16. (a); A's work per day = $\frac{1}{15}$

B's work per day = $\frac{1}{20}$

(A+B)'s work per day = $\frac{1}{15}+\frac{1}{20}=\frac{7}{60}$

$\therefore$ (A+B)'s work in 4 days = $4\times\frac{7}{60}=\frac{7}{15}$

$\Rightarrow$ fraction of work left $=1-\frac{7}{15}=\frac{8}{15}$

17. (c); Here, $M_1 = 270$, $M_2 = 180$, $D_1 = 10$, $D_2 = x$

By the formula

$M_1D_1 = M_2D_2 \Rightarrow 270 \times 10 = 180 \times x$

$x=\frac{270\times 10}{180}$ =15 Days

18. (d); Given, $M_1 = 4$, $D_1 = 4$, $W_1 = 4$

$M_2 = 8$, $D_2 = 8$, $W_2 = ?$

$\frac{M_1D_1}{W_1}=\frac{M_2D_2}{W_2} \Rightarrow \frac{4\times 4}{4}=\frac{8\times 8}{W_2}$

$4W_2 = 64 \Rightarrow W_2 = 16$

19. (c); A's one day's work $=\frac{1}{6}$

B's one day's work $=\frac{1}{12}$

(A + B)'s one day's work $=\frac{1}{6}+\frac{1}{12}=\frac{2+1}{12}=\frac{1}{4}$

(A + B)'s three day's work $= \frac{3}{4}$

$\therefore$ Required number of days = Remaining work × B' s time $= \frac{1}{4} \times 12 = 3$

Hence, total days = 3 + 3 = 6

Shortcut:

In 3 days, (A + B) done = 9 units

Remaining work = 12 – 9 = 3 unit

B done remaining work $= \frac{3}{1} = 3$ days

Total work completed in = 3 + 3 = 6 days

20. (c); A's one day's work $= \frac{1}{18}$

B's one day's work $= \frac{1}{15}$

Part of work done by B in 10 days $10 \times \frac{1}{15} = \frac{2}{3}$

Remaining work $= 1 - \frac{2}{3} = \frac{1}{3}$

$\therefore$ Time taken by A $= \frac{1}{3} \times 18 = 6$ days.

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Shortcut:

Work done by B 10 in days = 10 × 6 = 60 units

Remaining work = (90 – 60) = 30 units

Remaining work completed by A in $\frac{30}{5} = 6$ days.

21. (b); 10 men require 8 days to plough 20 acres of land

Let x men require 10 days to plough 100 acres of land

$$\frac{(10 \times 8)}{20} = \frac{x \times 10}{100} \Rightarrow x = 40$$

22. (a); Given, A's 1 day's work $= \frac{1}{20}$

A's 4 day's work $= \frac{4}{20} = \frac{1}{5}$

Remaining work $= 1 - \frac{1}{5} = \frac{4}{5}$

This part is completed by A and B together.

Now, (A + B)'s 1 day's work $= \frac{1}{20} + \frac{1}{12} = \frac{3+5}{60} = \frac{8}{60} = \frac{2}{15}$

Now, $\frac{2}{15}$ work is done by (A + B) in 1 day

$\therefore$ $\frac{4}{5}$ work is done in $= \frac{15}{2} \times \frac{4}{5} = 6$ days

Hence, the work lasted for 4 + 6 = 10 days.

Shortcut:

In 4 days A done = 4 × 3 = 12

Remaining work = 48

(A + B) done remaining work $= \frac{48}{5+3} = 6$ days

Work completed in (4 + 6) = 10 days

23. (a); 1 day's work of A $= \frac{1}{12}$

1 day's work of B $= \frac{1}{15}$

1 day's work of A and B $= \frac{1}{12} + \frac{1}{15} = \frac{5+4}{60} = \frac{9}{60} = \frac{3}{20}$

5 day's work of A and B $= \frac{15}{20}$

Remaining work $= 1 - \frac{15}{20} = \frac{20-15}{20} = \frac{5}{20} = \frac{1}{4}$

Time taken by A to complete $\frac{1}{4}$ work $= \frac{1}{4} \times 12 = 3$ days

Shortcut:

In 5 days,

(A + B) completed = 5(5 + 4) = 45 units

Remaining work done by A only $= \frac{60-45}{5} = 3$ days

24. (b); (A + B)'s 1 day's work $= \frac{1}{12}$ ...(i)

(B + C)'s 1 day's work $= \frac{1}{15}$ ...(ii)

(C + A)'s 1 day's work $= \frac{1}{20}$ ...(iii)

By eq. (i) + eq. (ii) + eq. (iii)

We get 2(A + B + C)'s 1 day's work

$$= \frac{1}{12} + \frac{1}{15} + \frac{1}{20} = \frac{5+4+3}{60} = \frac{12}{60} = \frac{1}{5}$$

$\therefore$ (A + B + C)'s 1 day's work $= \frac{1}{5\times 2} = \frac{1}{10}$

$\therefore$ The time taken by A, B, C together to do the same work =10 days

Shortcut:

2(A + B + C) 1 day work = 5 + 4 + 3 = 12

(A + B + C) 1 day work $= \frac{12}{2} = 6$

Total work completed by (A + B + C) in $= \frac{60}{6} = 10$ days

25. (a); 18 w's one day's work $= \frac{1}{12}$ ...(i)

12 m's one day's work $= \frac{1}{9}$ ...(ii)

Now dividing equation (i) by equation (ii), we have

$\frac{18w}{12m} = \frac{1}{12} \times \frac{9}{1} = \frac{9}{12}$ 2w = 1m

Or, 1 man = 2 women $\Rightarrow$ 8 men = 16 women

$\therefore$ 8 men and 8 women = 16 + 8 = 24 women

$\because$ 18 women can complete the work in 12 days

$\therefore$ 24 women can complete the work in $= \frac{12 \times 18}{24} = 9$ days.

26. (d);

2 (A + B + C)'s 1 day work = 4 + 3 + 2

(A + B + C)'s 1 day work = $\frac{9}{2}$

(A + B + C) completed the work in $= \frac{24 \times 2}{9} = \frac{16}{3}$

1 day work of B = 1 unit

B completed the work in 48 days.

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27. (b); Suppose there were x men originaly

Then by using formula, $M_1D_1 = M_2D_2$

we have $10x = 12(x - 5)$

$$\therefore \quad x = \frac{(12 \times 5)}{12 - 10} = 30 \text{ men}$$

28. (a); Let B alone can do the work in x days.

$\therefore$ A can do the work in $\frac{3x}{2}$ days.

According to the question,

$$\frac{1}{x} + \frac{2}{3x} = \frac{1}{18} \Rightarrow 3x = 18 \times 5 \Rightarrow \frac{18 \times 5}{3} = 30 \text{ days}$$

29. (a); A's one day's work $= \frac{1}{4}$, B's one day's work $= \frac{1}{6}$

$\therefore$ Required no. of days to complete the work by A and B together

$$= \frac{12}{5} = 2\frac{2}{5} \text{ days.}$$

Shortcut:

Work completed in $= \frac{12}{3+2} = \frac{12}{5} = 2\frac{2}{5}$ days

30. (c); Work done by (A + B) in 1 day $= \frac{1}{18}$ ...(i)

Work done by (B + C) in 1 day $= \frac{1}{24}$ ...(ii)

Work done by (C + A) in 1 day $= \frac{1}{36}$ ...(iii)

On adding equation (i), (ii) and (iii)

Work done by 2(A + B + C) in 1 day

$$= \frac{1}{18} + \frac{1}{24} + \frac{1}{36} = \frac{4+3+2}{72} = \frac{9}{72} = \frac{1}{8}$$

$\therefore$ Work done by (A + B + C) in 1 day $= \frac{1}{8 \times 2} = \frac{1}{16}$

$\therefore$ A, B, C together finish the work in 16 days

Shortcut:

2(A + B + C)'s 1 day work = 4 + 3 + 2 = 9 units

(A + B + C)'s 1 day work $= \frac{9}{2}$

Total work completed by (A + B + C) in $\frac{72}{\frac{9}{2}} = \frac{72 \times 2}{9}$ = 16 days

31. (a); Let A and B worked together for x days

According to the question,

Part of work done by A for (x + 10) days + part of work done by B for x days = 1

$$\frac{x+10}{20} + \frac{x}{30} = 1 \Rightarrow \frac{3x+30+2x}{60} = 1$$

$5x + 30 = 60 \Rightarrow 5x = 30 \quad \Rightarrow \quad x = \frac{30}{5} = 6$ days

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32. (b); A can complete the work in 6 days.
B can complete the work in 5 days.
We know that there is inverse relation between time and work and amount of Rs. 220 will be distributed in the ratio of their work.

B will get an amount $= \frac{6}{11} \times 220 = \text{Rs. } 120$.

33. (c); Let the total work be 11 units

Then, $P + Q \rightarrow 8$ units

R does $\rightarrow (11 - 8)$ units $= 3$ units

R's share $= \frac{3}{11} \times 660 = \text{Rs. } 180$

34. (b); Given, $H_1 = 6h$, $D_1 = 18$, $H_2 = ?$, $D_2 = 12$
By the Formula

$H_1D_1 = H_2D_2 \Rightarrow H_2 = \frac{6 \times 18}{12} = 9h$

35. (b); B's 1 day's work = [(A + B)'s 1 day's work] – [A's 1 days's work]

$\left(\frac{1}{2} - \frac{1}{6}\right) = \frac{2}{6} = \frac{1}{3}$

∴ B alone can finish the job in 3 days.

36. (b); According to question.
(6M+8B) x 10 = (26M + 48B) x 2
∴ 60M + 80B = 52M + 96B or, 1M = 2B
∴ 15M + 20B = (30 + 20) B = 50 boys
6M + 8B = (12 + 8) boys = 20 boys
20 boys can finish the work in 10 days.

∴ 50 boys can finish the work in = $\frac{20 \times 10}{50}$ = 4 days

37. (a); 10 men = 20 boys

$\therefore$ 1 man = 2 boys $\Rightarrow$ 8 men = 16 boys

(8M + 4B) = (16 + 4) boys = 20 boys

Hence 8 men and 4 boys will make 260 shirts in 20 days.

38. (c); Work done by A in 3 days = $\left(3 \times \frac{1}{12}\right) = \frac{1}{4}$.

Remaining work = $\left(1 - \frac{1}{4}\right) = \frac{3}{4}$.

Now , (A + B)'s 1 day's work

$= \left(\frac{1}{12} + \frac{1}{15}\right) = \frac{9}{60} = \frac{3}{20}$

Remaining work will be finished in

$x = \frac{3}{4} \times \frac{20}{3} = 5$ days.

39. (d); Man : boy = 3 : 1

$\therefore$ Boy's share $= \frac{1}{4} \times 800 =$ Rs. 200

$\therefore$ The daily wages of boy $=$ Rs. $\left(\frac{200}{5}\right) =$ Rs. 40

40. (a); (A + B)'s 1 day's work = $\left(\frac{1}{30} + \frac{1}{60}\right) = \frac{1}{20}$

$\therefore$ Both working together can finish the work in 20 days.

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Moderate

1. (d); Let $M_1 = x$ and $D_1 = 18$ days
But 6 men went on leave and it took 20 days to complete the work.
$\therefore$ $M_2 = (x - 6)$ and $D_2 = 20$ days
By the formula
$M_1D_1 = M_2D_2 \Rightarrow (x \times 18) = (x - 6) \times 20$
$18x = 20x - 120 \Rightarrow 20x - 18x = 120$
$2x = 120 \Rightarrow x = 60$ men.

2. (a); 3(5men + 5 women) = 660

$$(5 \text{ men} + 5 \text{ women}) = \frac{660}{3} = 220 \quad ...(i)$$

5(10 men + 20 women) = 3500

$$(10 \text{ men} + 20 \text{ women}) = \frac{3500}{5} = 700 \quad ...(ii)$$

On solving 1 and 2
$10w = 700 - 440 = 260 \Rightarrow 1w = 26$
Similarly,
$5m + 5 \times 26 = 220$

$$1m = \frac{220 - 130}{5} = \frac{90}{5} = \text{Rs. } 18$$

Required no. of days

$$= \frac{1060}{(18 \times 6 + 26 \times 4)} = \frac{1060}{212} = 5 \text{ days}$$

3. (a); 7 men = 10 women, 1 man $= \frac{10}{7}$ women

14 men + 20 women

$$= \left(\frac{10 \times 14}{7} + 20\right) = 40 \text{ women}$$

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By the formula

$$\frac{M_1D_1}{W_1} = \frac{M_2D_2}{W_2} \Rightarrow \frac{10 \times 10}{100} = \frac{40 \times D_2}{600}$$

$$D_2 = \frac{600}{40} \Rightarrow D_2 = 15 \text{ days}$$

4. (b); Work done by A and B in 2 days $= \frac{1}{3} \times 2 = \frac{2}{3}$

Remaining work $= 1 - \frac{2}{3} = \frac{1}{3}$

Now, $\frac{1}{3}$ work is done by A in 2 days

$\therefore$ Whole work will be done by A in = 2 × 3 = 6 days

$\therefore$ B's 1 days' work $= \frac{1}{3} - \frac{1}{6} = \frac{2-1}{6} = \frac{1}{6}$

$\therefore$ B alone can do the work in 6 days.

Shortcut:

$$A + B \rightarrow 3 \xrightarrow{1} 3$$

In 2 days (A + B) done 2 unit of work. Remaining work done by A in 2 days. 1 day's work of

$$A = \frac{1}{2} \text{ unit}$$

1 day's work of $B = \frac{1}{2}$ unit

Work is completed by A in $= \frac{3}{\frac{1}{2}} = 6$ days

5. (b); Time taken by P in completing whole work = 10 × 4 = 40 days.
Time taken by Q in completing whole work

$$= \frac{15 \times 5}{2} = \frac{75}{2} \text{ days} = 37\frac{1}{2} \text{ days}$$

Time taken by R in completing 1 work = 13 × 3 = 39 days
Time taken by S in completing 1 work = 7 × 6 = 42 days
Clearly, Q took the least time

i.e., $37\frac{1}{2}$ days.

Work done time ratio of P, Q, R, S to complete the whole work will be (total time / one day's work)

$$P : Q : R : S = \frac{10}{\frac{1}{4}} : \frac{15}{\left(\frac{40}{100}\right)} : \frac{13}{\frac{1}{3}} : \frac{7}{\frac{1}{6}} \qquad = 40 : 37\frac{1}{2} : 39 : 42$$

Hence, Q will be able to complete the work first.

6. (a); (A + B)'s 1 day's work $= \frac{1}{20} + \frac{1}{40} = \frac{2+1}{40} = \frac{3}{40}$

∴ (A + B)'s 5 day's work $= 5 \times \frac{3}{40} = \frac{3}{8}$

∴ Remaining work $= 1 - \frac{3}{8} = \frac{5}{8}$

Trick;

5 days work of (A + B) = 5(2 + 1) = 15

Remaining work $= \frac{25}{40} = \frac{5}{8}$

7. (b); C's efficiency $= \frac{1}{20}$

$\therefore$ The efficiency of $(A+B) = 2 \times \frac{1}{20} = \frac{1}{10}$

$\therefore$ A's efficiency + B's efficiency $= \frac{1}{10}$

$\therefore$ A's efficiency + 2 × A's efficiency $= \frac{1}{10}$

3 × A's efficiency $= \frac{1}{10}$

$\therefore$ A's efficiency $= \frac{1}{10 \times 3} = \frac{1}{30}$

$\therefore$ B's efficiency $= \frac{1}{10} - \frac{1}{30} = \frac{3-1}{30} = \frac{2}{30} = \frac{1}{15}$

$\therefore$ (A + B + C)'s efficiency $= \frac{1}{30} + \frac{1}{15} + \frac{1}{20} = \frac{2+4+3}{60} = \frac{9}{60} = \frac{3}{20}$

A, B, C together can do the work in $\frac{20}{3} = 6\frac{2}{3}$ days.

8. (a); 12 men = 18 women $\Rightarrow$ 2 men = 3 women

$\Rightarrow$ 8 men = 12 women

$\therefore$ 8 men and 16 women = 12 women + 16 women = 28 women

$\therefore$ 18 women can make a wall in 14 days

Let 28 women can make the same wall in x days

$\therefore$ 18 × 14 = 28 × x $\Rightarrow$ x $= \frac{18 \times 14}{28} = 9$ days

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9. (d); Let the original number of men be x

$x \times 160 = (x + 18)(160 - 20)$

Original number of men, x $= \frac{18 \times (160 - 20)}{20} = 126$

10. (a); 35 men do the rest of the job in = (38 – 25 – 1) days = 12 days

∴ 30 men can do the rest of the job in $= \frac{12 \times 35}{30} = 14$ days

Thus the work would have been finished in 25 + 14 = 39 days, that is 39 – 38 = 1 days after the scheduled time.

11. (d); If each child takes twice the time taken by a man, 8 children = 4 men.

∴ 8 children + 12 men = 16 men do the work in 9 days

∴ 12 men finish the work in $\frac{9 \times 16}{12} = 12$ days.

CAREER POWER

12. (a); $18(A + B + C) \rightarrow$ Rs. 2700

$A + B + C \rightarrow 150$ ...(i)

$10(A + C) \rightarrow 940$

$A + C \rightarrow 94$ ...(ii)

$20(B + C) \rightarrow 1520$

$B + C \rightarrow 76$ ...(iii)

On solving (i) and (ii)

(A + B + C) – (A + C) = 150 – 94

Daily wages of B = Rs. 56

B + C = 76 $\Rightarrow$ C = Rs. 20

13. (a); In the first hour Sita mows $\frac{1}{8}$ of the field.

In the second hour Gita mows $\frac{1}{12}$ of the field.

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$\therefore$ In first 2 hrs $\left(\frac{1}{8}+\frac{1}{12}=\frac{5}{24}\right)$ of the field is mowed.

$\therefore$ In 8 hrs $\frac{5}{24}\times 4=\frac{5}{6}$ of the field is mowed.

Field remained to be mowed = $1-\frac{5}{6}=\frac{1}{6}$

In the 9th hour Sita mows $\frac{1}{8}$ of the field.

$\therefore$ Gita will finish the mowing of $\left(\frac{1}{6}-\frac{1}{8}\right)=\frac{1}{24}$ of

the field in $\left(\frac{1}{24}\div\frac{1}{12}\right)$ or $\frac{1}{2}$ of an hour.

$\therefore$ the total time required is $\left(8+1+\frac{1}{2}\right)$ or $9\frac{1}{2}$ hrs.

Thus, the work will be finished at 6:30 pm.

14. (b); By formula $\frac{M_1D_1E_1}{W_1}=\frac{M_2D_2E_2}{W_2}$

Let the number of men be x

$$x=\frac{45\times 48\times 17250\times 1}{46575\times 16\times 2}=25 \text{ men}$$

15. (d); 5 men = 7 women

$\therefore$ 7 men $=\frac{7}{5}\times 7=\frac{49}{5}$ women

and 7 men + 13 women $=\frac{49}{5}+13=\frac{114}{5}$ women

Now,

$\because$ 7 women get Rs. 5250

$\because$ $\frac{114}{5}$ women get $\frac{5250}{7} \times \frac{114}{5} =$ Rs. 17100

16. (d); C's 1 day's work

= [(A + B + C)'s 1 day's work] – [(A's 1 day's work) + (B's 1 day's work)]

$= \frac{1}{4} - \left(\frac{1}{12} + \frac{1}{18}\right) = \left(\frac{1}{4} - \frac{5}{36}\right) = \frac{4}{36} = \frac{1}{9}$

C complete the work in 9 days

17. (a); A's 1 day's work = $\frac{1}{20}$

A's 4 days' work $= \frac{4}{20} = \frac{1}{5}$

Remaining work = $1 - \frac{1}{5} = \frac{4}{5}$

This part is completed by A and B together.

Now, (A+B)'s 1 day's work $= \frac{1}{20} + \frac{1}{12} = \frac{3+5}{60} = \frac{8}{60} = \frac{2}{15}$

Now, $\frac{2}{15}$ work is done by (A+B) in 1 day.

$\therefore$ $\frac{4}{5}$ work is done in = $\frac{15}{2} \times \frac{4}{5} = 6$ days.

Hence, the work lasted for 4 + 6 = 10 days.

18. (a); Work done by 1 woman in 1 day

$= \frac{1}{3} - \frac{1}{6} - \frac{1}{18} = \frac{6-3-1}{18} = \frac{1}{9}$

$\therefore$ 1 Woman will do the work in 9 days.

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19. (a); Let there be x men originally.
Now, x men do the job in 20 days.

$\therefore$ (x – 12) men can do it in $\frac{20x}{(x-12)}$ = 32 days

hence, x = 32

20. (d); 16 men = 20 women $\Rightarrow$ 4 men = 5 women.
Now, according to question,
16 men complete the work in 25 days.

$\therefore$ 1 man one day's work = $\frac{1}{25 \times 16}$

$\therefore$ 4 men one day's work = $\frac{1}{25 \times 4} = \frac{1}{100}$

$\therefore$ 5 women one day's work= $\frac{5}{25 \times 20} = \frac{1}{100}$

$\therefore$ 28 men = $\frac{28}{4} \times 5 = 35$ women

$\therefore$ 50 women one day's work $= \frac{50}{25 \times 20} = \frac{1}{10}$

Therefore, 28 men and 15 women can complete the whole work in 10 days.

21. (d); Let number of persons in beginning be x
$M_1 = x$, $D_1 = 40$, $M_2 = (x + 45)$ and $D_2 = 25$
By the formula
$M_1D_1 = M_2D_2 \Rightarrow x \times 40 = (x + 45) \times 25$
$x \times 8 = (x + 45) \times 5 \Rightarrow 8x - 5x = 225$

$$x = \frac{225}{3} = 75$$

22. (c); Given, $M_1 = 7$, $D_1 = 12$, $W_1 = 1$

And $M_2 = ?$, $D_2 = 8$, $W_2 = 2$

By the Formula

$M_1D_1W_2 = M_2D_2W_1 \Rightarrow 7 \times 12 \times 2 = M_2 \times 8 \times 1$

$$M_2 = \frac{7 \times 12 \times 2}{8} = 21$$

$\therefore$ Number of additional men = 21 – 7 = 14

23. (c); 6 men = 12 women

$\therefore$ 1 man = 2 women

Now, 8 men + 16 women = (8 × 2 + 16) = 32 women

According to the question,

$$\frac{M_1D_1}{W_1} = \frac{M_2D_2}{W_2} \Rightarrow \frac{12 \times 20}{1} = \frac{32 \times D_2}{2}$$

$12 \times 20 = 16D_2 \Rightarrow D_2 = 3 \times 5 \Rightarrow D_2 = 15$ days

24. (c); Part of work done by A and B in first 2 days

$$= \frac{1}{9} + \frac{1}{12} = \frac{4+3}{36} = \frac{7}{36}$$

Part of work done in first 10 days $= \frac{35}{36}$

Remaining work $= 1 - \frac{35}{36} = \frac{1}{36}$

Now, it is the turn of A.

$\therefore$ Time taken by A $= \frac{1}{36} \times 9 = \frac{1}{4}$ days

$\therefore$ Total time $= 10 + \frac{1}{4} = 10\frac{1}{4}$ days

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Shortcut:

2 days work = 4 + 3 = 7

Remaining work = 1 unit

A takes $= \frac{1}{4}$ days

Total work completed in

$10 + \frac{1}{4}$ days $= 10\frac{1}{4}$ days

25. (a); 10 men = 18 boys $\Rightarrow$ 5 men = 9 boys

$\Rightarrow$ 15 men = 27 boys

15 men and 33 boys = 27 boys + 33 boys

= 60 boys

$\because$ 18 boys can do a work in 15 days

Let 60 boys can do twice work in x days

$\therefore \quad \frac{18 \times 15}{1} = \frac{60 \times x}{2} \Rightarrow x = \frac{18 \times 15 \times 2}{60} = 9$ days

26. (b); Given, time taken by 20 women = 16 days

Time taken by 16 men = 15 days

Then, the ratio of a man and women

20 × 16 women = 16 × 15 men

4 women = 3 men $\frac{\text{men}}{\text{women}} = \frac{4}{3}$

$\therefore$ Ratio of working capacity = 4 : 3

27. (c); Change the time into hours

Ram finish in 15 × 8 = 120 hrs

Hari finish in $\frac{20}{3} \times 9 = 60$ hrs

Both of them working together finish the work in

$= \frac{120 \times 60}{120 + 60} = 40$ hrs

$\therefore$ number of days $= \frac{40}{10} = 4$ days.

28. (c); (3 men + 2 women) × 15 = (2 men + 3 women) × 18

(3 men + 2 women) × 5 = (2 men + 3 women) × 6

15 men + 10 women = 12 men + 18 women

$\therefore$ 15 men – 12 men = 18 women – 10 women

$\therefore$ 3 men = 8 women $\Rightarrow$ 1 man $= \frac{8}{3}$ women

$\therefore$ 1 man + 1 women = $\left(\frac{8}{3} + 1\right)$ women $= \frac{11}{3}$ women

and 3 men + 2 women = (8 + 2) women = 10 women

$\therefore$ 10 women can do a work in 15 days

Let $\frac{11}{3}$ women can do that work in x days

$\therefore$ $10 \times 15 = \frac{11}{3} \times x \Rightarrow x = \frac{450}{11} = 40\frac{10}{11}$ days.

