(1) RATIO AND PROPORTION

→ comparison of 2 same/eq quantities.

→ denoted by $a:b$ / $\frac{a}{b}$.

$a:b$ — Antecedent, consequent.

→ Inverse ratio of $a:b = 1/a : 1/b$

$\Rightarrow b:a$

→ IR of $a:b:c = 1/a : 1/b : 1/c$

$\Rightarrow bc : ac : ab$

→ Duplicate ratio of $a:b \Rightarrow a^2 : b^2$

→ Subduplicate ratio of $a:b \Rightarrow \sqrt{a} : \sqrt{b}$

→ Triplicate ratio of $a:b \Rightarrow a^3 : b^3$

→ Subtriplicate ratio of $a:b \Rightarrow \sqrt[3]{a} : \sqrt[3]{b}$

Subt. ratio

512 : 1331 → 8 : 11

→ Compound ratio

$a:b$, $c:d$, $e:f$

$\frac{a \times c \times e}{b \times d \times f}$

→ Proportion

· Equality of 2 ratios.

① $a:b$; $c:d$

$a:b = c:d$

$\therefore \boxed{ad = bc}$

· 4th proportion

$a:b = c:d$ → 4th prop.

$ad = bc$

$\boxed{d = bc/a}$

· 3rd prop $a:b = c:d$ → 3rd prop.

[a, b, c] — 3rd

$c = ad/b$

$ac = b^2$

$\boxed{c = b^2/a}$

2nd prop

a : b = b : c

b → Mean proportion

$ac = b^2$

$\boxed{b = \sqrt{ac}}$ ✓

Q) 4, 24, 16
a, b, c

find 4th prop.

$\frac{4}{24} = \frac{16}{d}$

$\Rightarrow d = \frac{bc}{a} = \frac{24 \times 16}{4} = 96$ ✓

Q1) 4, 16
a b

$\boxed{c = 64}$ $c = b^2/a$ ✓

$b^2 = ac$.

$16^2 = 4c$.

$\frac{16 \times 16}{4}$

Q2: 4, 16
a, bc

$b^2 = ac$.

$b^2 = ac$.

$\boxed{b = 8}$ (2nd proportn)

* Ratio mul/div by same no. ⇒ no change.

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Problems

Q1) a : b = 7 : 8,
b : c = 4 : 5
then find a : b : c = ?

a	b	c
7	8	
	4	5

28 : 32 : 40
⇒ 7 : 8 : 10

Q2) 3x = 4y = 7z
then find:
x : y : z

Q3) p : q = 3 : 4, q : r = 7 : 6, r : s = 1 : 2
then find p : q : r : s = ?

Soln

1) $\frac{a}{b} = \frac{7}{8}$, $\frac{b}{c} = \frac{4}{5} = \frac{8}{10}$

$\therefore \boxed{a : b : c = 7 : 8 : 10}$ ✓

2: $\frac{x}{y} = \frac{4}{3}$, $\frac{y}{z} = \frac{4}{7}$ ✗

4 : 3 : 7

3.

1) a : b = (7 : 8) × 4
b : c = (4 : 5) × 8

⇒ 28 : 32 : 40
⇒ 7 : 8 : 10

VI

(Gen rule).

2. $a:b:c$
$a:b$
$b:c$
$ab:bb:bc$

$7:8$
$4:5$
$28:32:40$

3. $3x=4y=7z$

$\frac{x}{y}=\frac{4}{3}$; $\frac{y}{z}=\frac{7}{4}$

$x:y:z = 4\ \ 3$
$\quad\quad\ 7\ \ 4$
$28:21:12$

$\Rightarrow 28:21:12$. Ans

5. $p:q:r:s$

Q. $a:b:c:d$ ratio:

$a:b$
$b:c$
$c:d$
$abc:bbc:bcc:bcd$

Easy M.

$p\ \ q\ \ r\ \ s$
$\Rightarrow 3:4$
$\quad\quad 7:6$
$\quad\quad\ 1:2$
$21:28:24:48$. Ans.

Problems

Q1 In a map, the scale is represented as 1 : 10 lakh (1 : 10,00000). The distance between 2 cities is 2.5 cm in the map. What is the actual dist between 2 cities in kms.

Q2 A and B together has 1881. 4 times of A's share is same as the 5 times of B's share. What is the difference between shares of A & B?

Q3 A Vessel of 375 l capacity is full of pure milk. On the first time, 2/5 of milk is drawn and filled with water.
Second time, 2/5 of Solution is drawn and filled with water and again the same thing is done on 3rd time.
Find the quantity of milk at the end

Q4 A Vessel of 48 l full of pure alcohol. For the first time, 1/3 of the alcohol is replaced by water, & for the second time, $\frac{3}{4}$th of solution is replaced by water.
Find the quantity of the water at the end?

Q5 2 Vessels of equal capacity contain milk and water in the ratio 2 : 3 and 3 : 5. If these are blended. Find the ratio of

Solution

milk & water in resulting solution ?

Soln. (Try)

1. 25 Lakh m
25,00000 → 2500 km 0 00 cm.

2. 25 km

2. $x + y = 1441$

$4x = 5y$ ✗

$\Rightarrow 4x + 4y = 5764$

$\Rightarrow 9y = 5764$

$y = 640.4$, $x = 800.6$

4. Map → 1 unit : 10 L cms.

1 Km = 10,00000 cms.

1000 cm

Map
1 cm = 10 Km
2.5 cm = ?

∴ 25 Km

2. $4A = 5B$ $\boxed{A:B = 5:4}$

$\frac{A}{B} = \frac{5}{4}$ → diff (A − B)

$\Rightarrow \frac{1}{9} \times 1881 \Rightarrow 209$ ₹. Ans

3. 2nd tym → 225 l milk 150 l water

3. 375 l → milk

$\frac{2}{5} \times 375 \Rightarrow 150$ l (drawn)

I 375 l − 150 l = 225 l (milk) + 150 (W)

II $\frac{2}{5} \times 225$ [drawn] $\frac{2}{5} \times 150 = 60$

$\Rightarrow$ 90 l (M) + 60 l (W) [drawn]

M → 225 − 90 = 135 (M) + 240 l (W)

$\frac{2}{5} \times 135$ $\frac{2}{5} \times 240$

$\Rightarrow$ 54 l (M) [drawn] + 96 l (W)

240 − 96 = 144

135 − 54 = 81 l (M) + 144 l (W)

M-2 $1-\frac{2}{5}=\frac{3}{5}$

$375\times\frac{3}{5}\times\frac{3}{5}\times\frac{3}{5}=81\,l\,(M)$

$375-81=294\,l\,(W)$.

Q4 $48\times\frac{2}{3}\times\frac{1}{4}=8\,l$ alcohol

$40\,l\rightarrow$ Water

I time: $1-\frac{1}{3}=\frac{2}{3}$ (V. capacity = 1)

$1-\frac{3}{4}=\frac{1}{4}$

Q5

	$\frac{2}{3}$		$\frac{3}{5}$	
C	M : W	V-1		V-2
		2 : 3		3 : 5
		M	W	M	W
		$\frac{2}{5}$	$\frac{3}{5}$	$\frac{3}{8}$	$\frac{5}{8}$

$\frac{2}{5}+\frac{3}{8}:\frac{3}{5}+\frac{5}{8}$

$\Rightarrow \frac{31}{40}:\frac{49}{40}$

$\Rightarrow 31:49$

After blending M & W

Problems

Q1 In a group, some rabbits and pigeons
total no. of Heads $\Rightarrow$ 90
Total no. of legs $\Rightarrow$ 224.

Find the no. of rabbits in a group

Q2 ₹1390 divided amongst 600 boys & girls. Each boy gets ₹2.5. Each girl gets ₹2. Find the no. of boys exceed the no. of girls.

Q3 In a box, there are 1₹, 50p, 25p coins in the ratio 3:4:5. If the total amount is ₹300. Find the no. of 50p coins.

Q4 2 numbers are in the ratio 4:5. If 20 is added to each no., the ratio becomes 8:9. Find the two numbers earlier

Q5 2 no. are in the ratio 4:5. If 24 is added to each number, the ratio will become 16:19.
Find the 2 numbers difference.

Q6 In what ratio should be added 40% alcohol solution be mixed with 75% alcohol solution to get mixer worth of 60% alcohol.

Try

Solution

1. $x + y = 90$.

$4x + 2y = 224$.

$2x + y = 112$.

$2x + 2y = 180$

$y = 68$, $x = 22$. ✓

2. $B + G = 600$

$2.5B + 2G = 1390$.

$2B + 2G = 1200$

$0.5B = 190$

380 Boys, 220 Girls.

160. ✓

3. $x : y : z = 3 : 4 : 5$.

$x + \frac{y}{2} + \frac{z}{4} = 300$.

4. $\frac{x}{y} = \frac{4}{5}$ $\quad 5x = 4y$

$10x = 8y$

$\frac{x+20}{y+20} = \frac{8}{9}$.

$9x + 180 = 8y + 160$.

$9x - 8y = -20$.

$\Rightarrow 9x - 10x = -20$

$x = 20$, $y = 25$

1. No. of pigeons → P.
No. of rabbits → R

General

$\therefore P + R = 90$ —— (i)

$2P + 4R = 224$ —— (ii)

$R = 22$ ✓

M-2

Let assume all are rabbits

90 animals.

P: $90 \times 2 = 180$ (P-Legs)

R: $90 \times 4 = 360$ (R-Legs)

Mix: 224 (Mix-Legs)

cross-diff.

136 : 44

34 : 11

$R = \frac{11}{45} \times 90$.

$\Rightarrow 22R$ ✓

2. ₹1390.

B + G = 600

2.5/- , 2/-

Assume all are boys.

Assume all are girls

B: 600 × 2.5 — G: 600 × 2

1500₹ , 1200₹

1390₹ → mixture (middle)

190 , 110

⇒ 19 : 11 ⇒ $\frac{8}{30} \times 600 \Rightarrow 160$ ✓

6. 40% , 75%

60%

15% , 20%

⇒ 3 : 4 Ans ✓

↑ (same as above)

3. 1₹, 50P, 25P.

Total = ₹300.

Coins → 3 : 4 : 5 ← Coin Ratio

× × ×

100p 50p 25p

V → 300 : 200 : 125

12 : 8 : 5 ← Value ratio

$\frac{8}{25} \times 300 = 96$₹ → 50p coins V.

$96 = \frac{1}{2} y$

∴ 192 coins of 50p ✓

4. Take no: as 4x, 5x.

$\frac{4x+20}{5x+20} = \frac{8}{9}$ ← required placed.

SM

4 : 5

4P (+20) 4P (4 parts of ratio increased by 20 is added)

8 : 9

P = 5

20, 25 → Nos are 4P, 5P.

✓

d=1

5. (4 : 5) ×3

+24 ( ) +24

(16 : 19) ×1

+12p +14p.

M-2

d=3 ∴ parts not equal.

12 : 15

+24 ( ) +24

16 : 19

+4p +4p.

p = 6

4p = 24

difference = 3p = 18

(15p − 12p)

M-3

Fra./S.no/Sum of No./diff of NO x

Add or Sub x Second ratio diff.

Two ratio cross multiplication diff

⇒ 1 × 24 × 3 / 76 − 80 = 18 / (4×19) − (5×16)

$\frac{47x+24}{5x+24} = \frac{16}{19}$

x → Ans (diff)

M-1

V-I

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Ratio & Prop. (Handout) Pg 2

1. $x + y = 20$

$x - y = 21/2$

$\Rightarrow 2x = 22\ 1/2$.

$x = 11.25,\ y = 8.75$.

$x : y = \frac{11.25}{8.75} \Rightarrow 9 : 7\ (35)$ or $7 : 9$

2. $0.7x = 0.075y$

$\frac{x}{y} = \frac{0.075}{0.7} \Rightarrow \frac{75}{1000} \times \frac{10}{7}$

$\Rightarrow 3 : 28\ (1)$

3. x 1/27. [proportion]

3/11 5/9 $x : 1/27 = 3/11 : 5/9$

$x = \frac{3}{11} \times \frac{1}{27} \div \frac{5}{9}$

$= \frac{1}{99} \times \frac{9}{5} \Rightarrow 1 : 55\ (2)$

4. 1 x 12.5 x

$\frac{x}{1/27} = \frac{3/11}{5/9}$

M-1 (formula)

4. 8:7 Earlier.
(12.5 decrease) = 25/2
336:3
11/3 : 3
11:9 Now.

Soln
1 x 25/2 x 82 / 5
⇒ 205 Ans (3)

M-2
16 : 14
(5)
11 : 9.
5p = 25/2
p = 2.5
2p = 5

5. x + y = 37.
5x + 11y = 227
5x + 5y = 185
6y =
y = 7, x = 30 (1)

6. 7/18 x 324.36
⇒ 126.14 (3)

7. x + y = 90.3.
A + B = 90.3.
A/B = 2/1
A : B = 2 : 1.
x = 24.
y = 30.10

8. a + b + c = 625. (data missing)
a = 2/9 B
c = 3/4 A
M-1
A + 9A/2 + 3A/4
⇒ 4A + 18A + 3A = 2500
A = 100

M-2
A : B : C.
4x 2 9
2x 4 3
8 : 36 : 6
4 : 18 : 3
∴ 4/25 x 625 → 100
VI

9. A = 5B — (1)
C = 1/2 (A + B) — (2) 2C = A + B
⇒ 6B
C = 3B.
A + B + C = 99 — (3)
2C
C + C/3 + 5C/3 = 99
C(1 + 1/3 + 5/3) = 99
C(9/3)
C = 33

10. A, B, C, D → Battalions.

$\frac{1}{2}F = \frac{2}{3}S = \frac{3}{4}T = \frac{4}{5}F = K$

$F = 2K, \quad S = \frac{3K}{2}, \quad T = \frac{4K}{3}, \quad F = \frac{5K}{4}$

$2K + \frac{3K}{2} + \frac{4K}{3} + \frac{5K}{4} = 7300$

$(24 + 18 + 16 + 15)K = 7300$

$\frac{24}{73} \times 7300 = 2400$ (4)

(2, 3, 4) → 12

F : S : T : F = 24 : 18 : 16 : 15

⇒ $\frac{F}{\text{Total}}$

11. ₹1 : 50p : 25p ✗

4 : 2 : 5 : 1 · 5 → Val. ratio.

11. ₹1, 50p, 25p.

Coin → 4 : 5 : 6 ← Coin ratio

× 100p 50p 25p

400 : 250 : 150

8 : 5 : 3 ← Value ratio

$\frac{3}{16} \times 32 = ₹6$

⇒ $\frac{8}{16} \times 32 = 16₹ \cdot 17$

⇒ $\frac{5}{16} \times 32 = 10₹ \ 50p.$

12. 3 : 4 → added to numbers.

( ) + y

4 : 5.

$\frac{3x + y}{4x + y} = \frac{4}{5}$

$15x + 5y = 16x + y$

$x = y$

(4) Data inadequate.

13. 19 : 23 → Terms of ratio → 19, 23 subtracted from terms of ratio

3 : 4

⇒ $\frac{19 - x}{23 - x} = \frac{3}{4}$

$76 - 4x = 69 - 3x$

$x = 7$

*14. $\frac{3\cancel{9}}{\cancel{8}_4} : \frac{x + 7}{\cancel{15}_5} \quad \frac{14}{} \leftarrow$ before. ← present

⇒ 21 ← bill b4

20 ← bill after.

15. 1R — A. 1R — B.

90p — B. 110p — C

$\frac{A}{B} = \frac{\cancel{9}}{\cancel{10}} \frac{10}{9}$ $\quad \frac{C}{B} = \frac{11}{10}$

100 B = 90 A

BJ

A B
100

A : B = 10 : 9 , B : C = 10 : 11

A B C
10 9 10 11
100 : 90 : 99

$\therefore \frac{90}{289} \times 86700 = 27000$ (B)

16. 2 : 3 : 5
+20 +2P (4 Parts rat eq) [not pass]
4 : 5 : 7

2P = 20
P = 10
$\therefore$ 10P ⇒ 100 (3)

17. $\frac{3}{4}x = \frac{13}{10}y$

$\frac{x}{y} = \frac{4 \times 13}{3 \times 10} = \frac{52}{30} = \frac{26}{15}$ ⇒ 5

18. $\frac{G}{8} = \frac{6}{5}$

6x, 5x
⇒ 11x = 44 , x = 4

24 yr, 20 yr.
+8
32 yr, 28 yr.
8 : 7 (3)

19. R G K.

R G K.
7 17
7 17
49 : 119 : 289

4 (1) 2890

20. $\frac{7 \cdot 5}{10 \cdot 5} = \frac{80/21}{x}$

$x = \frac{10 \cdot 5 \times 80/21}{7 \cdot 5}$ ⇒ $5\frac{1}{3}$ (2)

21. 15, 25 (4)

3 : 5

10 ($2p = 10$; $p = 5$

5 : 7

22. M : F = 5 : 3

$2p = 40$ (2p ~~less~~)

$p = 20$

$8p = 160$ members [Total]

23. $\frac{F}{S} = \frac{4}{1}$ 1

$4x$; x $4x^2 = 196$

$x = 7$

Now → 28, 7.

