

NQT BASIC APTITUDE

Part 1

- Percentage.**
- Profit and loss.**
- Ratio and proportion.**
- Time and Work.**

Handwritten Solved question and answers.

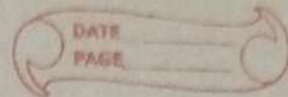
by vipul yadav

$$(40+2)(80+3)$$

$$3200 + 160 + 120 + 6$$

$$3800$$

$$50 + 39$$



$$\frac{420}{500} \times 100$$

$$84$$

TCS Aptitude

$$\frac{60}{48}$$

Percentage

$$\frac{11}{11}$$

$$200$$

$$\frac{56}{11}$$

$$500$$

$$- 420$$

$$120$$

$$a\% \cdot b = \frac{a \cdot b}{100}$$

$$\Rightarrow 76\% \cdot 89 = 74.94 \cdot 67.64$$

$$124 \cdot x = 67.9$$

$$\frac{124 \cdot x}{100} = \frac{67.9}{100}$$

$$\left(\frac{76}{89} \right)$$

$$67.64$$

$$\frac{60}{80} \times 100$$

$$75$$

$$x = \frac{67.9}{124}$$

$$x + 40\% \cdot x$$

$$500 + 200$$

$$140\% \cdot x = 700 \cdot x$$

$$700 \times 80$$

$$140\% \cdot x =$$

$$x \cdot 80$$

$$140\%$$

$$560$$

$$MP = 700$$

$$SP = 420$$

$$Q. \frac{22}{100} \times 100 = 60\%$$

$$Q. 7400 + 25\% \cdot 400 = 500$$

Percentage Increase / decrease

$$\% \text{ change } (\uparrow/\downarrow) = \frac{\text{Difference}}{\text{Initial Value}} \times 100$$

$$\frac{\text{Compand Value}}{\text{Initial Value}}$$

oblique not Divide



Case:-

Whenever the initial and final value are same then

If $\frac{n}{x}$ is increment then the decrement would be $\frac{n}{x+n}$

or eg $\frac{1 \uparrow}{3} = \frac{1 \downarrow}{4} \quad \text{or} \quad \frac{2 \uparrow}{5} = \frac{2 \downarrow}{7}$
(1+1) (5+2)

Q. At a supermarket a certain item has increased from 75 cents per month pound to 81 cents per pound. What is the percent increase in the cost of the item?

$$= \frac{81 - 75}{75} \times 100 = \frac{6}{75} \times 100 = 8\%$$

Q. A Teacher by mistake entered a student's mark as 320 instead of 400. Find the percentage error?

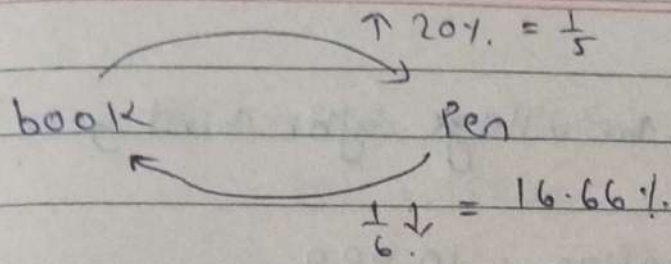
$$\frac{400 - 320}{400} \times 100$$

$$\frac{80}{400} \times 100 = 20\%$$

$$\frac{400 - 320}{400} \times 100$$

$$\frac{80}{400} \times 100 = 20\%$$

Q. The price of a book is 20% more than a pen. By what percentage is the price of the pen less than the book?



Successive Percentage change

1st day $\rightarrow$ 2nd day $\rightarrow$ 3rd day (no gap)

$$\text{overall \%} = a + b + \frac{a \cdot b}{100}$$

+ For increment, - For decrement.

Q The population of a village decreases at the rate of 20% per annum. If its population 2 years ago was 10000, what is its present population?

1st year = 20% ↓

2nd year = 20% ↓ overall % = $-20 + (-20) + \frac{(-20)(-20)}{100}$

$$= -36\%$$

$$\begin{aligned} \text{Present population} &= 10000 \cdot (-36\%) \cdot 10000 \\ &= 10000 \cdot (-3600) \\ &= 6400 \text{ Ans.} \end{aligned}$$

Q2 The population of a village is 10,000. In the first year it increases by 20%, in the second year it decreased by 40%, in the third year it again increases by 30%.

Find the population of the village after third year?

Present Population = 10,000

$$\begin{array}{l} 1^{\text{st}} \text{ yr} \rightarrow \uparrow 20\% \\ 2^{\text{nd}} \text{ yr} \rightarrow \downarrow 40\% \\ 3^{\text{rd}} \text{ yr} \rightarrow \uparrow 30\% \end{array} \quad a + b + \frac{ab}{100} = \frac{20 - 40 + (20)(-40)}{100}$$

$$= -20 - 8 = -28\%$$

$$\Rightarrow \frac{-28 + 30 + (-28)(30)}{100}$$

$$\Rightarrow 2 - 8.4$$

$$= -6.4\%$$

$$\Rightarrow 10,000 - 6.4\% \cdot 10,000$$

$$\Rightarrow 10,000 - 640$$

$$\Rightarrow 9360$$

Election voting Problem.

Q. In an election between two candidates, a person who gets 35% of the votes lost the election by a margin of 15,000 votes. Find the total no. of votes casted?

A
 $\downarrow$
35%

B
 $\downarrow$
65%

lost margin = 15000 means

$$B - A = 15000$$

$$65\% - 25\% = 15,000$$

$$30\% = 15000$$

$$100\% = \frac{5000}{15000} \times 100$$

$$= 50000$$

8. 10% of the voters did not cast their votes in an election between two candidates. 10% of the votes polled were found invalid. The successful candidate got 54% of the valid votes and won by a majority of 1620 votes. The total number of voters enrolled for election were

Let total percentage of voters be 100%.

Then total valid voters are :- ~~100% - 10%~~ $90\% \cdot 100 = 90$

~~The total valid voters are :- 90% - 10% = 80%~~

$$\text{Invalid votes } 10\% \cdot 90 = 9$$

$$\text{valid votes} = 81$$

Winner = $54\% \cdot 81$
Loser = $46\% \cdot 81$

$$8\% \cdot 81 = 1620$$

	Total	majority
org	x	1620
assumed	100	81.81

$$8\% \cdot 81 \cdot x = 100 \cdot 1620$$

$$x = \frac{100 \cdot 1620 \cdot 100}{8 \cdot 81} = \frac{10000 \cdot 1620}{648}$$

$$= 10000 \times 2.5$$

$$= 25000 \text{ Ans.}$$

Q. 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,

Let the total valid votes = ~~1000~~ 7500

Then the total invalid votes = 20% of 7500 = 1500

total valid votes = 6000

A got = 55% of 6000 = 3300

The valid votes other got = 2700. Ans.