29. (d); If B takes x days to finish the work.

$\therefore$ A takes 2x days and C takes 3x days to do the work

$\therefore$ $\frac{1}{2x} + \frac{1}{x} + \frac{1}{3x} = \frac{1}{12} = \frac{3+6+2}{6x} = \frac{1}{12}$

$\therefore$ $\frac{11}{6x} = \frac{1}{12} \Rightarrow 6x = 11 \times 12 \Rightarrow x = 22$ days.

$\therefore$ The number of days taken by A = 2x = 2 × 22 = 44 days

30. (a); Let 100 men only complete the work in x days
Work done by 100 men in 35 days + work done by 200 men in 5 days = 1

$$\frac{35}{x}+\frac{200\times 5}{100x}=1,\ \frac{35}{x}+\frac{10}{x}=1 \qquad \frac{45}{x}=1,\ x=45 \text{ days}$$

Therefore, if additional men were not employed, the work would have lasted (45 – 40) = 5 days behind schedule time.

31. (c);

The share of R = $\frac{5}{21}\times 4200$ = Rs. 1000

32. (d); Given, 8 men = 10 women
4 men = 5 women
Now, according to the question
8 men complete the work in 50 days.

$\therefore$ 1 man one day's work $=\frac{1}{50\times 8}$

or 4 men one days' work $=\frac{4}{50\times 8}=\frac{1}{100}$

Similarly, 1 women one day's work $=\frac{1}{50\times 10}$

or 5 women one day's work $=\frac{5}{50\times 10}=\frac{1}{100}$

$\therefore$ 28 men $=\frac{28}{4}\times 5=35$ women

$\therefore$ 50 women one day's work $=\frac{50}{50\times 10}=\frac{1}{10}$

Required days = 10

33. (a); 7 (3m + 4b) = 2100

$3m + 4b = \frac{2100}{7} = 300$ ...(i)

8 (11m + 13b) = 8300

$11m + 13b = \frac{8300}{8} = 1037.50$ ...(ii)

On solving (i) and (ii)

44b – 39b = 187.5 $\Rightarrow$ 5b = 187.5

1b = Rs. 37.5

Similarly, 3m + 150 = 300

3m = 300 – 150 $\Rightarrow$ 1m = Rs. 50

Required no. of days = $\frac{11000}{7 \times 50 + 9 \times 37.5} = \frac{11000}{687.5}$ = 16 days

34. (b); The rest of the food will last for 31 – 28 = 3 days if nobody leaves the place.

Number of men eating everyday = 400

So, 1200 men could eat the remaining food completely in one day.

But there are 120 men left, so they can eat the remaining food in 10 days.

35. (c); By using MDH formula $= \frac{M_1D_1H_1}{W_1} = \frac{M_2D_2H_2}{W_2}$

$\frac{28 \times 1}{\frac{7}{8}} = \frac{x}{\frac{1}{8}}$ $\Rightarrow$ x = 4 men

36. (b); By Direct Formula:

$M_1D_1W_2 = M_2D_2W_1$

Or, 45 × 200 × 7.5 = M_2 × 150 × 4.5

$\therefore$ $M_2 = \frac{45 \times 200 \times 7.5}{150 \times 4.5} = 100$

$\therefore$ required number of persons to be added = 100 – 45 = 55 men.

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37. (c); Total money = Rs. 4500

A's one day's work $= \frac{1}{8}$, B's one day's work $= \frac{1}{12}$

(A + B + C)'s 1 day's work $= \frac{1}{4}$

C's 1 day work $= \frac{1}{4} - \left(\frac{1}{8} + \frac{1}{12}\right) = \frac{1}{4} - \left(\frac{3+2}{24}\right) = \frac{1}{4} - \frac{5}{24} = \frac{6-5}{24} = \frac{1}{24}$

∴ Ratio of their one day's work

$A : B : C = \frac{1}{8} : \frac{1}{12} : \frac{1}{24}$ = 3 : 2 : 1 (taking LCM)

Sum of the ratio = 3 + 2 + 1 = 6

C's share $= \left(\frac{1}{6} \times 4500\right) =$ Rs. 750

38. (a); Work done by A in 1 day $= \frac{1}{16}$

Work done by B in 1 day $= \frac{1}{24}$

Work done by A, B and C in 1 day $= \frac{1}{6}$

Then, work done by C in 1 day = (A + B + C)'s 1 day work – (A + B)'s 1 day work – A's 1 day work

$\frac{1}{C} = \frac{1}{6} - \frac{1}{16} - \frac{1}{24} \Rightarrow \frac{1}{C} = \frac{8-3-2}{48} = \frac{3}{48} = \frac{1}{16}$

∴ Ratio of wages of A, B and C

$= \frac{1}{A} : \frac{1}{B} : \frac{1}{C} = \frac{1}{16} : \frac{1}{24} : \frac{1}{16}$ = 3 : 2 : 3 (taking LCM)

Share of A $= \frac{3}{3+2+3} \times 400 = \frac{3}{8} \times 400 =$ Rs. 150

Share of B $= \frac{2}{3+2+3} \times 400 =$ Rs. 100

Share of C $= \frac{3}{(3+2+3)} \times 400 =$ Rs. 150

39. (b); Total money = Rs. 1800
Ratio of wages of A, B and C, respectively
= 5 × 6 : 6 × 4 : 4 × 9 = 30 : 24 : 36 = 5 : 4 : 6
∴ Amount received by A

$= \frac{A}{A+B+C} \times$ Total money $= \frac{5}{5+4+6} \times 1800 = \frac{5}{15} \times 1800 =$ Rs. 600

40. (a); A man can complete a work in 10 days
(Man + child) can do it in 6 days
Let the total work be 30 units
One day work of man = 3 units
One day work of (man + child) = 5 units
So, one day work of child = 2 units

Boy will get an amount $= \frac{2}{5} \times 50 =$ Rs. 20

Difficult

1. (d); Ratio of the working capabilities of a man, a woman and a child = 5 : 4 : 2
∴ Ratio of man, woman and child equivalence

$= \frac{1}{5} : \frac{1}{4} : \frac{1}{2} = \frac{1}{5} \times 20 : \frac{1}{4} \times 20 : \frac{1}{2} \times 20 = 4 : 5 : 10$

Or 4 men = 5 women = 10 children 4 men = 10 children
∴ 2 men = 5 children ⇒ and 6 men = 15 children
5 women = 10 children
∴ 3 women = 6 children ⇒ 4 women = 8 children
∴ 2 men + 3 women + 4 children = 15 children

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6 men + 4 women + 7 children = 30 children

By the Formula

$$\frac{M_1D_1}{W_1} = \frac{M_2D_2}{W_2} \Rightarrow \frac{15 \times 10}{10} = \frac{30 \times x}{16}$$

$$x = \frac{15 \times 10 \times 16}{10 \times 30} \Rightarrow x = 8 \text{ days}$$

2. (c); A's 1 day's work = (B + C)'s 1 days' work

(A + B)'s 1 days' work $= \frac{1}{10}$

C's 1 days' work $= \frac{1}{50}$

(A + B + C)'s day's work $= \frac{1}{10} + \frac{1}{50} = \frac{5+1}{50} = \frac{6}{50} = \frac{3}{25}$

(A+B + C)'s 1 day's work $= \frac{3}{25}$

A's 1 days' work $= \frac{3}{50}$

B's 1 days work $= \frac{1}{10} - \frac{3}{50} = \frac{5-3}{50} = \frac{2}{50} = \frac{1}{25}$

Hence, B alone will complete the work in 25 days.

3. (b); 1M + 3W + 4B in 96 hrs ...(i)

2M + 8B in 80 hrs ...(ii)

Or, 1M + 4B in 160 hrs ...(iii)

2M + 3W in 120 hrs ...(iv)

From (i) and (iii), we have,

3W do the work in

$$\frac{160 \times 96}{160 - 96} = 240 \text{ hrs} \quad ...(v)$$

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From (iv) and (v), we have
2M do the work in

$$\frac{240 \times 120}{240 - 120} = 240 \text{ hrs} \quad ...(vi)$$

$\therefore$ 5M do the work in $240 \times \frac{2}{5} = 96$ hrs ...(vii)

From (ii) and (vi) we have,

12B do the work in $\frac{120 \times 8}{12} = 80$ hrs ...(viii)

Now, from (vii) and (viii) we have,
5M + 12B do the work in

$$\frac{96 \times 80}{96 + 80} = \frac{480}{11} = 43\frac{7}{11} \text{ hrs}$$

4. (a); Remaining part of work after 50 days

$$= 1 - \left(\frac{1}{4} + \frac{7}{32} + \frac{3}{16} + \frac{5}{32} + \frac{2}{16}\right) = \frac{1}{16}$$

Similarly, part of work done by 15 men in 10 days $= \frac{15 \times 10}{1600} = \frac{3}{32}$

$\frac{1}{16}$ part of the work is done in $10 \times \frac{32}{3} \times \frac{1}{16} = \frac{20}{3} = 6\frac{2}{3}$ days

$\therefore$ Total number of days to complete the work $= 50 + 6\frac{2}{3} = 56\frac{2}{3}$ days

Shortcut:

Total work = 40 × 40 = 1600
After every 10 days, 5 men left the job

Therefore,

Work done in first 10 days = 40 × 10
Next 10 days = 35 × 10
Next 10 days = 30 × 10

Next 10 days = 25 × 10
Next 10 days = 20 × 10
Work done in 50 day = 1500
Remaining work 1600 – 1500 = 100
15 men × No. of days = 100

No. of days $= \frac{100}{15} = 6\frac{10}{15} = 6\frac{2}{3}$

$\therefore$ Total work completed in $\left(50 + 6\frac{2}{3}\right)$ days $= 56\frac{2}{3}$ days

5. (d); 3 women + 18 children complete the work in 2 days. Therefore, (3 × 2) women + (18 × 2) children complete the work in 1 day
6 women + 36 children complete work in 1 day.

Work of 36 children for 1 day $= 1 - \frac{1}{3} = \frac{2}{3}$

$\left[\because \text{work of 6 women for 1 day} = \frac{1}{3}\right]$

$\therefore$ 36 children do $\frac{2}{3}$ part of the work in 1 day.

or 36 children can do the work in $\frac{3}{2}$ days.

or 9 children can do the work in $\left(\frac{3}{2} \times 4\right) = 6$ days

6. (c); A's 1 day's work $= \frac{1}{120}$ B's 1 day's work $= \frac{1}{150}$

(A + B)'s 1 day's work $= \frac{1}{120} + \frac{1}{150} = \frac{5+4}{600} = \frac{9}{600} = \frac{3}{200}$

(A + B) work together for 20 days Hence, (A + B)'s 20 day's work

$= 20 \times \frac{3}{200} = \frac{3}{10}$

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After 20 days B leaves, and A alone works for 12 days

$\therefore$ A's 12 day's work $= \frac{1}{120} \times 12 = \frac{1}{10}$

Now, after 12 days, C joins A and the work is finished in 48 days. It means A works for 48 days more.

$\therefore$ A's 48 day's work $= \frac{1}{120} \times 48 = \frac{2}{5}$

$\therefore$ Total work done by A and B together

$$= \frac{3}{10} + \frac{1}{10} + \frac{2}{5} = \frac{3+1+4}{10} = \frac{8}{10} = \frac{4}{5}$$

$\therefore$ remaining work $= 1 - \frac{4}{5} = \frac{1}{5}$

This part of work, i.e., $\frac{1}{5}$ is done by C in 48 days

$\therefore$ C's 48 day's work $= \frac{1}{5}$

$\therefore$ C's 1 day's work $= \frac{1}{5 \times 48} = \frac{1}{240}$

Hence, C alone can finish the work in 240 days.

7. (b); Let man be represented by m and woman be represented by w.

$\because$ $2m + 1w = \frac{1}{14}$

$\Rightarrow$ 14 (2m + 1w) = 1 ...(i)

and $4w + 2m = \frac{1}{8}$

or 8 (4w + 2m) = 1 ...(ii)

On equating Eqs. (i) and (ii), we get

14 (2m + 1w) = 8 (4w + 2m)

28m + 14w = 32w + 16m

28m – 16m = 32w – 14w $\Rightarrow$ 12m = 18w

$\therefore \quad \frac{m}{w} = \frac{18}{12} = \frac{3}{2}$

So, efficiency of 1 man and 1 woman is 3 : 2. So, their wages must be in the same ratio i.e. $\frac{90}{x} = \frac{3}{2}$

[here, x = wages of a woman]

$\therefore \quad x = \frac{90 \times 2}{3} = \text{Rs. } 60$

8. (c); Efficiency of Heena = 5%

Efficiency of Himani = 4%

Thus, in 10 days working together they will complete only 90% of the work.

[(5 + 4) × 10] = 90

Hence, the remaining work will be surely done by Mayuri, which is 10%.

Thus, Mayuri will get 10% of Rs. 700, which is Rs. 70.

9. (a); A's 1 day's work $= \frac{1}{12}$

B's 1 day's work $= \frac{1}{18}$

Part of work done by A and B in first two days

$= \frac{1}{12} + \frac{1}{18} = \frac{3+2}{36} = \frac{5}{36}$

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Part of work done by A and B in 14 days = $\frac{35}{36}$

Remaining work $= 1 - \frac{35}{36} = \frac{1}{36}$

Now A will work for 15th day.

A will do the $\frac{1}{36}$ work in $\frac{1}{36} \times 12 = \frac{1}{3}$ day.

$\therefore$ Work will be done in $14\frac{1}{3}$ days.

10. (d); (A + B)'s 2 day's work

$$2 \times \left(\frac{1}{8} + \frac{1}{10}\right) = 2 \times \frac{5+4}{40} = 2 \times \frac{9}{40} = \frac{9}{20}$$

$\therefore$ remaining work $= 1 - \frac{9}{20} = \frac{11}{20}$

(B + C)'s 1 day's work $= \frac{1}{10} + \frac{1}{15} = \frac{5}{30} = \frac{1}{6}$

$\therefore$ Working efficiency of (B + C) $= \frac{1}{6}$

$\therefore$ The days taken by B and C to complete the remaining work

$$= \frac{\text{remaining work}}{\text{working efficiency of B and C}} = \frac{\frac{11}{20}}{\frac{1}{6}} = \frac{11}{20} \times \frac{6}{1} = \frac{33}{10}$$

$\therefore$ Total days to complete the whole work

$$= 2 + \frac{33}{10} = \frac{20+33}{10} = \frac{53}{10} \text{ days}$$

Shortcut:

2 days work of (A + B) = 2(27) = 54

Remaining work = 120 – 54 = 66

Remaining work completed by (B + C) in

$\frac{66}{20} = \frac{33}{10}$ days

Total work completed in $2 + \frac{33}{10} = \frac{53}{10}$ days

11. (b); A's work for the first day $= \frac{1}{10}$

B's work for the second day $= \frac{1}{20}$

C's work for the third day $= \frac{1}{40}$

Work done in 3 days by them $= \frac{1}{10} + \frac{1}{20} + \frac{1}{40} = \frac{4+2+1}{40} = \frac{7}{40}$

Hence, $\frac{7}{40}$ part of work will be completed in 3 days.

$\therefore$ $\frac{7 \times 5}{40}$ i.e $\frac{35}{40}$ part of work will be completed in = 3 × 5 or 15 days.

Remaining work $= 1 - \frac{35}{40} = \frac{5}{40} = \frac{1}{8}$

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Now, A will work on 16th day. The remaining work after 16 days

$$= \frac{1}{8} - \frac{1}{10} = \frac{5-4}{40} = \frac{1}{40}$$

Again, B will work on 17th day.

$\because$ B completes the work in 20 days.

$\therefore$ B will complete $\frac{1}{40}$ part of work in

$$= 20 \times \frac{1}{40} = \frac{1}{2} \text{ day}$$

$\therefore$ Total time taken in completion of work

$$= 15 + 1 + \frac{1}{2} = 16\frac{1}{2} \text{ days}$$

12. (a); Let the total work be completed in x days.

Then, as per question

Work of A for 2 days + work of B for (x – 3) days + work of C for x days = 1

$$2 \times \frac{1}{10} + (x-3) \times \frac{1}{12} + x \times \frac{1}{15} = 1$$

$$\frac{5(x-3) + 4 \times x}{60} = 1 - \frac{1}{5} \Rightarrow 9x - 15 = \frac{4}{5} \times 60 = 48$$

$$x = \frac{(48+15)}{9} = 7 \text{ days}$$

13. (b); Let x men are employed at first.

x men do $\frac{1}{2}$ of the work in 24 days

$\therefore$ 1 man do the whole work in

24 × 2 × x = 48x days.

Now, (x + 16) men do the remaining work

$\left(1-\frac{1}{2}=\frac{1}{2}\right)$ in (40 – 24 = 16) days.

∴ 1 man do the whole work in

16 × 2 (x + 16) days.

or, 48x = 32 (x + 16) ∴ x = 32 men.

14. (c); According to the formula,

$$\frac{M_1D_1H_1}{W_1}=\frac{M_2D_2H_2}{W_2}$$

Given, $M_1 = 105$, $D_1 = 25$, $H_1 = 8$, $W_1=\frac{2}{5}$

Now, let the additional men be x.

Then, $M_2 = 105 + x$, $H_2 = 9$, $D_2 = 25$

and $W_2=1-\frac{2}{5}=\frac{3}{5}$

On putting these values in the above formula,

$$\frac{105\times25\times8}{\frac{2}{5}}=\frac{(105+x)\times25\times9}{\frac{3}{5}}\Rightarrow\frac{105\times8}{2}=\frac{(105+x)\times9}{3}$$

105 × 4 = (105 + x) × 3 ⇒ 105 × 4 = 105 × 3 + 3x

3x = 105 ⇒ x = 35 men

15. (b); Let A can do in (x – 5) days and B in x days.

$$\therefore\frac{1}{x-5}+\frac{1}{x}=\frac{9}{100}\left[\because 11\frac{1}{9}=\frac{100}{9}\text{days}\right]$$

or $\frac{x+x-5}{x(x-5)}=\frac{9}{100}\Rightarrow\frac{2x-5}{x^2-5x}=\frac{9}{100}$

or $9x^2-45x=200x-500\Rightarrow 9x^2-245x+500=0$

or $9x^2-225x-20x+500=0\Rightarrow(9x-20)(x-25)=0$

or $9x-20\neq 0$ but $x-20=0\Rightarrow x=20$

$\therefore$ time taken by B alone to do the same work = 20 days.

16. (d); Let A worked for x days.

A's 1 day's work $=\frac{1}{45}$

$\therefore$ A's x day's work $=\frac{x}{45}$

B's 1 day's work $=\frac{1}{40}$

$\therefore$ B's x day's work $=\frac{1}{40}\times x=\frac{x}{40}$

(A + B) together worked for x days.

$\therefore$ (A + B)'s x day's work $=\frac{x}{45}+\frac{x}{40}=\frac{8x+9x}{360}=\frac{17x}{360}$

$\therefore$ Remaining work $=1-\frac{17x}{360}=\frac{360-17x}{360}$

This part of work, i.e., $\frac{360-17x}{360}$ is completed by B alone in 23 days.

$\therefore$ $\frac{360-17x}{360}=23\times$ B's 1 day's work

$\frac{360-17x}{360}=23\times\frac{1}{40}=\frac{23}{40}\quad\Rightarrow 360-17x$

$=\frac{23}{40}\times 360=207\quad\Rightarrow\quad 17x=360-207=153\quad\Rightarrow\quad x=\frac{153}{17}=9$ days

Hence, A worked for 9 days.

17. (d); 8(4m + 6w) = 10 (3m + 7w)

32m + 48w = 30m + 70w

$2m = 22w \Rightarrow 1m = 11w \quad \Rightarrow \quad 4m + 6w = 50w$

$\therefore \quad M_1D_1 = M_2D_2 \quad \Rightarrow \quad 50 \times 8 = 20 \times D_2$

$D_2 = \frac{50 \times 8}{20} = 20$ days.

18. (b); Shortcut:

Therefore, Total work = 15 units

A + B = 3 ...(i)

$2A + \frac{B}{3} = 5$ ...(ii)

On solving (i) and (ii), $A = \frac{12}{5}$

One day work of A is $\frac{12}{5}$ units

$\therefore$ Total work will be completed by A in $= \frac{15}{\frac{12}{5}}$

$= \frac{15 \times 5}{12} = \frac{25}{4} = 6\frac{1}{4}$ days

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19. (a); Remaining work $= \left(1 - \frac{4}{7}\right) = \frac{3}{7}$

Remaining period = (92 – 66) = 26 days

Let the number of additional men = x

$M_1 = 234$, $D_1 = 66$, $H_1 = 16$,

$W_1 = \frac{4}{7}$, $M_2 = (234 + x)$, $D_2 = 26$, $H_2 = 18$, $W_2 = \frac{3}{7}$

According to the question,

$M_1W_2H_1D_1 = M_2W_1H_2D_2$

$$234 \times \frac{3}{7} \times 16 \times 66 = (234 + x) \times \frac{4}{7} \times 18 \times 26$$

$$\Rightarrow \quad 234 + x = \frac{3 \times 66 \times 16 \times 234}{4 \times 26 \times 18}$$

234 + x = 36 × 11 = 396 $\Rightarrow$ x = 396 – 234 = 162

Additional men to be employed = 162

20. (b); Shortcut:

Here, Total work = 120 units

Let A and B do not left the job and add the work done by A in 2 days and by B in 4 days.

∴ Now, Total work = 120 + 8(2) + 4(4) = 120 + 32 = 152 units

Total work completed in $= \frac{152}{15} = 10\frac{2}{15}$ days

21. (a); Work done by A and B in 1 day $= \frac{1}{8} + \frac{1}{12} = \frac{5}{24}$

2 day's work of A and B $= \frac{10}{24}$

After 2 days A left the work

$\therefore$ Remaining work $= 1 - \frac{10}{24} = \frac{14}{24}$

One day work of B and C together $= \frac{1}{12} + \frac{1}{15} = \frac{9}{60}$

So, the number of days required by B and C to finish work $= \frac{\frac{14}{24}}{\frac{9}{60}} = \frac{14}{24} \times \frac{60}{9} = \frac{35}{9}$

$\therefore$ Total days to complete the work

$= 2 + \frac{35}{9} = \frac{53}{9} = 5\frac{8}{9}$ days

22. (a); Work of a man for 1 hour $= \frac{3}{2} \times$ women's work for 1 hour. Again, work of a man for 1 day

$= \left(\frac{3}{2} \times \frac{9}{7.5}\right) \times$ women's work for 1 hour

$\Rightarrow$ Work of a man for 1 day $= \frac{9}{5} \times$ women's work for 1 day $\Rightarrow$ 1 man $= \frac{9}{5}$ women

$\therefore$ 10 men + 6 women $= 10 \times \frac{9}{5} + 6 = 24$ women

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$\therefore$ 10 men + 9 women $= 10 \times \frac{9}{5} + 9 = 27$ women

Now, $M_1 \times D_1 = M_2 \times D_2 \Rightarrow 18 \times 24 = D_2 \times 27$

$\Rightarrow D_2 = 16$ days

23. (b); In 5 days, (4 men + 6 women) get Rs. 1600

$\therefore$ In 1 day, (4 men + 6 women) get

$$\frac{1600}{5} = \text{Rs. } 320 \quad \text{...(i)}$$

In 1 day, number of persons to get Rs. 1

$$= \frac{320}{4 \text{ men} + 6 \text{ women}} \quad \text{...(ii)}$$

Similarly, in second codition,

In 1 day, number of persons to get Rs. 1

$$= \frac{1740}{6(3 \text{ men} + 7 \text{ women})} = \frac{290}{3 \text{ men} + 7 \text{ women}} \quad \text{...(iii)}$$

From Eqs. (ii) and (iii), we get

$$\frac{320}{4 \text{ men} + 6 \text{ women}} = \frac{290}{3 \text{ men} + 7 \text{ women}}$$

96 men + 224 women = 116 men + 174 women

$\Rightarrow$ 20 men = 50 women

$$\Rightarrow \frac{\text{Men}}{\text{Woman}} = \frac{5}{2} \Rightarrow 1 \text{ woman} = \frac{2}{5} \text{ man}$$

From Eq. (i), in 1 day,

(4 men + 6 women) = (4 men + $6 \times \frac{2}{5}$ men)

$$= \frac{32}{5} \text{ men get Rs. } 320$$

$\therefore$ In 1 day, 1 man get $= \frac{320 \times 5}{32} = \text{Rs. } 50$

$\therefore$ In 1 day, 1 woman get $= 50 \times \frac{2}{5} =$ Rs. 20

$\therefore$ In 1 day, (7 men + 6 women) get

$7 \times 50 + 6 \times 20 =$ Rs. 470

$\therefore$ Required number of days $= \frac{3760}{470} = 8$ days

24. (b); Ratio of number of men, women and children

$= \frac{18}{6} : \frac{10}{5} : \frac{12}{3} = 3x : 2x : 4x$

$(3x + 2x + 4x) = 18 \Rightarrow x = 2$

Therefore, number of women = 4

Share of all women $= \frac{10}{40} \times 4000 =$ Rs. 1000

$(\because 18 + 10 + 12 = 40)$

$\therefore$ Share of each woman $= \frac{1000}{4} =$ Rs. 250

25. (a); (5M + 3B) can reap 23 hectares in 4 days

(3M + 2B) can reap 7 hectares in 2 days

$\frac{4(5M + 3B)}{23} = \frac{2(3M + 2B)}{7} \Rightarrow 1M = 4B$

Now, 5M + 3B = 23B

i.e, 23 boys can reap 23 hectares in 4 days.

or, 1 boys can reap 1 hectare in 4 days.

or, 4 boys can reap 1 hectare in 1 day.

or, $\frac{4 \times 45}{6}$ boys can reap 45 hectares in 6 days.

or, 30 boys can reap 45 hectares in 6 days.

or, 30B = 28B + 2B = 7M + 2B

$\therefore$ 2 boys must assist 7 men $\Rightarrow 3x - x = 60$

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Previous Year (Memory Based)

1. (a); In 1 hr Subhash can copy $= \frac{50}{10} = 5$ pages

Subhash and Prakash both can copy in 1 hr $= \frac{300}{40} = 7.5$ pages

$\therefore$ Prakash will copy in 1 hr = (7.5 – 5) = 2.5 pages

$\therefore$ To copy 2.5 pages Prakash take time = 1 hr

To copy 30 pages Prakash take time $= \frac{1}{2.5} \times 30$ = 12 hr

2. (d); Part of the work B will do in 1 day $= \frac{3}{20} - \frac{1}{15} = \frac{9-4}{60} = \frac{5}{60} = \frac{1}{12}$

$\therefore$ Required days = 12

3. (b); Part of the work C will finish in 1 hr

$$= \frac{1}{2} - \frac{1}{6} - \frac{1}{5} = \frac{15-5-6}{30} = \frac{4}{30} = \frac{2}{15}$$

$\therefore$ Required time $= \frac{15}{2} = 7.5$ hrs

4. (a); Part of the work will be complete in 1 day

$$= \frac{1}{20} + \frac{1}{40} = \frac{4+2}{80} = \frac{6}{80} = \frac{3}{40}$$

$\therefore$ Part of the work will complete in 5 days

$$= \frac{5 \times 3}{40} = \frac{15}{40}$$

$\therefore$ Remaining part $= 1 - \frac{15}{40} = \frac{25}{40} = \frac{5}{8}$

5. (c); Part of the work done by all of them in 1 day

$$= \frac{1}{10} + \frac{1}{12} + \frac{1}{15} = \frac{6+5+4}{60} = \frac{15}{60} = \frac{1}{4}$$

$\therefore$ Required days = 4

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6. (a); Let time Required by B to finish the whole work = x days

$\therefore$ A will take (x – 10) days.

$$\frac{1}{x}+\frac{1}{x-10}=\frac{1}{12} \Rightarrow \frac{x-10+x}{x(x-10)}=\frac{1}{12}$$

$$\frac{2x-10}{x^2-10x}=\frac{1}{12} \Rightarrow 24x-120=x^2-10x$$

$$x^2-34x+120=0$$

$$30\times 4 \rightarrow 30+4=34$$

$\therefore$ x = 30, 4 $\Rightarrow$ Time taken by B = 30 days

(4 days is not possible)

7. (b); C alone can complete the work $=\dfrac{1}{\frac{1}{30}-\frac{1}{50}}=\dfrac{150}{5-3}=\dfrac{150}{2}=75$ min.