33, 12 ⇒ 11 : 4 (3)

24. $A = \frac{B}{2}$ $\frac{A}{B} = \frac{1}{2}$ $A + B + C = 5625$

$A = \frac{1}{2}(B + C)$; $B = \frac{1}{4}(A + C)$

$A = 1875$, $B = 1125$

Rs 750 (1)

25. $\frac{S}{T} = \frac{3}{2}$

$3x - 2x = 6000$

$x = 6000$

∴ Rs 12000 (2)

1P more

$1P = 6000$

26. $\frac{M}{W} = \frac{8}{3}$

$\frac{8x}{3x + 3} = \frac{2}{1}$

$8x = 6x + 6$

$x = 3$

24 L (2)

27. $\frac{a}{b} = \frac{2}{3}$

$\frac{a^2}{b^2} = \frac{4}{9}$ (4)

28. $\frac{a}{4} = \frac{b}{5} = \frac{c}{9}$ $a = 4c/9$

$\frac{a + b + c}{c} \Rightarrow \frac{4c/9 + 5c/9 + c}{c}$

$\Rightarrow \frac{4}{9} + \frac{5}{9} + 1$

$\Rightarrow 2$ (1)

Lecture 2

Income = Expenditure + Saving.

A:B — I = 6:7
A:B — E = 8:5

I = 6x, 7x (Income)
E = 8y, 5y (Expense).

$\frac{2}{3} \times 6x = E_A$.

$E_A = 4x$ ∴ $4x = 8y$

$\boxed{x = 2y}$

I → 12y, 14y
E → 8y, 5y
S → 4y, 9y ∴ 4:9 (4)

Assumption:

I — 6:7 → 600, 700
E — 8:5 → 400, 250

$\frac{2}{3} \times 600$ $\quad 8p = 400$, $p = 50$

S → 200, 450

⇒ 4:9

30. I → 2x, 3x
E → y, 4y

$2x - y = \frac{2x}{3}$

$2x - \frac{2x}{3} = y$

$2x\left(1 - \frac{1}{3}\right) = y$

$2x \cdot \frac{2}{3} = y$ ∴ $y = 4x/3$ $\quad x = 3y/4$.

I → 3y/2, 9y/4
E → y, 4y ✗

$\frac{3y}{2} - y$, $\frac{9y}{4} - 4y$

$\frac{y}{2}$, $\frac{-7y}{4}$

$\frac{2y}{4}$, $\frac{-7y}{4}$

P Q

I → 2x, 3x (Q saves 1/3 of income)
E → y, 4y.

$3x - 4y = x$.

$2x = 4y$, $x = 2y$

I → 4y, 6y
E → y, 4y

3y, 2y 3:2 (4)

(2) PERCENTAGE

out of 100 P, 1 P?

percentage $\xrightarrow{\div 100}$ fractn

Fraction $\xrightarrow{\times 100}$ percentage

eg: 20% (P) $\longrightarrow$ 20/100 (F) = 1/5

2/5 (F) $\longrightarrow$ $\frac{2}{5} \times 100 = 40\%$ (P)

* Some percentages converted into fractions

$6\frac{1}{4}\% \Rightarrow \frac{25}{4}\% \Rightarrow \frac{25}{4\times 100} = \frac{1}{16}$

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

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

$37\frac{1}{2}\% = \frac{75}{2\times 100} = \frac{3}{8}$

$62\frac{1}{2}\% = \frac{125}{2\times 100} = \frac{5}{8}$

$75\% = \frac{3}{4}$

$87\frac{1}{2}\% = \frac{175}{2\times 100} = \frac{7}{8}$

$14\frac{2}{7}\% = \frac{1}{7}$

$16\frac{2}{3}\% = \frac{50}{3\times 100} = \frac{1}{6}$

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

$66\frac{2}{3}\% = \frac{200}{3\times 100} = \frac{2}{3}$

$11\frac{1}{9}\% = \frac{100}{9\times 100} = \frac{1}{9}$

$9\frac{1}{11}\% = \frac{100}{11\times 100} = \frac{1}{11}$

Problems

Q1 The Salary of A is 10% more than the Salary of B. By what % the salary of B is less than that of A.

Q2 The price (SP) of the article increased by 20%. after that, it is decreased by 20%. Find the overall % change.

Q3 The price of the good increased by 30%. The sales was decreased by 20%. Find the overall % change in the revenue.

Soln

1. Salary of B = x. M-1

A → 1.1x.

$\frac{1.1x - x}{1.1} \Rightarrow \frac{0.1}{1.1} = \frac{1}{10} \times \frac{10}{11}$

100 × 1.1

$100 \times \frac{120}{100} \times \frac{80}{100}$

A B
110% 100%

B < A
A < B
A > B
B > A

How much % B less than that of A

$\frac{\text{diff}}{\text{right side value}} \times 100$ VI

$\frac{100}{11} \times 100 = 9\frac{1}{11}\%$

or $\frac{\text{change}}{\text{result}} \times 100 \Rightarrow \frac{10}{110} \times 100$

$\Rightarrow 100/11$

2. 100% 120% 96%

$\frac{20}{100} \times 120$

2. Let us assume cost price 100%.

100% 120%

$100 \times \frac{120}{100} \times \frac{80}{100}$

$\Rightarrow 96\% \Rightarrow$ 4% decrease.

1) x% ↑ x% ↑ = $+x + x + \frac{x \times x}{100}$ ↑

2) x% ↓ x% ↓ = $-x - x + \frac{x \times x}{100}$ ↓

3) x% ↑ x% ↓ = $+x - \left[x - \frac{x \times x}{100}\right]$ ↓

% change = $\frac{x \times x}{100}$

Tricks

3) Gold price & Sales → 100%.

considering this 100%

$\left(100\% \times \frac{130}{100}\right) \times \frac{80}{100}$ VI

$= 104\% = 4\% \uparrow$

1. x% ↑ y% ↓ = $+x - y - \frac{xy}{100}$

2. x% ↓ y% ↓ = $-x - y + \frac{xy}{100}$

3. x% ↑ y% ↑ = $+x + y + \frac{xy}{100}$

Handout

1. $100\% \times \frac{64}{100} \times$

Manpower ↓ , Prodⁿ ↓ 36%

Manpower	bikes
100	100 — x
64	64 — y.

⇒ 64% present.

$\frac{\text{change}}{\text{result}} \times 100 = \frac{36}{64} \times 100 = 56.25\%$ (4)

2. Salary → 100%

30% + 10% + 25% = 65% (expenses).

35% Balance = 10,500.

100% bal = x

x = 30,000 (4)

3. Salary = 100%

50% left after s/l.

$\frac{20}{100} \times 50 \Rightarrow 10\%$

40% left. $\frac{75}{100} \times 40 \Rightarrow 30$

30	4200
100	x

x = 100 × 4

Salary → 100%

50% (S/L)

$50\% \times \frac{20}{100} = 10\%$ (PN)

rem 40%

M-1

$\frac{25}{100} \times 40$

10%

30% — 4200

100% — x

x = 14000

M-2

$\left(\left(x \times \frac{50}{100}\right) \times \frac{80}{100}\right) \times \frac{75}{100} = 4200$

⇒ x = 14000.

4. x.

$x \times \frac{86}{100} \times \frac{75}{100} = 1290$

= x = 2000. (2).

16. $x \times \frac{60}{100} \times \frac{50}{100} = \frac{19200 + x}{12}$

$\frac{1}{3}\left(\frac{3x}{10}\right) \frac{x}{8} = 19200$

$\frac{3x}{10} \rightarrow$ left $= 19200$

$x = 192000$

$\therefore$ Monthly $= \underline{16000}$ (3)

5. Total 9000 members $\rightarrow$ 9600

$\therefore$ (600) $\rightarrow$ M+F vice.

M	F
x	$9000 - x$
5% ↑	8% ↑.

M-1

$\frac{5}{100}x + \frac{(9000-x)8}{100} = 600$

(Mixed Meth)

Assume all females.

$\frac{9000 \times 5}{100}$ $\qquad$ $\frac{9000 \times 8}{100}$

450 $\qquad$ 720.

600

120 $\qquad$ 150

$\therefore$ 4:5

6. $\frac{25}{100}x = y - 30$

$\frac{50}{100}x = y + 20$

M-1

$x = 4y - 120$

$x = 2y + 40$

$2y + 40 = 4y - 120$

$160 = 2y$ $\qquad$ $[y = 80]$

$y = 80$, $x = 680$

-30M $\qquad$ 50 $\qquad$ $+20$M

A $\qquad$ B

25% $\qquad$ 50%

25% $\qquad$ 25%

diff in marks $\Rightarrow$ diff in %.

M-2

25% $\rightarrow$ 50M.

1% $\rightarrow$ 2M

Comp perc & marks

25% $+30$ = Pass. $\rightarrow$ 15%.

Pass = 80M

25% + 15% $\rightarrow$ 40% (Pass %)

7. 100% $\rightarrow$ 80%

140% $\rightarrow$

7. Express

$100 = 80\text{₹} + 20\text{₹}$

40% ↓ 25% ↓

$140 = 100 + 40$

$\frac{25}{100} \times 80$

$\frac{5}{20}$

Change % = $\frac{\text{Diff}}{\text{prev value}} = \frac{20}{20} \times 100 = 100\%$

8. 100 Kg soln = 5 Kg (salt) + 95 Kg (water).

Try: 80 Kg soln = 12 Kg

$\frac{15}{100} \times 80$

$\frac{4}{5}$

∴ Salt Quantity same.

$\frac{5}{100} \times x = (x-20) \times \frac{15}{100}$

$\Rightarrow \frac{x}{20} = (x-20) \cdot \frac{3}{20}$

$x = 3x - 60$

$x = 30$

9. 16

$\frac{25}{100} x = \frac{20}{100}(x+16)$

$= \frac{x}{4} = \frac{x+16}{5}$ X.

$5x = 4x + 64$

9. $\frac{25}{100} \times 16 = \frac{20}{100}(16+x)$

$= 4 = \frac{16+x}{5}$

$x = 4$ Ls (2).

10. $\frac{30}{100} \times 12 = \frac{40}{100}(12-x)$

$\Rightarrow \frac{18}{5} = \frac{x}{5}(12-x)$

$x = 3$ l. (3)

11. (1 ₹) 100p —— x oranges.

100p x $33\frac{1}{3}$%.

$\Rightarrow 33\frac{1}{3}$p ↓ —— x + 8 ↑

100p —— x.

$x = 24$ oranges

16 oranges for 1 ₹.

$\frac{5}{100} \times \text{sum} = \frac{15}{100}(x-20)$

12. 40p ↓ 20 ↓
100p x

$x = \frac{20 \times 100}{40} \Rightarrow$ 50 oranges — 1₹

20 — x oranges.

$\frac{120 \times 40}{100} = 48$ — 20 oranges.

$x = \frac{120 \times 20}{48} = 50$ oranges

50 − 20 = 30 oranges for 120 ₹

each orange = ₹4.

13. Ram, Shyam — 4:5.

R : S
4 : 5
10% ?

15%

? − 15% 5%

4 : 5 = ? − 15% : 5%.

20 = 5(x − 15)
20 = 5x − 75

$\frac{x}{5} = \frac{x-15}{5}$

5x = 95
x = 19%

14. 2 : 5
5% x

15%

x − 15 10%

$\frac{2}{5} = \frac{x-15}{10}$

20 = 5x − 75
95 = 5x
x = 19%

15. 100 Rs — 30 kg consumed.
132 Rs — 30 kg

10%

110 Rs — x

$x = \frac{110 \times 30}{132} = 25$ kg

17. A B C
118.75% 95% 100%

⇒ 18.75% = 1875
950 ₹

Scanned with CamScanner

18. M F
700, 800

MC → 175, FC → 160.

18. M : F = 7 : 8.

$\frac{80}{100} \times 8x = 156800$

M − 100% F − 100%
CM = 25% CF = 20%

AM = 75% AF = 80%

80% = 156800.
100% − x

8p → x = 196000

p = 24500

∴ 15p → 367,500.

19. A B C
120% 110% 120%

A B C → 3 : 5 : 8

3 : 5 : 6
20% 10% 20%

A : C → 1 : 2

A − 1998 = ?
∵ value not given, only ratio

20. Let total bill be x.

$\frac{x}{6}$ ← 1 person paying bill.

$\frac{15}{100} \times x = \frac{3x}{20} = \frac{x}{6} - 15$.

$\Rightarrow \frac{3x}{20} = \frac{x - 90}{6}$

$18x = 20x - 1800$

$1800 = 2x$

$x = 900p$

₹9

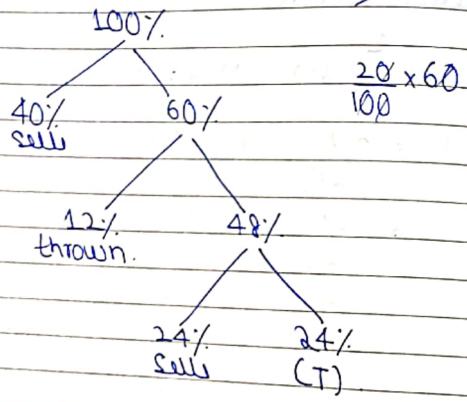
21. 100₹ ——— 16. X
80₹ ——— x.

21. 100₹ —— 16 Kg purchased.
80₹ —— 16 kg.
100₹ —— x

$x = \frac{5}{100} \times 16 = 20$.

22. $x \times \frac{60}{100} \times \frac{80}{100} \times \frac{50}{100}$

VI



$\frac{20 \times 60}{100}$

24% + 12% = 36%

23. $6d - \frac{6d - d/6}{d/6} \times 100$

$\frac{d(6 - 1/6)}{d/6} \times 100$

$\frac{35}{36} \times \frac{6}{1}$

1+3+5+7+9

33. Let no be x.

6x → Correct
x/6 → Error.

M-2

PNO: 6.
Correct = 36.
Wrong = 1

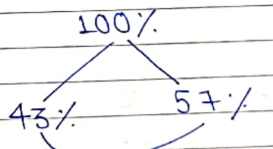
$\frac{35}{36} \times 100 = 97.22\%$

$\frac{\text{error}}{\text{corr}} \times 100$

24. 4l soln ——→ 25% sugar
+1l
5l ——→ $\frac{\text{less}}{\text{more}}$ × given value

$\Rightarrow \frac{4}{5} \times 25 = 20\%$.

25.



diff = majority = 14%.

14% —— 420
100% —— x

$x = \frac{100 \times 420}{14}$

= 3000 Votes.

VI

0.27 × 4 ⇒ 1l.

14% = 420.

SIMPLE INTEREST & COMPOUND INTEREST

SI

10000 → 10% → 1K [interest on P every yr]
10% → 1K
10% → 1K → same interest every year.
1000 1K

CI

P → 10K → 10% → I → 1K
A → 11K → 10% → 1100
12100 → 10% → 1210.
diff interest every year.
[interest on A every year].

A = P + I
P = A

SI

for first year d = 0.

$SI = \frac{PTR}{100}$

$P = \frac{100I}{TR}$; $T = \frac{100I}{PR}$

$R = \frac{100I}{PT}$;

$A = P + I = P + \frac{PTR}{100} = P\left[1 + \frac{TR}{100}\right]$

→ P = 100%) I = TR%
I = TR%

eg: P = 5000
R = 10%) TR% = 20%
T = 2

$I = 5000 \times \frac{20}{100} = 1000(I)$

∴ A = P + I

VI

A = 100% + TR%

Case 1:

P, T, R p, t, r.

$I = \frac{PRT}{100}$; $I = \frac{PRT}{100} = \frac{Prt}{r}$

i) Interest same.

$P : p = \frac{1}{TR} : \frac{1}{tr}$

Case 2:

ii) Amount same (A = a)

$P\left[1 + \frac{TR}{100}\right] = p\left[1 + \frac{tr}{100}\right]$

P, T, R p, t, r

$P : p = \frac{1}{100 + TR} : \frac{1}{100 + tr}$

SIMPLE INTEREST & CI

(i) Every year, equal interest obtained (SI)

(ii) In CI, different interests obtained due to principle on interest & interest on interest.