Income - Expenditure Problem

Q. 5% of A's income is equal to 15% of B's income and 10% of B's income is equal to 20% of C's income.

If income of C is Rs. 2000, then the total income of A, B, and C is:

$$5\% A = 15\% B \Rightarrow \frac{A}{B} = \frac{3}{1}$$

$$10\% B = 20\% C \Rightarrow \frac{B}{C} = \frac{2}{1}$$

$$A:B:C :: 6:2:1$$

~~A=6x~~ If income of C = Rs 2000

$$\begin{aligned} \text{Total} &= A + B + C \\ &= 6x + 2x + 1x \\ &= 6 \cdot 2000 + 2 \cdot 2000 + 2000 \\ &= 9 \times 2000 \\ &= 18000 \end{aligned}$$

Q Radha's salary is 50% more than Seeta's salary. Radha got a raise of 40% on her salary while Seeta got a raise of 30% on her salary. By what percentage is Radha's salary more than Seeta's.

Let ^{Seeta's} Radha's salary is x 100

$$= 50\%$$

$$\begin{aligned} \text{Radha} &= x + 50\% x = 150\% \cdot 100 = 150 \\ &= 140\% \cdot (150\% \cdot x) = 140\% \cdot (150) = 210 \end{aligned}$$

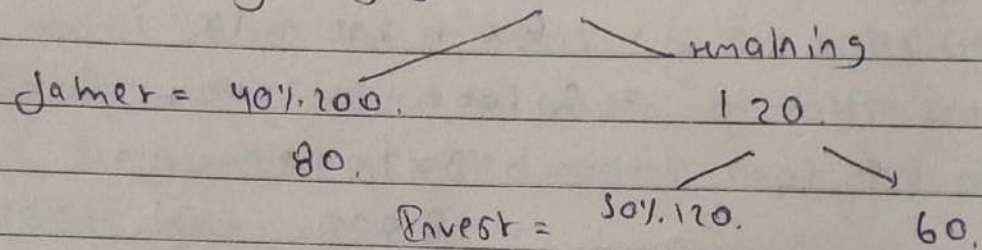
$$\text{Seeta} = 130\% \cdot (100) = 130$$

$$\%T = \frac{210 - 130}{130} \times 100 = \frac{80}{13} \times 10$$

$$= 61.53\%$$

Q. Sanjay gives 40% of his monthly salary to his father. 50% of his remaining salary, he invests in share market and insurance in the ratio of 5:1, if the difference between the amount he gave to his father and the amount he spent on share market is Rs. 6800. Find the income of Sanjay?

Let income of Sanjay = 200.



$$\begin{aligned} Sh &= 5x \\ Ins &= x \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} 8x = 60$$

$$x = \frac{60}{8} = \frac{30}{4}$$

$$\begin{aligned} Sh : Ins \\ 5 : 1 \end{aligned}$$

$$Sh = 5 \times \frac{30}{4} = \frac{150}{4}$$

$$Ins = 1 \times \frac{30}{4} = \frac{30}{4}$$

$$Diff = 80 - \frac{150}{4} = \frac{320 - 150}{4} = \frac{170}{4}$$

	Total	Diff.
Original	x	6800
Assumed	200	$\frac{170}{4}$

$$\frac{x \cdot 120}{4} = 6800 \cdot 200$$

$$x = \frac{6800 \cdot 200 \cdot 4}{120}$$

$$x = 32000$$

Percentage Ratio equivalence

Q The angles of a triangle are in the ratio 1:2:3
And the measures of each angle. What will be the percentage of second angle?

$$\text{Ratio} = 1 : 2 : 3$$

$$\left. \begin{array}{l} 1^{\text{st}} \text{ Angle} = 1x \\ 2^{\text{nd}} \text{ Angle} = 2x \\ 3^{\text{rd}} \text{ Angle} = 3x \end{array} \right\} \begin{array}{l} 6x = 180^\circ \\ x = 30^\circ \end{array}$$

$$\Rightarrow 30^\circ, 60^\circ, 90^\circ$$

$$2^{\text{nd}} \text{ angle} = \frac{2}{6} \times 100 = 33.33\%$$

Q The prices of two articles are in the ratio 3:4,
If the price of the first article be increased by
10% and that of the second by Rs. 4, the original
ratio remains the same. The original price of second
article is :-

$$\text{Articles} = 3 : 4$$

$$3x + 0.3x$$

$$110\%.3x$$

$$A = 3x \rightarrow 110\%.3x \quad 3x + 10\%.3x = 3.3x$$

$$4x + 4$$

$$B = 4x \rightarrow 4x + 4$$

$\rightarrow$

$$\frac{3.3x}{4x + 4} = \frac{3}{4}$$

$$\rightarrow \frac{1.1x}{x + 1} = \frac{1}{1}$$

$$1.1x = x + 1$$

$$0.1x = 1$$

$$x = \frac{10}{0.1}$$

$$x = 10$$

$$\text{Original Price of 2nd Article} = 4x = 40$$

Q 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.

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

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

$$\Rightarrow 5A + 4B = 4A + \frac{16B}{3}$$

$$\Rightarrow 5A - 4A = \frac{16B}{3} - 4B$$

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

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

Profit and loss.

Q A man sold two houses for Rs. 625958 each. On one he gains 16% and on one he loses 16%. How much does he gain or lose in whole transaction.

$$SP_1 = SP_2, \quad P\% = L\% = 16\%$$

$$\text{Loss} = -\frac{16^2}{100} = -\frac{256}{100} = -2.56\%$$

loss of 2.56%.

Q A man purchased two items for Rs. 100 each. On one he gains 25% 10% and on one he loses 10%. How much does he gain or lose in whole transaction.

$$CP_1 = CP_2$$

$$P\% = L\%$$

$$CP_1 = 100/-$$

$$G = 10\%$$

$$CP_2 = 100/-$$

$$L = -10\%$$

$$SP_1 = 110/-$$

$$SP_2 = 90/-$$

$$\text{Total SP} = \text{Total CP}$$

It means No profit no loss.