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8. (a); A alone will complete the work $=\dfrac{1}{\frac{1}{15}-\frac{1}{20}}=\dfrac{60}{4-3}=60$ days

9. (c); B alone can do it in $=\dfrac{1}{\frac{1}{10}-\frac{1}{30}}=\dfrac{30}{3-1}=15$ days

10. (a); Ratio of their work = $\frac{1}{6}:\frac{1}{12}$ = 2 : 1

$\therefore$ portion of work done by A $=\dfrac{2}{3}$

11. (b); Given (A + B)'s 1 day work $=\dfrac{1}{10}$

(B + C)'s 1 day work $=\dfrac{1}{12}$

$$(A + C)\text{'s 1 day work} = \frac{1}{15}$$

$$2(A + B + C)\text{'s 1 day work} = \left(\frac{1}{10} + \frac{1}{12} + \frac{1}{15}\right)$$

$$(A + B + C)\text{'s 1 day work} = \left(\frac{6+5+4}{60}\right)\frac{1}{2} = \frac{1}{2}\left(\frac{15}{60}\right) = \frac{1}{4} \times \frac{1}{2} = \frac{1}{8}$$

$$\text{Time taken by A} = \frac{1}{\frac{1}{8} - \frac{1}{12}} = \frac{24}{3-2} = 24 \text{ days}$$

12. (c); $(A + B)\text{'s 1 day work} = \frac{1}{8}$

$$(B + C)\text{'s 1 day work} = \frac{1}{12}$$

$$(C + A)\text{'s 1 day work} = \frac{1}{8}$$

$$2(A + B + C)\text{'s 1 day work} = \frac{1}{8} + \frac{1}{12} + \frac{1}{8}$$

$$(A + B + C)\text{'s 1 day work} = \frac{1}{2}\left(\frac{3+2+3}{24}\right)$$

$$= \frac{1}{2} \times \frac{8}{24} = \frac{1}{6} \quad \Rightarrow \quad \text{Required time = 6 days}$$

13. (d); $(A + B + C)\text{'s 1 day work} = \frac{1}{2}\left(\frac{1}{30} + \frac{1}{20} + \frac{1}{15}\right)$

$$= \frac{1}{2}\left(\frac{2+3+4}{60}\right) = \frac{9}{60} \times \frac{1}{2} = \frac{3}{40}$$

$$\therefore \quad \text{Required time} = \frac{40}{3} = 13\frac{1}{3}$$

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14. (b); Given $A = \frac{1}{4}$, $B + C = \frac{1}{3}$, $A + C = \frac{1}{2}$

$(A + C) - A = \frac{1}{2} - \frac{1}{4} \Rightarrow C = \frac{1}{4}$

Now $(B + C) - C = \frac{1}{3} - \frac{1}{4}$

$\therefore$ B's 1 day work $= \frac{4-3}{12} = \frac{1}{12}$

$\therefore$ B alone will do it in 12 hr

15. (a); B's 1 day work $= \frac{1}{12} \times \frac{60}{100} + \frac{1}{12} = \frac{1}{20} + \frac{1}{12} = \frac{3+5}{60} = \frac{8}{60} = \frac{4}{30} = \frac{2}{15}$

$\therefore$ B alone would take $= 7\frac{1}{2}$ days

16. (b); Let A's time = x days

$\therefore$ B's time = 2x days

$\therefore \frac{1}{x} + \frac{1}{2x} = \frac{1}{14} \Rightarrow \frac{2+1}{2x} = \frac{1}{14} \Rightarrow \frac{3}{x} = \frac{1}{7}$ x = 21

$\therefore$ Required time = 21 days

17. (c); Sita's 1day work $= \frac{50}{100} \times \frac{1}{15} + \frac{1}{15} = \frac{1}{30} + \frac{1}{15} = \frac{1+2}{30} = \frac{3}{30} = \frac{1}{10}$

Required time = 10 days

18. (a); Let B take x days.

$\therefore$ Time taken by $\frac{A}{2} = \frac{3}{4} \times x = \frac{3x}{2}$

$\frac{1}{x} + \frac{2}{3x} = \frac{1}{18} \Rightarrow \frac{3+2}{3x} = \frac{1}{18}$ $3x = 18 \times 5 \Rightarrow x = 6 \times 5 = 30$

$\therefore$ Required time = 30 days

19. (b); 1M will do it in = 20 × 4 = 80 days

Let women's 1 day work $= \frac{1}{x}$

$$\therefore \quad \frac{2}{80} + \frac{3}{x} = \frac{1}{20} \quad \Rightarrow \quad \frac{3}{x} = \frac{1}{40} \quad \Rightarrow \quad x = 120$$

$$\therefore \quad \frac{3}{80} + \frac{3}{120} = \frac{9+6}{240} = \frac{15}{240} = \frac{1}{16}$$

$\therefore$ Required time = 16 days

20. (b); $\frac{M_1D_1H_1}{W_1} = \frac{M_2D_2H_2}{W_2}$

$15 \times 20 \times 8 = H_2 \times 20 \times 12$

$12H_2 = 120 \Rightarrow H_2 = 10$ hrs

21. (c); 1 men can do it = 45 × 16

Part of work done by 45 men in 4 days

$$= \frac{4 \times 45}{45 \times 16} = \frac{1}{4}$$

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

Now no. of men = 45 + 36 = 81

$$\therefore \quad \text{Required time} = \frac{\frac{3}{4}}{\frac{81}{45 \times 16}}$$

$$= \frac{3 \times 45 \times 16}{81 \times 4} = \frac{20}{3} = 6\frac{2}{3} \text{ days}$$

22. (b); $M_1D_1 = M_2D_2 \Rightarrow 10 \times 12 = 12 \times D_2$

$D_2 = 10$ days

23. (a); $M_1D_1H_1 = M_2D_2H_2 \Rightarrow 10 \times 18 \times 6 = H_2 \times 15 \times 12$

$$H_2 = \frac{180}{2 \times 15} = \frac{12}{2} = 6 \text{ days}$$

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24. (b); Let originally no. of persons = x

$\therefore$ $x \times 55 = (x + 6)(55 - 11) \Rightarrow 55x = (x + 6)\,44$

$5x = 4(x + 6) \Rightarrow 5x = 4x + 24 \Rightarrow x = 24$

25. (c); 1 M can do the piece of work = 20 × 6 = 120 days

1 W can do the piece of work = 20 × 12 = 240 days

Now work is twice, so required no. of days to complete the work will also be twice by Men or women

$$\therefore \quad \frac{8}{240} + \frac{16}{480} = \frac{16+16}{480} = \frac{32}{480} = \frac{1}{15}$$

$\therefore$ Required time = 15 days

26. (a); In 3 days, part of the work done by $A = 3 \times \frac{1}{12} = \frac{1}{4}$

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

Let B will do the work in x days.

$$3 = \frac{\frac{3}{4}}{\frac{1}{12} + \frac{1}{x}} \Rightarrow 3\left(\frac{1}{12} + \frac{1}{x}\right) \Rightarrow \frac{3}{4}$$

$$\frac{1}{x} = \frac{1}{4} - \frac{1}{12} \quad \Rightarrow \quad x = \frac{3-1}{12} = \frac{2}{12} = \frac{1}{6}$$

$\therefore$ Required time = 6 days

27. (c); Time taken by B to complete the work = 12 days

Time taken by A to complete the work $= \frac{1}{\frac{1}{8} - \frac{1}{12}} = \frac{24}{3-2} = 24$ days

work done by B in 4 days $= \frac{4}{12} = \frac{1}{3}$

$\therefore$ Remaining work $= 1 - \frac{1}{3} = \frac{2}{3}$

Now required time $= \frac{\frac{2}{3}}{\frac{1}{24}} = \frac{48}{3}$ = 16 days

28. (c); (B + C)'s 1 day work $= \frac{1}{9} + \frac{1}{12} = \frac{4+3}{36} = \frac{7}{36}$

(B + C)'s 3 days work $= \frac{21}{36}$

$\therefore$ Remaining work $= 1 - \frac{21}{36} = \frac{15}{36} = \frac{5}{12}$

Required time $= \frac{\frac{5}{12}}{\frac{1}{24}}$ = 10 days

29. (a); A's working hours = 7 × 6 = 42 hr
B's working hours = 8 × 7 = 56 hr

$\therefore$ (A + B)'s 1 hr work $= \frac{1}{42} + \frac{1}{56} = \frac{4+3}{168} = \frac{7}{168}$

(A + B)'s 8 hrs work $= \frac{8 \times 7}{168} = \frac{8}{24} = \frac{1}{3}$

$\therefore$ Required time = 3 days

30. (c); (A + B)'s 2 days work $= \frac{1}{10} + \frac{1}{15} = \frac{3+2}{30} = \frac{5}{30} = \frac{1}{6}$

$\therefore$ Required time = 2 × 6 = 12 days

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31. (b); (A + B)'s 2 days work $= \frac{1}{9} + \frac{1}{15} = \frac{8}{45}$

$\therefore$ (A + B)'s 10 days work $= \frac{8 \times 5}{45} = \frac{40}{45}$

$\therefore$ Remaining work = $1 - \frac{40}{45} = \frac{5}{45} = \frac{1}{9}$

$\therefore$ $\frac{1}{9}$ work will be done by A = 1 days

$\therefore$ Total time = (10 + 1) = 11 days

32. (c); (A + B)'s 1 day work $= \frac{1}{20} + \frac{1}{30} = \frac{5}{60} = \frac{1}{12}$

(A + B)'s 7 days work $= \frac{7}{12}$

Remaining work $= 1 - \frac{7}{12} = \frac{5}{12}$

Let C finishes the work in x days $\Rightarrow$ $10 = \frac{5}{12} \times x$

x = 24 days

33. (c); (A + B)'s 4 days work $= 4\left(\frac{1}{12} + \frac{1}{15}\right) = 4\left(\frac{9}{60}\right) = \frac{3}{5}$

Remaining work $= 1 - \frac{3}{5} = \frac{2}{5}$

$\therefore$ Required time $= \frac{\frac{2}{5}}{\frac{1}{15}}$ = 6 days

34. (b); Let after x days A left

$$\frac{x}{45}+\frac{(23+x)}{40}=1 \Rightarrow \frac{8x+9(23+x)}{360}=1$$

8x + 207 + 9x = 360 $\Rightarrow$ 17 x = 153 $\Rightarrow$ x = 9 days

$\therefore$ A left after 9 days.

35. (c); Remaining work $=1-\frac{1}{8}=\frac{7}{8}$

$$\text{Time by (A + B)} = \frac{\frac{7}{8}}{\frac{1}{6}+\frac{1}{12}} = \frac{\frac{7}{8}}{\frac{3}{12}} = \frac{28}{8} = \frac{14}{4} = \frac{7}{2} = 3\frac{1}{2}$$

36. (b); 1 men to paint the house = 5 × 4 = 20

1 women to paint the house = 6 × 5 = 30

1 children to paint the house = 10 × 5 = 50

part of the work will be done in 1 day

$$=\frac{1}{20}+\frac{1}{30}+\frac{5}{50}=\frac{1}{20}+\frac{1}{30}+\frac{1}{10}=\frac{3+2+6}{60}=\frac{11}{60}$$

$$\text{Required time} = \frac{60}{11} = 5\frac{5}{11}$$

37. (b); $M_1D_1H_1 = D_2 \times M_2 \times H_2$

$39 \times 12 \times 5 = D_2 \times 30 \times 6$

$$D_2 = \frac{39\times5\times2}{30} \Rightarrow D_2 = 13 \text{ days}$$

38. (b); Let original No. of carpenters = x

$\therefore$ x × 9 = (x – 5) × 12

9x = 12x – 60 $\Rightarrow$ 3x = 60 $\Rightarrow$ x = 20

39. (b); 1 women will do it = 20 × 16

1 men will do it = 16 × 15

$\therefore$ Required ratio = $\frac{20\times16}{15\times16} = \frac{20}{15}$ = 4 : 3

40. (b); In 200 days, part of work will complete $= \frac{200}{250} = \frac{4}{5}$

Remaining work $= 1 - \frac{4}{5} = \frac{1}{5}$

to do $\frac{1}{5}$ of the work in 40 days, Let no. of men = x

$$40 = \frac{\frac{1}{5}}{\frac{x}{250\times60}} \Rightarrow 40 = \frac{250\times60}{5\times x} \quad 40x = 3000 \Rightarrow x = 75$$

$\therefore$ Required men = (75 – 60) =15

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Chapter 8

Pipe and Cistern

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Chapter 8

Pipe and Cistern

Pipes and Cistern problems generally consist of a cistern (tank) to which one or more pipes fill the cistern or empty the cistern. These problems of pipes and cisterns can be solved by using the same method used in time and work. And we changes our formulae according to the requirement of the pipes and cisterns.

(i) A pipe connected with a tank or a cistern that fill the tank is known as inlet.

(ii) A pipe connected with a tank that empty it is known as outlet.

Important Points:

1. If a pipe can fill a tank in x hours, then the part filled in 1 hour $= \frac{1}{x}$
2. If a pipe can empty a tank in y hours, then the part of the full tank emptied in 1 hour $= \frac{1}{y}$
3. If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours (y > x), then the net part filled in 1 hour, when both the pipes are opened $= \left(\frac{1}{x} - \frac{1}{y}\right) = \frac{y-x}{xy}$

   Time taken to fill the tank $= \frac{xy}{y-x}$
4. If a pipe can fill a tank in x hours and another pipe can fill the same tank in y hours, the part of the tank filled in 1 hour when both pipes are opened simultaneously $= \left(\frac{1}{x} + \frac{1}{y}\right) = \frac{x+y}{xy}$

   $\therefore$ Time taken to fill completely the tank when both pipes are open simultaneously $= \frac{xy}{x+y}$

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5. If three pipes can fill a tank separately in x, y and z h respectively, then time taken to fill the tank by working together $= \frac{xyz}{xy + yz + zx}$ h.

6. If a pipe fills a tank in x hours and another fills the same tank in y hours, but a third pipe empties the full tank in z hours and all of them are opened together, the net part filled in 1 hour $= \left(\frac{1}{x} + \frac{1}{y} - \frac{1}{z}\right)$.

   Time taken to fill the tank $= \frac{xyz}{yz + xz - xy}$ hours

Example: Pipe A can fill a water tank in 25 minutes, Pipe B can fill the tank in 40 minutes and Pipe C can empty the tank in 30 minutes. If all the 3 pipes are opened together, then in how many minutes will the tank be completely filled?

Sol. Time taken to fill the tank

$$= \frac{25 \times 40 \times 30}{40 \times 30 + 25 \times 30 - 25 \times 40} = \frac{600}{19} = 31\frac{11}{19} \text{ minutes}$$

7. Two pipes A and B can fill a tank in x minutes and y minutes respectively. If both the pipes are opened simultaneously, Then the time after which pipe B should be closed, so that the tank is full in 't' minutes is $\left[y\left(1 - \frac{t}{x}\right)\right]$ minutes.

Example: Two pipes A and B can fill a tank is 12 minutes and 16 minutes respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full is 9 minutes?

Sol. Pipe B should be closed after $= \left(1 - \frac{9}{12}\right) \times 16 = \frac{3}{12} \times 16 = 4$ min.

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Types of Questions

1. Pipe A can fill the tank in 80 minutes and pipe B in 120 minutes. Then after how much time both the pipe can together fill the tank?

Sol. Part filled by two taps in 1 minutes

$$= \frac{1}{80} + \frac{1}{120} = \frac{3+2}{240} = \frac{5}{240} = \frac{1}{48}$$

$\therefore$ Time taken to fill the tank = 48 minutes

Shortcut:

$\therefore$ Take LCM as the total capacity of the tank.

Time taken to fill the tank $= \frac{240}{3+2} = 48$ minutes

2. Two pipes A and B can empty a full tank in 20 hours and 25 hours respectively. In how many hours will tank be emptied when they are opened together?

Sol. Efficiency of both pipes $= \frac{1}{20} + \frac{1}{25} = \frac{5+4}{100} = \frac{9}{100}$

$\therefore$ Tank will be emptied in $\frac{100}{9} = 11\frac{1}{9}$ hours

Shortcut:

A can empty 5 units / hour and B can empty 4 units / hours.

Time taken to empty the tank $= \frac{100}{9} = 11\frac{1}{9}$ hours

3. A can fill a cistern in 10 hours and B can empty it in 5 hours. If they are opened together, in how many hours will cistern be empty?

Sol. Required time $= \frac{10 \times 5}{10 - 5} = \frac{10 \times 5}{5} = 10$ hours.

Shortcut:

Take negative sign when a pipe empty the tank therefore tank will be empty in $= \frac{10}{1 - 2} = 10$ hours

4. Two pipe P and Q can fill a cistern in 12 and 15 min, respectively. If both are opened together and at the end of 3 min the first is closed. How much extra time will Q take to fill the cistern?

Sol. Given, time taken by P to fill the tank = 12 min.

And time taken by Q to fill the tank = 15 min.

Part filled by both pipes in 1 min $= \frac{1}{12} + \frac{1}{15} = \frac{5+4}{60} = \frac{9}{60}$

Now, part filled in 3 min $= \frac{3 \times 9}{60} = \frac{27}{60} = \frac{9}{20}$

$\therefore$ Remaining part $= 1 - \frac{9}{20} = \frac{11}{20}$

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Now, the remaining part is filled by pipe Q in x min.

$$x = \frac{11}{20} \times 15 = \frac{3 \times 11}{4} = \frac{33}{4} = 8\frac{1}{4} \text{ min}$$

Shortcut:

Total capacity = 60

Part filled by (P + Q) in 3 min = 3 (5 + 4) = 27 units

Remaining part is filled by Q only $= \frac{60-27}{4} = \frac{33}{4} = 8\frac{1}{4}$ min

5. A tank can be filled by two pipes A and B in 20 min and 30 min, respectively. When the tank was empty the two pipes were opened. After some time, the first pipe was stopped and the tank was filled in 18 min. After how much time of the start was the first pipe stopped?

Sol. Given, tank filled by A = 20 min

And tank filled by B = 30 min

Let the first pipe be closed after x min.

Then, work done by first pipe in x min = $\frac{x}{20}$

According to the question,

$$\frac{x}{20} + \frac{18}{30} = 1 \Rightarrow \frac{x}{20} = 1 - \frac{18}{30} \Rightarrow \frac{x}{20} = 1 - \frac{3}{5} = \frac{2}{5}$$

$$\therefore \quad x = \frac{2}{5} \times 20 = 8 \text{ min}$$

Shortcut:

B work all time, therefore part filled by B in 18 min
= 2 × 18 = 36 units

Remaining part is filled by A in $\frac{24}{3} = 8$ min

Therefore, after 8 min the first pipe is closed.

6. Pipe A can fill a cistern in 20 minutes and pipe B can fill it in 30 minutes. While pipe C can empties the full cistern in 1 hours. If all the pipes be turned on at the same time, in how much time will the cistern be full?

Sol. Filled part of cistern in 1 minute, when A, B and C be turned on at same time $= \frac{1}{20} + \frac{1}{30} - \frac{1}{60} = \frac{3+2-1}{60} = \frac{4}{60} = \frac{1}{15}$

$\therefore$ time taken to fill the cistern = 15 minutes

Shortcut:

Therefore Cistern will be filled in $\frac{60}{3+2-1} = \frac{60}{4} = 15$ minutes

7. Pipe A can fill a cistern in 5 hours and B can fill it in 20 hours. Both pipes are turned on but there is a leakage in the bottom of the cistern. So the cistern is filled in 30 minutes more. In how many time will leakage emptie the full cistern?

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Sol. Efficiency of pipe A and B $= \frac{1}{5} + \frac{1}{20} = \frac{4+1}{20} = \frac{15}{20} = \frac{1}{4}$

$\therefore$ Pipe A and B working together will fill the cistern in 4 hours

But time taken with leakage = 4 hours + 30 minutes

$= \left(4 + \frac{1}{2}\right)$ hours $= \frac{9}{2}$ hours

$\frac{1}{5} + \frac{1}{20} - \frac{1}{x} = \frac{2}{9} \Rightarrow \frac{1}{5} + \frac{1}{20} - \frac{2}{9}$

$\frac{1}{x} = \frac{36+9-40}{180} = \frac{5}{180} = \frac{1}{36} \Rightarrow$ x = 36 hours

$\therefore$ Leakage will empty the cistern in 36 hours

Shortcut:

A and B fill the cistern in $\frac{20}{5} = 4$ hours

But when there is a leakage in the bottom then the tank is filled in

$\left(4 + \frac{1}{2}\right) = \frac{9}{2}$ hours

$\frac{4x}{x-4} = \frac{9}{2} \Rightarrow$ x = 36 hours

8. Two pipes can fill a cistern in 20 minutes and 25 minutes respectively. These are opened alternatively for 1 minutes each, beginning with first. In how much time will the cistern b full?

Sol. Filled cistern in 1 round (or 2 minutes) $= \frac{1}{20} + \frac{1}{25} = \frac{5+4}{100} = \frac{9}{100}$

$\left(\frac{9}{100} \Rightarrow 100 \div 9 \text{ gives 11 round complete}\right)$

$\therefore$ Filled cistern in 11 round (or 22 minutes) $= \frac{9}{100} \times 11 = \frac{99}{100}$

$\therefore$ Empty part of cistern $= 1 - \frac{99}{100} = \frac{1}{100}$

On 23rd min., it is first pipe's is opened.

$\therefore$ Time taken to fill empty part by first pipe

$$= \frac{\text{empty part}}{\text{efficiency of first pipe}} = \frac{\frac{1}{100}}{\frac{1}{20}} = \frac{1}{100} \times \frac{20}{1} = \frac{1}{5} \text{ minutes}$$

$\therefore$ Total time $= 22 + \frac{1}{5} = 22\frac{1}{5}$ minutes

Shortcut:

A and B opened alternatively.