(iii) In CI, present year amount is next year's principle

(iv) For 1 year, SI & CI, difference (d) = 0 [Principle, Rate of Interest same]

⇒ From the both cases, interest are the same, principle ratio is same as the reciprocal value of TRs ratio

Case 1

$$P : p = \frac{1}{TR} : \frac{1}{tr}$$ ✓ VI

⇒ Case 2

From the both cases, amounts are equal, principal ratio is same as the reciprocal value of 100+TRs ratio

$$P : p = \frac{1}{TR+100} : \frac{1}{100+tr}$$

* Compound Interest

$$A = P\left(1+\frac{R}{100}\right)^T.$$

$A = P + I$ → $I = A - P$.

$$CI = P\left(1+\frac{R}{100}\right)^T - P$$ ✓

$$d = \frac{PTR}{100} - \left(P\left(1+\frac{R}{100}\right)^T - P\right)$$ VI

(i) for 1 year, SI & CI; diff (d) = 0 (R, Prop)

(ii) for 2 years, SI & CI, diff (d)

$$10^4 d = PR^2$$

(iii) for 3 years, SI & CI

$$10^6 d = PR^2(R+300)$$

HANDOUTS :

4. $SI = \frac{PRT}{100}$

Tool :

$A = P\left[1 + \frac{TR}{100}\right]$

$3P = P\left[1 + 16R\%\right]$

$2 = \frac{16R}{100}$

$R = \frac{200}{16} \Rightarrow 12.5$ ~~12.75~~ %

2. $1344 = P\left[1 + \frac{4R}{100}\right]$

$1416 = P\left[1 + \frac{6R}{100}\right]$

$\Rightarrow 141600 = P(100 + 6R)$ — (i)

$134400 = P(100 + 4R)$

$1.053 = \frac{100 + 6R}{100 + 4R}$

$105.3 + 4.214R = 100 + 6R$.

$5.3 = 1.79R$

$R = 2.9$

$I = \frac{PRT}{100}$ $\quad 2P = \frac{PRT}{100}$

$3P = \frac{PRT}{100}$

$I = P/8$. $\quad 2P = 16I$.

$\frac{2P}{P} = \frac{P \times 16}{100}$ Page No. 49 Date YOUVA

$\frac{8}{P} = \frac{P \times 16}{100}$ $\quad I = \frac{P \times t}{100}$

$100 \times \frac{1}{16}$

$\frac{P}{8} = \frac{P \times 16}{100}$

$\frac{100}{16}$.

1. Assume

(A) 100% — 300%
P A

$A - P = I$

200% — 16.
(I)

$2P = \frac{PRT}{100}$

TR

$T = \frac{200}{16} = 12.5\%$

$x + 4I = 1344$
$x + 6I = 1416$

2. $T = 4$, $A = 1344$ $\quad A - I = P$

$T = 6$ $\quad A = 1416$.

$\Delta T = 2$ $\quad \Delta A = 72$ $\quad I_4 - I_6 = 72$

$SI = 36$

$I_2 = 72$ $\quad$ ∵ Interest is same.

$I_1 = 36$.

$I_4 = 36 \times 4 = 144$.

$A - I = P$.

$1344 - 144 = 1200$ (P).

3. $T = 2$ $\quad A = 2800$

$T = 5$ $\quad A = 3250$

$\Delta T = 3$ $\quad \Delta A = 450$

300
150
~~300~~ $\quad \frac{2500 \times R \times 2}{100}$

$\therefore I = 150$.

$\Rightarrow I_2 = 300$ $\quad P = 2500$ ₹

$x + 2I = 2800$
$x + 5I = 3250$

6%

$\frac{PRT}{100} = 150$ $\quad \frac{x}{100} \times 2500 \times 3 = 150$

4. 1500 T=3

P — 5% — T=3

1500−P — 8% — T=3.

$\frac{P \times 3 \times 5}{100} + \frac{(1500-P) \times 8 \times 3}{100} = 270.$

$15P + 36000 - 24P = 27000$

$-9P = -9000$

$P = ₹1000$ $P_{8\%} = 500$

M-2

$\frac{1500 \times 3 \times 5}{100} = 225$ $\frac{1500 \times 3 \times 8}{100} = 360$

270

90 — 45

2:1

$\frac{1}{3} \times 1500 = 500$

Mixture allegation Method

5. 12500

10%

$\frac{12500 \times 10 \times 4}{100} = 5000$ $\frac{12500 \times 12 \times 4}{100} = 6000$

5520

480 — 520

12 : 13

$\frac{12}{25} \times 12500 = ₹6000$ (A)

6. 2500 R=5% T= 4 & 6 yrs.

A = a

$P : p = \frac{1}{100+TR} : \frac{1}{100+tr}$

$= \frac{1}{100+30} : \frac{1}{100+24}$

$= \frac{1}{13} : \frac{1}{12}$

$= 12 : 13$

Small part $= \frac{12}{25} \times 2500 = 1200.$

7. $P = 2000$

$A = P\left(1 + \frac{TR}{100}\right)$

$A = 2000\left(1 + \frac{8 \times 6}{100}\right)$

$A = 2960$

$\therefore$ Watch = 460₹ ✓

8. $I_1 = \frac{7500 \times 3 \times R}{100} + \frac{8000 \times 2 \times R}{100} = 770$

$= 225R + 160R = 770$

$R = 2\%$ ✓

9. $\boxed{A = P\left(1 + \frac{R}{100}\right)^T}$

$A = 1875\left(1 + \frac{4}{100}\right)^2$

$A = 2028$

M-2

$\left(1 + \frac{R}{100}\right)^T = \frac{676}{625} \times P = A$

$P \times \frac{51}{625} = C.I$

$\Rightarrow 153$ (d)

10. $\left(1 + \frac{R}{100}\right)^T \Rightarrow \left(1 + \frac{5}{100}\right)^3$

$\Rightarrow \left(\frac{21}{20}\right)^3 = \frac{9261}{8000}$

$P \times \frac{9261}{8000} = 4630.5$

$P = ₹4000$ (2) ✓

11. $A = 2420, \quad t = 2$

$2420 = P\left(1 + \frac{R}{100}\right)^2$ — (1)

$2662 = P\left(1 + \frac{R}{100}\right)^3$ — (2)

$\frac{2420}{2662} = \frac{1}{1 + R/100} = \frac{100}{100 + R}$

$2420(100 + R) = 266200$

$R = 10$ ✓

$2420 = P\left(1 + \frac{10}{100}\right)^2$

₹2000 (1) ✓

$\frac{104}{100} = \frac{52}{50} = \frac{26}{25} = \frac{676}{625}$

11. $T = 2yr \quad A = 2420$
$T = 3yr \quad A = 2662$
$\Delta T = 1yr \quad \Delta A = 242$

$A = P\left(1 + \frac{R}{100}\right)^T$

$2420 = P\left(\frac{11}{10}\right)^2$

$R\% = \frac{242}{2420} \times 1 = 10\%$

$I = \frac{PRT}{100}$ $\quad I = PR$

$242 = \frac{2420 \times R \times 1}{100}$

12. 2602

elder — younger

2yr, $r = 4\%$ $\quad$ 4yr, $r = 4\%$

$P_1\left(1 + \frac{4}{100}\right)^2 = P_2\left(1 + \frac{4}{100}\right)^4$

$\frac{P_1}{P_2} = \left(1 + \frac{4}{100}\right)^2$

$\frac{P_1}{P_2} = \left(\frac{26}{25}\right)^2 = \frac{676}{625}$

$\frac{676}{1301} \times 2602 = 1352 (4)$

$P = 2420$.
$A = 2662$.
$I = 242 = \frac{2420 \times R}{100}$

28

13. $P_1\left(1 + \frac{5}{100}\right)^5 = P_2\left(1 + \frac{5}{100}\right)^7$

$\Rightarrow \frac{P_1}{P_2} = \left(1 + \frac{5}{100}\right)^2$

$\frac{P_1}{P_2} = 1\left(\frac{21}{20}\right)^2$

$\frac{P_1}{P_2} = \frac{441}{400}$

$\Rightarrow \frac{400 \times 8410}{841} = 4000 (3)$

14. $104 d = PR^2$. $\rightarrow$ 2 years.

$104 * 144 = P \cdot \left(\frac{15}{100}\right)^2$

$\Rightarrow$ Rs 6400 (4)

15. $240 = \frac{P \times R \times 3}{100}$ VI

$\frac{x}{100} \times 80 = 10$

$T = 3, \quad I = 240 \rightarrow SI \rightarrow 80, 80, 80$.
$T = 2 \quad I = 170 \rightarrow CI$

80 $\quad$ 90 $\quad$ [80 + 10]

$\frac{x}{100} \times 80$.

Prince: I $\rightarrow$ 80 $\quad$ 10 $\leftarrow$ Interest on interest.

$10/80 \times 100 = 12.5\%$.

$\frac{x}{100} \times 80 = 10$

12.5% — 80
100% — x

x = 640₹ ✓

16. P = 1200, A = 1323, T = 2, R% ?

→ P = 1600, T = 3, A = ?

$1200\left(1+\frac{R}{100}\right)^2 = 1323$

$\left(\frac{100+R}{100}\right)^2 = \left(\frac{21}{20}\right)^2$

R = 5% ✓

⇒ $A = 1600\left(1+\frac{5}{100}\right)^3$

$= \left(\frac{21}{20}\right)^3 \times 1600$

⇒ $\frac{9261}{8000} \times 1600$

A = 1852.2₹ ✓

17. $I = \frac{PRT}{100}$ VI

$80 = \frac{P \times 4 \times 2}{100}$

$P = \frac{80 \times 100}{8} \Rightarrow$ 1000₹

$A_2 = 1000\left(1+\frac{4}{100}\right)^2$

$= 1000 \times \left(\frac{26}{25}\right)^2 = \frac{676}{625} \times 1000$ ✓

M-2

I = 80 → 40, 40

CI = ? 81.6 → 40, 40 + 4/100 × 40 → 40, 41.6 ✓

Int. on Int.

18. T = 3, R = 5%, CI = 157.625, SI = ?

Place with place → 0. CALL COLL

SI = 150

$\left(1+\frac{R}{100}\right)^3 = \left(1+\frac{5}{100}\right)^3 = \frac{9261}{8000}$

$\frac{21}{20}$

$\frac{9261}{8000} \times 1$

$\frac{1261}{8000} \times P = 157.625$

$P = 1000$

$SI = \frac{1000 \times 5 \times 3}{100}$

$\Rightarrow 150$

19. $SI = \frac{13200 \times 3 \times 10}{100} = 3960$

Try: $A = 17160$ ×

19. $A = 13200$, $T = 3$, $R\% = 10\%$

unit →	I	II	III
P →	100%	100%	100% ← eq. payment
I →	0%	10%	10%
			10%
	100%	110%	120%

$330\% = 13200$

$1\% = 40$

$100\% = 4000$

~~20~~. $P = 22,500$. $T = 3$, $R = 20\%$

eq. paym →	I	II	III
	100%	100%	100%
	0%	20%	40%
	100	120	140

$\Rightarrow 360\%$

$100\% \longrightarrow 22500$

$160\% \longrightarrow ?\ (A)$ 60% add

~~$I = 13,500$~~ $I = 13,500$

$A = 36000$,

$100\% = ?$

$360\% = 36000$

$100\% = ?$

$P = 10,000$ → amount initially

×

PROFIT & LOSS

CP < SP

Profit = SP − CP.

$\text{Profit}\% = \frac{P}{CP} \times 100$

CP > SP

Loss (L) = CP − SP.

$L\% = \frac{L}{CP} \times 100$

CP = 100%
P = P%
L = L%

SP = 100% + P%
or
100% − L%

$CP = \frac{100}{100+P} \times SP$ or, $\frac{100}{100-L} \times SP$

VII $SP = \frac{100+P}{100} \times CP$ or $\frac{100-L}{100} \times CP$

* 4AR CP = 3AR SP. What is loss/gain%?

Dsn = SP
net

P = 1AR.

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

* Two Article CP equal. One gain x%, other loss x%, overall no loss / no gain.

CP = 100,

20↑ = 120 (SP)

20% = 80 (SP)

120 + 80 = 200
100 × 20 = 200.

* Two articles SP are equal. One he gain x%, other he loss x%. Overall always loss. x = 10%

$100 \times \frac{11}{10} \times \frac{9}{10} = 99\%$

1% Loss.

* DISCOUNTS

Discount = Rebate = Concession

Marked price / Market price / Tag Price / labelled price / Announced price / Box Price.

on SP → not given discount.

MP × Balance of Discount % = Seller to SP / Buyer to CP.

eg: MP = 2000
d = 10%

$2000 \times \frac{90}{100} = 1800$ → Seller to SP / Buyer to CP.

MP = 10,000
d = 10% 20%

$10,000 \times \frac{90}{100} \times \frac{80}{100} = 7200$

⇒ Successive discounts

x%, y%

⇒ $x + y - \frac{xy}{100}$

⇒ $10\% + 20\% - \frac{200}{100} = 28\%$ (Total discount)

$\frac{72}{100} \times 10K = 7.2K$

* 2 Successive discounts of x, y% are equivalent of a single discount is:

$(x+y) - \frac{xy}{100}$ VI

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Class Handout

Try

1. CP = 2400
SP = 2700

$\frac{300}{2400} \times 100 \Rightarrow 12.5\%$ (d)

2. SP = 1530
% Loss = 10.

$\frac{90}{100} \times CP = 1530.$

$CP = \frac{1530 \times 100}{90} = Rs\ 1700$ (b)

3. SP = 2,97,000.

CP = x

$x \times \frac{110}{100} \times \frac{90}{100} = 297000 \times 2$

1. CP = 2400
SP = 2700

P = 300

$P\% = \frac{300}{2400} \times 100 = 12.5\%$ (d)

2. CP = 100%
Loss = 10%
SP = 90%

90% = 1530
100% — x

CSP = 1700 (b)

3. SP = 2,97,000 × 2 = 5,94,000 (SP)

1% Loss.

SP = 99 × 5,94,000 / 100

⇒ SP.
99% — 594000
100% — x
x = 600000 (CP)
⇒ 60 L = 6000

4. CP = 100%
L = 6%

SP = 94%. or SP, 6%.

94% —(+6/- , 12%)→ 106%.

12% = 6
100% = 50/-
↳ CP.

5. X/- ——— 12 Eggs (CP)
8X ——— 100 Eggs (SP).
8X ——— 96 eggs (CP)

96 eggs (CP) = 100 Eggs (SP).

∴ Loss = 4/100 × 100 = 4%.

6. 9 oranges ——— 16 ₹ (CP)
11 oranges ——— ₹20 (SP)

99 oranges ——— 176 ₹ (CP)
99 oranges ——— ₹180 (SP)

6. 450 ——— 180 ₹
99 ——— ₹180

6. (9 oranges — CP — 16/-) × 11
(11 or — SP — 20/-) × 9

⇒ 99 or ——— 176 CP. (eq. of oranges)
99 or ——— 180 SP

Profit = ₹4/176 × 100
CP = 23/11% Profit

7. 120 ——— x.

$\therefore CP = 12x$

$\frac{8 \times 3x}{2}$ ——— $12x$

$\frac{4 \times x}{2}$ ——— $2x$.

$\therefore SP = 14x$ ✓

$P = 2x$; $\frac{2x}{12x} \times 100 = 16\frac{2}{3}\%$ P

✓. (b)

8. CP = 800, 800, 800.

15% P | 20% L | x%

$\frac{-5 + x}{3} = 10$.

$x = 35\%$ ✓

9. $x \times \frac{125}{100} \times \frac{87.5}{100} = 875$

CP · MP

$\therefore CP = 800$ ✓

10. CP = 100%

2% ——— 140%

98% SP.

CP.

P = 42%

$\frac{42}{98} \times 100 = 42\frac{6}{7}\%$ ✓

Selling to SP

Buying to CP.

11. 8% 18%

10%

8% 2%

4 : 1

$\frac{1}{5} \times 100 = 20$ kg ✓

12. 100 l × 2 = 200/- CP ✓

(M)

(25% W)

125 l × 2.5 ⇒ 312.5/- SP.

112.5 = P.

$\Rightarrow \frac{112.5}{200} \times 100 = 56.25\%$ ✓

13. SP = 475 CP = SP + Profit/

$SP_1 = 335$. SP + loss.

✓

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SP

$475 - P = 335 + L + 10$ $\quad L = P$.

$130 = 2L, \quad L = 65$.

$CP = 335 + 65 = 400$

$CP = 475 - (65 + 10) = 400$.

M-2

$CP = \frac{SP_1 + SP_2}{2} = \frac{475 + 335}{2} = 405$

$L = \frac{-10}{2}, \quad = \frac{-5}{400}$

14. CP → 100%. $\quad L = 4\%$

loss 96% ——— 20 tables

120% ——— ?

$\frac{\text{less}}{\text{more}} \times GV$.

$\Rightarrow \frac{96}{120} \times 20 = 16$.

15. 7(5 eggs ——— ₹7 CP.)
5(7 eggs ——— ₹10 SP.) $\quad P = 2450$.

35 eggs ——— ₹49 CP

35 eggs ——— ₹50 SP.

every 35 eggs ——— ₹1 Profit.

x ——— 2450

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$\therefore x = 85750$.

16. 15 B CP = 12 B SP. ← from book seller

$P\% = \frac{3}{12} \times 100 = 25\%$

17. 12/- 15/- 18/- 21/- per 100g

4 : 3 : 2 : 1

400g 300g 200g 100g $\quad$ 10% Profit.

$\Rightarrow 1000g = 1kg$.

$48 + 45 + 36 + 21 = 150/-$ per kg. ← CP.

$\frac{150 \times 110}{100} = 165/- \rightarrow SP$

18. SP = 450/-

P = CP.

$SP = CP + P$.

$450 = 2CP$.