Q The cost price of 21 articles is equal to the selling price of 18 articles, profit percentage is.

$$CP \cdot 21 = SP \cdot 18$$

$$CP \cdot 7 = SP \cdot 6$$

$$SP = \frac{7}{6} CP$$

$$P\% = \frac{SP - CP}{CP} \times 100$$

$$= \frac{7/6 CP - CP}{CP} \times 100$$

$$= \left(\frac{7}{6} - 1 \right) \times 100$$

$$= \frac{1}{6} \times 100 = 16.66\%$$

Shortcut:-

$$SP = \frac{7}{6} CP \Rightarrow SP = 1.1666 CP$$

$$\boxed{SP = CP \pm P\%}$$

$$SP = \text{here}$$

$$P\% = .1666 \dots$$

$$\frac{P}{100} = .1666 \dots$$

$$P = 16.66\%$$

Q. A vendor bought toffees at 6 for a rupee. How many for a rupee must he sell to gain 20%?

$$\begin{aligned} \text{CP of 6 toffee} &= 1/- \\ \text{CP of 1 toffee} &= \frac{1}{6} \end{aligned}$$

$$\begin{aligned} \text{SP of 6 toffee} &= 120\% \text{ CP} \\ &= 120\% \cdot 1 \\ &= \frac{6}{5} \end{aligned}$$

$$\text{SP of 1 toffee} = \frac{6}{5} \times \frac{1}{6}$$

$$\text{SP of } \cdot = \frac{1}{5}$$

For rupee 1 he must sell
5 toffees.

Shortcuts:-

$$\text{Now, } \text{SP}(6) = \frac{1.2}{1.2} \cdot 6$$

$$\text{SP}(6) = 1.2 \cdot 1$$

$$\text{SP}(x) = 1 \cdot 1$$

$$x \cdot 1.2 = 6$$

$$x = \frac{60}{1.2}$$

$$x = 5 \text{ Ans}$$

Percentage Discount.

Q A shopkeeper purchased an article at 20% discount on list price, he marked up his article in such a way that after selling the article at 20% discount, he gained 20% on S.P. What percent is S.P. of the list price?

Let, marked price be 100 rupees.

$$SPA = 80\%. MP = 80\% \cdot 100 = 80 \text{ ₹}$$

$$\begin{aligned} \text{Overall Profit} &= 120\% \cdot 80 \\ &= 96 \text{ ₹} \end{aligned}$$

$$\begin{aligned} x\% &= \frac{SP}{LP} \Rightarrow x\% = \frac{96}{100} \times 100 \\ &= 96\% \end{aligned}$$

Q While selling a watch a shopkeeper gives a discount of 5%. If he gives a discount of 7%, he earns Rs. 15 less as profit. What is the marked price of the watch?

$$\begin{aligned} \text{Let marked price} &= x \\ \text{Discount Diff} &= \text{Profit Diff} \end{aligned}$$

$$71\%x - 51\%x = 15$$

$$20\%x = 1500$$

$$x = 7500 \text{ Rs.}$$

Q A shopkeeper bought 150 calculators at the rate of Rs 250 per calculator. he spent Rs 2500 on transportation and packing. If the marked price of calculator is Rs. 320 per calculator and the shopkeeper gives a discount of 5% on the marked price then what will be the percentage profit gained by the shopkeeper?

$$C.P. = 150 \text{ cal} \times 250 \frac{\text{Rs}}{\text{cal}}$$

$$C.P. = 37500$$

$$\text{other charges} = +2500$$

$$\text{Total Cost Price} = 40000$$

$$M.P. = 320 \text{ per cal} \times 150 \text{ cal.}$$

$$M.P. = 48000$$

$$S.P. = 95\% \text{ of } 48000$$

$$S.P. = 95 \times 480$$

$$S.P. = 45600$$

$$\text{Gain}(\%) = \frac{S.P. - C.P.}{C.P.} \times 100$$

$$= \frac{5600}{40000} \times 100$$

$$= 14\% \text{ Ans.}$$

Successive Discount Problem.

Q A successive discount series of 10%, 20%, and 40% is equal to a single discount of ?

Let MP = 100/-

after $D_1 = 10\%$

$$\hookrightarrow SP_1 = 90/- = MP_2$$

MP₂ - after $D_2 = 20\%$

$$\hookrightarrow SP_2 = 72/- = MP_3$$

after $D_3 = 40\%$

$$\hookrightarrow SP_3 = 43.2/-$$

$$MP_1 - SP_3 \Rightarrow 100 - 43.2 = 56.8/-$$

$$\text{Ans} = 56.8\%$$

Thick

$$a + b + \frac{ab}{100} \Rightarrow -10 + 20 + \frac{10 \cdot 20}{100} = 92/-$$

$$\Rightarrow -28 - 40 + \frac{28 \cdot 40}{100} \Rightarrow -68 + \frac{112}{10} = -72/-$$

Single discount = 56.8%

Q. Arjay bought a motor cycle for Rs 50,000. 2 years later he sold it to Bijoy spent 5% of the purchasing price on its maintenance. Later Bijoy displayed the sale price of his motorcycle Rs. 50,000. Chetan wanted to purchase it at 15% discount but Bijoy gave him two successive discounts of 10% and 5% instead of 15%. In one time, what is the actual discount availed by Chetan?

Actual discount = successive discount by Bijoy.

$$(-10) + (-5) + \frac{(-10)(-5)}{100}$$

$$-15 + \frac{50}{100}$$

$$-14.5\% \text{ Ans.}$$

Faulty Weighing Problem / Dishonest shopkeeper.

Q. A fruit seller declares that he sells fruits at the cost price. However, he uses a weight of 450g instead of 500g. His percentage profit is.

$$\begin{array}{ccc} 450g & & 500g \\ & \text{Saving } 50g & \end{array}$$

$$P\% = \frac{SP - CP}{CP} \times 100$$

but for this concept :-

$$P\% = \frac{\text{Saving (9m/Kgs)}}{\text{Spending (9m/Kgs)}} = \frac{50}{450} = \frac{1}{9}$$

$$= 11.11\%$$

Q A retailer cheats both to his whole-seller and his customer by 10%. by his faulty balance i.e, he actually weighs 10% more while purchasing from wholesaler and weighs 10% less while selling to his customer. What is his net profit percentage, when he sells at CP?

buys ; 10% more while purchasing

So, while buying he gets = 1100g

but, while selling he sells = -10%.

$$\frac{96}{100} \times 1000 = 960g$$

$$P\% = \frac{960g - 900g}{900g} = \frac{60}{900} = 6.67\%$$

Problems in terms of goods.