$\therefore$ In 2 minutes filled is 9 units.

Minutes Tank Filled

$$\times 11\begin{pmatrix} 2 & 9 \\ 22 & 99 \end{pmatrix}\times 11$$

Remaining part = 100 – 99 = 1 unit

1 unit is filled by A in $= \frac{1}{5}$ minutes

Total time $= 22 + \frac{1}{5} = 22\frac{1}{5}$ minutes

9. A swimming pool has 3 drain pipes. The first two pipes A and B, operating simultaneously can empty the pool in half the time that C, the 3rd pipe, alone takes to empty it. Pipe A, working alone, takes half the time taken by pipe B. Together they take 6 h 40 min to empty the pool. Time taken by pipe A to empty the pool, in hours, is

Sol. Let the taken by pipe B = 2x h

Part of the pool emptied by B in 1 h $= \frac{1}{2x}$

Part of pool emptied in 1 h by A $= \frac{1}{x}$

$\therefore$ Time taken by pipe C $= \frac{2}{\frac{1}{2x}+\frac{1}{x}} = \frac{2}{\frac{1+2}{2x}} = \frac{4x}{3}$ h

Now, part of the tank filled by all together

$$= \frac{1}{x}+\frac{1}{2x}+\frac{3}{4x} = \frac{4+2+3}{4x} = \frac{1}{6+\frac{2}{3}}$$

$$= \frac{4+2+3}{4x} = \frac{3}{20} = 9\times 20 = 4x\times 3 \quad \Rightarrow \quad x = \frac{9\times 20}{4\times 3} = 15 \text{ h}$$

10. A tank has a leak which would empty the completely filled tank in 10 h. If the tank is full of water and a tap is opened which admits 4 L of water per minutes in the tank, the leak takes 15 h to empty the tank. How many litres of water does the tank hold?

Sol. Let the capacity of the tank = x L

According to the question,

Quantity of water emptied by the leak in 1 h $= \frac{x}{10}$ L

Quantity of water emptied with inlet pipe in 1 h = $\frac{1}{15}$

Let Inlet pipe fills tank in x h

So, $\frac{1}{x} - \frac{1}{10} = -\frac{1}{15} \Rightarrow \frac{1}{x} = \frac{1}{10} - \frac{1}{15} \Rightarrow \frac{3-2}{30} = \frac{1}{30}$

So, Intel pipe fills tank in 30 h

Capacity of tank = 30 × 60 × 4 = 7200 L.

Shortcut:

Therefore B admit 1 unit/hour and originally B admit 4 L/min. Therefore

1 = 4 × 60 $\Rightarrow$ 1 ≡ 240

Total Capacity = 30 × 240 = 7200 L

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Foundation

1. If a pipe fills a tank in 6 h, then what part of the tank will the pipe fill in 1 h?

(a) $\frac{1}{3}$ (b) $\frac{1}{6}$ (b) $\frac{1}{4}$

(d) $\frac{1}{5}$ (e) None of these

2. An inlet pipe fills $\frac{1}{8}$ part of a tank in 1 h. How much time will the pipe take to fill the empty tank?

(a) 4h (b) 2h (b) 6h

(d) 8h (e) None of these

3. An outlet pipe can empty a cistern in 3 h. In what time will the pipe empty two-third part of the cistern?

(a) 4h (b) 2h (b) 3h

(d) 5h (e) None of these

4. There are two taps A and B to fill up a water tank. The tank can be filled in 40 min, if both taps are on. The same tank can be filled in 60 min, if tap A alone is on. How much time will tap B alone take, to fill up the same tank?

(a) 64 min (b) 80 min (b) 96 min

(d) 120 min (e) None of these

5. A pipe can fill a tank in 10 h, while an another pipe can empty it in 6 h. Find the time taken to empty the tank, when both the pipes are opened simultaneously?

(a) 11h (b) 15h (b) 18h

(d) 16h (e) None of these

6. Three taps are fitted in a cistern. The empty cistern is filled by the first and the second taps in 3 and 4h, respectively. The full cistern is emptied by the third tap in 5 h. If all three taps are opened simultaneously, the empty cistern will be filled up in?

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(a) $1\frac{14}{23}$ h (b) $2\frac{14}{23}$ h (b) 2 h 40 min

(d) 1 h 56 min (e) None of these

7. Pipe A can fill a tank in 30 min, while pipe B can fill the same tank in 10 min and pipe C can empty the full tank in 40 min. If all the pipes are opened together, how much time will be needed to make the tank full?

(a) $9\frac{3}{13}$ h (b) $9\frac{4}{13}$ h (b) $9\frac{7}{13}$ h

(d) $9\frac{9}{13}$ h (e) None of these

8. Three taps A, B and C together can fill an empty cistern in 10 min. The tap A alone can fill it in 30 min and the tap B alone can fill it in 40 min. How long will the tap C alone take to fill it?

(a) 16 min (b) 24 min (b) 32 min

(d) 40 min (e) None of these

9. Two pipes A and B can fill a tank in 1 h and 75 min, respectively. There is also an outlet C. If all the three pipes are opened together. The tank is full in 50 min. How much time will be taken by C to empty the full tank?

(a) 100 min (b) 150 min (b) 200 min

(d) 125 min (e) None of these

10. A, B and C are three pipes connected to a tank. A and B together fill the tank in 6 h, B and C together fill the tank in 10 h and A and C together fill the tank in 12 h. In how much time A, B and C fill up the tank together?

(a) 9 h (b) $5\frac{3}{7}$ h (b) $5\frac{2}{7}$ h

(d) $5\frac{5}{7}$ h (e) None of these

11. Inlet A is four times faster than inlet B to fill a tank. If A alone can fill it in 15 min, how long will it take if both the pipes are opened together?
(a) 10 min (b) 12 min (b) 15 min
(d) 14 min (e) None of these

12. There are two inlets A and B connected to a tank. A and B can fill the tank in 16 h and 10 h, respectively. If both the pipes are opened alternately for 1 h, starting from A, then how much time will the tank take to be filled?
(a) $13\frac{1}{4}$ h (b) $11\frac{6}{8}$ h (b) $12\frac{2}{5}$ h
(d) $12\frac{1}{4}$ h (e) None of these

13. A pipe can empty a cistern in 27 hours. Find the time in which $\frac{2}{3}$ part of the cistern will be emptied?
(a) 9 hours (b) 12 hours (b) 15 hours
(d) 18 hours (e) None of these

14. A water tank is $\frac{2}{3}$ rd full. Pipe A can fill the tank in 10 minutes and the pipe B can empty it in 6 minutes. If both the pipes are open, how long will it take to empty or fill the tank completely?
(a) 6 minutes to empty (b) 6 minutes to fill
(c) 9 minutes to empty (d) 9 minutes to fill
(e) None of these

15. A tap can fill a cistern in 8 hours and another can empty it in 16 hours. If both the taps are opened simultaneously, the time (in hours) to fill the tank is?
(a) 8 (b) 10 (c) 16
(d) 24 (e) None of these

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16. A pipe can empty a tank in 15 hrs and another pipe can empty it in 10 hours. If both the pipes are opened simultaneously, find the time in which a full tank is emptied?
(a) 8 hrs (b) 6 hrs (c) 4 hrs
(d) 5 hrs (e) None of these

17. Two pipes A and B can fill a cistern in 20 minutes and 25 minutes respectively. Both are opened together, but after 5 minutes, B is turned off. How much longer will the cistern take to fill?
(a) 16 minutes (b) 18 minutes (c) 11 minutes
(d) C.N.D. (e) None of these

18. 12 pumps working 6 hours a day can empty a completely filled reservoir in 15 days. How many such pumps working 9 hours a day will empty the same reservoir in 12 days?
(a) 15 (b) 9 (c) 10
(d) 12 (e) None of these

19. A tank has a leak which would empty it in 8 hrs. A tap is turned on which admits 6 litres a minutes into the tank, and it is now emptied in 12 hrs. How many litres does the tank hold?
(a) 8260 litres (b) 8450 litres (c) 8640 litres
(d) 8660 litres (e) None of these

20. A tap can fill the cistern in 8 hours and another can empty it in 16 hours. If both the taps are opened simultaneously, the time (in hours) to fill the tank is?
(a) 16 hrs (b) 8 hrs (c) 10 hrs
(d) 12 hrs (e) None of these

21. A pipe can fill any tank with water in 5 hours and an another pipe can empty the same tank in 4 hours. If the tank is completely filled and both the taps are opened together than the tank will be empty in following time (hour)?
(a) 9 (b) 18 (c) 20
(d) $20\frac{1}{2}$ (e) None of these

22. Two pipes can fill a tank respectively in 15 and 12 hours while a third pipe can empty it in 20 hours. If the tank is empty and all three pipes are opened together then in how much time will it take to fill the tank completely?
(a) 10 hours (b) 5 hours (c) 15 hours
(d) 20 hours (e) None of these

23. 2 pipes A and B can fill a tank separately in 60 min and 70 min respectively. There is a third pipe attached to the bottom of the tank to empty it. The tank is filled in 60 min when all three pipes are opened. In how much time (min) the third pipe alone take to fill the tank?
(a) 110 min (b) 70 min (c) 120 min
(d) 90 min (e) None of these

24. Two pipes A and B can fill any tank in $37\frac{1}{2}$ min and 45 min respectively. If both the pipes are opened together, then after how much time should B be closed so that the tank is full in half hours?
(a) 15 min (b) 10 min (c) 21 min
(d) 9 min (e) None of these

25. A big tanker can be filled by two pipes A and B in 60 and 40 min respectively. Then what time it will take to fill an empty tanker if tap B is used half of time and tap A and B together are used rest half of time?
(a) 24 min (b) 30 min (c) 18 min
(d) 32 min (e) None of these

26. Two taps A and B can fill an oil tank in 15 min and 18 min respectively while a third tap is used to empty the tank. The third tap is opened after 6 min of opening of tap A and B. If the tank empties in $16\frac{1}{2}$ min after opening the third tap then in how much time the third tap can empty the full tank?
(a) 6 min (b) 12 min (c) 10 min
(d) 15 min (e) None of these

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27. Three pipes A, B and C can fill a tank in 6 hours. After running them together for two hours the tap C is closed and A and B fills it completely in 7 hours. How much time would C take to fill the tank alone?
(a) 7 hours (b) 10.5 hours (c) 14 hours
(d) 21 hours (e) None of these

28. A water tank has three taps A, B, C. Tap A, when opened, can fill the water tank alone in 4 hours. Tap B, when opened, can filled the water tank alone in 6 hours and tap C, when opened, can empty the water tank alone in 3 hours. If taps A, B and C are opened simultaneously how long will it take to fill the tank completely?
(a) 10 hours (b) 8 hours (c) 18 hours
(d) 12 hours (e) None of these

29. A water tank has two taps A and B. A can fill it in 6 hours, and tap B empty it in 5 hours. If Both the taps open simultaneously the times required to fill the tank?
(a) 20 hours (b) 30 hours (c) 25 hours
(d) 35 hours (e) None of these

30. 18 pumps can fill reservoir of capacity 1440 kilo liter in 5 hours. Then how many hours required to fill a reservoir of capacity 1920 kilo liter by 8 pumps?
(a) 10 hours (b) 16 hours (c) 15 hours
(d) 20 hours (e) None of these

Moderate

1. Two pipes can fill a cistern in 14 h and 16 h, respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom, it took 92 min more to fill the cistern. When the cistern is full, in what time will the leak empty it?

(a) $43\frac{15}{23}$ h (b) $43\frac{17}{23}$ h (c) $43\frac{13}{23}$ h

(d) $43\frac{19}{23}$ h (e) None of these

2. A pipe P can fill a tank in 12 min and another pipe R can fill it in 15 min. But, the 3rd pipe M can empty it in 6 min. The 1st two pipes P and R are kept open for 5 min in the beginning and then the 3rd pipe is also opened. In what time is the tank emptied?
(a) 30 min (b) 25 min (c) 45 min
(d) 35 min (e) None of these

3. A tap having diameter 'd' can empty a tank in 40 min. How long another tap having diameter '2d' take to empty the same tank?
(a) 5 min (b) 20 min (c) 10 min
(d) 40 min (e) None of these

4. If two pipes function together, the tank will be filled in 12 h. One pipe fils the tank in 10 h faster than the other. How many hours does the faster pipe take to fill up the tank?
(a) 20 h (b) 60 h (c) 25 h
(d) 25 h (e) None of these

5. Two pipes A and B can fill a cistern in 15 and 20 min, respectively. Both the pipes are opened together, but after 2 min, pipe A is turned off. What is the total time required to fill the tank?
(a) $\frac{46}{3}$ min (b) $\frac{52}{3}$ min (a) $\frac{46}{3}$ min
(d) $\frac{41}{3}$ min. (e) None of these

6. Two pipes A and B can fill a tank in 24 and 32 min, respectively. If both the pipes are opened together, after how much time pipe B should be closed so that the tank is full in 9 min?
(a) 40 min (b) 30 min (c) 10 min
(d) 20 min (e) None of these

7. 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 the tank take to be filled?
(a) 105 min (b) 120 min (c) 167 min
(d) 185 min (e) None of these

8. Two taps A and B can fill a tank in 25 min and 20 min, respectively. But taps are not opened properly, so the taps A and B allow $\frac{5}{6}$th and $\frac{2}{3}$rd part of water, respectively. How long will they take to fill the tank?
(a) 12 min (b) 13 min (c) 14 min
(d) 15 min (e) None of these

9. Three taps A, B and C fill a tank in 20 min, 15 min and 12 min, respectively. If all the taps are opened simultaneously, how long will they take to fill 40% of the tank?
(a) 1 min (b) 2 min (c) 3 min
(d) 4 min (e) None of these

10. A pipe can fill a cistern in 4 min and another pipe can fill it in 15 min, but a third pipe can empty it in 2 min. The first two pipes are kept open for 2 min in the beginning and then the third pipe is also opened. Time taken to empty the cistern is?
(a) 20 min (b) 22 min (c) 42 min
(d) 18 min (e) None of these

11. Taps A, B and C attached with a tank and velocity of water coming through them are 42 L / h, 56 L / h and 48 L / h, respectively. A and B are inlets and C is outlet. If all the taps are opened simultaneously, tank is filled in 16 h. What is the capacity of the tank?
(a) 2346 L (b) 1600 L (c) 800 L
(d) 960 L (e) None of these

12. A boy and girls together fill a cistern with water. The boy pours 4 litres of water every 3 minutes and the girl pours 3 litres every 4 minutes. How much time will it take to fill 100 litres of water in the cistern?
(a) 36 minutes (b) 42 minutes (c) 48 minutes
(d) 44 minutes (e) None of these

13. A tap takes 36 hours extra to fill a tank due to a leakage equivalent to half of its inflow. The inlet pipe alone can fill the tank in how many hours?
(a) 36 (b) 24 (c) 30
(d) 18 (e) None of these

14. A cylindrical tank of diameter 25 cm is full of water. If 11 litres of water is drawn off, the water level in the tank will drop by (Use $\pi = 22/7$)?
(a) $10\frac{1}{2}$ cm (b) $12\frac{6}{7}$ cm (c) 14 cm
(d) $22\frac{2}{5}$ cm (e) None of these

15. Two pipes A and B can fill a tank in 36 hours and 45 hours respectively. If both the pipes are opened simultaneously, how much time will be taken to fill the tank?
(a) 10 hrs (b) 15 hrs (c) 20 hrs
(d) 25 hrs (e) None of these

16. In what time would a cistern be filled by three pipes whose diameters are 1 cm, $1\frac{1}{3}$ cm, 2 cm, running together, when the largest alone will fill it in 61 minutes, the amount of water flowing in by each pipe being proportional to the square of its diameter?
(a) 32 minutes (b) 34 minutes (c) 36 minutes
(d) 38 minutes

17. Two pipes can separately fill a tank in 20 hrs and 30 hrs respectively. Both the pipes are opened to fill the tank but when the tank is $\frac{1}{3}$ full a leak develops in the tank through which $\frac{1}{3}$ of the water supplied by both the pipes per hour leak out. What is the total time taken to fill the tank?

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(a) 12 hrs (b) 14 hrs (c) 16 hrs
(d) 18 hrs (e) None of these

18. A cistern can be filled by two pipes A and B in 4 hours and 6 hours respectively. When full, the tank can be emptied by a third pipe C in 8 hours. If all the taps be turned on at the same time, the cistern will be full in?

(a) $2\frac{2}{7}$ hrs (b) $3\frac{3}{7}$ hrs (c) $4\frac{3}{7}$ hrs
(d) $5\frac{5}{7}$ hrs (e) None of these

19. If two pipes function simultaneously, the reservoir will be filled in 6 hours. One pipe fills the reservoir 5 hours faster than the other. How many hours does the faster pipe take to fill the reservoir?
(a) 8 hrs (b) 10 hrs (c) 12 hrs
(d) C.N.D. (e) None of these

20. Three pipes A, B and C can fill cistern in 6 hrs. After working together for 2 hours, C is closed and A and B fill the cistern in 8 hrs. Then find the time in which the cistern can be filled by pipe C?
(a) 6 hrs (b) 12 hrs (c) 14 hrs
(d) 20 hrs (e) None of these

Difficult

1. Two pipes A and B can fill a tank in 24 minutes and 32 minute respectively. If both the pipes are opened simultaneously, after how much time should B be closed so that the tank is full in 18 minutes?
(a) 2 min. (b) 4 min. (c) 6 min.
(d) 8 min. (e) None of these

2. If three taps are opened together, a tank is filled in 12 hrs. One of the taps can fill it in 10 hrs and another in 15 hrs. How many hours does the third tap take alone to empty it completely?
(a) 8 hrs (b) 10 hrs (c) 12 hrs
(d) 16 hrs (e) None of these

3. A tank can be filled with water by two pipes A and B together in 36 minutes. If the pipe B was closed after 30 minutes, the tank is filled in 40 minutes. The pipe B can alone fill the tank in?
(a) 45 minutes (b) 60 minutes (c) 75 minutes
(d) 90 minutes (e) None of these

4. A tank has two pipes. The first pipe can fill it in 45 minutes and the second can empty it in 1 hour. In what time will the empty tank be filled if the pipes be opened one at a time in alternate minutes?
(a) 2 hrs 55 min (b) 3 hrs 40 min (c) 4 hrs 48 min
(d) 5 hrs 53 min (e) None of these

5. A tank can be filled by a tap in 20 min and by another tap in 60 min. Both the taps are kept open for 5 min and then the 1st tap is shut off. After this, how much time the tank will be completely filled?
(a) 20 min (b) 30 min (c) 45 min
(d) 40 min (e) None of these

6. A cistern has three pipes A, B and C. Pipes A and B can fill it in 3 h and 4 h, respectively, while pipe C can empty the completely filled cistern in 1 h. If pipes are opened in order at 3:00 pm, 4:00 pm and 5:00 pm, respectively, at what time will the cistern be empty?
(a) 6 : 15 pm (b) 7 : 12 pm (c) 8 : 12 pm
(d) 8 : 35 pm (e) None of these

7. Three pipes A, B and C can fill a tank in 30 min, 20 min and 10 min, respectively. When the tank is empty, all the three pipes are opened. If A, B and C discharge chemical solutions P, Q and R respectively, then the part of solution R in the liquid in the tank after 3 min is:
(a) $\frac{8}{11}$ (b) $\frac{5}{11}$ (c) $\frac{6}{11}$
(d) $\frac{7}{11}$ (e) None of these

8. Three pipes A, B and C can fill a cistern in 6 hrs. After working together for 2 hours, C is closed and A and B fill the cistern in 8 hrs. Then find the time in which the cistern can be filled by pipe C?
(a) 14 hrs. (b) 12 hrs. (c) 16 hrs.
(d) 18 hrs. (e) None of these

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9. A, B and C are three pipes connected to tank. A and B together fill the tank in 6 hrs. B and C together fill the tank in 10 hrs. A and C together fill the tank in $7\frac{1}{2}$ hrs. In how much time will A, B and C fill the tank together?

(a) 36 hrs. (b) 32 hrs. (c) 30 hrs.
(d) 5 hrs. (e) None of these

10. Two pipes A and B can fill a tank in 15 hours and 20 hours respectively while a third pipe C can empty the full tank in 25 hours. All the three pipes are opened in the beginning. After 10 hours C is closed. Find, in how much time will the take be full?

(a) 12 hrs (b) 8 hrs (c) 10 hrs
(d) 14 hrs (e) None of these

11. Three pipes A, B and C can fill a cistern in 10 hours, 12 hours and 15 hours respectively. First A was opened. After 1 hour, B was opened and after 2 hours from the start of A, C was also opened. Find the time in which the cistern is just full?

(a) 2 hrs (b) 4 hrs (c) 2 hrs 52 min
(d) 4 hrs 52 min (e) None of these

12. A, B, C are pipes attached to a cistern. A and B can fill it in 20 and 30 minutes respectively, while C can empty it in 15 minutes. If A, B, C be kept open successively for 1 minute each, how soon will the cistern be filled?

(a) 167 min (b) 160 min (c) 166 min
(d) 164 min (e) None of these

13. A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank?

(a) 20 hrs (b) 25 hrs (c) 35 hrs
(d) 15 hrs (e) None of these

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14. Two pipes A and B can fill a tank in 15 minutes and 20 minutes respectively. Both the pipes are opened together but after 4 minutes, pipe A is turned off. What is the total time required to fill the tank?
(a) 10 min 20 sec (b) 11 min 45 sec
(c) 12 min 30 sec (d) 14 min 40 sec
(e) None of these

15. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in?
(a) 6 hrs (b) $6\frac{2}{3}$ hrs (c) 5 hrs
(d) 7 hrs (e) None of these

16. A booster pump can be used for filling as well as for emptying a tank. The capacity of the tank is 2400 m^3. The emptying capacity of the tank is 10 m^3 per minute higher than its filling capacity and the pump needs 8 minutes lesser to empty the tank than it needs to fill it. What is the filling capacity of the pump?
(a) 50 m^3/min (b) 60 m^3/min (c) 72 m^3/min
(d) 32 m^3/min (e) None of these

17. A leak in the bottom of a tank can empty the full tank in 8 hours. An inlet pipe fills water at the rate of 6 litres a minute. When the tank is full, the inlet pipe is opened and due to the leak, the tank is empty in 12 hours. How many litres does the tank hold?
(a) 7580 (b) 7960 (c) 8290
(d) 8640 (e) None of these

18. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 gallons per minute. All the three pipes working together can fill the tank in 15 minutes. The capacity of the tank is?
(a) 60 gallons (b) 100 gallons (c) 120 gallons
(d) 180 gallons (e) None of these

19. Three pipes A, B and C can fill a tank in 6 hours. After working at it together for 2 hours, C is closed and A and B can fill the remaining part in 7 hours. The number of hours taken by C alone to fill the tank is?
(a) 10 (b) 12 (c) 14
(d) 20 (e) None of these

20. Two pipes A and B can fill a tank in 24 min. and 48 min. respectively. If both the pipes are opened simultaneously, after how much time B should be closed so that the tank is full in 20 minutes?
(a) 8 (b) 12 (c) 14
(d) 16 (e) None of these

Previous Year (Memory Based)

1. Two taps can fill a tank respectively in 20 and 30 min. When the tank was empty both the taps were opened and after some time first tap was closed. It took 18 min to fill the tank. After how much time of the begining the first tap was closed?
(a) 5 min (b) 8 min (c) 10 min
(d) 12 min (e) None of these

2. Two taps P and Q can fill a water tank respectively in 12 min and 15 min. They are opened together but after 3 min P is closed. How much more time will Q take to fill the tank?
(a) 7 min (b) $7\frac{1}{2}$ min (c) 8 min
(d) $8\frac{1}{4}$ min (e) None of these

3. A pipe can fill a tank with thrice the speed of an another pipe. If both the pipes together take 36 min to fill an empty tank completely then how much time it will take for slower pipe to fill the tank alone?
(a) 1 hours 21 min (b) 1 hour 28 min (c) 2 hours
(d) 2 hours 24 min (e) None of these

4. A tap can fill an empty tank in 12 hours and another tap can empty the half filled tank in 10 hours. If both the taps are opened together then how much time it will take to fill an empty tank half filled?
(a) 30 hours (b) 20 hours (c) 15 hours
(d) 12 hours (e) None of these

5. An oil drum can be filled with oil in 40 min by a filling pipe. An another outlet pipe can empty the entire drum in 60 min. The outlet pipe was opened when $\frac{2}{3}$ part of the drum was filled with oil and closed after 15 min. What time will it take to fill the drum when filling pipe is opened now?
(a) $23\frac{1}{3}$ min (b) $25\frac{2}{3}$ min (c) $27\frac{1}{3}$ min
(d) $28\frac{2}{3}$ min (e) None of these

6. Two taps A and B can fill a water tank respectively in 20 and 24 min. and a third tap C empties the tank at a speed of 3 gallon per min. It takes 15 min to fill the tank if A, B and C are opened together. The capacity of the tank is?
(a) 180 gallon (b) 150 gallon (c) 720 gallon
(d) 60 gallon (e) None of these

7. Three taps P, Q and R separately can fill a tank completely in 4, 8 and 12 hours respectively. An another taps S can empty the filled tank in 10 hours. Which technique among the following will fill the empty tank in lesser time than other.
(a) Q opened alone (b) P and S are opened
(c) P, R and S are opened (d) P, Q and S are opened
(e) None of these

8. A pipe can fill a tank in x h and another pipe can empty it in y(y>x) h. If both the pipes are open, in how many hours will the tank be filled?