$\boxed{CP = 225}$

19. SP = ₹75

CP = x

P = x%

SP = CP + P

$75 = x + \frac{x \times x}{100}$

$7500 = 100x + x^2$

$x = -150, 50$

CP = ₹50

20. SP − CP

20. CP = 100% 12.5% loss.

$\frac{1}{2}$SP = 87.5

SP = 175%

P = 75% (c)

21. CP = 100%.

SP = 120%.

21. CP of sugar = 100%.

Profit = 20.

SP = 120%.

100p ——— 72p.

120p ——— x

$x = \frac{120 \times 72}{100} \Rightarrow 86.4p$

$\Rightarrow$ 13.6 → $13\frac{3}{5}$% loss

22. $\frac{10 \times 40}{100} = 4/-$

4/- ——— 56

1 ——— x

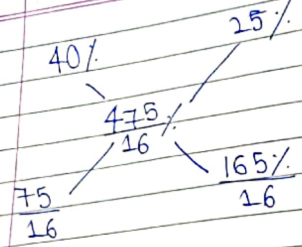
x = 14 eggs.

23. 20p + 12b → 320.

40% 25% 95/- ($\frac{475}{16}$)%.

$\frac{95}{320} \times 100$

$\frac{5}{16}$



Cost → 5 : 11

$\frac{11}{16} \times 320 = 220$

~~12 books — ₹220~~.

∴ Rs $18\frac{1}{3}$ (b)

24. CP = 100%.
SP = 115%.

In case,
CP = 75%

$\frac{75 \times 32}{100} = 24\%$.

(75+24)% SP = 99%

115% − 99% = 16% ⟶ 60.
100% ⟶ x.

x = CP = 375

25. 25 toffees — 1 ₹

100p — 25 toffees
Each toffee CP = 4p.

100p — 20 CP.
Each toffee CP = 5p

} 9p for 2 coffee (CP).

200p — 45 coffee (SP)

Each toffee = 40/9 p.

2 toffee = 80/9 p (SP)

$\text{loss} = \frac{9 - 80/9}{9p} \times 100$

$\Rightarrow 1\frac{19}{81}\%$ Loss (c)

AVERAGE

Average = Sum of quantities / No. of quantities.

A = S/N ; S = A * N

Q. Avg of 21, 23, 45, 46, 50.

$\Rightarrow \frac{185}{5} \Rightarrow 37$

Q. Avg of $3\frac{1}{3}, 4\frac{1}{2}, 5\frac{1}{4}$,

$\Rightarrow 12\left(1\frac{1}{12}\right) = \frac{13\frac{1}{12}}{3}$

$\Rightarrow \frac{157}{36} = 4\frac{13}{36}$ Ans

Handout

1. $x+1+x+7$

4. $x + x+2 + x+4 + x+6 + x+8 = 45 \times 5$

$5x + 20 = 225$

$5x = 105$

$x = 41$; $x = 41$

41, 43, 45, 47, 49
A B C D E

$\Rightarrow 2021(4)$

avg is always middle no. → convert add nos.

41 43 45 47 49

— — , 45 — , —

$47 \times 43 =$ Ans

2. A B C D. Avg = 65.

65

62 64 66 68

A B C D
62 64 66 68

$= 62 \times 68 = 4216$ (2)

3. 15 student ——— Avg = 24

Total = 15 × 24 = 360 yr

16 no ——— Avg = 25.

Total = 25 × 16 = 400 yr.

Teacher = 40 yr (2)

Q2. New person age = (old avg + new string (strength) × incr/decr avg)

VI

24 + 16 × 1

⇒ 40

4. Exp. age = 21 + 8 × 6

⇒ 21 + 48 = 69.

5. Boys avg M = 60 Girls avg M = 50 B : G = 7 : 3.

$\frac{60 \times 7 + 50 \times 3}{10}$

⇒ 57 Ans.

6. B – 25 G – 40. B : G (M) = 2 : 3

2x, 3x.

2, 3

4, 6

8, 9 12

$\frac{25 \times 2 + 40 \times 3}{45} \Rightarrow 2.4$

$\frac{25 \times 4 + 40 \times 6}{45} \Rightarrow 4.8$

$\frac{25 \times 8 + 40 \times 12}{45} \Rightarrow$

(4) cant be determined.

7. 269.47 × 7 = ₹ 1886.29

281.05 × 5 ₹ 1405.25

⇒ (4) 300. + 308.46

8. Total = 43x. (Total Wt)

$\frac{43x + 160}{x + 4} = 42.5$

43x + 160 = 42.5x + 170.

0.5x = 10.

x = 20

M-2

x 4 Ratio

43 40 (Avg).

42.5

2.5 0.5

5 : 1

x = 20

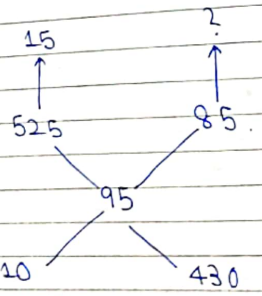
9. officers = $15 \times 525 = 7875$.
$W \times 85 = 85W$

$$\frac{85W + 7875}{W + 15} = 95$$

$$= 10W$$

M-2

$W + 0 \longrightarrow$ Avg Salary $= 95$.
all — 525 — 15
W — 85 — ?

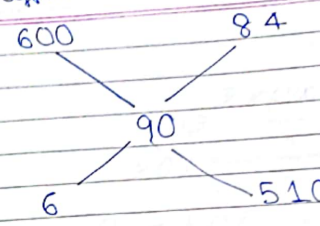


$15 : ? = 10 : 430$.

$? = 645$ workers

$E = 660$

10. 12 officers, clerks.



$$\frac{6}{510} = \frac{12}{x}$$

$x = 1020$ (3)

11. M T W Th = $48 \times 4 = 192$.
T W Th F = $46 \times 4 = 184$.

$192 + 184 + 42$

$M - F = 8$.
$F = 42 - 8 = 34$ C

12. $20 \times 5 = 100$ yr.
Present = 8 yrs.

0 yr = $-8 - 8 - 8 - 8 - 8$.

$\Rightarrow$ 60 yr.

$\Rightarrow$ 15 (2). 60/4.

13. x —— 50.

50 students —— avg x ₹ —— $50x$.

+10 students —— 70₹.

60 students —— $50x + 70$.

60 students —— $60(x-1)$.

$60(x-1) = 50x + 70$.

$\boxed{x = 13}$

Rs 650 (4)

14. Avg $= x$ $(x+5)$

$y+1$

$\frac{\text{Sum}}{6} = x$ ✓

$\frac{\text{Sum}_2}{6} = x-6$.

$\rightarrow \frac{\text{Sum}+20}{6} = x+5$

Sum +

20

$\frac{20+x(5)}{6} = x$ // $\frac{x+x(5)}{6} = x+5$

$x + 6x - 30 = 6x + 30$

(1)

14. New man wt = Old man wt + Strength x inc/dec wt

$\Rightarrow 20 + 6 \times 5$

$\Rightarrow 20 + 30$

$\Rightarrow \underline{50}$

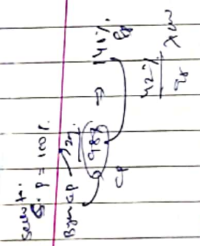
15. $A + B = 40$ yrs.

$B + C = 38$ yrs.

$A + C = 42$ yrs.

$A + B + C = 60$ yrs.

$C = 20$ yr, $A = 22$ yr, $B = 18$ yr.



$ABCD + E = 6x$ (6x)

$ABCD + E = 6(x+5)$ $x+5$

$6x - 20 + E = 6x + 30$ $6(x+5)$.

$50 = E$

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Lecture 3

* TIME & DISTANCE

600Km ——— 10hr.

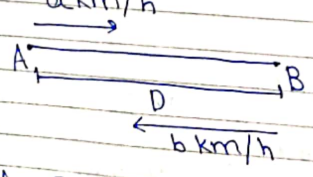
Speed = D/T D = S×T. ; T = D/S

1. General concept
2. Trains
3. Boats & Streams

→ 3 units

[1 km/h × 5/18 ——→ m/s
1 m/s × 18/5 ——→ km/h]

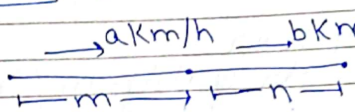
Case I : Both sides distance equal.



$$\text{Avg S} = \frac{D+D}{D/a + D/b} = \frac{2ab}{a+b}$$

$$\text{Avg S} = \frac{2ab}{a+b}$$

Case II : Distance not equal



$$\text{Avg S} = \frac{m+n}{m/a + n/b} = \frac{(m+n)ab}{mb+na}$$

$$\text{Avg S} = \frac{(m+n)ab}{mb+na}$$

* S ↑ t ↓ S ↓ t ↑ (if Distance same)

$$S \propto 1/t$$

* Relative Speed

1. S_1 ——→ (same dirn)
   S_2 ——→

$$RS = S_1 - S_2$$

2. S_1 ←—— S_2 ——→ (opp dirn)
   S_1 ——→ ←—— S_2

$$RS = S_1 + S_2$$

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* Trains.

TL → Length of train
BL/PL → Length of platform/Bridge

1. Train covers stationary man/ telephone pole/tree. (crosses)

$$D = TL$$

2. Train crosses platform.

$$D = TL + PL/BL$$

3. Train crosses another train.

$$D = TL + TL$$

* Boats & Streams

Man/Boat Speed = a km/h
river/water/flow/current speed = b km/h

along with water (Man/Boat Speed) = a + b Km/h [down Stream Speed]

against water (Man/Boat Speed) = a − b Km/h [up Stream Speed]

VI

$$\therefore \text{Man/Boat Speed} = \frac{1}{2}(dss + uss)$$

$$\text{Water/river/flow/current speed} = \frac{1}{2}(dss - uss)$$

* HANDBOOK

1. d = 24. s = 4 Km/h.
t = 6 hrs (3).

2. d left = 400.
t = 4 hrs.
s = 100 Km/h (3)

3. 168 Km —— 2 hr 40 min $2 + \frac{40}{60} \quad \frac{2}{3}$

$\frac{120}{90} \Rightarrow 4/3$ hr. $2 + \frac{2}{3} = 8/3$ hr

rem time = 4/3 hr,

(remaining)

$d = 48\,km$, $t = 4/3\,hr$

$S = \frac{48 \times 3}{4} = 36\,km/h$ (d)

4. x —— t. $\quad 20/60$

$3/4x$ —— $t + 1/3$.

M-1

$d = xt$

$\Rightarrow \frac{3x}{4} \times \left(t + \frac{1}{3}\right) = xt$

$\Rightarrow \frac{3xt}{4} + \frac{x}{4} = xt$

$\frac{x}{4} = xt - \frac{3}{4}xt$

$\frac{x}{x} = \frac{xt}{4}$ $\quad t = 1\,hr$ (2) (60 min)

5. x —— s.

$x/2$ —— $2x/s$ $\quad t$. $\quad x/t$, $x/2/2t$.

$t = x/s$.

M-1

$\frac{x/2}{2t} = \frac{x/2}{2x/s} = \frac{x}{2} \times \frac{s}{2x} = \frac{s}{4}$ (Naw) $\quad \frac{x}{t} = \frac{x/2}{2t}$, $\frac{x}{t} \times \frac{4t}{x}$, $4:1$.

8 × 4:1 = 8

(1) ~~4~~ 4:1

3. → Train crosses stationary man.

6. Speed = 42 mps. $\quad \therefore$ [Relative Speed]

S.(m) = −8

RS = 50. [$S_{TM} = 50\,m/s$]

T = 10s.

⇒ (1) 500 ms (TL)

7. 50 →

30 → → Train crosses stationary man

→ RS = 20 Km/h. = $20 \times 5/18 = 100/18$ m/s.

t = 18 s.

d = 100 m → TL

(2) 100 m

4. 3/4 S → Num value = usual time

[VI]

diff = 1p = 20 Min. $\quad$ M-2

3P × 20 → 60 M

5. D S1 T

D/2 S2 2T $\quad$ M-2 $\quad \frac{20/5 \times 18}{18}$

$S_1 : S_2 = \frac{D}{T} : \frac{D/2}{2T} = \frac{D}{T} : \frac{D}{4T}$

$= 1 : 1/4$

⇒ 4:1 (3)

8. BL = 220m
t = 36s

(BL + TL) = 36 × S ——— (i)

TL = 24 × S ——— (ii)

M-1

220 + TL = 36S
220 + 24S = 36S
220 = 12S
S = 18.33
TL = 440m (4)

→ extra dist = 220m
extra time = 12s
S = 18.33

M-2

$\frac{\quad}{TL} + \frac{\quad}{220}$

D = TL + 220. T = 36S

D = TL, T = 24S

ΔD = 220m, ΔT = 12s.

9. TL + 325 = 25S ——— (i)
TL + 250 = 20S ——— (ii)
75 = 5S
S = 15 m/s

(1) 50 m

10. ~~78~~ +

$x/7 + x/S1 = t$ ✗

$2x/S1 = t - 2.5$

$\frac{2x}{S1} = \frac{x}{7} + \frac{x}{S1} - 2.5$

$\frac{x}{S1} = \frac{x}{7} - 2.5$

$\frac{2x}{7}$

10. A ——— B T

M-1

W + R = 7 hr.
R + R = 4.5 hr.

2R = 4.5
R = 2.25 hr

W = 7 − 2.25 = 4.75.

∴ 2W = 9.5 hrs

$\frac{d}{w+r} = 7.$

$\frac{d}{2r} = 4.5$

$\frac{2r}{w+r} = \frac{7}{4.5}$

M-2

7+2.5 = 9.5 hrs

11. Avg speed = 50 km/h.
Avg speed (with stopp.) = 45 km/h.

$50t_1 = 45t_2$ X

1 hr ——— 50 km
1 hr ——— 45 km
5 km (not travelled due to stop)

60 min ——— 50 km
x ——— 5 min km

6 min

VI

* [diff of speed / Highest speed] X 60

12. 40 (T+11) = 50 (T+5)

40T + 440 = 50T + 250
190 = 10T
T = 19 min (4)

$40\left(T+\frac{11}{60}\right) = 50\left(T+\frac{5}{60}\right)$

$40T + \frac{40 \cdot 11}{60} = 50T + \frac{50 \cdot 5}{60}$

$\frac{40 \cdot 11 - 50 \cdot 5}{60} = 10T$

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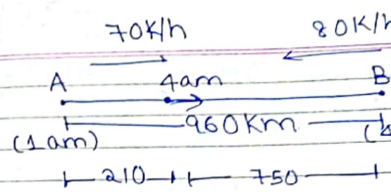
13.



A = 3 X 70 = 210 Km (already covered at 4 am).

960 − 210 = 750 Km (Rem dist.

(RS = 150 Km/h
Rd = 750 Km)

VI

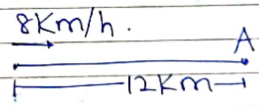
T = 5 hr

∴ 4am + 5 hrs ⟶ 9 am. (1)

14. T = 2 hrs

Ajay dist = 12 Km.
S = 2 Km/h.

T =



S = 2 Km/h
D = 12 Km
T = 6 hr

(4) 10 pm.

15. 60 Km/h ← 40 Km/h

100m 1Km 150m

Soln $\frac{1100}{100}$ $\frac{1100 \times 18}{100 \times 5}$

(app direct^n)

→ RS = 100 Km/h

→ D = 100m + 1000m + 150 + 1000.

D = 2250 mt. T = D/S

40K/h ← 150m | 60K/h → 100m

$= \frac{2250}{100 \times 5/18}$

$\Rightarrow$ 81S

16. $\frac{x}{10} + \frac{x}{20} + \frac{x}{30} + \frac{x}{40} = t$

$\Rightarrow 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = t$.

d = 40.

$S = \frac{40 \times 12}{12+6+4+3}$

$= \frac{840 \times 12}{25} \Rightarrow 19.2$ Km/h

17. d = 12Km

d = 3Km (walk)

walk d = 6Km

$\frac{3}{S} + \frac{12}{S} = T$.

$\frac{3}{S} + \frac{12}{S} + \frac{1}{2} = 2$.

M-1 $\frac{18}{S} = 4X$

$S = 18/4 = 9/2 =$

17. $d_{H-O} = 12$Km

M-2 D = 3Km (parcel).

D = 15Km (Total Journey)

T = 3/2 hr

$\therefore S = 10$Km/h

6Km/h

T = 3/6.

$\frac{1}{4} \times 2$

VI

$\frac{15}{S} = 2 - \frac{1}{2}$

$\frac{15}{S} = \frac{3}{2}$

$S = \frac{2 \times 15}{3}$

(3) 10 Km/h

18. $\frac{x}{14} + \frac{x}{10} = 2$

$24x = 280$

USS + DSS ⇒ 2 hr

DSS = 14, USS = 10.

$\frac{D}{14} + \frac{D}{10} = 2$

$\Rightarrow 11.66\ km$ (1)

19. $\frac{27}{a+b} = 4$ — (i) $27 = 4a + 4b$

$\frac{15}{a-b} = 4$ — (ii) $15 = 4a - 4b$

$12 = 8b$

$b = 6\ 3/2$

$a =$

$27 = 4a + 4 \cdot 6$.