Q. The cost price of a good is C and the selling price of the same good is S , where Z is the profit or loss percentage. If the CP and SP both are increased by same amount then which of the following is true :-

let,

$$CP_1 = 100 \quad SP_1 = 150$$

$$Z_1 = \frac{50}{100} = \frac{1}{2} = 50\%$$

Now :- After increment

$$CP_2 = 150 \quad SP_2 = 200$$

$$Z_2 = \frac{50}{150} = \frac{1}{3} = 33.33\%$$

Hence :- Z decreases.

Q. A dealer sells a good at a gain of 10%. If he had bought it at 10% less and sold it for Rs 132 less, he would have still gained 10%. The C.P. of the good is?

$$\text{let the CP of good} = 100$$

$$SP_1 = 110$$

$$CP_2 = 90$$

$$\text{obtain diff} = SP_1 - SP_2$$

$$SP_2 = 99$$

$$= 110 - 99$$

$$= 11$$

$$\text{Given diff} = 132$$

Total cost price

Diff

Assumed

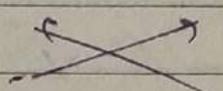
100

11

Original

x

132



$$11x = 132 \times 100$$

$$x = \frac{132 \times 100}{11} = 1200 \text{ Rs.}$$

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Questions in terms of money.

Q Ram bought 800 eggs at Rs. 3.25 each per dozen.
He sold 450 of them at 2 Rs. 1 and remaining
at 5 for Rs. 2. His gain % is?

$$CP_R = \frac{3.25}{12} \times 800 = 250$$

$$C_1: \text{Eggs sold} \Rightarrow 450 \text{ eggs} \\ 1 \text{ egg} \Rightarrow \frac{1}{2} \text{ Rs/egg}$$

$$SP_1 = \frac{450 \text{ Eggs} \times \frac{1}{2} \text{ Rs}}{\text{Egg}}$$

$$SP_1 = 225 \text{ Rs}$$

$$C_2 = \text{Remaining eggs sold} \Rightarrow 350 \text{ eggs} \\ 1 \text{ egg} \Rightarrow \frac{2}{5} \text{ Rs}$$

$$SP_2 = 350 \text{ Eggs} \times \frac{2}{5} \text{ Rs/Egg}$$

$$SP_2 = 140 \text{ Rs}$$

$$\text{Total SP} = 365 \text{ Rs}$$

$$\begin{aligned} \text{P\%} &= \frac{365 - 250}{250} \times 100 = \frac{115}{250} \times 100 \\ &= 46\% \end{aligned}$$

Q If 7 kg of tea of price ₹72 per kg is blended with 33 kg of tea of ₹87 per kg and 35 kg of ₹85 per kg, and the mixture is sold at 15% profit, then what is the selling price of the mixture?

$$SP_{mix} = 115\% \text{ CP}$$

$$CP_{mix} = \frac{7 \times 72 + 33 \times 87 + 35 \times 85}{75} \text{ Rs}$$

$$CP_{mix} = \frac{504 + 2871 + 2975}{75} = \frac{6350}{75}$$

$$CP_{mix} = 84.66\%$$

$$SP_{mix} = 115\% \times 84.66$$

$$SP_{mix} = 1.15 \times 84.66$$

$$SP_{mix} = 97.359 \text{ ₹ per kg}$$

Scheme Discount.

Q. A shopkeeper offers the following three schemes.
which scheme has the maximum discount percentage
(all articles have same marked price)?

1. Two successive discounts of 20% and 25%.

2. Buy 3 get 1 free.

3. Buy 2 get 2 free.

1.

$$-20 - 25 + \frac{(-20) \times (-25)}{100}$$

$$-45 + 5$$

$$D\% = -40\%$$

2.

$$D\% = \frac{\text{Total free items}}{\text{Total sold items}}$$

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

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

3.

$$D\% = \frac{2}{5} = 40\%$$

opt 1 and 3.

Q A retailer offers the following discount schemes for buyers on an article.

- (i) Two successive discounts of 10%.
- (ii) A discount of 12% followed by a discount of 8%.
- (iii) Successive discount of 15% and 5%.
- (iv) A discount of 20%.

The selling price will be minimum under the scheme.

$$(i) -10 - 10 + \frac{(-10)(-10)}{100}$$

$$d\% = -19\%$$

$$D\% \uparrow = SP \downarrow$$

Then correct option

$$(ii) -12 - 8 + \frac{(-12)(-8)}{100}$$

$$is = (iv)$$

$$-20 + \frac{96}{100} = -19.04\%$$

$$(iii) -15 - 5 + \frac{(-15)(-5)}{100}$$

$$-20 + 0.75 = -19.25\%$$

$$(iv) D = 20\%$$

Combination of cash and Scheme Discount.

Q. A shopkeeper's listed price is Rs. 2000. But he had two scheme options.

1. Giving three successive discounts of 10% each.

2. Giving a single discount of 30%.

Difference between two schemes.

$$1) -10 -10 + 1 = -19\%$$

$$-19 - 10 + \frac{(-19)(-10)}{100}$$

$$-29 + 1.9 = -27.1\%$$

$$SP = 27.1\% \times 2000$$

$$= 271 \times 2 = 542 \text{ Rs.}$$

$$2) SP = 30\% \times 2000 = 600 \text{ Rs.}$$

$$\text{diff} \Rightarrow \text{Ans} = 58 \text{ Rs.}$$

Q. The difference between a discount of 30% on 2000 and two successive discounts of 25% and 5% on the same amount is.

$$SP_1 = \cancel{2000} - 30\% \times 2000 = 1400$$

$$SP_2 \Rightarrow \cancel{2000}$$

$$\text{Total discount} \Rightarrow -25 - 5 + \frac{(-25)(-5)}{100}$$

$$-30 + 1.25 = -28.75\%$$

$$\Rightarrow -28.75$$

$$SP_2 = 3000 - \frac{28.75}{100} \times 3000$$

$$= 3000 - 862.5$$

$$= \cancel{2137.5} \quad 2137.5$$

$$diff \Rightarrow 2139 - 2100$$

$$= 39 \text{ Rs.}$$

$$= 37.5$$

Ratio.

Concept of Ratios :-

Total Amount $\rightarrow$ 33,000

Ratio of A & B $\rightarrow$ 5 : 6

Amount received by A = ?