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(a) $(x - y)\,h$ (b) $(y - x)\,h$ (c) $\frac{xy}{x-y}h$

(d) $\frac{xy}{y-x}h$ (e) None of these

9. A pipe can fill a tank with water in 3 h. Due to leakage in bottom, it takes $3\frac{1}{2}$ h to fill it. In what time the leak will empty the fully filled tank?

(a) 12 h (b) 21 h (c) $6\frac{1}{2}$ h

(d) $10\frac{1}{2}$ h (e) None of these

10. A water tank has two pipes. The empty tank is filled in 12 min by the 1st and the, full tank is emptied by the 2nd in 20 min. The time required to fill the 1/2 full tank when both pipes are in action, is?

(a) 16 min (b) 15 min (c) 20 min
(d) 30 min (e) None of these

11. Three taps are fitted to a cistern. The empty cistern is filled by the first and second taps in 3 and 4 h, respectively. The full cistern is emptied by the third tap in 5 h. If all three taps are opened simultanceously, the empty cistern will be filled up in?

(a) $1\frac{14}{23}$ h (b) $2\frac{14}{23}$ h (c) 2 h 40 min

(d) 1 h 56 min (e) None of these

12. A tank can be filled by pipe A in 2 h and pipe B in 6 h. At 10 am pipe A was opened. At what time will the tank be filled if pipe B is opened at 11 am?

(a) 12 : 45 (b) 5 pm (c) 11 : 45
(d) 12 pm (e) None of these

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13. An empty tank can be filled by pipe A in 4 h and by pipe B in 6 h. If the two pipes are opened for 1 h each alternately with first opening pipe A, then the tank will be filled in?

(a) $1\frac{3}{4}$ h (b) $2\frac{3}{5}$ h (c) $4\frac{2}{3}$ h

(d) $5\frac{1}{2}$ h (e) None of these

14. A cistern has two types . One can fill it in 8 h and other can empty it in 5 h. In how many hours will the cistern be emptied if both the pipes are opened together when $\frac{3}{4}$ of the cistern is already full of water?

(a) 12 h (b) 10 h (c) 6 h
(d) 8 h (e) None of these

15. Pipes P and Q can fill a tank in 10 and 12 h, respectively and C can empty it in 6 h. If all the three are opened at 7 am, at what time will one fourth of the tank be filled?

(a) 10 am (b) 10 pm (c) 11 pm
(d) 11 am (e) None of these

16. A tap can fill a tank in 6 h. After half the tank is filled, three more similar taps are opened. What is the total time taken to fill the tank completely?

(a) 4 h (b) 4 h 15 min (c) 3 h 15 min
(d) 3 h 45 min (e) None of these

17. Two pipes A and B can fill a water tank in 10 and 12 min, respectively and a third pipe C can empty at the rate of 6 gallons per min. If A, B and C opened together fill the tank in 20 min, the capacity (in gallons) of the tank is:

(a) 180 (b) 150 (c) 120
(d) 60 (e) None of these

18. A tap can fill a cistern in 40 min and a second tap can empty the filled cistern in 60 min. By mistake without closing the second tap, the first tap was opened. In how many minutes will the empty cistern be filled

(a) 72 (b) 84 (c) 108
(d) 120 (e) None of these

19. Pipe A can fill a cistern in 6 h and pipe B can fill it in 8 h. Both the pipes are opened simultaneously, but after 2 h, pipe A is closed. How many hours will B take to fill the remaining part of the cistern?

(a) 2 (b) $3\frac{1}{3}$ (c) $2\frac{2}{3}$
(d) 4 (e) None of these

20. Pipes P and Q can fill a tank in 5 and 6 h, respectively and C can empty it in 3 h. If all the three are opened at 7 am, at what time will two fifth of the tank be filled?

(a) 10 am (b) 7 pm (c) 11 pm
(d) 11 am (e) None of these

POWER

Foundation

1. (b); Time taken to fill the tank = 6 h.

Part of tank filled in 6 h = 1

Part of tank filled in 1 h = $\frac{1}{6}$

2. (d); Time taken to fill $\frac{1}{8}$ part of tank = 1 h

$\therefore$ Time taken to fill the empty tank = 8 h.

3. (b); Time taken to empty a cistern = 3h

Time taken to empty $\frac{2}{3}$ part of the cistern = $3 \times \frac{2}{3}$ = 2 h

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4. (d); Given time taken by tap A to fill the tank = 60 min
Let Time taken by tap B to fill the tank = x min

There, $\frac{1}{60}+\frac{1}{x}=\frac{1}{40} \Rightarrow \frac{1}{x}=\frac{1}{40}-\frac{1}{60}=\frac{3-2}{120}$

$\frac{1}{x}=\frac{1}{120} \Rightarrow x = 120$ min

5. (b); Given pipe A can fill a tank = 10 h
Pipe B can empty it = 6 h

Time taken to empty the full tank = $\frac{1}{\frac{1}{6}-\frac{1}{10}}$

$= \frac{1}{\frac{5-3}{30}} = \frac{1}{\frac{5-3}{30}} = 15$ h

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6. (b); Given,
Time taken by first tap to fill the tank (A) = 3 h
Time taken by second tap to fill the tank (B) = 4 h
And time taken to empty the full tank by third tap (C) = 5hr
∴ Part of the tank will be filled by all there taps in

1 hr = $\frac{1}{3}+\frac{1}{4}-\frac{1}{5}=\frac{20+15-12}{60}=\frac{23}{60}$h

Required time = $\frac{60}{23}$h = $2\frac{14}{23}$h

7. (a); Given,
A = 30 min, B = 10 min, C = 40 min

Part of the tank filled in 1 h = $\frac{1}{30}+\frac{1}{10}-\frac{1}{40}=\frac{4+12-3}{120}=\frac{13}{120}$

Required time = $\frac{120}{13}=9\frac{3}{13}$h

8. (b); Given, $\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=\frac{1}{10} \Rightarrow \frac{1}{a}=\frac{1}{30}, \frac{1}{b}=\frac{1}{40}$

$$\frac{1}{c}=\frac{1}{10}-\frac{1}{30}-\frac{1}{40} \Rightarrow \frac{12-4-3}{120}=\frac{5}{120} \Rightarrow c = 24 \text{ min}$$

9. (a); Given, a = 60, b = 75

$$\frac{1}{a}+\frac{1}{b}-\frac{1}{c}=\frac{1}{50} \Rightarrow \frac{1}{c}=\frac{1}{60}+\frac{1}{75}-\frac{1}{50}$$

$$=\frac{5+4-6}{300} \Rightarrow \frac{1}{c}=\frac{3}{300} \Rightarrow c = 100$$

10. (d); Let a, b, c be the time taken to fill the min tank by pipes A, B and C respectively

Given, $\frac{1}{a}+\frac{1}{b}=\frac{1}{6}, \frac{1}{b}+\frac{1}{c}=\frac{1}{10}, \frac{1}{a}+\frac{1}{c}=\frac{1}{12}$

Then, $2\left(\frac{1}{a}+\frac{1}{b}+\frac{1}{c}\right)=\frac{1}{6}+\frac{1}{10}+\frac{1}{12}=\frac{10+6+5}{60}$

$$\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=\frac{21}{120}$$

Required time = $\frac{120}{21}=\frac{40}{7}=5\frac{5}{7}$ h

11. (b); Let 4x is the time taken to fill the tank by inlet B
Then x will be the time taken to fill tank by inlet A
$\Rightarrow$ x = 15

Part of he tank will fill in 1 min = $\frac{4+1}{60}=\frac{1}{12}$ min

Required time = 12 min

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12. (c); A = 16 h, B = 10 h

Part of the tank filled in (2h) = $\frac{1}{16}+\frac{1}{10}=\frac{5+8}{80}=\frac{13}{80}$

Part of the tank filled in (12 h) = $\frac{78}{80}$

Remaining part = $1-\frac{78}{80}=\frac{2}{80}=\frac{1}{40}$

$\frac{1}{40}$ part of the tank will be filled by inlet A

$=\frac{\frac{1}{40}}{\frac{1}{16}}=\frac{16}{40}=\frac{8}{20}=\frac{4}{10}=\frac{2}{5}$ hr

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Required time = $12+\frac{2}{5}=12\frac{2}{5}$ hr

13. (d); 1 part of cistern will be empty by pipe A = 27 h

$\frac{2}{3}$ part of cistern will be empty by pipe A = $27\times\frac{2}{3}=18$ hr.

14. (e); Given, A = 10 min, B = 6 min

Part of tank will be empty in 1 min = $\frac{1}{6}-\frac{1}{10}=\frac{5-3}{30}=\frac{1}{15}$

$\therefore$ Full tank will be empty in 15 min.

$\therefore$ $\frac{2}{3}$rd part of the tank will be empty in = $15\times\frac{2}{3}=10$ minutes

15. (c); Part of the tank will be filled in 1 h = $\frac{1}{8}-\frac{1}{16}=\frac{1}{16}$

Required time = 16 h

16. (b); Part of the tank will empty in 1 h = $\frac{1}{15}+\frac{1}{10}=\frac{2+3}{30}=\frac{5}{30}=\frac{1}{6}$

Required time = 6 hrs

17. (c); Given, A = 20 min, B = 25 min

In 1 min, part of the tank will be filled = $\frac{1}{20}+\frac{1}{25}=\frac{5+4}{100}=\frac{9}{100}$

In 5 min part of the tank will be filled = $\frac{45}{100}$

Remaining part = $1-\frac{45}{100}=\frac{55}{100}=\frac{11}{20}$

It will take pipe A to fill the $\frac{11}{20}$ part of the tank = $\frac{\frac{11}{20}}{\frac{1}{20}}$ = 11 min

18. (c); By the formula, $\frac{M_1D_1H_1}{W_1}=\frac{M_2D_2H_2}{W_2}$

Here, $D_1 = 15$, $H_1 = 6$, $M_1 = 12$

$M_2 = ?$, $D_2 = 12$, $H_2 = 9$

$15 \times 6 \times 12 = x \times 12 \times 9$

$x = \frac{5\times 6}{3} = 10$

Required time = 10 hrs.

19. (c); Time taken by second pipe to fill the tank

$= \frac{1}{\left(\frac{1}{8}+\frac{1}{12}\right)} = \frac{1}{\frac{3-2}{24}} = \frac{1}{\frac{1}{24}} = 24$ hrs

Capacity of tank = 24 × 60 × 6 = 8640 litres

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20. (a); Given,
First tap to fill the tank (A) = 8 hr
Second tap to empty the tank (B) = 16 hr

Part of the tank will be filled in 1 h = $\frac{1}{8}-\frac{1}{16}=\frac{2-1}{16}=\frac{1}{16}$

Required time = 16 hr

21. (c); Given,
First tap to fill the tank (A) = 5 hr
Second tap to empty the tank (B) = 4 hr

Part of the tank will be empty in 1 hr = $\frac{1}{4}-\frac{1}{5}=\frac{5-4}{20}=\frac{1}{20}$

Required time = 20 hr

22. (a); Part of the tank will be filled in 1 hr

$$=\frac{1}{15}+\frac{1}{12}-\frac{1}{20}=\frac{4+5-3}{60}=\frac{6}{60}=\frac{1}{10}$$

Required time = 10 hr

23. (b); Part of tank will be emptied in 1 hr by 3rd pipe

$$=\frac{1}{60}+\frac{1}{70}-\frac{1}{60}=\frac{1}{70}$$

Required time = 70 min

24. (d); Let after x min the pipe be closed so that the tank will be filled full in half hour

$$\therefore \frac{30}{75}\times 2+\frac{x}{45}=1 \Rightarrow \frac{180+5x}{225}=1$$

$180 + 5x = 225 \Rightarrow 5x = 45 \Rightarrow x = 9$ min

25. (b); Let the required time = x
Part of the tank will be filled by tap (A and B)

$$=\frac{1}{60}+\frac{1}{40}=\frac{5}{120}=\frac{1}{24}$$

Then according to question

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$$\frac{x}{2\times 40}+\frac{x}{2\times(24)}=1 \Rightarrow \frac{x}{80}+\frac{x}{48}=1 \Rightarrow x=30$$

Required time = 30 min

26. (a); Part of tank filled in 1 min $=\frac{1}{15}+\frac{1}{18}=\frac{6+5}{90}=\frac{11}{90}$

Part of the tank that will be filled in 6 min $=\frac{66}{90}=\frac{11}{15}$

Let x be the time taken to empty the tank by third tap.

$$\frac{\frac{11}{15}}{\frac{1}{x}-\frac{11}{90}}=\frac{33}{2} \Rightarrow \frac{90-11x}{90x}=\frac{11}{15}\times\frac{2}{33}$$

$$180x = 4050 - 495x \Rightarrow x=\frac{4050}{675}=6 \text{ min}$$

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27. (c); Part of the tank filled by all the three tap A, B, C in 1 hr $=\frac{1}{6}$

In 2 hr part of the tank will be fill $=\frac{1}{3}$

Remaining part $=1-\frac{1}{3}=\frac{2}{3}$

Let a and b be time to fill the tank tap A and B respectively.

$$7=\frac{\frac{2}{3}}{\frac{1}{a}+\frac{1}{b}} \Rightarrow \frac{1}{a}+\frac{1}{b}=\frac{2}{3}\times\frac{1}{7}=\frac{2}{21}$$

Part of the tank will be fill by the tap C 1 hr

$$=\frac{1}{6}-\frac{2}{21}=\frac{7-4}{42}=\frac{3}{42}=\frac{1}{14} \Rightarrow \text{Required time} = 14 \text{ hr.}$$

28. (d); Part of the tank will be filled by all of the taps in 1 min

$= \frac{3+2-4}{12} = \frac{1}{12}$

Required time = 12 hour

29. (b); Part of the tank will be empty in 1 hr = $\frac{1}{5} - \frac{1}{6} = \frac{1}{30}$

Required time = 30 hr

30. (c); By formula; $\frac{18 \times 5}{1440} = \frac{x \times 8}{1920}$

$x = \frac{18 \times 5 \times 1920}{1440 \times 8} \Rightarrow x = 15$ hour

Moderate

CAREER POWER

1. (d); Part of the cistern that can be filled in 1 hr = $\frac{1}{14} + \frac{1}{16} = \frac{8+7}{112} = \frac{15}{112}$

Time taken to fill the cistern = $\frac{112}{15}$ hr

$= \frac{112}{15} \times 60$ min = 448 min

Due to leakage, time taken to fill the cistern
= 448 + 92 = 540 min = 9 hr

Time required to empty the tank $= \frac{1}{\frac{15}{112} - \frac{1}{9}} = \frac{112 \times 9}{23} = 43\frac{19}{23}$ h

2. (c); Part of the tank that will be filled when pipe P and R are opened

for 1 min = $\frac{1}{12} + \frac{1}{15} = \frac{9}{60}$

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$\therefore$ Part of the tank that will be filled after 5 min = $\frac{45}{60} = \frac{3}{4}$

6 min be the time to empty the tank by tap M.

$\therefore$ Required time = $\frac{3}{4} \times \frac{1}{\left(\frac{1}{6} - \frac{9}{60}\right)} = \frac{3}{4} \times \frac{60}{1}$ = 45 min

3. (c); Required time = $\frac{40}{4}$ min = 10 min

4. (a); Let first pipe fill the tank in (x) h then
Second pipe will fill it in (x + 10)h

$$\frac{1}{x} + \frac{1}{x+10} = \frac{1}{12} \Rightarrow \frac{x+10+x}{x(x+10)} = \frac{1}{12}$$

$$\frac{2x+10}{x^2+10x} = \frac{1}{12} \Rightarrow 24x + 120 = x^2 + 10x$$

$x^2 - 14x - 120 = 0 \Rightarrow x^2 - 20x + 6x - 120 = 0$

$x(x - 20) + 6(x - 20) = 0 \Rightarrow x = 20$

5. (b); Let total time = x

$$\therefore \frac{2}{15} + \frac{x}{20} = 1 \Rightarrow \frac{x}{20} = 1 - \frac{2}{15} \Rightarrow \frac{x}{20} = \frac{13}{15} \Rightarrow x = \frac{52}{3} \text{ min}$$

6. (d); Part of the tank that will be filled by both pipe A and B in 1 min

$$= \frac{1}{24} + \frac{1}{32} = \frac{4+3}{96} = \frac{7}{96}$$

Let after x min, pipe B should be closed

$$\therefore x \times \frac{7}{96} + \frac{(9-x)}{24} = 1 \Rightarrow \frac{7x+36-4x}{96} = 1$$

$3x + 36 = 96 \Rightarrow 3x = 60 \Rightarrow x = 20$ min

7. (c); Part of the tank will be filled when all of the pipes A, B and C are opened alternatively, each of 1 min (3 min)

$$= \frac{1}{20} + \frac{1}{30} - \frac{1}{15} = \frac{3+2-4}{60} = \frac{1}{60}$$

$\therefore$ Time taken to fill $\left[1 - \left(\frac{1}{20} + \frac{1}{30}\right)\right]$ Or

$\frac{55}{60}$th part of the tank filled in = 3 × 55 = 165 min

$\therefore$ Remaining part $= 1 - \frac{55}{60} = \frac{1}{12}$

Tank A fills $\frac{1}{20}$ part in 1 min

$\therefore$ Remaining part $= \frac{1}{12} - \frac{1}{20} = \frac{1}{30}$

i.e., $\frac{1}{30}$ th part is filled by B in 1 min

$\therefore$ Total time = (165 + 1 + 1) = 167 min

8. (d); When taps are not opened properly

Tap A will fill the tank $= 25 \times \frac{6}{5} = 30$ min

Tap B will fill the tank $= 20 \times \frac{3}{2} = 30$ min

$\therefore$ Part of the tank will be filled in 1 min $= \frac{1}{30} + \frac{1}{30} = \frac{1}{15}$

$\therefore$ Required time = 15 min

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9. (b); Part of the tank will be filled in 1 min

$$= \frac{1}{20} + \frac{1}{15} + \frac{1}{12} = \frac{3+4+5}{60} = \frac{12}{60} = \frac{1}{5}$$

$\therefore$ Required time $= 5 \times \frac{40}{100} = 2$ min

10. (d); Part of the tank will be filled in 1 min by tap A and B

$$= \frac{1}{4} + \frac{1}{5} = \frac{5+4}{20} = \frac{9}{20}$$

In 2 min. part of the tank will be filled $= 2 \times \frac{9}{20} = \frac{9}{10}$

Time Required by third pipe to empty the tank

$$= \frac{9}{10} \times \frac{1}{\left(\frac{1}{2} - \frac{1}{4} - \frac{1}{5}\right)} = \frac{9}{10} \times 20 = 18 \text{ min}$$

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11. (c); In 1 hr the amount of water that will be filled in the tank
= 42 + 56 – 48 = 50 L
$\therefore$ Capacity of the tank = 50 × 16 = 800 L

12. (c); In 1 min the boy will pour water in tank $= \frac{4}{3}$ L

In 1 min the girl will pour water in tank $= \frac{3}{4}$ L

$\therefore$ Both will pour water in 1 min $= \frac{1}{\frac{4}{3} + \frac{3}{4}} = \frac{12}{25}$

$\therefore$ Required time $= \frac{12}{25} \times 100 = 48$ min

13. (a); Let inlet pipe fill the tank in x hr

$\therefore$ Outlet pipe will empty the tank in 2x hr

$$\therefore \quad \frac{1}{x}-\frac{1}{2x}=\frac{1}{x+36} \quad \Rightarrow \quad \frac{1}{2x}=\frac{1}{x+36} \quad \Rightarrow \quad x = 36 \text{ hr}$$

14. (d); Volume of cylinder = $\pi r^2 h$

Given, $r=\frac{25}{2}\text{cm}$

Volume = $\frac{22}{7}\times\frac{25}{2}\times\frac{25}{2}\times h$ = 11000 cm

$$h=\frac{11000\times7\times2\times2}{22\times25\times25} \quad \Rightarrow \quad h=\frac{112}{5}=22\frac{2}{5}\text{cm}$$

15. (c); Part of the tank will be filled in 1 hr $=\frac{1}{36}+\frac{1}{45}=\frac{9}{180}=\frac{1}{20}$

$\therefore$ Required time = 20 hr

16. (c); In 1 minute the pipe of 2 cm fills $\frac{1}{61}\times\frac{1}{4}$ of the cistern

In 1 min the pipe of $1\frac{1}{3}$ cm diameter fill $\frac{1}{61}\times\frac{4}{9}$ of the cistern

In 1 min the pipe of 1 cm diameter fill $\frac{1}{61}$ of the cistern.

$$\therefore \quad \frac{1}{61\times4}+\frac{1}{61}\times\frac{4}{9}+\frac{1}{61}=\frac{9+16+36}{9\times4\times61}=\frac{61}{36\times61}=\frac{1}{36}$$

$\therefore$ The whole is filled with 36 minutes.

17. (c); Part of the tank will be filled, by both pipe in 1 hr

$$=\frac{1}{20}\times\frac{1}{30}=\frac{5}{60}=\frac{1}{12}$$

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$\therefore$ In 1 hr the leak will empty the part of tank $= \frac{1}{12} \times \frac{1}{3} = \frac{1}{36}$

And to fill $\frac{1}{3}$ of the tank, both pipe will take $= \frac{12}{3}$ = 4 hr.

to fill other $\frac{2}{3}$ part of the tank, it will take

$$= \frac{2}{3} \times \frac{1}{\frac{1}{20} + \frac{1}{30} - \frac{1}{36}} = \frac{2}{3} \times \frac{1}{\frac{9+6-5}{180}} = \frac{2}{3} \times \frac{180}{10} = 12 \text{ hr}$$

$\therefore$ Total time = (12 + 4) hr = 16 hr

18. (b); Part of tank will be full in 1 hr $= \frac{1}{4} + \frac{1}{6} - \frac{1}{8} = \frac{6+4-3}{24} = \frac{7}{24}$

$\therefore$ Required time $= \frac{24}{7} = 3\frac{3}{7}$ hrs.

19. (b); Let first pipe can fill the reservoir in x hr

$\therefore$ Second pipe will fill it in (x + 5) hr

$$\therefore \quad \frac{1}{x} + \frac{1}{x+5} = \frac{1}{6} \Rightarrow \frac{x+5+x}{x(x+5)} = \frac{1}{6}$$

$6(2x + 5) = x^2 + 5x \Rightarrow 12x + 30 = x^2 + 5x$

$x^2 - 7x - 30 = 0 \Rightarrow x^2 - 10x + 3x - 30 = 0$

$(x + 3)(x - 10) = 0 \Rightarrow x = 10$ hrs

20. (b); Let x, y and z be time to fill the cistern by pipes, A, B and C respectively. The part of the tank will be filled in 2 hr by all the pipe $= 2 \times \left(\frac{1}{6}\right) = \frac{1}{3}$

Remaining part $= 1 - \frac{1}{3} = \frac{2}{3}$

$\therefore$ Time taken by pipe A and B together to fill the tank

$= 8 \times \frac{3}{2} = 12$ hour

$\therefore$ by pipe C alone to fill the tank $= \frac{1}{6} - \frac{1}{12} = \frac{1}{12}$

$\therefore$ Required time = 12 hr

Difficult

1. (d); Let x be the time, after that B be closed so that the tank is full in 18 min.

$\therefore \frac{18}{24} + \frac{x}{32} = 1 \Rightarrow \frac{72 + 3x}{96} = 1$

$72 + 3x = 96 \Rightarrow 3x = 24 \Rightarrow x = 8$ min

2. (c); Part of the tank will be empty in 1 hr

$= \frac{1}{10} + \frac{1}{15} - \frac{1}{12} = \frac{6 + 4 - 5}{60} = \frac{5}{60} = \frac{1}{12}$

$\therefore$ Required time = 12 hr

3. (d); In 30 min the part of the tank will be filled by both tap $= \frac{30}{36} = \frac{5}{6}$

$\therefore$ Required part $= 1 - \frac{5}{6} = \frac{1}{6}$

$\therefore \frac{1}{6}$ part of the tank will be filled by pipe A in 10 min

$\therefore$ tap A will take 60 min. to fill the tank

$\therefore$ Pipe B will take time to fill the tank

$= \frac{1}{36} - \frac{1}{60} = \frac{5 - 3}{180} = \frac{2}{180} = \frac{1}{90}$

Hence B will take 90 min to fill the tank.