$21 = 4a$

$a = 21/4$

$5.25 = 5 + \frac{1}{4} \times 60$

$a = 5\ 1/4\ Km/h$

20. $a = 7\ 1/2\ Km/h$.

$\frac{x}{a}$ = $\frac{x}{a-b}$

a, b, c, d

ab, ac, ad, bc, bd, cd

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$\frac{x}{a-b} = 2 \cdot \frac{x}{a+b}$ — (1)

$\frac{1}{a-b} = 2 \cdot \frac{1}{a+b}$

$a + b = 2a - 2b$

$3b = a$

$b = \frac{a}{3} = \frac{7.5}{3}$

$b = 2.5\ Km/h$ (5)

$(a-b)\ t = 15$

$(a+b)\ \frac{t}{4} = 24$

* PERMUTATIONS & COMBINATIONS

arrangements → "P"

selection → "C"

Factorial Values

- 0! = 1
- 1! = 1
- 2! = 2
- 3! = 3x2x1 = 6
- 4! = 24
- 5! = 120.
- 6! = 720. (6x5x4x3x2x1)
- 7! = 5040
- 8! = 40320

$$ {}^{n}P_{r} = \frac{n!}{(n-r)!} $$

$$ {}^{10}P_{3} = \frac{10!}{7!} = \frac{10\times9\times8\times\cancel{7!}}{\cancel{7!}} $$

$$ \Rightarrow 720 $$

10x9x8. (upto 3 digits)

$$ {}^{5}P_{2} = 5\times4 $$

$$ \Rightarrow 20. $$

$$ {}^{6}P_{3} = 6\times5\times4 = 120. $$

$$ {}^{8}P_{3} = 8\times7\times6 = 336. $$ → stop after 3 nos.

* Permutation Models:

(1) All letter type problems. [A–Z]

(2) All digit type problems. (div. by 4, 5 digit no.)

(3) A to B → b/w n stations present

1 passenger travel 1 place to another place. How many diff. kinds of tickets must be printed?

[${}^{n}P_{2}$ arrangements] (not ${}^{n}C_{2}$, ∵ return Ticket = unique)

(4) n person sitting in a row for a photograph. How many different ways arranged?

→ n! A B

AB, BA.

(5) n person sitting in a round table. Total arrangements = (n−1)!

n = 5, → 4! ⇒ 24 ways.

(6) n beads of flowers to be arranged in necklace/garland of into

$\frac{1}{2}(n-1)!$ ways.

* Combinations

$$^nC_r = \frac{n!}{(n-r)!\,r!}$$

$^5C_3 = \frac{5!}{2!\,3!} = \frac{5\times4\times3!}{2\times3!} \Rightarrow 10$

$\frac{5\times4\times3}{3\times2\times1}$

$^{10}C_3 = \frac{10\times9\times8}{3\times2\times1} = 120$

$^7C_2 = \frac{7\times6}{2\times1} = 21$

$^{10}C_4 = \frac{10\times9\times8\times7}{4\times3\times2} \Rightarrow 210$

* $^nC_0 = 1$

$^nC_1 = n$

$^nC_n = 1$

$^nC_r = {}^nC_{n-r}$ (VI)

$^5C_3 = {}^5C_2$

* Fundamental Counting Rule (FCR)

10M, 5W

Select — 5M and 5W

$^{10}C_5 \times {}^5C_5$

Select 5M or 5W

$^{10}C_5 + {}^5C_5$

* Combination Models

1. All committee type problems.

(4M, 5W, 3C) → (2M, 2W, 2C)

2. All balls/marbles/ribbons type problems.

eg: 7B, 5W, 3R → select → 3R, 2B, 1W.

3. n vertices to form a total no. of triangles.

$^nC_3$

eg: 5 vertices → $^5C_3 = {}^5C_2 = \frac{5\times4}{2\times1} = 10$

10 triangles formed

the adjacent pairs.

4. n sides of Polygon to form a total no. of diagonals.

$\boxed{{}^nC_2 - n}$

if $n=4$, ${}^4C_2 - 4 = 2$ diagonals

5. n people meeting in a place. Total no. of shake hands?

$\boxed{{}^nC_2 = \frac{n(n-1)}{2}}$

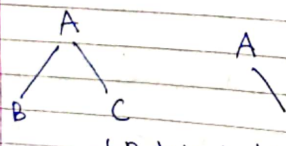
$n=6$, ${}^6C_2 = {}^6C_4 =$

$6\times5\times4\cdots = \frac{6\times5}{2} = 15$

6. n teams participated in a tournament. Total no. of games played at a place

${}^nC_2 = \frac{n(n-1)}{2}$.

VII



$= 3$

(B deleted)

(AB, BC, CA)

$\rightarrow {}^nC_2$

$A \leftrightarrow B$

(A play with B. B play with A)

$\Rightarrow$ Same thing.

EA, I.

E D A T I L

Handouts

1. CAREER — 4D. Letters.

$\cdot\ {}^6P_4 = \frac{6!}{2!} = 6\times5\times4\times3$ ✗

$- \frac{6!}{2!\times2!}$ → rep not allowed; total arr ⇒ $= \frac{720}{4} = 180$.

2. "PORTION"

Total arr − All consan together = consonants not together

$\frac{7!}{2!} - \frac{4!\times4!}{2!} = 2520 - 288 = 2232$

int. arrans.

PRTN, OIO

1 3

3. 8! − ALLS together.

VII

SSSS AAIN

1 4

$\frac{8!}{4!\times2!} - \frac{5!}{2!} = \frac{8!}{4!\times2!} - \frac{5!\times4!}{2!\times4!}$

$\Rightarrow 840 - 60 = 780$ (4)

{SOLUTIONS}

4. SOLUTION

S, L, U, T, I, O, N

$\Rightarrow 7! = 7 \times 6!$

$= 7 \times {}^{6}P_{6}$ (2)

$\frac{6!}{0!}$

5. "DETAIL"

E_A_I_ TLD.

AEI → Vowels.

$\frac{3}{①}\ \frac{3}{}\ \frac{2}{③}\ \frac{2}{}\ \frac{1}{⑤}\ \frac{1}{}$

36 $3! \times 3!$

6. ${}^{4}C_{3} \times {}^{4}C_{1} =$

$\frac{4 \times 3}{2 \times 1} \times \frac{4}{1} \Rightarrow 24$ (4)

7. B G Committee

6 6 B (5) 1 (G)

${}^{6}C_{5} \times {}^{6}C_{1} = {}^{6}C_{1} \times {}^{6}C_{1}$

$= 36$ (3)

8. 7 6 4

$7 - 2(J+A) = 5$ → out of rem 5 contest, 4 needs to be selected.

${}^{5}C_{4} = 5$ (3)

9. n = 8 — 6, 2 (1 unit) VI

Total arr — 2(AB) come together = 'AB' never come together

$\Rightarrow 8! - (7! \times 2!) = 30240$.

int. arr

10. A to Z

${}^{26}P_{3} = 26 \times 25 \times 24 = 15600$

11. 10 9 8 7.

$10 \times 9 \times 8 \times 7 = 5040$ (1)

${}^{10}P_{4}$

$10 \times 9 \times 8 \times 7$ 8! — (7! C(10, 4)

10, 4

12. 4 letters — 5 Post boxes. $^5P_4$

$5 \times 4 \times 3 \times 2 = 120$ (2)

13. 8 7 6 5

$9 \times 8 \times 7 \times 6 \times 5$.

$9 \times 10 \times 8 \times 7 \times 6$

$\rightarrow 9\ 9\ 8\ 7\ 6 = 27216$ (2)

14. 5 5 45 — 0 1 2 3 4 5 6 7 8 9

$\Rightarrow$ 125 (4) (1, 3, 5, 7, 9)

15. 9 9 2 = 180 (4)

10

16. 2 2 5

5, 7 — (0, 2, 4, 6, 8)

7, 5

21. $5 \times 2 = 10$ (5).

— 2

17. 5 5 5 5 — × — 5, 6, 7, 8, 9

V(4, 1) $5C_4 \times 4!$

V(4, 5) $\times C_1$ $5 \times 4! \times 4$.

V-I

3 2 1 — 4 ways.

shud be divisible by 4

[56, 76, 96, 68]

$\Rightarrow$ 24 (3)

48. $^8C_3 \times {}^6C_1 + {}^8C_2 \times {}^6C_2 + {}^8C_1 \times {}^6C_3 + {}^6C_4$

$\Rightarrow$ Total committee − No woman committee

= At least (1W) committee.

$\Rightarrow$ $^{14}C_4 - {}^8C_4$

$\frac{14 \times 13 \times 12 \times 11}{4 \times 3 \times 2 \times 1} - \frac{8 \times 7 \times 6 \times 5}{4 \times 3 \times 2 \times 1}$

$\Rightarrow$ 931 (1)

49. $^8C_2 \times {}^6C_2 + {}^8C_3 \times {}^6C_1 + {}^8C_4$

[1M, 3W / 0M, 4W] → not req.

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$1001 - \left({}^{8}C_1 \times {}^{6}C_3 + {}^{6}C_4 \right)$

$1001 - \left[8 \times \frac{6 \times 5 \times 4}{3 \times 2 \times 1} + \frac{6 \times 5}{2 \times 1} \right]$

8×20

$160 + 15$

$1001 - 175 = 826.$ (5)

20. ${}^{8}C_3 \times {}^{6}C_3$

$\Rightarrow \frac{8 \times 5 \times 4}{3 \times 2} \times \frac{6 \times 5 \times 4}{3 \times 2}$

$\frac{40 \times 2}{3} \times 20$

$\Rightarrow 1120$ (3)

30/6/19
Sunday

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Lecture 4

21. $n = 40$.
Total hs $= {}^{40}C_2 = \frac{40 \times 39}{2} = 780$ (4)

22. $\frac{n(n-1)}{2} = 28$

$n = 8$ (4)

23. (Later) → Probability. VII

24.

Part 1	Part 2	Total → 6Q.
6Q	6Q.	
4	2	= 6
3	3	= 6
2	4	= 6.

${}^{6}C_4 \times {}^{6}C_2 + {}^{6}C_3 \times {}^{6}C_3 + {}^{6}C_2 \times {}^{6}C_4$.

$\Rightarrow \left({}^{6}C_2\right)^2 + \left({}^{6}C_3\right)^2 + \left({}^{6}C_2\right)^2$

$\Rightarrow 225 + 400 + 225$

$\Rightarrow 850$ (3)

cant start with G,
na → 5 Gs.

25. _B_B_B_B_B_ X.

5B/4G → stand alternately.

(BGBGBGBGB)

↳ 5! × 4! = 2880 (3)

PROBABILITY

- Selection chances

P(E)/n(E)/n(S)

P(E) = Probability
n(E) = required events
n(S) = total na. of events.

$$P(E) = \frac{n(E)}{n(S)}$$

$$P(E) + P(\bar{E}) = 1.$$

↳ not required probab.

① Coins
② Dice
③ Playing cards
④ Miscellaneous.

} (Basic Models)

Coins

1 coin tossed → 2 events
2 coin tossed → $2^2 = 4$
⋮
n coin tossed → 2^n events

Dice

1 dice thrown → 6^1 events
2 dice thrown → $6^2 = 36$
⋮
n dice thrown → 6^n events

2 Dice thrown {1, 2, 3, 4, 5, 6}

VI

2 dice total value	2	3	4	5	6	7	8	9	10	11	1
No: of outcome	1	2	3	4	5	6	5	4	3	2	1

Total → $6^2 = 36$.

Playing Cards

52 cards

- 26 (Black)
  - 13 (Spades)
  - 13 (Clubs)
- 26 (Red)
  - 13 (Diamond)
  - 13 (Heart)

- Honar cards {K, Q, A, J} → Ace.

  4 × 4 = 16 cards

- Face cards {K, Q, J}

  3 × 4 = 12 cards

- Number cards {2, 3, 4, 5, 6, 7, 8, 9, 10}

  9 × 4 = 36 cards

- Total = 36 + 16 → 52 cards

Handbook

∵ 4 Ace Cards.

1. $\frac{^4C_2}{^{52}C_2} = \frac{^2\cancel{4}\times 3}{\cancel{2}\times 1} \times \frac{2\times 1}{\cancel{52}_{26}\times 51}$

   $\Rightarrow \frac{1}{221}$ (4)

2. 16 Honar cards.

   $\frac{^{16}C_3}{^{52}C_3} = \frac{\overset{8}{\cancel{16}}\times \overset{3}{\cancel{15}}\times 14}{52\times 51\times \cancel{50}\ 5}$

   $\Rightarrow \frac{28}{1105}$ (2)

3. 1J, 1K, 1Q.

   $\frac{^4C_1 \times {}^4C_1 \times {}^4C_1}{^{52}C_3}$

   $\Rightarrow \frac{4\times 4\times 4 \times \cancel{3!}}{22100}$

   $\Rightarrow \frac{16}{5525}$ (3)

4. 2 balls are drawn. Both are black balls. If first one is not replaced, second one is drawn.

Scanned with CamScanner

(kept at same place)

B-7, W-5

$\frac{^7C_1}{^{12}C_1} \times \frac{^6C_1}{^{11}C_1}$ ✓

$\frac{^7C_2}{^{12}C_2}$

$\Rightarrow \frac{7}{12} \times \frac{6}{11} = \frac{7}{22}$ (3) ✓

5. $\frac{^7C_1}{^{12}C_1} \times \frac{^7C_1}{^{12}C_1}$ [Successive].

$\Rightarrow 49/144$ (3) ✓ ✓

6. certain 2 children.

3M, 2W, 4C

3 | 2C.

$\frac{^5C_3 \times ^4C_2}{^9C_5}$ ✓

$\Rightarrow \frac{10 \times 6}{3} \times \frac{4 \times 3 \times 2 \times 1}{9 \times 8 \times 7 \times 6}$ ✓

$= 10/21$ (3) ✓

$\frac{^4C_1}{^{52}C_1} \times \frac{^4C_1}{^{51}C_1} \times \frac{^4C_1}{^{50}C_1}$

$6 \times \frac{4 \times 4 \times 4}{52 \times 51 \times 50}$

13

9 10 10 10 10 5 — even.

9 10 10 10 10 10 — all nos.

{0, 2, 4, 6, 8}

7. 9 _ _ _ _ _ _

$\Rightarrow \frac{^5C_1}{^{10}C_1} = 1/2$ (1) ✓

[0–9 digits] ⇒ 10. ✓

8. 8R, 7B, 6G

x x

$\frac{^7C_1}{^{21}C_1} = 1/3$ (5) ✓

9. 2R, 3G, 2B

x

(either red/green).

[select among them]

$\frac{^5C_2}{^7C_2} = \frac{5 \times \cancel{4}^{2}}{7 \times \cancel{6}_{3}} = 10/21$ (2) ✓

10. $\frac{1}{3} \times \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} \times 4 \times$

[1 – All are wrong = at least 1 of them correct.]

$1 - \left(\frac{2}{3}\right)^4$

$\Rightarrow 1 - \frac{16}{81} = 65/81$ (3) ✓

$\frac{^7C_2}{^{12}C_2}$ $\frac{7 \times 6 \times 2}{2 \times 12}$

11. 5W, 4B, 3Y, 4 = same colour

4 | 4 | 3 X

all white ← $\frac{^5C_4 + {}^4C_4}{^{12}C_4}$ ← all blue.

$\Rightarrow \frac{5+1}{12 \times 11 \times 10 \times 9} \times 4 \times 3 \times 2 \times 1$

$\Rightarrow \frac{6}{165}$ (1) ✓

12. 4B, 4R, 4W, 4Black.

$\frac{4C_4}{16C_4}$ $\quad \frac{1}{\frac{16 \times 15 \times 14 \times 13}{4 \times 3 \times 2}}$

$\frac{1}{1820}$

$\Rightarrow \frac{1}{1820}$ (1) ✓

13. $1 - \frac{4C_4}{16C_4}$ $\quad \frac{12C_4}{16C_4} \times$ Not woman is red.

$= 1819/1820$ (2) ✓

14. No white ball.

$\frac{12C_4}{16C_4} = \frac{495}{1820} \quad \frac{99}{364}$ ✓

15. $4/1820$

$4\left(\frac{4C_4}{16C_4}\right) = 1/455$ (4) ✓

16. $\frac{6! \times 5!}{10!} \quad 10 \times 9 \times 8 \times 7$

B = 5, G = 5 → 1 unit.

$\frac{6! \times 5!}{10!} \Rightarrow \frac{5 \times 4 \times 3 \times 2}{10 \times 9 \times 8 \times 7} = 1/42$ (3) ✓

17. n = 19.

$(n \geq 1)!$

19 → 14 | 5 (1 unit.)