Amount received by B = ?

$$5x + 6x = 33,000$$

$$x = 3000$$

$$A = 5x \Rightarrow 15,000; B = 6x = 18,000$$

THUR:-

$$A \rightarrow \frac{\text{No. of Part of A} \times \text{Total Amount}}{\text{Total no. of Parts}}$$

Q King bahubali had ordered the distributions of apples according to the following plan; for every 20 apples the elephant gets, the zebra should get 13 apples, and the deer should get 8 apples. Now his servant Kartapa is in a fix. Can you help him by telling how much should he give to the elephant if there were 820 apples in total.

$$20 : 13 : 8$$

$$\text{for elephant} = \frac{70}{41} \times 820 = \frac{16400}{41} = 400 \text{ Ans}$$

Q If Rs. 23,000 is divided into three parts,
proportional to $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$ Then the first
part is

$$\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$$

$$\text{LCM of } (2, 3, 4) = 12$$

$$\frac{12 \times \frac{1}{2}}{2} : \frac{12 \times \frac{2}{3}}{3} : \frac{12 \times \frac{3}{4}}{4}$$

$$6 : 8 : 9$$

$$\text{First} = \frac{6}{23} \times \frac{1000}{23,000} = 6000 \text{ Ans}$$

Q In a mixture of 60L, The ratio of milk and water 2:1
if this ratio is to be 1:2, Then the quantity of water
to be further added is :-

$$\text{mixture} = 60\text{L}$$

$$\text{milk} : \text{water}$$

$$2 : 1$$

$$\text{milk} = \frac{2}{3} \times 60 = 40\text{L}$$

$$\text{water} = \frac{1}{3} \times 60 = 20\text{L}$$

→ 1:2

$$\text{Milk} = 40$$

$$\text{Water} = 20 + x$$

$$\frac{M}{W} = \frac{1}{2}$$

$$\frac{40}{20+x} = \frac{1}{2} \Rightarrow 20+x = 80$$

$$x = 60 \text{ l}$$

$$\text{Ans} = 60 \text{ l}$$

Q 8 apples and 12 bananas cost as much as 5 apples and 13 bananas. And the ratio of the cost of 2 bananas and 7 apples.

$$8A + 12B = 5A + 13B$$

$$8A - 5A = 13B - 12B$$

$$3A = 1B$$

$$\frac{A}{B} = \frac{1}{3}$$

$$\text{For } 3B : 1A \Rightarrow 3 \times 3 : 1 \times 1$$

$$\Rightarrow 9 : 1 \text{ Ans.}$$

Q If a carton containing a dozen mirrors is dropped, which of the following cannot be the ratio of broken mirrors to unbroken mirrors.

(a) 4:2

(c) 3:2

dozen = 12 $\Rightarrow$ Factors {2, 3, 4, 6}

(b) 3:1

(d) 7:5

$4+2=6 \checkmark$, $3+2=5 \times$

Ans = (c)

$3+1=4 \checkmark$, $7+5=12 \checkmark$

Q. A bag contains Rs 102 in the form of 1 Rupee, 50 paise and 10 paise coins in the ratio of 3:4:10. What is the number of 10 paise coins?

No. of coins $\Rightarrow 3 : 4 : 10$

Amount Ratio $\Rightarrow 1 \times 3 : 50 \times 4 : 10 \times 10$
 $= 3 \text{ rupee} : 200 \text{ paise} : 100 \text{ paise}$
 $\Rightarrow 3 \text{ rupee} : 2 \text{ rupee} : 1 \text{ rupee}$

$$6x = 102$$

$$x = 17$$

For 10 paise

$$\Rightarrow 10x = 10 \times 17 = 170 \text{ Ans.}$$

Q. Dheeraj went to a cool corner. He gave the shopkeeper a Rs. 10 note and asked for a coke costing Rs 5. The shopkeeper returned the change to him in the denominations of Rs. 1, 50 paise and 25 paise. What could be the ratio of number of coins of Rs 1, 50 paise and 25 paise respectively.

$\Rightarrow 1 \text{ rs} ; 50 \text{ paise} , 25 \text{ paise}$

$$1 \text{ rs} , \frac{1}{2} \text{ rs} , \frac{1}{4} \text{ rs.} \leftarrow$$

$\Rightarrow$ check the sum of options in this multiple
if it is equal to Rs 5 then it is correct

$$\begin{array}{r} 19 \\ 19 \overline{) 361} \\ \underline{38} \\ 81 \\ \underline{81} \\ 0 \end{array}$$

Q. By mistake, instead of dividing Rs. 117 among three persons P, Q, and R in the ratio $\frac{1}{2} : \frac{1}{3} : \frac{1}{4}$ it was divided in the ratio 2:3:4 who gains most and how much?

$$\begin{array}{c} 117 \\ P : Q : R \\ \frac{1}{2} : \frac{1}{3} : \frac{1}{4} \\ 2 \quad 3 \quad 4 \end{array}$$

$$6 : 4 : 3$$

$$192 = 117$$

$$x = 9$$

$$\text{For P} \Rightarrow \frac{6 \times 117}{19} = 57$$

$$\text{For Q} \Rightarrow 4 \times 9 = 36$$

$$\text{For R} \Rightarrow 3 \times 9 = 27$$

$$\begin{array}{c} 117 \\ P : Q : R \\ 2 : 3 : 4 \end{array}$$

$$\text{For P} \Rightarrow \frac{2 \times 117}{9} = 26$$

$$\text{For Q} \Rightarrow 3 \times 13 = 39$$

$$\text{For R} \Rightarrow 4 \times 13 = 52$$

R gains most $\Rightarrow$

$$\Rightarrow 52 - 27 \Rightarrow 25$$

Proportions.

equating two ratios is proportions.

$$a:b = b:c$$

$$\text{or } a:b = c:d$$

→ a and c
are extremes

→ a and d are extremes

→ b is mean

→ b and c are means

product of extremes = product of means

$$a:b = 1:2$$

$$a:b = (1:2) \times 3$$

$$b:c = 2:3$$

$$b:c = (2:3) \times 2$$

$$a:b:c = 1:2:3$$

$$a:b:c = 3:6:8$$

Q The sum of three numbers is 210. If the ratio between the first and second number be 2:3 and that between the second and third be 4:5, then the difference between first and third number?