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4. (d); The part of tank that will filled in

2 min = $\frac{1}{45}-\frac{1}{60}=\frac{4-3}{2}=\frac{1}{180}$

Part of the tank $\left(1-\frac{1}{45}=\frac{44}{45}\right)$ will be filled in

$=\frac{176}{180}\times 180\times 2$ = 352 min

And $\frac{1}{45}$ of the tank will be filled in 1 min

$\therefore$ Total time = (352 + 1) min = 353 min = 5 hr 53 min

5. (d); Let time = x

$\therefore \frac{5}{20}+\frac{(x+5)}{60}=1 \Rightarrow \frac{15+x+5}{60}=1$

20 + x = 60 $\Rightarrow$ x = 40 min

6. (b); (A's 1 hour work) + (A + B)'s 1 hour work

$\frac{1}{3}+\left(\frac{1}{3}+\frac{1}{4}\right)=\frac{11}{12}$

At 5'o' clock $\frac{11}{12}$ part of the cistern is filled.

Total discharge if all the pipes opened

$=1-\left(\frac{1}{3}+\frac{1}{4}\right) \Rightarrow \frac{12-(3+4)}{12}=\frac{5}{12}$

Time required to empty $\frac{11}{12}$ part of the tank = $\frac{\frac{11}{12}}{\frac{5}{12}}=\frac{11}{15}=2.2$ hr.

Hence required time = 7.12 PM

7. (c); Part of the tank will be filled in 1 min

$$= \frac{1}{30}+\frac{1}{20}+\frac{1}{10} = \frac{2+3+6}{60} = \frac{11}{60}$$

In 3 min the part of the tank will be filled = $\frac{33}{60} = \frac{11}{20}$

Part of the solution R in the liquid after 3 min = $\frac{\frac{3}{10}}{\frac{11}{20}} = \frac{60}{110} = \frac{6}{11}$

8. (b); Part of tank will be filled by both pipe A and B in

1 hr = $\frac{2}{3}\times\frac{1}{8} = \frac{1}{12}$

$\therefore$ Required time = $\frac{12}{2-1}$ = 12 hr

9. (d); Part of the tank that will fill the tank in 1 hr by all these pipes =

$$\frac{1}{2}\left(\frac{1}{6}+\frac{1}{10}+\frac{2}{15}\right) = \frac{1}{5}$$

So, tank will be filled in 5 hour

10. (a); Let tank is filled in x hours

$$\frac{x}{15}+\frac{x}{20}-\frac{10}{25} = 1 \quad \Rightarrow \quad \frac{20x+15x-120}{300} = 1$$

$35x = 300 + 120 \Rightarrow x = \frac{420}{35} = 12$

Therefore tank is filled in 12 hours

11. (d); (A's 1 hour work) + (A + B)'s 1 hour work = $\frac{1}{10}+\left(\frac{1}{10}+\frac{1}{12}\right) = \frac{17}{60}$

Remaining part = $1-\frac{17}{60} = \frac{43}{60}$

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Now (A + B + C)'s 1 hour work = $\frac{1}{10}+\frac{1}{12}+\frac{1}{15}=\frac{1}{4}$

$\frac{1}{4}$ part is filled by then in $\left(4\times\frac{43}{60}\right)$ = 2 hr 52 min

$\therefore$ Total time = 2 + 2 hr 52 min = 4 hr 52 min

12. (a); Part of the tank that will filled when all the pipes are open in 3 min = $\frac{1}{20}+\frac{1}{30}-\frac{1}{15}=\frac{3+2-4}{60}=\frac{1}{60}$

$\left[\left(1-\frac{1}{20}-\frac{1}{30}\right)=\frac{55}{60}\right]$ part of the tank will be filled in = 55 × 3

= 165 min

Remaining part = $1-\frac{55}{60}=\frac{1}{12}$

Tap A fills $\frac{1}{20}$ part in 1 min

Remaining part = $\frac{1}{12}-\frac{1}{30}=\frac{1}{30}$

$\frac{1}{30}$ th part is filled by B in 1 min.

$\therefore$ Total time = (165 + 1 + 1) = 167 min.

13. (c); Let A can fill the tank = x

$\therefore$ B will fill the tank = $\frac{x}{2}$

$\therefore$ C will fill the tank = $\frac{x}{4}$

$\therefore \frac{4}{x}+\frac{2}{x}+\frac{1}{x}=\frac{1}{5} \Rightarrow \frac{7}{x}=\frac{1}{5} \Rightarrow$ x = 35 hrs

14. (d); Let total time = x

$$\therefore \quad \frac{4}{15}+\frac{x}{20}=1 \quad \Rightarrow \quad \frac{16+3x}{60}=1 \quad \Rightarrow \quad 3x = 60 - 16$$

$$x = \frac{44}{3}\text{min} \quad \Rightarrow \quad \frac{44}{3}\times 60 \text{ sec} = 880 = 14 \text{ min } 40 \text{ sec}$$

15. (d); In one hour the part of the tank will be filled

$$=\frac{1}{12}+\frac{1}{15}=\frac{5+4}{60}=\frac{9}{60}$$

In second hour part of the tank will be filled

$$=\frac{1}{12}+\frac{1}{20}=\frac{5+3}{60}=\frac{8}{60}$$

$\therefore$ In two hour part of the tank will be filled $=\frac{9}{60}+\frac{8}{60}=\frac{17}{60}$

In 6 hour part of the tank will be filled $=\frac{51}{60}$

Remaining part $= 1-\frac{51}{60}-\frac{9}{60} = \frac{3}{20}$

$\therefore$ Remaining part will be filled in $= \dfrac{\frac{3}{20}}{\frac{9}{60}}$

$=\frac{3}{20}\times\frac{60}{9} = 1$ hr ; $\quad\quad \therefore$ Total time = (6 + 1) = 7 hr.

16. (a); Let the filling capacity of the tank = x m^3/min
Emptying capacity of the tank = (x + 10) m^3/min

$$\therefore \quad \frac{2400}{x}-\frac{2400}{(x+10)}=8 \quad \Rightarrow \quad x^2 + 10x - 3000 = 0$$

$(x - 50)(x + 60) = 0 \quad \Rightarrow \quad x = 50 \ m^3/min$

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17. (d); Work done by the inlet in 1 hr $= \frac{1}{8} - \frac{1}{12} = \frac{1}{24}$

Work done by the inlet in 1 min $= \frac{1}{24} \times \frac{1}{60} = \frac{1}{1440}$

Volume of $\frac{1}{1440}$ part = 6 litres

Volume of tank = 6 × 1440 = 8640 litres

18. (c); Part of the tank will be empty by waste pipe in

1 min $= \frac{1}{20} + \frac{1}{24} - \frac{1}{15} = \frac{6+5-8}{120} = \frac{3}{120} = \frac{1}{40}$

capacity of tank = 40 × 3 = 120 gallons.

19. (c); Part of the tank will be filled in = 2 hr $= \frac{2}{6} = \frac{1}{3}$

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$\therefore$ Remaining part $= 1 - \frac{1}{3} = \frac{2}{3}$

$\therefore$ together (A + B) can fill the tank = $\frac{7}{2} \times 3 = \frac{21}{2}$

$\therefore$ C's 1 hour work = $\frac{1}{6} - \frac{2}{21} = \frac{1}{14}$

Required time = 14 hrs

20. (a); Let after x minute the pipe B should be closed

$\frac{20}{24} + \frac{x}{48} = 1 \Rightarrow \frac{40+x}{48} = 1 \Rightarrow 40 + x = 48 \Rightarrow x = 8$

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Previous Year (Memory Based)

1. (b); Let after x min. The first tap was closed.

Then, $\frac{x}{20}+\frac{18}{30}=1 \Rightarrow \frac{3x+36}{60}=1$

3x + 36 = 60, x = 8 min

2. (d); Let x is the required time.
According to question

$\frac{3}{12}+\frac{x+3}{15}=1 \Rightarrow \frac{15+4x+12}{60}=1$

4x + 27 = 60 $\Rightarrow$ 4x = 33

$x=\frac{33}{4} \Rightarrow x=8\frac{1}{4}$

3. (d); Let first pipe takes x min to fill the tank then
Second pipe will take 3x time to fill it

$\therefore \frac{1}{3x}+\frac{1}{x}=\frac{1}{36} \Rightarrow \frac{1+3}{3x}=\frac{1}{36}$

4 × 12 = x $\Rightarrow$ x = 48

Required time = 3 × 48 = 144 = 2 hr 24 min

4. (c); Part of the tank filled with both taps in 1 h $=\frac{1}{12}-\frac{1}{20}=\frac{5-3}{60}=\frac{1}{30}$

Required time to fill the tank completely = 30 hr.

Required time $=\frac{30}{2}$ = 15 hr

5. (a); Part of the tank will be empty in 15 min $=\frac{15}{60}=\frac{1}{4}$

Part of the tank Remained $=\frac{2}{3}-\frac{1}{4}=\frac{5}{12}$

Part of the tank that have to be filled $= 1 - \frac{5}{12} = \frac{7}{12}$

Required time $= \frac{\frac{7}{12}}{\frac{1}{40}} = \frac{40 \times 7}{12} = \frac{20}{6} \times 7 = \frac{140}{6} = 23\frac{1}{3}$

6. (c); Part of the tank will empty by tap C in 1 min

$= \frac{1}{20} + \frac{1}{24} - \frac{1}{15} = \frac{6+5-8}{120} = \frac{3}{120}$

Tap C will empty the tank in 120 min

Capacity of four 120 × 6 = 720 gallon

7. (d); Let us check option wise.

(i) Q opened alone required time = 8 hr

(ii) P and S are opened

$\frac{1}{4} - \frac{1}{10} = \frac{10-4}{40} = \frac{6}{40} = \frac{3}{20}$

Required time = 6.67 hr

(iii) P, R and S are opened $= \frac{1}{4} + \frac{1}{12} - \frac{1}{10} = \frac{15+5-6}{60} = \frac{14}{60} = \frac{7}{30}$

Required time = 4.28 hr

(iv) P, Q and S are opened $= \frac{1}{4} + \frac{1}{8} - \frac{1}{10} = \frac{10+5-4}{40} = \frac{11}{40}$

Required time $= \frac{40}{11}$ = 3.636 hr

So by option conclude that (d) is correct.

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8. (d); Part of the tank that will fill when both pipe are opened

$$= \frac{1}{x} - \frac{1}{y} = \frac{y-x}{xy}$$

$\therefore$ Required time = $\frac{xy}{y-x}$ h

9. (b); Part of the tank that will empty in 1 h = $\frac{1}{3} - \frac{2}{7} = \frac{7-6}{21} = \frac{1}{21}$

Required time = 21 h

10. (b); Part of the tank is filled when both pipes are opened in 1 hour

$$= \frac{1}{15} - \frac{1}{30} = \frac{2-1}{30} = \frac{1}{30}$$

$\therefore$ Required time to fill half of the tank = $\frac{30}{2}$ = 15 min

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11. (b); Part of the cistern will be filled up when all the taps are opened

in 1 h = $\frac{1}{3} + \frac{1}{4} - \frac{1}{5} = \frac{20+15-12}{60} = \frac{23}{60}$

$\therefore$ Required time = $\frac{60}{23} = 2\frac{14}{23}$

12. (c); Let in x h the tank will be filled up completely

$$\frac{x}{2} + \frac{(x-1)}{6} = 1 \Rightarrow \frac{3x+x-1}{6} = 1 \Rightarrow 4x - 1 = 6$$

$$4x = 7 \Rightarrow x = \frac{7}{4}\text{hr} \Rightarrow x = \frac{7}{4} \times 60$$

$x = 105 \Rightarrow x = 1$ hr 45 min

$\therefore$ Exact time = 11 : 45

13. (c); Part of the tank will be filled up when two pipes are opened alternatively in 2h $= \frac{1}{4} + \frac{1}{6} = \frac{6+4}{24} = \frac{10}{24} = \frac{5}{12}$

In 4 hr the part of the tank will be filled up $= \frac{10}{12}$

Remaining part $= 1 - \frac{10}{12} = \frac{2}{12} = \frac{1}{6}$

Time required to fill $\frac{1}{6}$ part of the tank by pipe A $= \frac{1}{6} \times 4 = \frac{2}{3}$

$\therefore$ Required time $= 4 + \frac{2}{3} = \frac{14}{3} = 4\frac{2}{3}$

14. (b); Part of the cistern, emptied in 1 h $= \frac{1}{5} - \frac{1}{8} = \frac{8-5}{40} = \frac{3}{40}$

Since, $\frac{3}{40}$ part is emptied in 1hr.

$\therefore$ $\frac{3}{4}$ part is empted in; $\frac{40}{3} \times \frac{3}{4} = 10h$

15. (b); Part of the tank will be filled when all the taps are opened in 1 hr $= \frac{1}{10} + \frac{1}{12} - \frac{1}{6} = \frac{6+5-10}{60} = \frac{1}{60}$

Time to fill one fourth of the tank $= \frac{60}{4} = 15$ hr

$\therefore$ Exact time = 10 PM

16. (d); Time taken to fill up half tank = 3 hr
After half an hour time required to fill the tank

$= \frac{1}{2} \times \frac{6}{4}$ hr $= \frac{3}{4}$, $\therefore$ Total time $= 3 + \frac{3}{4} = \frac{15}{4}$ hr

$= \frac{15}{4} \times 60$ min = 225 min = 3 hr 45 min

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17. (c); Part of the tank emptied by tap C in 1 hr

$$= \frac{1}{10} + \frac{1}{12} - \frac{1}{20} = \frac{6+5-3}{60} = \frac{8}{60}$$

$\therefore$ Capacity of tank = $\frac{60}{8} \times 6 = 45$ gallons

18. (d); Given, part of cistern filled by A = 40 min
and emptied by B = 60 min
Part of the cistern filled in 1 min by both the taps

$$= \frac{1}{40} - \frac{1}{60} = \frac{3-2}{120} = \frac{1}{120}$$

Hence, empty cistern will be filled in 120 min

19. (b); Part of the tank will be filled-up by both pipe A and B in 2 hr

$$= 2\left(\frac{1}{6} + \frac{1}{8}\right) = 2\left(\frac{14}{48}\right) = 2\left(\frac{7}{24}\right) = \frac{14}{24}$$

Remaining part $= 1 - \frac{14}{24} = \frac{10}{24} = \frac{5}{12}$

Required time $= \frac{5}{12} \times \frac{8}{1} = \frac{40}{12} = \frac{10}{3} = 3\frac{1}{3}$

20. (b); Given, tank filled by P = 5 h,
tank filled by Q = 6 h
and tank emptied by C = 3 h
Part of tank filled in 1 h when all three pipes are opened

$$= \frac{1}{5} + \frac{1}{6} - \frac{1}{3} = \frac{6+5-10}{30} = \frac{1}{30}$$

Hence, the tank will be filled in 30 h.

Two fifth of the tank will be filled in $= 30 \times \frac{2}{5} = 12$ h

i.e., the tank will be filled at 7 pm

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Chapter 9

Speed, Time and Distance

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Chapter 9

Speed, Time and Distance

The concepts of time distance are most important in the terms of competitive exams. The basic concept of time and distance is used in solving the question based on motion in a straight line. The applications of time & distance are used to solve the problems related to trains and races.

The relation between time, distance and speed is

Distance = Time × Speed

i.e, $D = T \times S$ $\Rightarrow \text{Time (T)} = \dfrac{\text{Distance (D)}}{\text{Speed (S)}}$ $\Rightarrow \text{Speed (S)} = \dfrac{\text{Distance (D)}}{\text{Time (T)}}$

Example: A car covers 200 km in 4 hours, then find the speed of the car.

Sol. We know that, $\Rightarrow \text{Speed (S)} = \dfrac{\text{Distance (D)}}{\text{Time (T)}}$

Required speed = $\dfrac{200}{4} = 50\ km/h$

Conversion of Units:

(i) When we convert km/h into m/s, we multiply the speed by $\dfrac{5}{18}$.

i.e, $1 km/h = \dfrac{5}{18} m/s$.

(ii) When we convert m/s into km/h, we multiply the speed by $\dfrac{18}{5}$.

i.e, $1 m/s = \dfrac{18}{5} km/h$

Example: Convert 72 km/h into m/s.

Sol. We know that, $72\ km/h = \left(72 \times \dfrac{5}{18}\right) m/s = 4 \times 5 = 20\ m/s$

Concept 1:

Average speed: A certain distance is covered at 'x' km / h and the same distance is covered at 'y' km / h then the average speed during the whole journey.

$$\text{Average speed} = \frac{2xy}{x+y} \text{ km / h}$$

Example: Rohit covers a certain distance by car driving at speed of 40 km / h and he returns back to the starting point riding on a scooter with a speed of 10 km / hr. Find the average speed of the whole journey?

Sol. $$\text{Average speed} = \frac{2\times 40\times 10}{40+10} = \frac{2\times 400}{50} = 16 \text{ km / hr}$$

Concept 2: A person covers a distance in T hours and the first half at S_1 km / h and the second half at S_2 km / h, then the total distance covered by the person.

$$D = \frac{2\times T\times S_1\times S_2}{S_1+S_2}$$

Example: A car covers a distance in 10 hrs, the first half at 40 km / h and the second half at 20 km / h. Find the distance travelled by car?

Sol. $$\text{Distance} = \frac{2\times 10\times 40\times 20}{40+20} \text{ km / h} = \frac{2\times 10\times 40\times 20}{60} = 266.67 \text{ km}$$

Concept 3: If two persons P and Q start at the same time in opposite directions from two points and after passing each they complete their journeys in 'a' and 'b' hrs respectively then

$$\frac{\text{P's speed}}{\text{Q's speed}} = \frac{\sqrt{b}}{\sqrt{a}}$$

Example: Shivam sets out to cycle from Delhi to Ghaziabad and at the same time Hemant starts from Ghaziabad to Delhi, After passing each other they complete their journeys in 4 and 16 hours respectively. At what rate does Hemant cycle if Shivam cycle at 18 km per hour?

Sol. $\Rightarrow \dfrac{18}{\text{Hemant's speed}} = \dfrac{4}{2} \Rightarrow$ Hemant's speed

$= \dfrac{18}{2} = 9 \text{ km / h}$

Concept 4: If a man travelled a certain distance by bus at a rate of x km/h and walked back at the rate of 'y' km/h. If the whole journey took 't' hours, then the distance he travelled is $\left(\dfrac{xy}{x+y}\right)$ t km.

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Example: A man travelled a certain distance by train at a rate of 15 km/h and walked back at the rate of 12 km/h. The whole journey took 9 hours. Find the distance he travelled?

Sol. Required distance = $\left(\dfrac{xy}{x+y}\right)t = \left(\dfrac{15\times 12}{15+12}\right)9 = \dfrac{15\times 12\times 9}{27} = 60 \text{ km}$

Concept 5: If a person changes his speed to $\dfrac{a}{b}$ of its usual speed and late by T minutes, then the usual time taken by him is $\dfrac{T}{\frac{b}{a}-1}\left[\dfrac{a}{b}<1\right]$ and when $\left[\dfrac{a}{b}>1\right]$ then the usual time taken by him is $\dfrac{T}{1-\frac{b}{a}}$.

Example: Walking $\frac{4}{5}$ of his usual speed, a man is 16 minutes late. Find the usual time taken by him to cover that distance?

Sol: Usual time = $\frac{T}{\frac{b}{a}-1} = \frac{16}{\frac{5}{4}-1} = \frac{16\times 4}{5-4} = \frac{16\times 4}{1}$ = 64 minutes

Concept 6: (i) If speed is constant, then distance is directly proportional to the time; $D \propto T$

(ii) If time is constant, then distance is directly proportional to the speed; $D \propto S$

(iii) If Distance is constant, then speed is inversely proportional to the time; $S \propto \frac{1}{T}$

Example: A person covers a certain distance with a speed of 54 km/h in 15 min. If he wants to cover the same distance in 30 min, what should be his speed?

Sol. We know that, Distance = Speed × Time

$$= 54\times\frac{15}{60} = \frac{9}{10}\times 15 = \frac{27}{2}\text{ km}$$

Speed to cover $\frac{27}{2}$ km in 30 min $= \frac{\frac{27}{2}}{\frac{30}{60}} = \frac{27}{2}\times 2$ = 27 km/h

Concept 7: (i) When a train passes a pole or any other object, the distance covered by train is equal to the length of the train.

(ii) If a train passes a bridge, platform etc, then distance travel by train is equal to the sum of the length of train and the stationary object through which the train is passing.

Example: A 100 m long train passes a platform of 200 m long. Find the distance covered by the train in passing the platform?

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Sol. Required distance = length of train + length of platform = 100 + 200 = 300 m

Concept 8: (i) When two trains are moving is opposite directions, then their relative speed is equal to the sum of the speed of both trains.

(ii) When two trains are moving is same directions, then their relative speed is equal to the difference of the speed of both trains.

Example: Two trains are moving in the same direction with speed of 40 km/h and 50 km/h respectively. Find the relative speed?

Sol. Required relative speed = (50 – 40) km/h = 10 km/h

Concept 9: Two trains start at the same time from P and Q and proceed towards each other at the rate of x km/h and y km/h respectively. When they meet it is found that one train has travelled D km more than the other. The

Distance between P and Q is $\left(\frac{x+y}{x-y}\right)D$,

$$\text{Distance} = \frac{\text{Sum of speeds}}{\text{Difference of speed}} \times \text{Difference in distance}$$

Example: Two trains start at the same time from Kanpur and Delhi and proceed towards each other at the rate of 74 km/h and 47 km/h respectively. When they meet it is found that the train has travelled 13 km more than the other. Find the distance b/w Kanpur and Delhi?

Sol. Required Distance $= \frac{\text{Sum of speed}}{\text{Difference of speeds}} \times$ Difference in Distance

$$= \frac{(73+47)}{(73-47)} \times 13 = \frac{120}{26} \times 13 = 60 \text{ km}$$

Concept 10: When the speed of two trains are in the ratio x : y. They are moving in opposite directions on parallel tracks. The first train crosses a telegraph pole in 't_1'seconds where as the second train crosses the pole in 't_2' seconds. Time taken by the trains to cross each other completely is given by Time taken $= \frac{t_1x + t_2y}{x+y}$ seconds.

Example: The speed of two trains are in the ratio 4 : 5. They are moving in opposite directions along the parallel tracks. If each takes 3 seconds to cross a pole. Find the time taken by the train to cross each other completely?

Sol. Time taken = $\left(\frac{t_1x + t_2y}{x+y}\right) = \frac{3\times4+3\times5}{4+5} = \frac{27}{9} = 3$ seconds

Types of Questions

1. A man covers a certain distance between his house and office on bike. When his speed is 30 km / h, he is late by 20 min. However, with a speed of 40 km / h, he reaches his office 10 min earlier. Find the distance between his house and office?

Sol. Let the distance be x km.

Time taken to cover x km at 30 km / h = $\frac{x}{30}$ h

Time taken to cover x km at 40 km / h = $\frac{x}{40}$ h

Difference between time taken = (20 + 10) m = $\frac{1}{2}$ h

$\therefore \quad \frac{x}{30} - \frac{x}{40} = \frac{1}{2} \Rightarrow 40x - 30x = \frac{30\times40}{2} \qquad x = \frac{30\times40}{20} = 60$ km

Hence, the required distance is 60 km.

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2. A boy goes to school at a speed of 6 km/h and return to his house at a speed of 4 km/h. If he takes 5 hrs in all, what is the distance between his house and the school?

Sol. Let the required distance be x km.

Then time taken when he goes to school = $\frac{x}{6}$ h

Time taken when he goes to his house = $\frac{x}{4}$ h

Therefore, $\frac{x}{6}+\frac{x}{4}=5 \Rightarrow \frac{2x+3x}{12}=5 \qquad \therefore x=\frac{5}{5}\times 12 = 12$ km

3. The distance between two stations A and B is 450 km. A train starts from A and moves towards B at an average speed of 20 km/h. Another train starts from B, 20 minutes earlier than the train at A, and moves towards A at an average speed of 30 km/h. How far from A will the two trains meet?

Sol. Let the trains meet at a distance of x km from A.

$$\frac{450-x}{30}-\frac{x}{20}=\frac{20}{60}; \quad \frac{20\,(450-x)-30x}{20\times 30}=\frac{1}{3}$$

$$9000 - 20x - 30x = \frac{20\times 30}{3}, \quad 9000 - 50x = 200$$

$$8800 = 50x \quad \Rightarrow \quad x = \frac{8800}{50} = 176 \text{ km}$$

4. Two men P and Q start from a place walking at 6 km and 8 km an hour respectively. How many km will they be apart at the end of 2 hours, if they walk in same direction?

Sol. Distance travelled by P in 2 hours = 2 × 6 = 12 km
Distance travelled by Q in 2 hours = 2 × 8 = 16 km
Distance between P and Q = (16 – 12) km = 4 km

5. Two runners cover the same distance at the rate of 10 km/h and 15 km/h respectively. Find the distance travelled when one takes 16 minutes longer than the other?

Sol. Let the distance be x km.

Time taken by the first runner = $\frac{x}{10}$ h

Time taken by the second runner = $\frac{x}{15}$ h

Now, $\frac{x}{10}-\frac{x}{15}=\frac{16}{60} \Rightarrow \frac{3x-2x}{30}=\frac{16}{60}$ $x = \frac{16}{60}\times 30 = 8$ km

6. Without any stoppage a person travels a certain distance at an average speed 80 km/h and with stoppages he covers the same distance at an average speed of 60 km/h. How many minutes per hour does he stop?