VI

$\frac{(15-1)! \times 5!}{18!} = \frac{14! \times 5!}{18!}$ (5) ✓

$\Rightarrow \frac{}{19 \times 1}$ ✓

18. 5R, 4G 3R, 7B

1 − Both are same colour

$1-\left[\frac{{}^5C_1}{{}^9C_1} \times \frac{{}^3C_1}{{}^{10}C_1}\right]$

$1-\left[\frac{5}{9_3} \times \frac{3}{10_2}\right]$

5/6 (2)

19. add in favour → S : F
add in against favour → F : S

Favour : Success

$\frac{{}^4C_2}{{}^{52}C_2} = \frac{1}{221}$ (S)

F $\left(\frac{220}{221}\right)$

VI

$\frac{1}{221} \times \frac{221}{220} = \frac{1}{220}$ (3)

	T	F
A	1/5	4/5
B	3/8	5/8

20. A → T : F → 1 : 4
B → T : F → 3 : 5

likely to give → both truth
→ both false

$\left(\frac{1}{5} \times \frac{3}{8} + \frac{4}{5} \times \frac{5}{8}\right) \times 100$

$\frac{23}{40} \times 100 = 57.5\%$ (4)

→ likely to contradict 42.5%

PNC (remaining)

23. 6^3 → 216 total events

total − Any die not obtained "4" on the face

216 − 5 × 5 × 5

216 − 125 = 91 (3)

Scanned with CamScanner

TIME – WORK

→ A can do a job → n days.

per day work = 1/n th part

→ A half work → 15 days
A full work → 30 days.

* A alone can do → 25 days.
2A can do → 25/2 = 12 1/2 days
[Inverse Proportn]

* 2A can do → 15 days
A → (2A × 15)/A ⇒ 30 days.

(Capacity per day) ↑ ↓ days.

→ inversely prop.

capacity ∝ 1/days

* 10M → 100 days
100M → (10 × 100)/100 = 10 days

→ work done amount.

⇒ Depending on capacities, wages / Salaries are divided.

* 15C → 12 days
12C → 15 days

1. A → x days → (1/x) per day work
B → y days → (1/y) per day work

1/x + 1/y = (x+y)/xy per day work

∴ Total days = xy/(x+y)

VI

2. A+B → x days.
A → y days

B → xy/(x−y) → diff product

3. A → x days.
B → y days.
C → z days.

Total days = xyz/(xy + yz + zx)

84

Chain Rule

$MD = md$

$MDH = mdh$

$MD/W = md/W$

$MDH/W = mdh/W$

VI

Handout

$\frac{1}{84} \times 5 \times x = \frac{7}{12}$ ← W remain

1. 7 men ——— 12 days.
   7 men ——— 5 days.
   7 men ——→ 7 days. ← remaining work.
   Now, 5 men ——→ x days.
   $7m \times 7d = 5m \times xd$
   $49/5 \Rightarrow 9.$ days ✓

2. x ——— 50.
   $x+8$ ——— 40
   $50x = 40x + 320$
   $x = 32$

   5M ——— 7/12 W.
   $\frac{1}{x} \times 7 = 12$
   $\frac{1}{84} \times 5 \times x = \frac{7}{12} \times 8$

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3. Man = 1/100, Man + W = 1/6.
   $\frac{1}{10} + \frac{15}{y} = \frac{1}{6}$
   $\frac{15}{y} = \frac{1}{6} - \frac{1}{10} = \frac{4}{60}$
   $y = \frac{15 \times 60}{4} 15 \Rightarrow$ 225 days

M-2

3. 10M ——— 10 days (A)
   (10M + 15W) ——→ 6 days (A+B)
   15W ——→ 15 days.
   1W = 225 days

M-2 $xy/x-y$

4. A + B ——→ 60 — 1/60
   B + C ——→ 40. — 1/40.

   (A+B+C) + B ∵ (A & C absent)
   $A + 2B + C = \frac{1}{\frac{1}{60} + \frac{1}{40}}$
   $\Rightarrow \frac{60 \times 40}{100} \Rightarrow$ 24 cycles

   (A+B+C) | B | (A+B+C) | B
   → 24 cycles ∴ 48 days (3)

7. A → 20h C → 18h.
B → 30h

$\left(\frac{1}{20}+\frac{1}{30}\right)8 = \left(\frac{1}{18}\right)x$ ✗

A → 1hr work = 1/20
B → 1hr work = 1/30. ✓

1hr work = 1/12 (A+B)

$\frac{8}{12} = \frac{2}{3}$ Tank can be filled.

1 tank → 18 hr.
2/3 hr → x.

1/18 th → 1h
2/3 th → x.

$x = \frac{2}{3} \times 18 = 12$

12hr. (4) ✓

8. A → 1/3, B → 1/4, C → 1/12 (per hour work)

W → 7hrs.

1/12 W → 1hr.
x → 7hr
7/12 W → C

$\frac{1}{18} x = \frac{2}{7}$

$x = \frac{2 \times 18}{7}$

7/12

⇒ A+B = 7/12 (1hr work).

1hr ✓

$\frac{7}{12} x = \frac{1}{12} x$.

9. Peter, Paul, Pat

VI

$\frac{1}{Pet} + \frac{1}{Paw} = \frac{1}{20}$ — (i)

$\frac{1}{Paw} + \frac{1}{Pat} = \frac{1}{30}$ — (ii)

$\frac{1}{Pet} + \frac{1}{Pat} = 1/40$ — (iii). Pat = ?

$\frac{1}{Pet} - \frac{1}{Paw} = \frac{1}{40} - \frac{1}{30} \Rightarrow \frac{-10}{120}$

pet + paul − pat − pat −

2 pet = 5/120. → $\frac{1}{20} + \frac{1}{40} - \frac{1}{} = 5/120$

2 pet = 24 min

pet = 48 min ✓

Peter + Paul = 30
Paul + Pat = 30
Peter + Pat = 40.

2 Peter + Paul + Pat − Paul − Pat = 30.

$\frac{1}{18} \times x =$

$x =$

10. A ⟶ x 1/x (per day work)
B ⟶ 15 1/15

A in 5 days = 5/x of 1/x

1/15 × 5 = 1/3 work completed by B

₹40(1)

11. 12M ⟶ 18D 1 Men = 12×18
12C ⟶ 27D 1C = 12×27

M-1
5/(6×12×18) + x/(12×27)

∴ Same work

12M × 18D ⟶ 12C × 27D

M-2
2M = 3C

M = 3C/2

10M + 12C = 10×3C/2 + 12
= 27C

12C ⟶ 27D
27C ⟶ x

12×27/27 = 12D

12. 6M, 9W ⟶ 10 days

1/6M + 1/9W = 1/10

6M ⟶ 9W

2M+3W = 30D.
2M+3W = 10×3 = 2x
(15)

12. 6M, 9W ⟶ 10D
4M, 6W

6M + 9W ⟶ 10D
3(2M + 3W) = 10D

VH

M-1
4M + 6W = ?
2(2M + 3W) = ?

3×10 = 2x
(15D)

3C = 10
2C = ?

8. = 15 days ⟶ 4M, 6W

13. A & B ⟶ work per day = 1/10
C ⟶ work per day = 1/15

A = B + C A = B + C (capacity)

1/15 × 3

do

A+B+C
2A = 6
A = 12, B = 60 days.

13. A = B + C (Capacity)

A+B ⟶ 10 days.
C ⟶ 15 days. — Y.
B = ?

2B + C ⟶ 10 days.
X Y

product / diff = 10×15 / 5 = 30 days.
2B = 30 days
B = 60 days

$\frac{2}{x} + \frac{1}{15} = \frac{1}{10}$

$\frac{2}{x} = \frac{1}{10} - \frac{1}{15}$

$\frac{2}{x} = \frac{5}{150}$

$x = \frac{150 \times 2}{5} = 60$

14. Rakesh ⟶ per day work = 1/15

1/15 × 3 = 1/5 th work = Rakesh.

$\left(\frac{1}{15} + \frac{1}{x}\right) * 8 = \frac{24}{5}$

$(x + 15)8 = \frac{4 \times 15x}{5}$

$x + 15 = \frac{12x}{8}$

$15 = \frac{12x}{8} - x = \frac{4x}{8}$

A+B+C = 6 days.
2A = 6 d
A = 12 days

14. Rakesh ⟶ 15 days
per day work = 1/15.
3 day work = 1/5 th.

Remaining work = 4/5

4/5 ——— 8 days (N+R)
1W ——— 10 days.

N = 30 days.

A+B = 10
A = 12.
B = 120/2 = 60

15. A+B ———

A ——— 7 days
B ——— 8 days.

Amount = ₹1400

×24	×21	×?	×56
1/7	+ 1/8	+ 1/x	= 1/3

$\frac{1}{x} = \frac{1}{3} - \left(\frac{1}{7} + \frac{1}{8}\right)$

$= \frac{1}{3} - \frac{15}{56} = \frac{11}{56 \times 3}$

? p = 11p.

24p ⟶ 600
21p ⟶ 525.
11p ⟶ 275.

56p = 1400
1p = 25

A: 1/7 × 3 × 1400

B: 1/8 × 3 × 1400.

16. $\frac{3}{7}W$ —— 2 hours.

X — $\frac{3}{7Z}$ per hour work.

$Y = \frac{6}{7Z}$ (capacity)

M-1

$\frac{6}{7Z} \times N = \frac{2}{7}\frac{84}{}$

$N = \frac{84}{7} \times \frac{7Z}{6}$

⇒ $\frac{3}{7}W$ —— 2 hrs. (X)

M-2 $\frac{3}{7}W$ —— $2/2$ h. (Y)

$4/7 W$ —— ?

$? = \frac{4/7}{3/7} \times 2/2 = 2/3 Z$.

17. $\frac{1}{X} + \frac{1}{Y} + \frac{1}{Z} = \frac{1}{18}$ —— (1)

$\frac{1}{X} + \frac{1}{Z} = 2\left[\frac{1}{X} + \frac{1}{Y} + \frac{1}{Z}\right] - 3\left[\right.$

$\frac{1}{X} + \frac{1}{Z} = \frac{2}{Y}$ —— (2)

//

$\frac{1}{X} + \frac{1}{Y} = \frac{3}{Z}$ —— (3)

$\frac{1}{X} + \frac{1}{Y} + \frac{1}{Z} = \frac{3}{Z} + \frac{2}{4}$

$\frac{1}{X} + \frac{1}{Z} + \frac{1}{2}\left(\frac{1}{X} + \frac{1}{Z}\right)$

$\frac{2}{Y} + \frac{1}{Y} = \frac{1}{18}$

$\frac{3}{Y} = \frac{1}{18}$ $Y = 3 \times 19 = 54$

$\boxed{Y = 1/6}$ 6 days.

$\frac{1}{X} + \frac{1}{Z} = 12$ — (1)

$\frac{1}{X} + 6 = \frac{3}{Z}$

$\frac{3}{Z} - 6 + \frac{1}{Z} = 12$.

$\frac{4}{Z} = 18$ $Z = 2/9$

$\frac{1}{X} = \frac{1}{18} - \frac{1}{6} - \frac{9}{2}$

⇒ $\frac{1}{18} - 3 -$

X [not required so much calculation].

18. M — 1/20
W — 1/30
C — 1/60

Soln

$$\frac{2}{20} + \frac{8}{30} + \frac{x}{60} = \frac{1}{2}$$

M-1

$$\frac{x}{60} = \frac{1}{2} - \frac{1}{10} - \frac{4}{15}$$

$$\frac{x}{60} = \frac{15-3-8}{30}$$

$$\frac{x}{60} = \frac{4}{30}$$ ✓

17. X+Y+Z = 18D
X+Z = 2Y
X+Y = 3Z

X?

VH

3Y = 18D Y = 6D ✓

4Z = 18D Z = 7.2D

$\frac{1}{x} = \frac{5}{216}$

X → 216/5 = 43.2D

(X+Y+Z) − Y − Z = 1/18 − 1/54 − 1/72.

1M — 20

18. 1M → 20 days.
1W → 30 days
1C → 60 days.

1M×20 = 1B×60D
1W×30 = 1B×60D

2M + 8W + xB → 2 days.

M-2

1M = 3B, 1W = 2B

⇒ 6B + 16B + xB → 2 days.

22B + xB → 2 days.
B → 60 days.

22d = 30B.

x = 8B

19. work per day = 1/40.

after 35 days = 35/40 = 7/8 th.

1/8 th work → 100 → 35
7/8 x → 200 — x

100/8 — 35
1400/8 — x

19. 100M —— 40 days.

100M = 35 days.

100M —— 5 days. (planned)
+100
200 —— 5 days.

$\Rightarrow \frac{100M \times 35 + 200M \times 5}{100M}$

$\Rightarrow \frac{4500}{100} \Rightarrow 45$ days.
−40
5 days

20. 1M = 4Bays, 1W = 2Bays

20B + 40B + 40B

100B —— 1W —— 120 × 6 h.
40+20+20

80B —— 3W —— x × 3h

$\frac{100 \times 120 \times 6}{W} = \frac{80 \times 3 \times x}{3W}$

$x = \frac{100 \times 120 \times 6 \times 3}{80 \times 3}$

$x = 900$

20. 100 B — 120 d — 6 hr — x
80 B — ? — 3 hr — 3x

21. $2\left(\frac{1}{Ajit}\right) = 3\left(\frac{1}{Balj}\right)$.

$4\left(\frac{1}{Balj}\right) = 5\left(\frac{1}{Dilj.}\right)$.

$\frac{1}{Ajit} + \frac{1}{Balj.} + \frac{1}{Dilj.} = 1/20$.

$\frac{3}{2Balj} + \frac{1}{Bal} + \frac{4}{5Bal} = \frac{1}{20}$

$\frac{3}{2B} + \frac{1}{B} + \frac{4}{5B} = \frac{1}{20}$

$\frac{15 + 10 + 8}{10B} = \frac{1}{20} \times 2$

$B = (15 + 18) \times 2$

$= 66$

Baljit ⟶ 66 days

VI

M-2

$2A = 3B$ $\quad A = 3/2 B$

$4B = 5D$ $\quad D = 4B/5$.

$A + B + D = 20$.

$\frac{3}{2}B^{\times 5} + B^{\times 10} + \frac{4B}{5}^{\times 2} = 20$.

$\frac{33B}{10} = 20$

$3.3B = 20d$

$\boxed{B = 66\,D}$ ✓

22. Raju ⟶ 10D
Ramu ⟶ $15\frac{2}{3}$D
Gitu ⟶ 32D

(Raju leaves after 4D)

$\left(\frac{1}{10} + \frac{3}{47} + \frac{1}{32}\right) \times 4$

⇒ Together work ⟶ x days.

Raju = $10 \cdot \frac{1}{10} \times 4 = \frac{2}{5}$
Ramu = $\frac{3}{47}(x-3)$
Gitu = $\frac{1}{32}x$

Raju did 2/5 work

$\frac{2}{5} + \frac{3}{47}(x-3) + \frac{x}{32} = 1$

$\frac{2}{5} + \frac{3x}{47} - \frac{9}{47} + \frac{x}{32} = 1$

* Complete remaining

MENSURATION

* Polygon

Exterior angle ⟶ 360°
Each exterior angle = $\frac{360}{n}$ ✓

Each interior angle = $180 - \frac{360}{n}$

⇒ $90\left[\frac{2n-4}{n}\right]$ ✓

* Polygon area = $\frac{na^2}{4} \cot\frac{180}{n}$ VI

n ⟶ no. of sides
a ⟶ length of the side

⇒ Hexagon area = $\frac{6a^2}{4} \cot\frac{180}{6}$

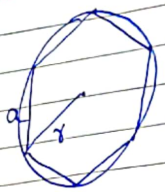
⇒ $\frac{6a^2\sqrt{3}}{4}$

$A = \frac{3\sqrt{3}}{2}a^2$ ✓

* (Polygon) no. of diagonals = $\frac{n(n-3)}{2}$ ← ${}^nC_2 - n$

⇒ In a circle, 1 regular hexagon is inscribed
The circumcircle radius = Hexagon side

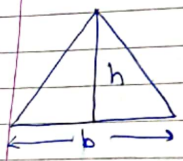
eg: n=7, 14 diag.