$$a:b:c$$

$$2:3$$

$$4:5$$

$$\rightarrow 8x + 12x + 15x = 210$$

$$x = \frac{210}{35} = 6$$

$$35$$

$$\Rightarrow 8:12:15$$

∴ difference b/w First and Third

$$\Rightarrow 15 \times 6 - 8 \times 6 = 90 - 48$$

$$= 42$$

Q2. Mean Proportion :-

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

$$\text{Hence : } b^2 = ac$$

$$\rightarrow b = \sqrt{ac} \quad b \text{ is mean Proportion of } a \text{ and } c$$

Q What is the mean Proportion between the Mean Proportion of $(2/7 \text{ to } 32/343)$ and $(2 \text{ to } 1/5000)$.

$$MP_1 = \sqrt{\frac{2 \times 32}{7 \times 343}}, \quad MP_2 = \sqrt{\frac{2 \times 1}{5000}}$$

$$MP_1 = \sqrt{\frac{124}{2401}} = \sqrt{\frac{2^6}{7^4}}, \quad MP_2 = \sqrt{\frac{1}{2500}} = \frac{1}{50}$$

$$MP_1 = \frac{8}{49}$$

MP :

$$\sqrt{\frac{124 \times 1}{2401 \times 2500}}$$

$$MP = \frac{124 \times 1}{2401 \times 2500} = \frac{48 \times 1}{49 \times 50}$$

$$MP = \frac{8 \times 2}{49 \times 5} = \frac{2}{35} \text{ Ans.}$$

Q Four numbers are in Proportion. The sum of the squares of the four number is 50 and the sum of the means is 5. The ratio of the first two terms is 1:3. What is the average of the four numbers?

$$1:3$$

$$a:b:c:d$$

$$b+c=5$$

$$a^2+b^2+c^2+d^2=50$$

$$9+4=13$$

$$\frac{a}{b} = \frac{1}{3}$$

$$\text{The } b+c=5 \Rightarrow c=5-b$$

$$3+c=5$$

$$c=2$$

$$a=1, b=3, c=2 \text{ In}$$

$$a^2+b^2+c^2+d^2=50$$

$$1+9+4+d^2=50$$

$$d^2=50-14$$

$$d^2=36$$

$$d=6$$

$$a+b$$

$$\text{Average of no} = \frac{a+b+c+d}{4}$$

$$\Rightarrow \frac{1+3+2+6}{4} \Rightarrow \frac{12}{4} = 3 \text{ Ans}$$

Direct and Indirect variation.

↓
 $a \propto b$

↓
 $a \propto \frac{1}{b}$

Q A varies directly as B and Inversely as C. A is 12 when B is 6 and C is 2. What is the value of A when B is 12 and C is 3?

$$A \propto B \propto \frac{1}{C} \Rightarrow 12 \propto 6 \propto \frac{1}{2}$$

$$\Rightarrow A \propto \frac{B}{C}$$

$$A \propto 12 \propto \frac{1}{3}$$

$$\Rightarrow A = K \frac{B}{C} \text{ Here}$$

$$12 = K \times \frac{6}{2}$$

$$\boxed{K = 4}$$

$$\text{So, } A = K \frac{B}{C}$$

$$A = 4 \times \frac{12}{3} = 16 \text{ Ans.}$$

Q Distance covered by train is directly proportional to the time taken and it also varies directly as the square root of fuel used and varies inversely as

The no. of wagons attached to it. A train covers 192 Km journey in 20 hours when there are 10 wagons attached to it and total fuel consumption was 256 liters of diesel. Find the consumption of fuel per km when a train goes 200 km in 25 hours with 15 wagons attached to it.

$$\text{Distance} \propto \text{Time taken} \propto \sqrt{\text{fuel used}} \propto \frac{1}{\text{no. of wagons}}$$

$$\text{Distance} = \frac{K \times \text{Time taken} \times \sqrt{\text{fuel used}}}{\text{no. of wagons}}$$

$$192 = \frac{K \times 20 \times \sqrt{256}}{10}$$

$$192 = K \times 2 \times 16$$

$$\Rightarrow K = \frac{192}{32} = 6$$

$\Rightarrow$

$$200 = \frac{6 \times 25 \times \sqrt{\text{fuel}}}{15}$$

$$\sqrt{\text{fuel}} = \frac{200}{10}$$

$$\text{fuel} = 400 \text{ Ans}$$

$$\text{fuel per km} = \frac{400}{200} = 2 \text{ km Ltr/km}$$

Joint variation

Que:- Weight of a sumo jointly varies as his height and his age. When height is ~~1.2~~ 1.5 m and his age is 20 yrs, his weight is 48 Kg. Find the weight of the sumo when his height is ~~1.5~~ 1.2 m and age is 30 yrs.

$$W \propto H \times A$$

$$W = K \times H \times A$$

$$1) \quad 48 = K \times \frac{1.5}{1.2} \times 20$$

$$K = 2$$

$$2) \quad W = 2 \times 1.2 \times 30$$

$$W = 2 \times 1.2 \times 30$$

$$W = 72 \text{ Kg Ans.}$$

Que:- The variable x is in joint variation with y and z when the values of y and z are 4 and 6, x is 16. What is the value of x when $y = 8$ and $z = 12$.

$$x \propto y \times z$$

$$x = K \times y \times z$$

$$1) \quad 16 = K \times 4 \times 6$$

$$K = \frac{16}{4 \times 6} = \frac{2}{3}$$

$$2) \quad x = \frac{2 \times 8 \times 12}{3}$$

$x = 64$ Ans.

Consider work as units of chocolate and then solve it...

DATE
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Time and Work

$$\text{Efficiency} \times \text{Days} = \text{Total work}$$

Basic Questions (no conditions)

$$A = 10d$$

$$\text{Total days} = 9$$

Trick: chocolate method

$$B = 40d$$

$$1) \text{ Chocolate : } C = \text{LCM}(10, 40) = 40$$

$$2) E_A = \frac{C}{D_A} = \frac{40}{10} = 4, E_B = \frac{40}{40} = 1$$

$$\text{Total Efficiency} = 5$$

$$TW = D \times E \therefore C = D \times E$$

$$D = \frac{C}{E} = \frac{40}{5} = 8 \text{ days Ans}$$

Q. A can do a piece of work in 12 days, B can do it in 15 days and C can do it in 20 days. If they work together, how long will they take to complete the work?

$$1) \text{ Chocolate} = \text{LCM}(12, 15, 20) = 60$$

$$2) E_A = \frac{60}{12} = 5, E_B = \frac{60}{15} = 4, E_C = \frac{60}{20} = 3$$

$$\text{Total E} = 12$$

$$3) \text{ Total days} = \frac{60}{12} = 5 \text{ days Ans}$$

Q Anand is twice as good a workman as Babu and is therefore able to finish a piece of work in 30 days less than Babu. In how many days they can complete the whole work; working together?