Sol. Let the total distance be x km.

Time taken at the speed of 80 km/h = $\frac{x}{80}$ h

Time taken at the speed of 60 km/h = $\frac{x}{60}$ h

$\therefore$ he rested for $\left(\frac{x}{60}-\frac{x}{80}\right)h=\frac{20x}{60\times 80}=\frac{x}{240}h$

He rested per hour = $\frac{x}{240}\div\frac{x}{60}=\frac{1}{4}h$ = 15 minutes

7. A train leaves the station 1 hour before the scheduled time. The driver decreases its speed by 2 km/h. At the next station 60 km away, the train reached on time. Find the original speed of the train?

Sol. Let it takes x hours in second case

$\frac{60}{x-1}-\frac{60}{x}=2$, $\frac{30}{x-1}-\frac{30}{x}=1$

$30x - 30(x-1) = x^2 - x \Rightarrow$ $30x - 30x + 30 = x^2 - x$

$x^2 - x - 30 = 0$

$x^2 - 6x + 5x - 30 = 0 \Rightarrow x(x-6) + 5(x-6) = 0$

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$(x + 5)(x - 6) = 0 \Rightarrow x = -5, 6; \quad \therefore x = 6$

Train takes 6 hours in second case

5 hours in original case

Original speed = $\frac{60}{5} = 12$ km / h

8. A thief is spotted by a policemen at a distance of 200 metres. When the policeman starts to chase, the theif also starts running. The speed of thief and policemen are 10 km / h and 14 km / h respectively. How far will have the thief run before he caught?

Sol. Relative Speed = (14 – 10) = 4 km / h

$\therefore$ The thief will be caught after = $\frac{200}{1000 \times 4} = \frac{1}{20}$ h

The distance covered by thief before he caught

$= 10 \times \frac{1}{20} = 0.5$ km = 500 m

9. The ratio between the speeds of Hemant and Nitish is 6 : 7. If Hemant takes 30 minutes more than Nitish to cover a distance. Find the actual time taken by Hemant and Nitish ?

Sol. Let the speed of Hemant and Nitish be x_1 km / h and x_2 km / h respectively.

and the time taken by Hemant and Nitish be t_1 and t_2 respectively.

Distance = $x_1 t_1 = x_2 t_2$, $\frac{x_1}{x_2} = \frac{t_2}{t_1}$ or $\frac{t_2}{t_1} = \frac{6}{7}$

$$\frac{t_1 - t_2}{t_1} = \frac{7-6}{7}, \quad \frac{t_1 - t_2}{t_1} = \frac{1}{7}, \quad \frac{\frac{30}{60}}{t_1} = \frac{1}{7}$$

$t_1 = \frac{7}{2}$ hours and $t_2 = \frac{7}{2} \times \frac{6}{7} = 3$ hours

Actual time taken by Hemant = $\frac{7}{2}$ hours

Actual time taken by Nitish = 3 hours

10. A man tries to ascend a greased pole 101 metres high. He ascends 10 metres in first minute and slips down 1 metre in the alternate minute. If he continues to ascends in this way. How long does he takes to reach the top?

Sol. In every 2 minutes, he is able to ascend (10 – 1) = 9 metres
In 22 minutes, he ascends upto 9 × 11 = 99 metres

For remaining distance he takes = $\frac{2}{10} = \frac{1}{5}$ min = 12 seconds

Total time taken = 22 min 12 seconds.

11. A train running at 25 km/h takes 18 seconds to pass a platform. Next, it takes 12 seconds to pass a man walking at 5 km/h in the opposite direction. Find the length of the train and platform?

Sol. Speed of train relative to man = (25 + 5) = 30 km/h

$$= 30 \times \frac{5}{18} = \frac{25}{3} \text{ m/sec}$$

Distance travelled in 12 seconds = $\frac{25}{3} \times 12 = 100$ m

Length of train = 100 m

Speed of train = 25 km/h = $25 \times \frac{5}{18} = \frac{125}{18}$ m/sec

Distance travelled in 18 seconds = $\frac{125}{18} \times 18 = 125$ m

Length of train + length of platform = 125 m
Length of platform = (125 – 100) = 25 m

12. Two trains of length 200 m and 250 m respectively with different speeds passes a static pole in 8 sec and 14 sec respectively. In what time will they cross each other when they are moving in same direction.

Sol. Speed of first train = $\frac{200}{8}$ = 25 m/s

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Speed of second train = $\frac{250}{14} = \frac{125}{7}$ m/s

Total distance to be travelled = 200 + 250 = 450 m

Relative speed when they are moving in the same direction

$$= 25 - \frac{125}{7}$$

Required time = $\frac{450 \times 7}{50}$ = 63 sec

13. A train overtakes two persons who are walking in the same direction as the train is moving, at the rate of 2 km/hr and 4 km/hr and passes them completely in 9 and 10 seconds respectively. Find the speed and the length of the train?

Sol. Speed of two men are:

2 km/hr = $2 \times \frac{5}{18} = \frac{5}{9}$ m/s and

4 km/hr = $4 \times \frac{5}{18} = \frac{10}{9}$ m/s

Let the speed of the train be x m/s. Then relative speed are $\left(x - \frac{5}{9}\right)$ m/s and $\left(x - \frac{10}{9}\right)$ m/s

Now, length of train = Relative speed × Time taken to pass a man

$\therefore$ length of train = $\left(x - \frac{5}{9}\right) \times 9 = \left(x - \frac{10}{9}\right) \times 10$

$\therefore$ $x = \frac{100}{9} - \frac{45}{9} = \frac{55}{9}$ m/s

$\therefore$ speed of the train = $\frac{55}{9} \times \frac{18}{5} = 22$ km/hr and

length of the train = $\left(x - \frac{5}{9}\right)9 = \left(\frac{55}{9} - \frac{5}{9}\right)9 = 50$m.

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14. A train after travelling 50 km meets with an accident and then proceeds at $\frac{3}{4}$ of its former speed and arrives at its destination 35 minutes late. Had the accident occurred 24 km further, it would have reached the destination only 25 minutes late. Find the speed of the train and the distance which the train travels?

Sol. Let the speed of the train be x km/hr and the distance D km.

From the question we have,

$$\frac{50}{x} + \frac{(D-50)4}{3x} = \frac{D}{x} + \frac{35}{60}$$

or, $$\frac{150 + 4D - 200}{3x} = \frac{12D + 7x}{12x}$$

or, $4D - 7x = 200$ ... (i)

and $$\frac{74}{x} + \frac{(D-74)4}{3x} = \frac{D}{x} + \frac{25}{60}$$

or, $$\frac{222 + 4D - 296}{3x} = \frac{12D + 5x}{12x}$$

$4D - 5x = 296$ ... (ii)

Now, subtracting equation (i) from the equation (ii), we have

$2x = 96$

$\therefore$ $x = 48$ km/hr

$\therefore$ Speed of the train = 48 km/hr

To find the distance, put the value of x in equation (ii)

$4D - 5x = 296$

or, $4D - 5 \times 48 = 296$

or, $D = \frac{536}{4} = 134$ km

$\therefore$ Distance which the train travel = 134 km.

15. In a race of 2500 m, A beats B by 500 m and in a race of 2000 m, B beats C by 800 m. By what distance A gives start to C so that they will end up at same time in 3 km race. Also, find by what distance A will win over C in 1 km race?

Sol. Ratio of speeds of A : B = 2500 : 2000 = 5 : 4
Ratio of speeds of B : C = 2000 : 1200 = 5 : 3
Ratio of speeds of A : B : C = 25 : 20 : 12
In 3 km race A run 3000 m,

B run = $\frac{3000 \times 20}{25}$ = 2400 m

C run = $\frac{3000 \times 12}{25}$ = 1440 m

So to end up the race at same time A should gives C the start of 1560 m.
In 1 km race, A will win over C by 520 m.

Foundation

1. A man travels first 50 km at 25 kmph, next 40 km at 20 kmph and then 90 km at 15 kmph. His average speed for the whole journey (in kmph) is :
(a) 25 (b) 20 (c) 18
(d) 40 (e) None of these

2. A man walks at the rate of 5 km / hr for 6 hours and at 4 km / hr for 12 hours. The average speed of the man (in km / hr) is :
(a) 4 (b) $4\frac{1}{2}$ (c) $4\frac{1}{3}$
(d) $4\frac{2}{3}$ (e) None of these

3. If a person travels $10\frac{1}{5}$ km in 3 hours, then the distance covered by him in 5 hours will be :

(a) 18 km (b) 17 km (c) 16 km
(d) 15 km (e) None of these

4. If a train 110m long passes a telegraph pole in 3 seconds, then the time taken (in seconds) by it to cross a railway platform 165 m long, is :
(a) 3 (b) 4 (c) 5
(d) 7.5 (e) None of these

5. A train 700 m long is running at the speed of 72 km / hr. If it crosses a tunnel in 1 minute, then the length of the tunnel (in metres) is :
(a) 700 (b) 600 (c) 550
(d) 500 (e) None of these

6. If a 200 m long train crosses a platform of the same length as that of the train in 20 seconds, then the speed of the train is :
(a) 50 km / hr (b) 60 km / hr (c) 72 km / hr
(d) 80 km / hr (e) None of these

7. Two trains, each of length 125 metre, are running in parallel tracks in opposite directions. One train is running at a speed 65 km / hour and they cross each other in 6 seconds. The speed of the other train is:
(a) 75 km / hour (b) 85 km / hour (c) 95 km / hour
(d) 105 km / hour (e) None of these

8. A man with $\frac{3}{5}$ of his usual speed reaches the destination $2\frac{1}{2}$ hours late. Find his usual time to reach the destination?
(a) 4 hours (b) 3 hours (c) $3\frac{3}{4}$ hours
(d) $4\frac{1}{2}$ hours (e) None of these

9. A train running at $\frac{7}{11}$ of its normal speed reached a place in 22 hours. How much time could be saved if the train would have run at its normal speed?
(a) 14 hours (b) 7 hours (c) 8 hours
(d) 16 hours (e) None of these

10. Walking at three-fourth of his usual speed, a man covers certain distance in 2 hours more than the time he takes to cover the distance at his usual speed. The time taken by him to cover the distance with his usual speed is:
(a) 4.5 hours (b) 5.5 hours (c) 6 hours
(d) 5 hours (e) None of these

11. A man goes from a place A to B at a speed of 12 km/hr and returns from B to A at a speed of 18 km/hr. The average speed for the whole journey is:
(a) $14\frac{2}{5}$ km/hr (b) 15 km/hr (c) $15\frac{1}{2}$ km/hr
(d) 16 km/hr (e) None of these

12. Two trains started at the same time, one from A to B and the other from B to A. If they arrived at B and A respectively 4 hours and 9 hours after they passed each other, the ratio of the speeds of the two trains was:
(a) 2 : 1 (b) 3 : 2 (c) 4 : 3
(d) 5 : 4 (e) None of these

13. A starts from a place P to go to a place Q. At the same time B starts from Q to P. If after meeting each other A and B took 16 and 25 hours more respectively to reach their destinations, the ratio of their speeds is:
(a) 3 : 2 (b) 5 : 4 (c) 9 : 4
(d) 9 : 13 (e) None of these

14. A train of 320 m cross a platform in 24 seconds at the speed of 120 km/h. while a man cross same platform in 4 minute. What is the speed of man in m/s?
(a) 2.4 (b) 1.5 (c) 1.6
(d) 2.0 (e) None of these

15. A car travel first 39 km distance in 45 minute while next 25 km distance in 35 minutes. What is its average speed?
(a) 45 Km/h (b) 35 Km/h (c) 48 Km/h
(d) 90 Km/h (e) None of these

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16. A 280 m long train moving with an average speed of 108 km/h cross a platform in 12 seconds. A boy crosses the same platform in 10 seconds. What is the speed of boy in m/s?
(a) 5 m/s (b) 8 m/s (c) 10 m/s
(d) Cannot be determined (e) None of these

17. A truck cover 224 km in 4 hours, the average speed of a bike is $\frac{1}{4}$ th the average speed of the truck how much distance will the bike cover in seven hour?
(a) 96 km (b) 98 km (c) 95 km
(d) 92 km (e) None of these

18. If a person walks at 14 km/h instead of 10 km/h he would have walked 20 km more. The actual distance travelled by him is:
(a) 85 Km (b) 50 Km (c) 80 Km
(d) 70 Km (e) None of these

19. Train fare between Patna to Munger for one adult is three times the train fair of one child. If adult fair is 102 then. What will be the fare of 2 adult and 3 children together for same distance?
(a) 306 (b) 212 (c) 206
(d) 214 (e) None of these

20. A car travels a distance of 75 km at the speed of 25 km/h. It covers the next 25 km of its journey at the speed of 5 km/h and the last 50 km of its journey at the speed of 25 km/h. What is the average speed of car?
(a) 15 Km/h (b) 12.5 Km/h (c) 40 km/h
(d) 25 km/h (e) None of these

21. If the length of the train is 700 m and length of platform is 500 m. Find the time taken by the train moving at 54 km/h to cross platform.
(a) 75 sec (b) 80 sec (c) 85 sec
(d) 90 sec (e) None of these

22. Amit start to go to Delhi from patna at speed of 50 km/h. Distance between Delhi and Patna is 1000 km. He takes rest of 20 minutes every 3 hours of journey. How much time will he take to arrive Delhi?
(a) 20 hours (b) 21 hours (c) 22 hours
(d) 23 hours (e) None of these

23. A car cover a distance of 330 km in a certain amount of time at speed of 55 km/h. What is the average speed of bike that cover distance of 15 km less than car in 1 hour less than time taken by car?
(a) 50 Km/h (b) 60 Km/h (c) 63 Km/h
(d) 65 Km/h (e) None of these

24. A car traveling at a speed of 40 km/hour can complete a journey in 9 hours. How long will it take to travel the same distance at 60 km/hour?
(a) 6 hours (b) 3 hours (c) 4 hours
(d) $4\frac{1}{4}$ hours (e) None of these

25. A 75 meter long train is moving at 20 kmph. It will cross a man standing on the platform in
(a) 12 seconds (b) 14 seconds (c) 13.5 seconds
(d) 15.5 seconds (e) None of these

26. In what time will a train 100 meter long cross an electric pole, if its speed be 144 km/hour?
(a) 2.5 seconds (b) 5 seconds (c) 12.5 seconds
(d) 3 seconds (e) None of these

27. A train running at a speed of 60 kmph crosses a platform double its length in 32.4 seconds. What is the length of the platform?
(a) 180 m (b) 240 m (c) 360 m
(d) 90 m (e) None of these

28. A train running at the speed of 66 kmph crosses a signal pole in 18 seconds. What is the length of the train?
(a) 330 m (b) 300 m (c) 360 m
(d) 320 m (e) None of these

29. Two trains of equal length take 10 seconds and 15 seconds respectively to cross a telegraph post. If the length of each train be 120 metres, in what time (in seconds) will they cross each other travelling in opposite direction?
(a) 16 sec (b) 15 sec (c) 12 sec
(d) 10 sec (e) None of these

30. A man covers a certain distance by car driving at 70 km / hr and he returns to the starting point riding on a scooter at 55 km / hr. Find his average speed for the whole journey.
(a) 61.6 km / hr (b) 62.8 km / hr (c) 63.6 km / hr
(d) 64.6 km / hr (e) None of these

31. A boy walking at a speed of 10 km / hr reaches his school 15 minutes late. Next time he increases his speed by 2 km / hr, but still he is late by 5 minutes. Find the distance of his school from his house.
(a) 10 km (b) 15 km (c) 20 km
(d) 25 km (e) None of these

32. A motor car does a journey in 10 hrs, the first half at 21 km / hr and the second half at 24 km / hr. Find the distance?
(a) 224 km (b) 225 km (c) 226 km
(d) 228 km (e) None of these

33. Two men A and B starts from a place P walking at 3 km and 3.5 km an hour respectively. How many kms will they be apart at the end of 3 hrs, if they walk in opposite directions?
(a) 13.5 km (b) 15.5 km (c) 17.5 km
(d) 19.5 km (e) None of these

34. What is the length of the bridge on which a man riding 15 km an hour can cross in 5 minutes?
(a) 850 m (b) 1050 m (c) 1250 m
(d) Can't be determined (e) None of these

35. A train moving with the speed of 180 km / hr. Its speed (in metres per second) is:
(a) 5 (b) 40 (c) 30
(d) 50 (e) None of these

36. If a train, with a speed of 60 km / hr, crossed a pole in 30 second, the length of the train (in metres) is:
(a) 1000 (b) 900 (c) 750
(d) 500 (e) None of these

37. Two trains are moving in the same direction at 50 km/hr and 30 km/hr. The faster train crossed a man in the slower train in 18 seconds. Find the length of the faster train?
(a) 80 m (b) 90 m (c) 100 m
(d) Can't be determined (e) None of these

38. A train running at 25 km/hr takes 18 seconds to pass a platform. Next, it takes 12 seconds to pass a man walking at 5 km/hr in the opposite direction. Find the sum of the length of the train and that of the platform?
(a) 125 m (b) 135 m (c) 145 m
(d) 155 m (e) None of these

39. A train is travelling at a rate of 45 km/hr. How many seconds, it will take to cover a distance of 4/5 km?
(a) 36 second (b) 64 second (c) 90 second
(d) 120 second (e) None of these

40. A 570 metre long train crosses a platform of equal length in 15 seconds. What is the speed of the train in metres/second?
(a) 38 (b) 54 (c) 76
(d) 70 (e) None of these

Moderate

1. A boy is running at a speed of p kmph to cover a distance of 1 km. But, due to the slippery ground, his speed is reduced by q kmph (p > q). If he takes r hours to cover the distance, then :
(a) $\frac{1}{r} = \frac{1}{p} + \frac{1}{q}$ (b) $\frac{1}{r} = p - q$ (c) $r = p + q$
(d) $r = p - q$ (e) None of these

2. A boy goes to the school with the speed of 3 kmph and returns with the speed of 2 kmph. If he takes 5 hours in all, then the distance (in kms) between the village and the school is :
(a) 6 (b) 12 (c) 8
(d) 9 (e) None of these

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3. A student walks from his house at 5 kmph and reaches his school 10 minutes late. If his speed had been 6 kmph he would have reached 15 minutes early. The distance of his school from his house is :
(a) 2.5 km (b) 12.5 km (c) 5.5 km
(d) 3.6 km (e) None of these

4. A train takes 18 seconds to pass completely through a station 162 m long and 15 seconds through another station 120 m long. The length of the train (in metres) is :
(a) 70 (b) 80 (c) 90
(d) 100 (e) None of these

5. Two trains of lengths 120 m and 80 m are running in the same direction with velocities of 40 kmph and 50 kmph respectively. The time taken by them to cross each other is :
(a) 60 sec (b) 72 sec (c) 75 sec
(d) 80 sec (e) None of these

6. A man standing on a railway platform observes that a train going in one direction takes 4 seconds to pass him. Another train of same length going in the opposite direction takes 5 seconds to pass him. The time taken (in seconds) by the two trains to cross each other will be :
(a) $\frac{31}{9}$ (b) $\frac{40}{9}$ (c) $\frac{49}{9}$
(d) $\frac{50}{9}$ (e) None of these

7. A train, 240m long crosses a man, walking along the line in opposite direction at the rate of 3 kmph in 10 seconds. The speed of the train is:
(a) 63 km/h (b) 75 km/h (c) 83.4 km/h
(d) 86.4 km/h (e) None of these

8. The distance between two cities A and B is 330km. A train starts from A at 8 am. and travels towards B at 60 km/hr. Another train starts from B at 9 am. and travels towards A at 75 km/hr. At what time do they meet?

(a) 10 am. (b) 10 : 30 am. (c) 11 am.
(d) 11 : 30 am. (e) None of these

9. Two men are standing on opposite ends of a bridge of 1200 metres long. If they walk towards each other at the rate of 5m / minute and 10m / minute respectively, in how much time will they meet each other?
(a) 60 minute (b) 80 minute (c) 85 minute
(d) 90 minute (e) None of these

10. Two trains one 160 m and the other 140 m long are running in opposite directions on parallel track, the first at 77 km an hour and the other at 67 km an hour. How long will they take to cross each other?
(a) 7 seconds (b) 7.5 seconds (c) 6 seconds
(d) 10 seconds (e) None of these

11. Two trains of equal length take 10 seconds and 15 seconds respectively to cross a telegraph post. If the length of each train be 120 meters, in what time (in seconds) will they cross each other travelling in same direction?
(a) 16 (b) 15 (c) 12
(d) 60 (e) None of these

12. A person travels 600 km by train at 80km / hr, 800 km by ship at 40 km / hr. 500 km by aeroplane at 400 km / hr and 100 km by car at 50 km / hr. What is the average speed for the entire distance?
(a) $65\frac{5}{123}$ km. / hr. (b) 60 km. / hr.
(c) $60\frac{5}{123}$ km. / hr. (d) 62 km. / hr.
(e) None of these

13. One third of a certain journey is covered at the rate of 25 km / hr one-fourth at the rate of 30 km / hr and the rest at 50 km / hr. The average speed for the whole journey is
(a) 35 km / hr (b) $33\frac{1}{3}$ km / hr (c) 30 km / hr
(d) $37\frac{1}{12}$ km / hr (e) None of these

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14. In covering certain distance, the speeds of A and B are in the ratio of 3 : 4 A takes 30 minutes more than B to reach the destination. The time taken by A to reach the destination is :

(a) 1 hour (b) $1\frac{1}{2}$ hours (c) 2 hours

(d) $2\frac{1}{2}$ hours (e) None of these

15. A car starts with the speed of 70 km / h with its speed increasing every two hours by 10 km / h. In how many hours will it cover 345 km?

(a) $2\frac{1}{4}$ hours (b) 4 hours (c) $4\frac{1}{2}$ hours

(d) 3 hour (e) None of these

16. Aditya rides a cycle at the speed of 15 km / h but stops for 10 minute to take rest every 20 kms. How much time will he take to cover a distance of 150 kms?

(a) 11 hours 10 minutes (b) 11 hours

(c) 12 hours 30 minutes (d) 15 hours

(e) None of these

17. The ratio between the speed of bike and train is 15 : 27 respectively. Also a bus cover a distance of 720 km in 9 hours. The speed of the bike is three fourth the speed of bus. How much distance will the train cover in 7 hours?

(a) 756 km (b) 760 km (c) 740 km

(d) Cannot be determined (e) None of these

18. A bus started its journey from Bettiah and reached Motihari in 44 minute with its average speed 50 km / h. If the average speed of bus is increased by 5 km / h how much time will it take to cover the same distance?