$r = a$

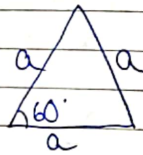
* Triangles (Area / Perimeter / SA)

3 types



$A = \frac{1}{2} \times b \times h$ ✓

⇒ Equilateral Δ



$P = 3a$

$A = \sqrt{3}/4\, a^2$

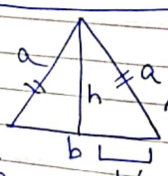
$h = \sqrt{3}/2\, a$

$\frac{\sqrt{3}a^2}{4} = \frac{1}{2} \times a \times h$

$h = \sqrt{3}a/2$

'h' given : $A = h^2/\sqrt{3}$

⇒ Isosceles Δ



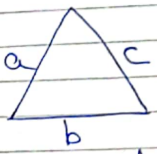
$A = \frac{b}{4}\sqrt{4a^2 - b^2}$ ✓

$P = 2a + b$ ✓

$\frac{1}{2} \times b \times h$

$h = \sqrt{a^2 - \frac{b^2}{4}}$ ✓

⇒ Scalene Δ :

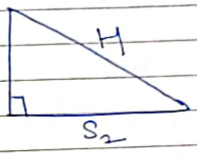


$P = a + b + c$

$s = (a+b+c)/2$

$A = \sqrt{s(s-a)(s-b)(s-c)}$ ✓

⇒ Right angled Δ

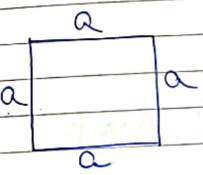


$A = \frac{1}{2} \times$ (Right angled Sides Product)

$H = \sqrt{S_1^2 + S_2^2}$ ✓

$P = H + S_1 + S_2$

* Square :



$P = 4a$ ✓

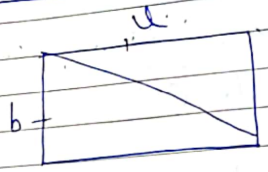
$A = a^2$ ✓

$d = \sqrt{a^2 + a^2} = \sqrt{2}\,a$ ✓

if 'd' given, $A = d^2/2$ ✓

(a^2)

* Rectangle

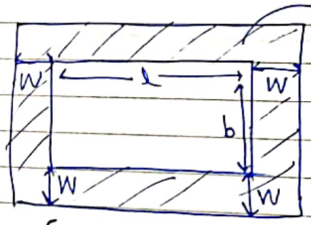


$P = 2(l+b)$ ✓

$A = l * b$ ✓

$d = \sqrt{l^2+b^2}$ ✓ → diagonal

* Rectangle outter Path area

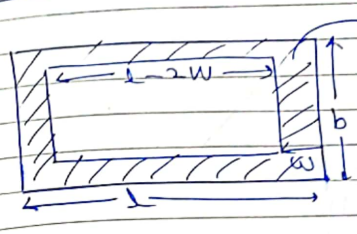


$OPA = [(l+2w)\cdot(b+2w)] - l \times b$

$OPA \Rightarrow 2w(l+b+2w)$ ✓

Q1 → $2(100+2) = 204\ m^2$ (Q1)
[Handbook]

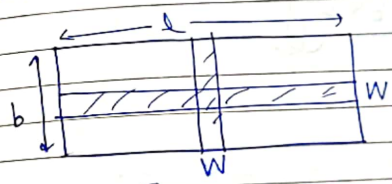
* Rectangle inner Path area



$IPA = lb - (l-2w)(b-2w)$

$IPA = 2w(l+b-2w)$ ✓

* Rectangle midway path area

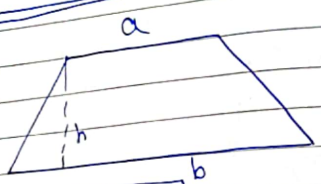


VI

$MPA = [(l \times w) + (b \times w)] - w \times w$

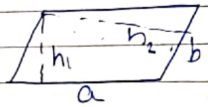
$MPA \Rightarrow w(l+b-w)$ ✓

TRAPEZIUM:



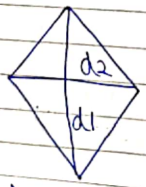
$$A = \frac{1}{2} h (a+b)$$

Parallelogram



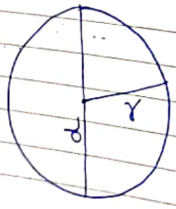
$A = a \times h_1$ $\quad b \times h_2$

Rhombus



$$A = \frac{1}{2} \times d1 \times d2$$

Circle:

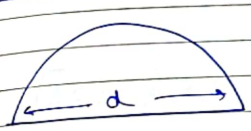


$A = \pi r^2$

$P = 2\pi r$

$d = 2r, \quad r = d/2$

Semicircle



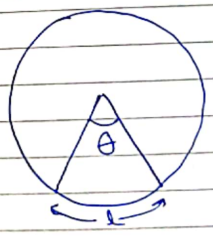
$\pi r + d = P$

$A = \pi r^2 / 2$

$C = r\left(\frac{22}{7} + 2\right)$

$C = \frac{36r}{7}$

Sector



$A = \frac{\theta}{360} \times \pi r^2$

Length of Arc (l)

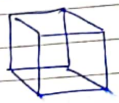
$= \frac{\theta}{360} \times 2\pi r$

⇒ Circumference of Sector = $l + 2r$

⇒ $\left(\frac{\theta}{360} \times 2\pi r\right) + 2r$.

3-DIMENSION

1. Cube



[LSA, TSA]

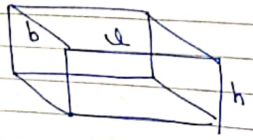
$V = a \times a \times a = a^3$

Lateral/Curved SA = $4a^2$ [Wall SA]

TSA = $6a^2$

Diagonal = $\sqrt{a^2+a^2+a^2} = \sqrt{3}a$.

2. Cuboid



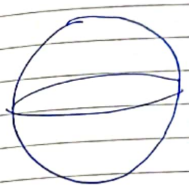
$V = l \times b \times h$.

LS = $2h(l+b)$ (4 Wall Area)

TSA = $2(lb + lh + bh)$

diagonal = $\sqrt{l^2+b^2+h^2}$.

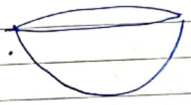
3. Sphere



$A = \frac{4}{3}\pi r^3$

LSA/TSA = $4\pi r^2$.

4. Semi-/Hemisphere



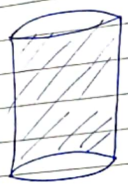
VIE

$V = \frac{2}{3}\pi r^3$.

LSA = $2\pi r^2$.

TSA = $3\pi r^2$ $(2\pi r^2 + \pi r^2)$

5. Cylinder

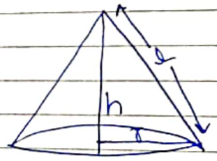


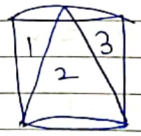
$V = \pi r^2 h$

$LSA = 2\pi r h$

$TSA = 2\pi r h + 2\pi r^2$.

6. Cone





$l^2 = h^2 + r^2$

$V = \frac{1}{3}\pi r^2 h$.

$LSA = \pi r l$

VI

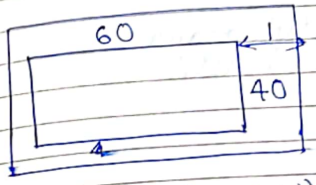
$TSA = \pi r l + \pi r^2$

$TSA \Rightarrow \pi r(l + r)$

$l \longrightarrow$ slant Height

Handout

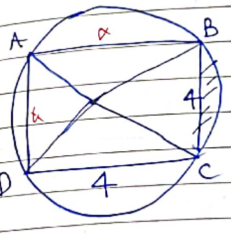
1.



$2w(l + b + 2w)$

$2(60 + 40 + 2) = 2 \times 102 = 204\ m^2$.

2.



$\sqrt{2}a$.

$\Rightarrow 4\sqrt{2}$ (diagonal)

↳ diameter.

$r = 2\sqrt{2}$

$\frac{CA - SA}{4} = \frac{\pi r^2 - a^2}{4}$

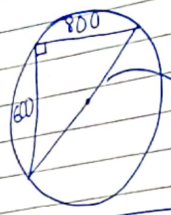
$\Rightarrow \frac{\pi(2\sqrt{2})^2 - 16}{4}$

$\Rightarrow \frac{8(\pi - 2)}{4}$

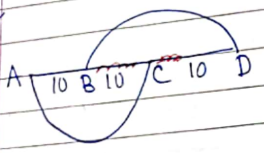
$= 2\pi - 4$ units

$60 \times \frac{1}{2} \times \cos 30 \times \frac{\sqrt{3}}{2}$

$\frac{360}{4}$

3. 

1000m (4).
Pythagorean triplet.

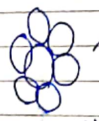
4. 

$10+10+2\pi(10)$

$AB = CD = 10$.

$AB + AC + CD + BD$

$2\pi r + 20 = 20(\pi + 1)$

5. 
Hexagon.

6.

6. $r = 8\,cm \rightarrow a = 8$

$A = \frac{3\sqrt{3}}{2} a^2$.

$= \frac{3\sqrt{3}}{2} \times 64^{32} = 96\sqrt{3}\,cm^2$ (2).

7. 10cm

8. Square $\rightarrow a^2$
rectangle $\rightarrow l * b$.

$a^2 = l * b$. Assume $a = 10$.

$l \times b = 100$.

$l = 2, b = 50$.

$P_2 = 104, \quad P_1 = 100$.

$P_2 > P_1$.

9. $A = 15 \times 18 = 270\,m^2$.

HCF = 3 tile side = 3×3.

$\frac{15^{5} \times 18^{6}}{3 \times 3} = 30$. (2)

10. a_1 a_2

$\sqrt{2} a_1 = a_2 = 10$.

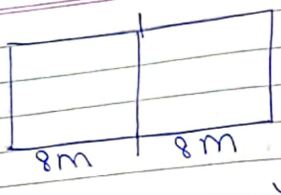
$\frac{a_1^2}{a_2^2} = \left(\frac{a_1}{a_2}\right)^2 = \left(\frac{10/\sqrt{2}}{10}\right)^2$

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

$a = 4$ $\quad l = 2$, $b = 8$

$8 < 20$

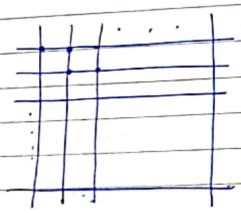
11.



$l = 16m$

(1) 8m.

12. $R = 10, C = 12$



C–C
R–R
R–C
C–R
} 2m

$l = 2m$, $b = 2m$

1R, 1C. left.

$\therefore R = 9$

$C = 11 \times 2 = 22m + 2m \longrightarrow 24m.$

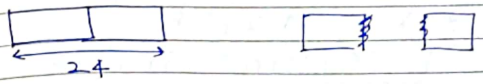
13. $r = 1\ 7/4 m$.

$C = 2\pi r = 2 \times \frac{22}{7} \times \frac{7}{4} = 11m.$

$13.2Km = 13200m / 11m$

$= 1200(2)$

14. $2 \times [(24 \times 12) + (12 \times 12) + (24 \times 12)]$



$\therefore 6a^2 + 6a^2 - 4a^2$.

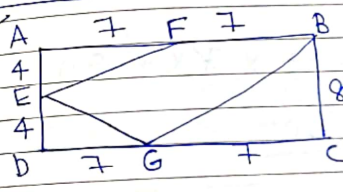
$\Rightarrow 10a^2 = 1440 m^2$

15. $\frac{4}{3}\pi r_1^3 = 2 \cdot \frac{4}{3}\pi r_2^3$.

$\frac{r_1^3}{r_2^3} = \frac{2}{1}$.

$\frac{r_1}{r_2} = 3\sqrt{2} : 1$.

16.



$14 \times 8 = 112 m^2$.

$112 - \left[\left(\frac{1}{2} \times 7 \times 8\right) + \left(\frac{1}{2} \times 7 \times 4\right) + \left(\frac{1}{2} \times 4 \times 7\right)\right.$

$112 - 56 \longrightarrow 56 cm^2$. (4)

$n \times C = 13.2 Km$.

$n \times 11 = 13200$

17. $\frac{4}{3} \times \frac{22}{7} \times 27 = \frac{22}{7} \times \frac{\pi (0.2)^2}{4} h$.

$36 \times 4 = (0.2)^2 h$.

$h = 3600\,cm \sim 36\,m$

18. $2 \times 2 \times 54 = a^3$

$\boxed{a = 6}$.

$2[4 + 108 + 108] - 6 \cdot 6^2$

$\Rightarrow 224\,cm^2$ (2)

19. $h = 50\,cm$.
$r = 7\,cm$.

$\frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 7 \times 7 \times 50$

$\therefore V = 7700\,m^2$

20. $\pi r^2 l$

$r = h = 1$ unit

CSA $_{cylinder} = 2\pi r h \Rightarrow 2\pi$.

CSA $_{Hemisphere} = 2\pi r^2 = 2\pi$.

CSA $_{cone} = \pi r \sqrt{2}$. $\quad \therefore l = \sqrt{r^2 + h^2}$

$2 : 2 : \sqrt{2}$

$\sqrt{2} : \sqrt{2} : 1$ (2)

21. $V_c = a^3$.

$d = a \cdot \quad r = a/2$.

$V_s = \frac{4}{3} \pi \frac{a^3}{8_2} \Rightarrow \pi a^3 / 6$

$\frac{V_s}{V_c} = \frac{\pi a^3}{6} \times \frac{1}{a^3} \Rightarrow \pi : 6$ (2)

22. $3 \times \frac{4}{3} \pi r^3 \Rightarrow 4\pi r^3$. $\quad r = 1$.

$C = \pi r^2 h = \pi r^2 \cdot 6r = 6\pi r^3$

$\frac{2 \cdot 4\pi}{3 \cdot 6\pi} \times 100 \Rightarrow 66\frac{2}{3}\%$ (2)

23. $V = 9 \times 40$

$= 900 \times 40 \times 20 = 720{,}000\,cm^3$.

$\Rightarrow 0.72 \times 50 = 36\,kg$.

$\frac{3 \times \frac{4}{3} \pi r^3}{\pi r^2 \times 6r}$.

Number Series

⇒ Model 1

(i) a, b, c, d, e, f, ?

(ii) 2, 3, 5, 7, 9, 13, 17 — which one is wrong?
11.
all are prime.

1. Add, sub, Mul, div
2. Add, sub, prime.
3. Squares, cubes, square Roots, cube Roots
4. $n^2 \pm 1$, $n^3 \pm 1$
5. $n^2 \pm 12$; $n^3 \pm 13$ .. etc
6. $n \times 1$, $n \times 1.5$, $n \times 2$ ....
7. $n \times 0.5 \pm 0.5$, $n \times 1 \pm 1$, $n \times 1.5 \pm 1.5$
8. $n \times 3$, $n \div 3$, $n \times 4$, $n \div 5$.

Same rule, depend on Q//.

Q1 114, 115, 107, 134, 70, ?
(1, −8, 27, 64)

Q2 2, 6, 33, 49, 174, 210, ?
(2^2, 3^3, 4^2, 5^3, 6^3)

Q3 64, 128, 92, 220, 148, ?
(64, −36, 128, −72, 256)

Sum/diff.

2, 21, 138, 705, ?

Page No.: 153
Date:

Q5 9, ?, 20, 31, 51, 82, 133
11
20+31=51 31+51=82
Soln. $+1^3 - 2^3 + 3^3 - 4^3 + 5^3$

Q4 1, 8, 27, 64, 125.
195

Q. 2^2, 27, 16, 49
20 33 4 24 42 53
$210 + 7^3 = 210 + 343 = 553$

Q3 64 + 64 = 128.
128 + = 92

148 + 256 = 404.

Q4 2 × 7 + 1 × 7 = 21
21 × 6 + 2 × 6 = 138.
138 × 5 + 3 × 5 = 705
705 × 4 + 4 × 4 ⟶ 2836

imp

Q5 9 + 11 ⟶ 20

Page No.:
Date:

6. 2, 9, 30, 105, ?, 2195 ✓

7. 3, 4, 12, 45, ? ✓

8. 1, 3, 9, 31, ?, 651 ✓

9. 5, ?, 4, 7.5, 17, 45.

10. * 15, 30, ?, 40, ?, 48 → 10
2 ÷3 ×4 ÷5 ×6 ✓

Soln

6. $2\times1+1\times7=9$
$9\times2+2\times6=30$.
$30\times3+3\times5=105$
$105\times4+4\times4=436$ ✓

7. $3\times1+1^2=4$.
$4\times2+2^2=12$
$12\times3+3^2=45$
$45\times4+4^2=196$.

$3\times1+1\times1=4$
$4\times2+2^2=12$.
$12\times3+3^2=45$

8. $1\times1+2=3$.
$3\times2+3=9$
$9\times3+4=31$
$31\times4+5=129$ ✓

$1\times1+2=3$.
$3\times2+3=9$
$9\times3+4=31$
$31\times4+5$?

9. ∴ 5 −
4×3 −

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$5\times0.5+0.5=3$
$3\times1+1=4$
$4\times1.5+1.5=7.5$
$7.5\times2+2=17$.
$17\times2.5+2.5=45$. ✓

11. 3, 10, 32, 100, ? ✓

12. * 5, 3, 4, ?, 38 ✓ VI

13. 5, 6, ?, 57, 244 ✓

14. 3, 10, 31, ?, 51 → 34 ✓
7 13 17
11

15. 5, 11, ?, 55, 117 → 25 ✓
×2+1 ×2+3 ×2+7.

Soln:

11. $3\times3+1=10$
$10\times3+2=32$
$32\times3+4=100$
$100\times3+8=308$. ✓

$5\times1-2=3$
$3\times2-2=4$.
$4\times3-2=10$
$10\times4-2=38$.