$$E_{\text{Anand}} = 2 \times E_{\text{Babu}} \quad \frac{E_A}{E_B} = \frac{2}{1}; E_A = 2x, E_B = x$$

$$30x - 30 \text{ days} \quad 30x \text{ days}$$

$$\text{Total days} = \frac{C}{TE} =$$

$$A - B = 30 \text{ d.}$$

$$A = 60 \text{ days}$$

$$2x - x = 30 \text{ d.}$$

$$\rightarrow B = 30 \text{ days}$$

$$x = 30 \text{ d.}$$

$$A = 2B \rightarrow \frac{A}{B} = \frac{2}{1} \text{ Ratio of efficiency}$$

Imp $\rightarrow$ Ratio of Days = Inversely (ratio of efficiency)

$$\Rightarrow \frac{A}{B} = \frac{1}{2}$$

$$A = x, B = 2x$$

$$|A - B| = 30 \text{ d}$$

$$\rightarrow A = 30 \text{ d, sum} = 60$$

$$|x - 2x| = 30 \text{ d}$$

$$B = 60 \text{ d.}$$

$$x = 30 \text{ d.}$$

$$E_A = \frac{60}{30} = 2, E_B = 1$$

$$TD = \frac{60}{3} = 20 \text{ days}$$

Alternate, leaving and joining work.

- Alternate work

Q. A, B and C can do a piece of work in 20, 30, 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?

$$A = 20, B = 30, C = 60$$

$$LCM = 60$$

$$E_A = \frac{60}{20} = 3, E_B = \frac{60}{30} = 2, E_C = \frac{60}{60} = 1$$

Timeline

1 st day	2 nd day	3 rd day
only A	only A	A + B + C
chocolates = 3C	3C	6C

12 chocolates in 3 days

$$\text{for 60 chocolates} = \frac{3 \times 60}{12} = 15 \text{ days} \text{ Ans.}$$

leaving the work

Q. Working together Rajeev and vikram can complete a piece of work in 48 days, Rajeev can alone complete it in 64 days, both of them work together for 30 days and then Rajeev left. Find how many long vikram alone takes to complete the work?

$$R + V = 48 \text{ days} \quad \text{LCM}(48, 64) = 192 \text{ chocolates}$$

$$R = 64 \text{ days}$$

$$E_{R+V} = \frac{192}{48} = 4, \quad E_R = \frac{192}{64} = 3$$

$$D_V = \frac{C}{E_V} = 9$$

$$E_V \Rightarrow E_{R+V} - E_R \Rightarrow 4 - 3 \Rightarrow 1$$

$$D_V = \frac{192}{1} \text{ days Ans}$$

Q A, B and C can do a piece of work in 20, 20 and 40 days respectively. They began the work together but C left 2 days before the completion of work. In how many days was the work completed?

C) $A = 20 \text{ d.}$
 $B = 20 \text{ d.}$
 $C = 40 \text{ d.}$ } LCM = 40 d

1) For last 2 days, only A and B worked

F) $E_A = 2$
 $E_B = 2$
 $E_C = 1$

$D = \frac{C}{E}$
 $C = D \times E$
 $C = 2 \times 4 = 8$

Timeline:- ~~A + B + C~~

Now rest of the days only (40-8) chocolates
 = 32 chocolates.

$$D = \frac{C}{E} = \frac{32}{5} = 6.4$$

$$\text{Total Days} = 6.4 + 2 = 8.4 \text{ Ans}$$

Joining the work

Q. A alone can do a piece of work in 6 days and B alone can do a piece of work in 8 days. A and B undertook it for ₹200. With the help of C, they completed the work in 3 days. How much is to be paid to C?

1)

$$\begin{array}{l} A \rightarrow 6d \\ B \rightarrow 8d \\ A+B+C \rightarrow 3d \end{array} \left. \vphantom{\begin{array}{l} A \rightarrow 6d \\ B \rightarrow 8d \\ A+B+C \rightarrow 3d \end{array}} \right\} \text{LCM (24)}$$

2)

$$E_A = 4, E_B = 3, E_{A+B+C} = 8$$

$$E_C = E_{A+B+C} - (E_A + E_B)$$

$$E_C = 8 - (4 + 3) = 1$$

$$\rightarrow 4x + 3x + 1x = 200$$

$$8x = 200$$

$$x = 400$$

$$\text{For C} \rightarrow 1x = 400 \text{ rupees.}$$

Q. A, B and C can do a piece of work individually in 8, 12 and 15 days, respectively. A and B start working but A quits after working for 2 days. After this, C joins B till the completion of work. In how many days will the work be completed?

1) $A \rightarrow 8d$
 $B \rightarrow 12d$
 $C \rightarrow 15d$ } Lcm $\rightarrow 120$.

2) $E_A \rightarrow 15$
 $E_B \rightarrow 10$
 $E_C \rightarrow 8$

Timeline:-

~~Timeline~~

2 days	Rest
A + B	C + D
$d = \frac{C}{E} = \frac{120}{25} = 24$	$d = \frac{C}{E} = \frac{120}{24 \times 18}$
$= 24 = 6 \text{ days}$	
Total days = $\frac{120}{24} + 6 = 10$	
$= \frac{282}{24 \times 9} = \frac{94}{9} = 10 \frac{4}{9}$	

~~Total days = $\frac{24}{5} + \frac{120}{18} = \frac{18 \times 24 + 120 \times 5}{90}$~~
 ~~$= \frac{432 + 600}{90} = \frac{1032}{90}$~~

Timeline

2 days	Rest
A + B	B + C
$C = d \times E$	$D = \frac{C}{E} = \frac{120 - 50}{18} = \frac{70}{9}$
$C = 2 \times 25 = 50$	
Total days = $\frac{70}{9} + 2 = \frac{50}{9} = 5 \frac{8}{9} \text{ days}$	

Replacement work

Q A, B and C can complete a work in 10 days, 20 days and 30 days respectively. A and C started the work and after 2 days B replaced A and then two have finished the remaining work. In how many days the remaining work is finished?

