -13$$

$$-2x = -38$$

$$x = 19 \quad (\underline{\text{ans}}).$$

Q.7) In a party, 60% of the invited guests are male and 40% are female. If 80% of the invited guests attend the party and if all the invited female guests attend. What would be the ratio of males to females among the attendees in the party?  
(GATE 2018)

(a) 2 : 3

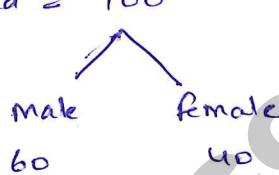
(b) 1 : 1

(c) 3 : 2

(d) 2 : 1

Solution

Let total people invited = 100



Attended = 80



$$\begin{aligned} \text{Male : female} &= 40 : 40 \\ &= 1 : 1 \end{aligned}$$

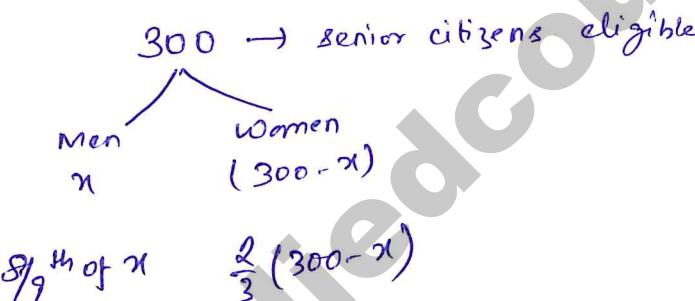
Q.8) In appreciation of the social improvements completed in a town, a wealthy philanthropist decided to gift ₹ 750 to each male senior citizen in the town and ₹ 1000 to each female senior citizen. Altogether, there were 300 senior citizens eligible for this gift. However, only  $\frac{8}{9}$ th of the eligible men and  $\frac{2}{3}$ rd of eligible women claimed the gift. How much money did the philanthropist give away in total? (GATE 2018)

(a) ₹ 1,50,000

(b) ₹ 2,00,000

(c) ₹ 1,75,000

(d) ₹ 1,51,000

Solution

$$\begin{aligned}\text{Total amount} &= 750 \times \frac{8x}{9} + 1000 \left[ \frac{2}{3} (300-x) \right] \\ &= 2000x + 1500 \times 200 - \frac{2000x}{3} \\ &= \underline{\underline{₹ 2,00,000}}.\end{aligned}$$

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