12. $5\times1-2=3$.
$3\times2-2=4$.
$4\times3-2=10$. ✓

13. $5\times1+1^2=6$.
$6\times2+2^2=16$ ✓
$16\times3+3^2=57$

$57\times4+4^2=244$. ✓

Date: 15/8

Module 2

Wrong number Series

1. 1, 2, 8, 21, 88, 445 ✓
2. 6, 7, 18, 63, 265, 1365 ✓
3. 7, 33, 58, 127, 269 ✓
4. 4, 5, 4, 9, 18, 57
5. 2, 7, 28, 146, 877

Soln.

1. 1×1+1 = 2
   2×2+2 = 6 ✓
   6×3+3 = 21
   21×4+4 = 88

2. 6×1+1² = 7
   7×2+2² = 18
   18×3+3² = 63
   63×4+4² = 268 ✓

3. 7×2+9 = 23
   23×2+11 = 57
   57×2+13 = 127
   127×2+15 = 269 ✓

1×1+1
2×2+2 = 5
6×3+3 = 21
21×4+4.
88×5+5.

6×1+1
7×2+4
18×3+9
63×4+16

4. 4×1+1 = 5
   5×1−1 = 4.
   4×2+2 = 10.
   10×2−2 = 18.
   18×3+3 = 57. ✓

5. 2×3+1 = 7
   7×4+1 = 29 ✓
   29×5+1 = 146.
   146×6+1 = 877. ✓

1. 1, 2, 4.5, 11, 30, 92.5, 329 ✓
2. 2, 5, 7, 12, 19, 32, 50. ✓ (31)
3. 2, 13, 65, 271, 817 ✓
4. 3, 4, 16, 75, 366, 1945 ✓
5. 2, 14, 91, 546, 3002, 15015.

Soln.

1. 1×1+1 = 2
   2×1.5+1.5 = 4.5
   4.5×2+2 = 11
   11×2.5+2.5 = 30.
   30×3+3 = 93 ✓

VI ✗

3. $2 \times 6 + 1 = 13$.
$13 \times 5 + 2 = 67$
$67 \times 4 + 3 = 271$
$271 \times 4 + 4 = 817$.

4. $3 \times 1 + 1 = 4$
$4 \times 1 + 2 = 16$
$16 \times 3 + 3 = 75$
$75 \times 4 + 4 = 364$
$364 \times 5 + 5 = 1945$

5. $2 \times 7 = 14$
$14 \times 6.5 = 91$
$91 \times 6 = 546$.
$546 \times 5.5 = 3003$.

VI ✗

* BLOOD RELATION ✓

G−1 → GM, GF.
G−2 → M, F, Uncle, Aunt
G−3
G−4

MA / PA.

Maternal uncle — paternal uncle

Son, daughter, Nephew, niece, Son-in-law, Daughter-in-law.

You, brother, sister, brother-in-law, sister-in-law, wife, husband.

my wife's brother.

(Don't marry Mama Ka Beta)

your sister's son = nephew.

your wife's brother's son = son in law

(your mother's brother's daughter/son → not brother/sister)

⇒ A & B are brother & sisters

A — B.

⇒ A & B are wife & Husband

A ⟷ B.

⇒ A & B are M/F to Son/Daughter:

A
|
B. ✓

⇒ A & B are GM/GF to GS/GD

A
|
( ) → gen. Gap.
|
B ✓

Q1 A is the brother of B.
C is the sister of B
D is the father of C.
E is the sister of D.
F is the husband of C.
A is the son of G.

(i) How is G related to D?

(ii) How is A " " to D?

(iii) " E " " to B?

(iv) " F " to G?

(v) How many children G have?

Soln.

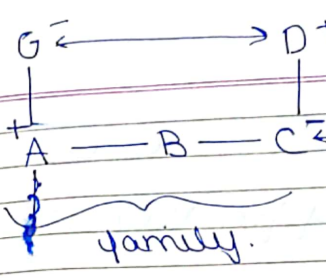
1.
(i) wife.

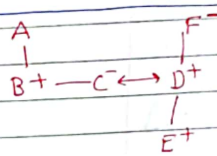
(ii) son

(iii) paternal aunt.

(iv) son in law

(v) 3





Q2 B is the son of A.
C is the sister of B
D is the husband of C
E is the son of D
F is the mother of D.

(i) How is A related to C?

(ii) " B " " E?

(iii) " F " " C?

(iv) How many male members are there?

Q3 B is the father of A but A was not a son of B. C is the sister of A, D is the husband of C. F is the daughter of D. E is the wife of B. G is the brother of E.

(i) How is A related to E?

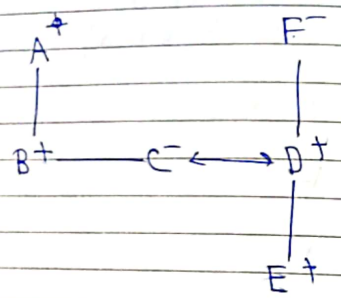
(ii) How is F related to E?

(iii) ↑ D " " G? ✓

(iv) How many females?

Soln

1.



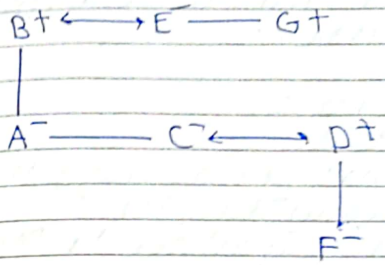
(i) father/mother. ✓

(ii) ↓ mother's brother. ✓
(Maternal uncle)

(iii) husband's mother. ✓
(mother in law)

(iv) 3/4. ✓

2.



(i) mother, daughter.

(ii) granddaughter

(iii) mother in law), brother. (son indirect).

(iv) 4. [niece's husband] ✓

* Model 2

1. Shown a person, Mahan told

"He was my father's father's daughter's son".

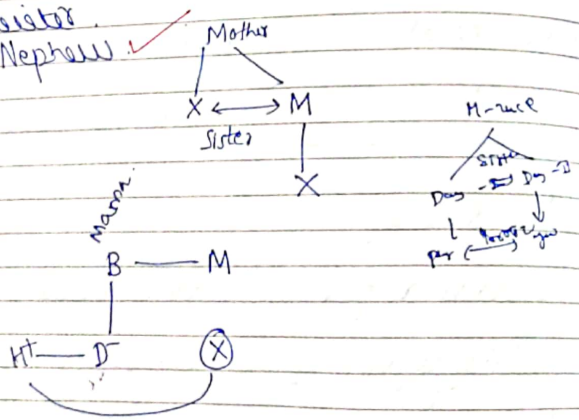
How is he related to Mahan?

2. In a Party, introduced a person. Sita told

"He was my mother's brother's daughter's husband". How is Sita related to that person?

3. Show a person:
Mohan tells
"His mother was my father's wife's only daughter.
How is boy related to Mohan?

1. brother in law (paternal aunt's son)
2. sister
3. Nephew ✓



your brother's son: my son.
your sister's son: nephew.

INTRO TO PROFIT & LOSS

- CP → buy raw products / money to build product
- SP
- Profit/Gain: (SP − CP). [SP > CP]
- Loss: (CP − SP)

Profit %:

CP — (SP − CP)
100 — [(SP − CP / CP) × 100]
y

- Loss % [Loss per 100]

CP → (SP − CP)
100 → [(CP − SP / CP) × 100]

Example 1

1. CP = 1000
SP = 1400
Profit = SP − CP = 400

1000 — 400
100 — x
x = 40% ✓

Prof/CP × 100
400/1000 × 100 = 40%

2. CP = 1000 → investment
SP = 800.
Loss = 200₹.

$\frac{\text{Loss}}{CP} \times 100$

1000 — 200.
100 — x.
x = 20%.

⇒ 20%.

* Example 2

CP = 2,00,000 + 50,000
⇒ 2,50,000$
SP = 3,00,000$

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

$= \frac{50,000}{2,50,000} \times 100$

Profit ⇒ 20%. ✓

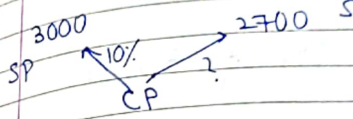
* Example 3

CP: 100 — 350₹ ; 18 — 3.5
SP: 128 — 48₹ ; 18 — 4₹
per banana.

$\frac{0.5}{3.5} \times 100 \Rightarrow 14.28\%$.

* Example 4

CP.
SP = $3000, P = 10%.



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

$\Rightarrow \frac{SP}{CP} - 1 = \frac{P}{100}$

$\Rightarrow \frac{SP}{CP} = \frac{P + 100}{100}$

$\therefore \boxed{SP = \left(\frac{100+P}{100}\right) CP}$ Profit

Note.
Loss: $SP = \left(\frac{100 - L\%}{100}\right) CP$.

$\boxed{CP = \left(\frac{100}{100+P}\right) SP}$ ✓

$CP = \left(\frac{100}{100 - L\%}\right) SP$

M-1.
$SP = \left(\frac{110}{100}\right) CP$.

or, $CP = \left(\frac{100}{110}\right) SP$.

$CP \Rightarrow \frac{10}{11} \times 3000\$$.

Now, $SP = \left(\frac{110}{100}\right) CP$ → constant

$CP \propto SP$

$\Rightarrow \frac{CP_1}{CP_2} = \frac{SP_1}{SP_2}$

$\frac{CP_1}{100} = \frac{3000}{110}$ $\quad CP_1 = \frac{10}{11} \times 3000$

M-2: $\boxed{SP = \frac{100+P}{100} \times CP}$ → $SP \propto 100+P$

$\frac{SP_1}{SP_2} = \frac{100+P_1\%}{100+P_2\%}$ → ∵ CP is constant.

$\Rightarrow \frac{2700}{3000} = \frac{100+x}{100+10}$

$x = -1$

$900+90 = 1000+x$

$P_1 = -1$ ∴ Loss = 1%

Example 5

₹13.5 (80) ₹16 (120)

$\frac{80 \times 13.5 + 120 \times 16}{200} = 15$ → ₹15 per chair is correct.

CP = ₹15

$SP = \frac{116}{100} \times 15$ (CP)

$SP = 17.4$ ₹

$SP = \frac{110}{100} \times CP$

Net CP = 3000 ₹

Net SP = $\frac{116}{100} \times 3000$

= 3480

SP of 1 chair = $\frac{3480}{200}$

Example 6

Similar hats ——— CP same.

1300 SP

P% / x

CP

CP → without

CP

4% / x

700

$\Rightarrow SP = \left(\frac{100+P}{100}\right) \times CP$ ∴ $SP \propto (100+P)$

$\Rightarrow \frac{SP_1}{SP_2} = \frac{100+x_1}{100+x_2}$

$\Rightarrow \frac{1300}{700} = \frac{100+x}{100-x}$

$1300 - 13x = 700 + 7x$

$\Rightarrow 20x = 600$

$x = 30\%$

$\therefore$ **% Profit / % Loss = 30%**

M-2: $\%P = \%L$

$$\frac{SP_1 - CP}{CP} \times 100 = \frac{CP - SP_2}{CP} \times 100$$

$\Rightarrow 2CP = SP_1 + SP_2$

$CP = 1000₹$

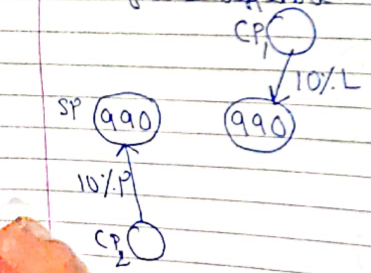
$$x = \frac{300}{1000} \times 100 \Rightarrow 30$$

$$x = \frac{300}{1000} \times 100 = 30$$

but!

Example 7

CP might be different.



Find the total investment.

CP: $SP = \frac{110}{100} * CP_2$

$\therefore CP_2 = \left(\frac{10}{11}\right) \times SP = \frac{10}{11} \times 990$

$\Rightarrow ₹900$

CP: $SP = \frac{90}{100} \times CP_1$

$CP_1 = \left(\frac{10}{9}\right) SP$

$= \frac{10}{9} \times 990 = 1100₹$

$\therefore$ Total CP = 2000₹

Total SP = 1980₹

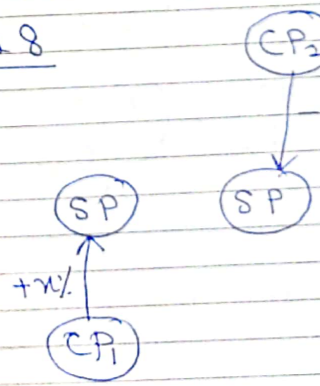
Loss = 20₹

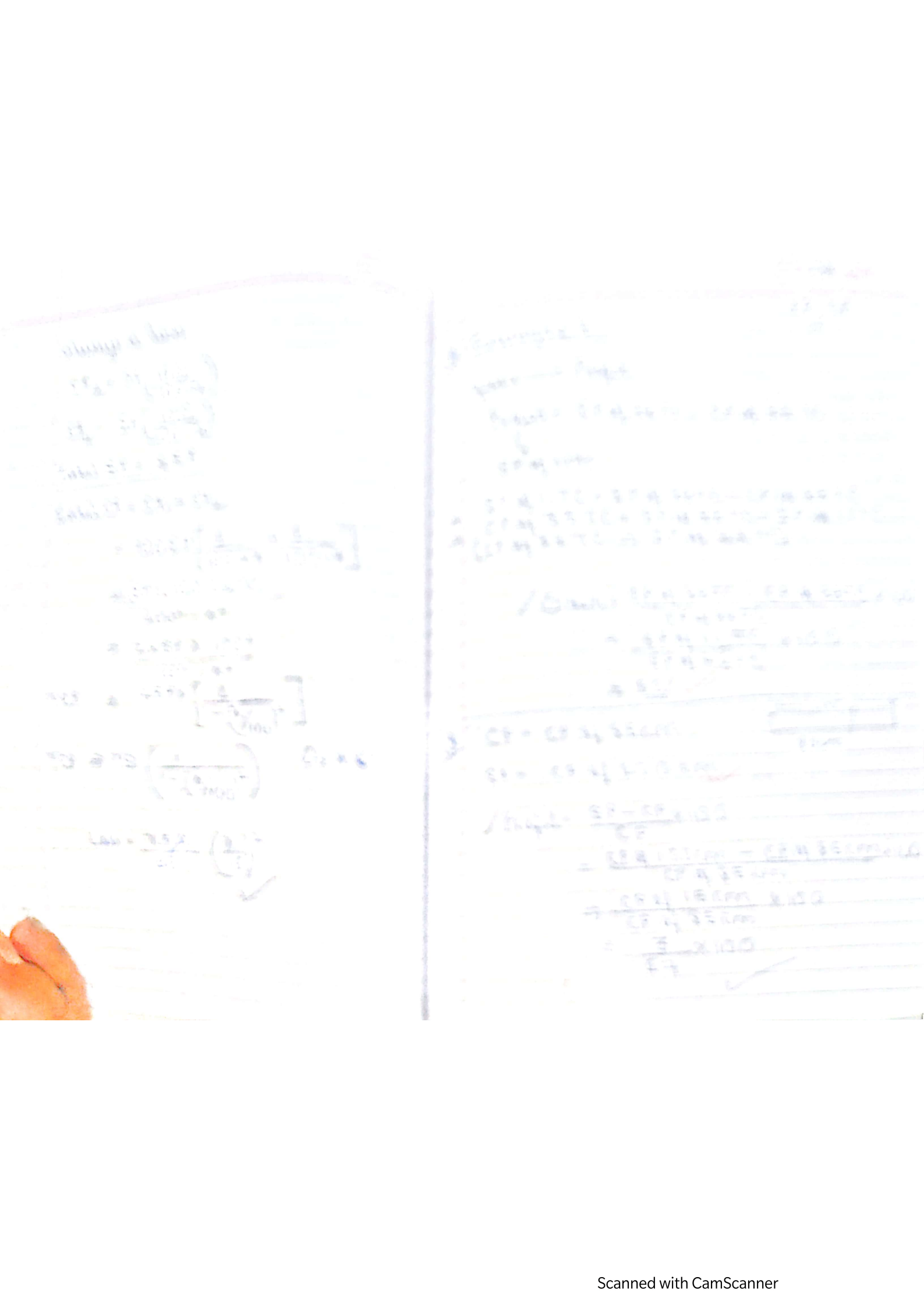
$\frac{20}{2000} \times 100 = 1\%$

if Same SP ; different CP.

1 Profit, 1 Loss & that is same.

Example 8





$x = 100$

Error $= 15$.

$$\%P = \frac{E}{x-E} \times 100$$

$(x-E)$ — x

$CP = (x-E)y$

$SP = xy$

$\therefore$ Profit $= Ey$

$$\%P = \frac{Ey}{(x-E)y} \times 100$$ ✓

Example 11

E. $SP = \left(\frac{95}{100}\right) \times 2000 \times 25L$.

~~Acp~~ $SP = \frac{125}{100} \times CP$.

$\therefore \left(\frac{95}{100}\right) \times 2000 \times 25L \times \frac{100}{125} \Rightarrow CP$.

$\therefore$ **CP = 38,000L**

//

$ASP = \frac{50}{100} \times 2000 \times 25L$.

ASP = 25000L

Loss $= 13000L$.

$5C_4 \times 4! \times 4$.

$5 \times 4 \times 4!$

$4! \times 5$.