1) $T_{\text{chordakr}} = (10, 20, 30) \text{ LCM} = 60$

2) $E_A = 6, E_B = 3, E_C = 2$

$\frac{A+C}{2 \text{ days}} \quad \frac{B+C}{\text{days}}$

$d = \frac{C}{E} \quad C_{\text{rem}} = T_C - C = 60 - 16 = 44$

$d = \frac{C}{E}$

$d_2 = \frac{C}{8}$

$C = 16$

$d = \frac{44}{5} = 8.8 \text{ days}$

Pipe and Cisterns (Tanks)

Q Two pipes M and N can fill a tank in 22 hours and 33 hours respectively. In how much time will the tank be full, if both the pipes are opened simultaneously?

1) chocolates = LCM(22, 33) $\rightarrow$ 66

2) $E_M = \frac{66}{22} = 3$, $E_N = \frac{66}{33} = 2$

Total time = $\frac{\text{Total chocolates}}{\text{Total Eff.}} = \frac{66}{5} = 13.2$ hours.

Q. A pipe can fill a tank in 6 hours. Another pipe can empty the tank in 12 hours. If both the pipes are opened simultaneously, in how much time will the tank get full?

(chocolates)

1) $A_f = 6$ h $\quad$ LCM(6, 12) $\rightarrow$ 12
 $B_e = 12$ h

2) $F_A = \frac{12}{6} = 2$ 1/h , $F_B = \frac{-12}{12} = -1$ 1/h

Total time = $\frac{12}{2-1} = 12$ hours

Q. A Tap can fill a tub in 24 hours. Due to a leak at the bottom of the tub, the tap fills the tub in 36 hours. If the tub is full, how much time will the leak take to empty it?

$$A_f = 24 \text{ hrs} \quad \text{LCM}(24, 36) \rightarrow 72$$

$$A_f + B_f = 36 \text{ hrs}$$

$$E_{A_f} = 3$$

$$T_{\text{Net}} = ?$$

$$E_{(A_f + B_f)} = 2$$

$$T_{\text{Net}} = \frac{72}{-1}$$

$$E_{B_f} = -1$$

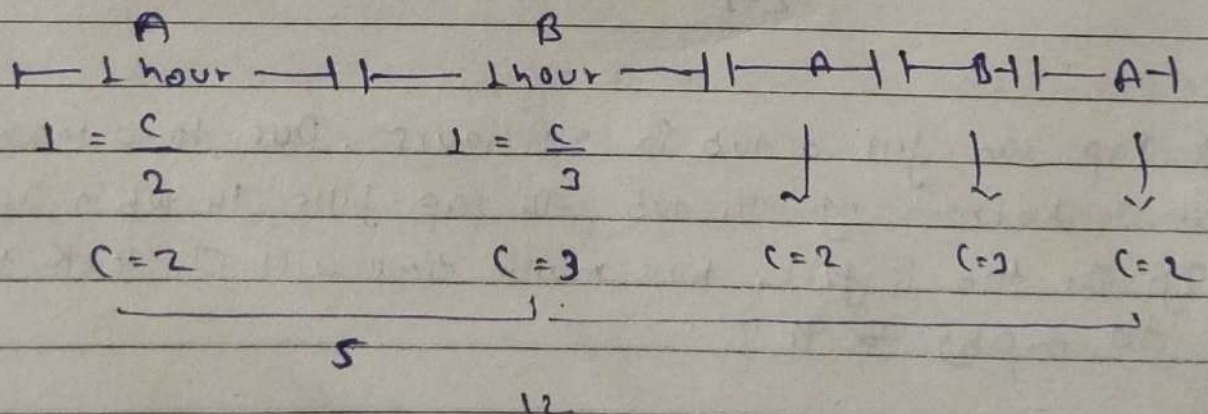
$$\text{Ans} = 72 \text{ hrs}$$

Q. A tap can fill tank in 6 hrs. Another tap fills the tank in 4 hours. If both the taps are working alternatively for every 1 hour. In what time the tank gets full?

$$1) \quad C = \text{LCM}(6, 4) \rightarrow 12$$

$$2) \quad E_A = 2, \quad E_B = 3$$

Timeline:-



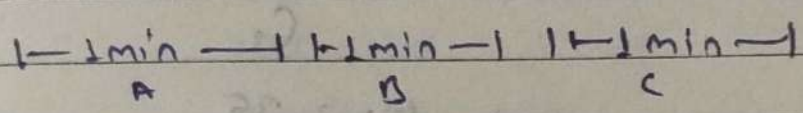
$$\text{Total Time} = 5 \text{ hrs}$$

Q. Two taps A and B can fill a tank in 20 min and 30 min, respectively. An outlet pipe C can empty the full tank in 15 min. A, B and C are opened alternatively, each for 1 min. How long will a tank to be filled.

1) LCM $\rightarrow (20, 30, 15) \rightarrow 60$

2) $E_A = 3, E_B = 2, E_C = -4$

3) Timeline



$C = 1 \times 3 \quad C = 1 \times 2 \quad C = 1 \times -4$

$C = 3 \quad C = 2 \quad C = -4$
 $\hline C = 1$

Let's take $T = 55$ then Total time = 165 min

Pr 1-

$165 \text{ min} = 55L$

$+ 1 \text{ min} = 3L$

$+ 1 \text{ min} = 2L$

$167 \text{ min} = 60L$

Ans = 167 min.

Man-Days or Work Equivalence Concept

More men $\rightarrow$ less time or More time $\rightarrow$ less men

Chain rule 1 - $\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$

Q. 30 workers can make 24 tables in 21 days working 8 hours a day. If 35 workers want to make 18 such tables in 12 days, how many hours should they work per every day?

C ₁	C ₂
M ₁ = 30	M ₂ = 35
W ₁ = 24	W ₂ = 18
D ₁ = 21	D ₂ = 12
H ₁ = 8	H ₂ = ?

$$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$$

$$\frac{30 \times 21 \times 8}{24} = \frac{35 \times 12 \times x}{18}$$

$$210 = \frac{30 \times x}{3}$$

$$x = \frac{210 \times 3}{30} = 9 \text{ hours}$$

Q A certain no. of men can finish a job in 100 days. If there are 10 men less the work will take 10 days more to finish, find the no. of men initially.

$$M_1 = x$$

$$D_1 = 100 \text{ days}$$

$$M_2 = x - 10$$

$$D_2 = 110 \text{ days}$$

$$M_1 D_1 = M_2 D_2$$

$$x \times 100 = (x - 10) \times 110$$

$$x \times 10 = 11x - 110$$

$$10x - 11x = -110$$

$$-x = -110$$

$$x = 110 \text{ men}$$