(a) 31 min (b) 36 min (c) 38 min

(d) 40 min (e) None of these

19. A train can travel 50% faster than a bus. Both start from point A at the same time and reach point B at same time. Point B is 75 km away from point A on the way the train stopping 12.5 minutes. The speed of bus is:
(a) 110 km / h (b) 120 km / h (c) 55 km / h
(d) 60 km / h (e) None of these

20. A train crosses a pole in 10 seconds and a platform, which is 40% longer than the length of train in 24 seconds. If the length of platform is 140 m, what is speed of the train?
(a) 36 m / s (b) 5 m / s (c) 10 m / s
(d) 15 m / s (e) None of these

21. It takes eight hours for a 600 km journey if 120 km is done by train and rest by car. It takes 20 minutes more if 200 km is done by train and the rest by car. The ratio of the speed of the train to that of car is:
(a) 2 : 3 (b) 3 : 2 (c) 4 : 3
(d) 3 : 4 (e) None of these

22. Aditya is travelling on his cycle and has calculated that he will reach point A at 2 pm, if he travel at 10 km / h. He will reach there at 12 noon, if he travel at 15 km / h. At what speed must he travel to reach D at 1 pm?
(a) 10 kmph (b) 11 kmph (c) 12 kmph
(d) 13 kmph (e) None of these

23. A train running at a speed of 40 m / s crosses a pole in 21 seconds less than the time it required to cross a bridge 3.5 times its length at the same speed. What is the length of the bridge?
(a) 1080 m (b) 240 m (c) 840 m
(d) 560 m (e) None of these

24. Two trains A and B start at the same time from Delhi and Patna respectively towards each other they met after 16 hours. If the distance between Delhi and Patna is 1872 km and train B runs 27 km / h faster than train A what is the speed of train A?
(a) 45 km / h (b) 72 km / h (c) 48 km / h
(d) 60 km / h (e) None of these

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25. Two trains M and N crosses a pole in 25 seconds and 1 min 15 seconds respectively. Length of train M is half length of train N. What is the respective ratio between speed of train M and train N?
(a) 2 : 3 (b) 1 : 2 (c) 2 : 1
(d) 3 : 2 (e) None of these

26. A truck cover a distance of 396 km in 5 hour 30 minutes. The average speed of bike is $\frac{4}{3}$ of average speed of truck. What is the time taken by bike to cover distance of 12 km less than the distance which the truck cover?
(a) 4 Hrs (b) 3 Hrs (c) 5 Hrs
(d) 4 hour 15 minutes (e) None of these

27. Train A starts its journey from Patna to Hazipur while train B starts from Hazipur to Patna. After crossing each other they finish their journey in 81 hours and 121 hours respectively. Then what will be speed of train B if train A speed is 44 km/h?
(a) 44 Km/h (b) 55 Km/h (c) 36 Km/h
(d) 46 Km/h (e) None of these

28. Two train start at same time from Delhi and Mumbai and comes towards each other at the rate of 85 km and 65 km per hour respectively. When they meet it is found that one train has travelled 20 km more than the other. Find the distance between Delhi and Mumbai?
(a) 140 Km (b) 75 Km (c) 150 Km
(d) Cannot be determined (e) None of these

29. A train start from Delhi on Sunday at 9 am with speed of 25 km/h, another train starts from there on same day at 40 km/h at 3 pm in the same direction. Find at what distance from Delhi both train will meet?
(a) 200 Km (b) 300 Km (c) 400 Km
(d) Cannot be determined (e) None of these

30. An aeroplane covers a certain distance at a speed of 240 km per hour in 5 hours. To cover the same distance in $1\frac{2}{3}$ hours, it must travel at a speed of :

(a) 300 km./hr. (b) 360 km./hr (c) 600 km./hr
(d) 720 km./hr (e) None of these

31. A boy goes to his school from his house at a speed of 3 km/hr. If he takes 5 hours in going and coming, the distance between his house and school is:
(a) 6 km (b) 5 km (c) 5.5 km
(d) 7.5 km (e) None of these

32. If a train runs at 40 km/hour, it reaches its destination late by 11 minutes. But if it runs at 50 km/hour, it is late by 5 minutes only. The correct time (in minutes) for the train to complete the journey is
(a) 13 (b) 15 (c) 19
(d) 21 (e) None of these

33. A train 800 meter long is running at the speed of 78 km/hr. if it crosses a tunnel in 1 minute, then the length of the tunnel (in meter) is :
(a) 772 (b) 500 (c) 1300
(d) 13 (e) None of these

34. A cyclist, after cycling a distance of 70 km on the second day, finds that the ratio of distance covered by him on the first two days is 4 : 5. If he travels a distance of 42 km. on the third day, then the ratio of distances travelled on the third day and the first day is:
(a) 3 : 4 (b) 5 : 2 (c) 9 : 4
(d) 9 : 13 (e) None of these

35. A thief is noticed by a policeman from a distance of 200m. The thief starts running and the policeman chases him. The thief and the policeman run at the rate of 10 km. and 11 km. per hour respectively. What is the distance between them after 6 minutes?
(a) 100 m (b) 190 m (c) 200 m
(d) 150 m (e) None of these

36. A boy started from his house by bicycle at 10 a.m. at a speed of 12 km per hour. His elder brother started after 1 hr 15 mins by scooter along the same path and caught him at 1.30 p.m. The speed of the scooter will be (in km/hr):

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(a) 4.5 (b) 36 (c) $18\frac{2}{3}$
(d) 9 (e) None of these

37. A student walks from his house at a speed of 2 km per hour and reaches his school 6 minutes late. The next day he increases his speed by 1 km per hour and reaches 6 minutes before school time. How far is the school from his house?

(a) $\frac{5}{4}$ km (b) $\frac{6}{5}$ km (c) $\frac{9}{4}$ km
(d) $\frac{11}{4}$ km (e) None of these

38. A moving train crosses a man standing on a platform and a bridge of 300 metres long in 10 seconds and 25 seconds respectively. What will be the time taken by the train to cross a platform 200 metres long?

(a) $16\frac{2}{3}$ seconds (b) 18 seconds (c) 20 seconds
(d) 22 seconds (e) None of these

39. A, B and C start at the same time in the same direction to run around a circular stadium. A completes a round in 252 seconds, B in 308 seconds and C in 198 seconds, all starting at the same point. After what time will they next meet at the starting point again?
(a) 46 minutes 12 seconds (b) 45 minutes
(c) 42 minutes 36 seconds (d) 26 minutes 18 seconds
(e) None of these

40. A and B run a kilometer and A wins by 25 sec. A and C run a kilometer and A wins by 275 m. When B and C run the same distance, B wins by 30 sec. The time taken by A to run a kilometer is
(a) 2 min 25 sec. (b) 2 min 50 sec. (c) 3 min 20 sec.
(d) 3 min 30 sec. (e) None of these

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Difficult

1. Aditya covered a certain distance at some speed. Had he moved 3 km / h faster he would have taken 40 minute less. If he had moved 2 km / h slower he would have taken 40 minutes more. The distance is:
(a) 40 (b) 35 (c) 49
(d) 45 (e) None of these

2. A bus take 15 hours to go from Delhi to Chandigarh. Bus go one-third time with speed of 80 km / h. 40% of rest time with speed of 70 km / h. $\frac{2}{3}$rd of rest of time with speed of 85 km / h rest with speed of 100 km / h. What is the distance that cover by bus?
(a) 1200 (b) 860 (c) 1120
(d) 1220 (e) None of these

3. In a race of one kilometer, A gives B a start of 100 metres and still wins by 20 seconds. But if A gives B a start of 25 seconds, B wins by 50 metres. The time taken by A to run one kilometer is:
(a) $\frac{500}{29}$ seconds (b) $\frac{1200}{29}$ seconds (c) $\frac{800}{29}$ seconds
(d) $\frac{700}{29}$ seconds (e) None of these

4. A man covers a certain distance between his house and office on scooter. Having an average speed of 30 km / hr, he is late by 10 min. However, with a speed of 40 km / hr, he reaches his office 5 min earlier. Find the distance between his house and office.
(a) 20 km (b) 25 km (c) 30 km
(d) 35 km (e) None of these

5. The distance between two stations, Delhi and Amritsar, is 450 km. A train starts at 4 p.m. from Delhi and moves towards Amritsar at an average speed of 60 km / hr. Another train starts from Amritsar at 3.20 p.m. and moves towards Delhi at an average speed of 80 km / hr. How far from Delhi will the two trains meet and at what time?

(a) 5.30 p.m. (b) 5.50 a.m. (c) 6.50 p.m.
(d) 6.30 a.m. (e) None of these

6. A, B and C can walk at the rates of 3, 4 and 5 km per hour respectively. They starts from Pune at 1, 2, 3 o'clock respectively. When B catches A, B sends him back with a message to C. When will C get the message?
(a) 4:15 o'clock (b) 5:15 o'clock (c) 6:25 o'clock
(d) Can't be determined (e) None of these

7. Two trains start at the same time from two stations and proceed towards each other at the rates of 20 km and 25 km per hour respectively. When they meet, it is found that one train has travelled 80 km more than the other. Find the distance between the two stations.
(a) 720 km (b) 740 km (c) 760 km
(d) 780 km (e) None of these

8. A goods train and a passenger train are running on parallel tracks in the same direction. The driver of the goods train observes that the passenger train coming from behind overtakes and crossed his train completely in 60 seconds. Whereas a passenger on the passenger train marks that he crossed the goods train in 40 seconds. If the speed of the train be in the ratio of 1 : 2, find the ratio of their lengths.
(a) 1 : 2 (b) 2 : 1 (c) 3 : 2
(d) 2 : 3 (e) None of these

9. A train after travelling 50 km meets with an accident and then proceeds at $\frac{3}{4}$ of its former speed and arrives at its destination 35 minutes late. Had the accident occurred 72 km further, it would have reached the destination only 15 minutes late. The normal speed of the train is
(a) 36 km/hr. (b) 38 km/hr. (c) 46 km/hr.
(d) 72 km/hr. (e) None of these

10. Two trains measuring 100 m and 80 m respectively, run on parallel lines of track. When travelling in opposite directions they are observed to pass each other in 9 seconds, but when they are running in the same direction at the same rate as before, the faster train passed the other in 18 seconds. Find the speed of the two trains in km per hour.

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(a) 12 km/hr, 5 km/hr (b) 14 km/hr, 18 km/hr
(c) 16 km/hr, 54 km/hr (d) 18 km/hr, 54 km/hr
(e) None of these

11. A 300 meters long train is travelling with the speed of 45 km/hr when it passes point A completely. At the same time, a motorbike starts from point A with the speed of 70 km/hr. When it exactly reaches the middle point of the train, the train increases its speed to 60 km/hr and motorbike reduces its speed to 65 km/hr. How much distance will the motorbike travel while passing the train completely?
(a) 3.8 km (b) 3.2 km (c) 2.37 km
(d) 2.2 km (e) None of these

12. Two trains, Kanpur Mail and Delhi Mail, start at the same time from stations Kanpur and Delhi respectively towards each other. After passing each other, they take 12 hours and 3 hours to reach Delhi and Kanpur respectively. If the Kanpur Mail is moving at the speed of 48 km/hr, the speed of the Delhi Mail is
(a) 90 km/hr (b) 96 km/hr (c) 86 km/hr
(d) 84 km/hr (e) None of these

13. Heena and Renu are competing in a 100 meters race. Initially, Heena runs at twice the speed of Renu for the first fifty meters. After the 50 meters mark, Heena runs at $\frac{1}{4}$th her initial speed while Renu continues to run at her original speed. If Renu catches up with Heena at a distance of N meters from the finish line, then N is equal to:
(a) 75 meters (b) 55 meters (c) 25 meters
(d) 30 meters (e) None of these

14. A horse rider travels on horse back from Bhopal to Chandigarh at a constant speed. If the horse increased its speed by 6 km/hr, it would take the rider 4 hours less to cover that distance. And travelling with a speed 6 km/hr lower than the initial speed, it would take him 10 hours more than the time he would have taken if he had travelled at a speed 6 km/hr higher than the initial speed. Find the distance between Bhopal and Chandigarh?

(a) 720 km (b) 680 km (c) 560 km
(d) 480 km (e) None of these

15. Seeta and Geeta cycled towards each other, one from point A and the other from point B, respectively. Seeta left point A 6 hours later than Geeta left point B, and it turned out on their meeting that Seeta had travelled 12 km less than Geeta. After their meeting, they kept cycling with the same speed, and Seeta arrived at B 8 hours later and Geeta arrived at A 9 hours later. Find the speed of the faster cyclist.
(a) 3 km / hr (b) 6 km / hr (c) 9 km / hr
(d) 12 km / hr (e) None of these

16. Two cyclists started simultaneously towards each other and meet each other 3 hours 20 minutes later. How much time will it take the slower cyclist to cover the whole distance if the first arrived at the place of departure of the second 5 hours later than the second arrived at the point of departure of the first?
(a) 5 hours (b) 10 hours (c) 15 hours
(d) 20 hours (e) None of these

17. A dog finds a cat at 25 leaps away. The cat sees the dog coming towards it and starts running with the dog in hot pursuit. In every minute, the dog makes 5 leaps and the cat makes 6 leaps and one leap of the dog is equal to 2 leaps of the cat. Find the time in which the dog will catch the cat.
(a) 12.5 minutes (b) 13 minutes (c) 11.5 minutes
(d) 10.5 minutes (e) None of these

18. Two guns were fired from the same place at an interval of 13 minutes but a person in a train approaching the place hears the second shot 12 minutes 30 seconds after the first. Find the speed of the train, supposing that sound travels at 330 metres per second.
(a) $47\frac{13}{25}$ km / hr (b) $47\frac{11}{25}$ km / hr (c) $47\frac{9}{25}$ km / hr
(d) $47\frac{12}{25}$ km / hr (e) None of these

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19. A man walks from A to B and back in a certain time at the rate of $3\frac{1}{2}$ km per hour. But if he had walked from A to B at the rate of 3 km an hour and back from B to A at the rate of 4 km an hour, he would have taken 5 minutes longer. Find the distance between A and B.
(a) 14 km (b) 12 km (c) 6 km
(d) 7 km (e) None of these

20. A carriage driving in a fog passed a man who was walking at the rate of 3 km an hour in the same direction. He could see the carriage for 4 minutes and it was visible to him upto a distance of 100m. What was the speed of the carriage?
(a) $5\frac{1}{2}$ km per hour (b) $4\frac{1}{2}$ km per hour
(c) $3\frac{1}{2}$ km per hour (d) $8\frac{1}{2}$ km per hour
(e) None of these

21. A man leaves a point P and reaches the point Q in 4 hours. Another man leaves the point Q, 2 hours earlier and reaches the point P in 4 hours. Find the time in which the first man meets to the second man.
(a) 2 hours (b) 3.5 hours (c) 1 hours
(d) 3 hours (e) None of these

22. A man travels 360 km in 4 hrs, partly by air and partly by train. If he had travelled all the way by air, he would have saved $\frac{4}{5}$ of the time he was in train and would have arrived at his destination 2 hours early. Find the distance he travelled by train?
(a) 75 km (b) 90 km (c) 85 km
(d) 80 km (e) None of these

23. One aeroplane started 30 minutes later than the scheduled time from a place 1500 km away from its destination. To reach the destination at the scheduled time the pilot had to increase the speed by 250 km/hr. What was the speed of the aeroplane per hour during the journey?

(a) 750 km / hr (b) 755 km / hr (c) 760 km / hr
(d) 745 km / hr (e) None of these

24. A train leaves the station 1 hour before the scheduled time. The driver decreases its speed by 4 km / hr. At the next station 120 km away, the train reached on time. Find the original speed of the train.
(a) 24 km / hr. (b) 25 km / hr. (c) 26 km / hr.
(d) 27 km / hr. (e) None of these

25. A hare sees a dog 100 metres away from her and run off in the opposite direction at a speed of 12 km an hour. A minute later the dog perceives her and gives chase at a speed of 16 km per hour. How much distance cover by hare after being spotted?
(a) 750 metres (b) 800 metres (c) 850 metres
(d) 900 metres (e) None of these

Previous Year (Memory Based)

1. Two friends started for a place one by motorcycle and the other by train. The speed of motorcycle is 30 km / h and that of train is 24 km / h. The first one takes 6 h 12 min to reach the destination. Find the time of reaching of second one?
(a) 8:00h (b) 7:25h (c) 7:50h
(d) 7:45h (e) None of these

2. The distance between places A and B is 999 km. An express train leaves place A at 6 am and runs at a speed of 55.5 km / h. The train stops on the way for 1 h 20 min. It reaches B at?
(a) 1 : 20 am (b) 12 : 00 pm (c) 6 : 00 pm
(d) 11 : 00 pm (e) None of these

3. A train covers a distance between station A and station B in 45 min. If the speed of the train is reduced by 5 km / h, then the same distance is covered in 48 min. The distance between stations A and B is?
(a) 60 km (b) 64 km (c) 80 km
(d) 55 km (e) No ne of these

4. A bus moving at a speed of 45 km / h overtakes a truck 150 m ahead going in the same direction in 30 s. The speeds of the truck is?

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(a) 27 km / h (b) 24 km / h (c) 25 km / h
(d) 28 km / h (e) None of these

5. A car goes 10 m in a second. Find its speed in km / h?
(a) 40 (b) 32 (c) 48
(d) 36 (e) None of these

6. The speed of a train going from Nagpur to Allahabad is 100 km / h while its speed is 150 km / h when coming back from Allahabad to Nagpur. Then, the average speed during the whole journey is?
(a) 120 km / h (b) 125 km / h (c) 140 km / h
(d) 135 km / h (e) None of these

7. A man goes from a place A to B at a speed of 12 km / h and returns from B to A at a speed of 18 km / h. The average speed for the whole journey is?
(a) $14\frac{2}{5}$ km / h (b) 15 km / h (c) $15\frac{1}{2}$ km / h
(d) 16 km / h (e) None of these

8. A man travels a distance of 24 km at 6 km / h another distance of 24 km at 8 km / h and a third distance of 24 km at 12 km / h. His average speed for the whole journey (in km / h) is?
(a) $8\frac{2}{3}$ (b) 8 (c) $2\frac{10}{13}$
(d) 9 (e) None of these

9. A man goes from A to B at a uniform speed of 12 km / h and returns with a uniform speed of 4 km / h. His average speed (in km / h) for whole journey is?
(a) 8 (b) 7.5 (c) 6
(d) 4.5 (e) None of these

10. The speeds of A and B are in the ratio of 3 : 4. A takes 20 min more than B to reach a destination. Find time in which A reach the destination?
(a) $1\frac{1}{3}$ h (b) 2 h (c) $2\frac{2}{3}$ h
(d) $1\frac{2}{3}$ h (e) None of these

11. A truck covers a distance of 550 m in 1 min whereas a bus covers a distance of 33 km in 45 min. The ratio of their speeds is:
(a) 4 : 3 (b) 3 : 5 (c) 3 : 4
(d) 50 : 3 (e) None of these

12. A student goes to school at the rate of $2\frac{1}{2}$ km/h and reaches 6 min late. If he travels at the speed of 3 km/h, he is 10 min early. The distance (in km) between the school and his house is:
(a) 5 (b) 4 (c) 3
(d) 1 (e) None of these

13. A student walks from his house at a speed of $2\frac{1}{2}$ km/h and reaches his school 6 min late. The next day he increases his speed by 1 km per hour and reaches 6 min before school time. How far is the school from this house?
(a) $\frac{5}{4}$ km (b) $\frac{7}{4}$ km (c) $\frac{9}{4}$ km
(d) $\frac{11}{4}$ km (e) None of these

14. A man can reach a certain place in 30 h. If he reduced his speed by $\frac{1}{15}$th, he goes 10 km less in that time. Find his speed per hour?
(a) 6 km/h (b) $5\frac{1}{2}$ km/h (c) 4 km/h
(d) 5 km/h (e) None of these

15. A man travelled a distance of 80 km in 7 h partly on foot at the rate of 8 km/h and partly by bicycle at 16 km/h. The distance travelled on the foot is:
(a) 32 km (b) 48 km (c) 36 km
(d) 44 km (e) None of these

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16. A man travelled a distance of 61 km in 9 h partly on foot at the rate of 4 km / h and partly on bicycle at the rate of 9 km / h. The distance travelled on foot was:
(a) 12 km (b) 16 km (c) 20 km
(d) 24 km (e) None of these

17. A man takes 6 h 15 min in walking a distance and riding back to the starting place. He could walk both ways in 7h 45 min. The time taken by him to ride both ways, is:
(a) 4 h (b) 4 h 30 min (c) 4 h 45 min
(d) 5 h (e) None of these

18. A, B and C starts together from the same place to walk round a circular path of length 12 km. A walks at the rate of 4 km / h. B 3 km / h and C $\frac{3}{2}$ km / h. They will meet together at the starting place at the end of:
(a) 10 h (b) 12 h (c) 15 h
(d) 24 h (e) None of these

19. Ravi and Ajay start simultaneously from a place A towards B, 60 km apart. Ravi's speed is 4 km / h less than that of Ajay. Ajay, after reaching B, turns back and meets Ravi at a place 12 km away from B. Ravi's speed is:
(a) 12 km / h (b) 10 km / h (c) 8 km / h
(d) 6 km / h (e) None of these

20. A person started his journey in the morning. At 11 am he covered $\frac{3}{8}$ of the journey and on the same day at 4:30 pm he covered $\frac{5}{6}$ of the journey. He started his journey at:
(a) 6 : 00 am (b) 3 : 30 am (c) 7 : 00 am
(d) 6 : 30 am (e) None of these

21. In a race of 800 m, A can beat B by 40 m. In a race of 500 m, B can beat C by 5 m. In a race of 200 m, A will beat C by?
(a) 11.9 m (b) 1.19 m (c) 12.7 m
(d) 1.27 m (e) None of these

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22. In a one kilometre race A, B and C are the three participants. A can give B a start of 50 m and C a start of 69 m. The start, which B can allow C is:
(a) 17 m (b) 20 m (c) 19 m
(d) 18 m (e) None of these

23. A and B run a kilometre and A wins by 25 s. A and C run a kilometre and A wins by 275 m. When B and C run the same distance, B wins by 30 s. The time taken by A to run a kilometre is?
(a) 2 min 25 s (b) 2 min 50 s (c) 3 min 20 s
(d) 3 min 30 s (e) None of these

24. A man travelled a certain distance by train at the rate of 25 km / h and walked back at the rate of 4 km / h. If the whole journey took 5 h 48 min, the distance is?
(a) 25 km (b) 30 km (c) 20 km
(d) 15 km (e) None of these

25. A man walks a certain distance and rides back in 4 h 30 min. He could ride both ways in 3 h. The time required by the man to walk both ways is?
(a) 4 h 30 min (b) 4 h 35 min (c) 5 h
(d) 6 h (e) None of these

26. A train running at the speed of 84 km / h pass man walking in opposite direction at the speed of 6 km / h in 4 s. What is the length of train (in metre)?
(a) 150 (b) 120 (c) 100
(d) 90 (e) None of these

27. A passenger train 150 m long is travelling with a speed of 36 km / h. If a man is cycling in the direction of train at 9 km / h, then time taken by the train to pass the man is?
(a) 10s (b) 15s (c) 18s
(d) 20s (e) None of these

28. A train passes two persons walking in the same direction at a speed of 3 km / h and 5 km / h, respectively in 10s and 11s, respectively. The speed of the train is:

(a) 28 km / h (b) 27 km / h (c) 25 km / h
(d) 24 km / h (e) None of these

29. A train crosses a platform in 30 s travelling with a speed of 60 km / h. If the length of the train be 200 m, then the length of the platform is:
(a) 420 m (b) 500 m (c) 300 m
(d) 250 m (e) None of these

30. How many seconds will a 500 m long train take to cross a man walking with a speed of 3 km / h in the direction of the moving train, if the speed of the train is 63 km / h?
(a) 25 (b) 30 (c) 40
(d) 45 (e) None of these

Foundation

1. (c); Average speed $= \dfrac{50+40+90}{\dfrac{50}{25}+\dfrac{40}{20}+\dfrac{90}{15}} = \dfrac{180}{2+2+6} = \dfrac{180}{10} = 18$ kmph

2. (c); Average speed= $\dfrac{\text{total distance}}{\text{total time}} = \dfrac{5\times6+4\times12}{6+12}$

$= \dfrac{30+48}{18} = \dfrac{78}{18} = \dfrac{13}{3} = 4\dfrac{1}{3}$ km / hr

3. (b); Speed $= \dfrac{\text{distance}}{\text{time}} = \dfrac{10\frac{1}{5}}{3} = \dfrac{51}{5}\times\dfrac{1}{3} = \dfrac{17}{5}$ km / hr

$\therefore$ Required distance = speed × time

$= \dfrac{17}{5}\times5 = 17$ km

4. (d); Speed of the train $= \dfrac{110}{3}$ m / sec.

Required time = $\dfrac{(165+110)}{110}\times3 = \dfrac{275}{110}\times3 = 7.5$ sec.

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5. (d); (Length of the 1st train + Length of the tunnel) = speed × time

$$x + 700 = \frac{72 \times 5}{18} \times (1 \times 60)$$

$x + 700 = 20 \times 60$

$x + 700 = 1200 \Rightarrow x = 1200 - 700$

$x = 500$ metres.

6. (c); Speed of the train $= \frac{200 + 200}{20}$

$$= \frac{400}{20} = 20 \text{ m/sec} = 20 \times \frac{18}{5} \text{ km/hr} = 72 \text{ km/hr}$$

7. (b); Since the trains are moving in opposite direction

∴ Relative speed = speed of first train + speed of second train

Let speed of second train = x km/hr

$$\therefore \quad (65 + x) \times \frac{5}{18} = \frac{125 + 125}{6}, \ (65 + x) \times \frac{5}{18} = \frac{250}{6}$$

$(65 + x) = 150 \Rightarrow x = 150 - 65 \Rightarrow x = 85$ km/hr.

8. (c); Let usual time = t, distance = d, and speed = s

$$\therefore \quad s = \frac{d}{t} \qquad \text{... (i)}$$

$$\text{and} \quad \frac{3}{5}s = \frac{d}{t + 2\frac{1}{2}} \qquad \text{... (ii)}$$

From equation (i) ÷ equation (ii)

$$\frac{s}{\frac{3}{5}s} = \frac{\frac{d}{t}}{\frac{d}{t + \frac{5}{2}}} \Rightarrow \frac{5}{3} = \frac{t + \frac{5}{2}}{t} \Rightarrow 5t = 3t + \frac{15}{2}$$

$$2t = \frac{15}{2} \Rightarrow t = \frac{15}{4} = 3\frac{3}{4} \text{ hours}$$

9. (c); At normal speed, Let usual time = t

$\therefore s = \frac{d}{t}$ ... (i)

and $\frac{7}{11}s = \frac{d}{22}$ ... (ii)

From equation (i) ÷ equation (ii)

$$\frac{s}{\frac{7}{11}s} = \frac{\frac{d}{t}}{\frac{d}{22}} \Rightarrow \frac{11}{7} = \frac{22}{t} \Rightarrow t = 14 \text{ hours.}$$

$\therefore$ saved time = (22 – 14) hrs = 8 hrs.

10. (c); Let required time = t hours;

$\therefore \quad s = \frac{d}{t}$ ... (i)

$\frac{3}{4}s = \frac{d}{(t+2)}$ ... (ii)

$$\frac{s}{\frac{3}{4}s} = \frac{\frac{d}{t}}{\frac{d}{(t+2)}} \Rightarrow \frac{4}{3} = \frac{t+2}{t} \quad 4t = 3t + 6 \Rightarrow t = 6 \text{ hours}$$

11. (a); Average speed $= \frac{2xy}{x+y} = \frac{2 \times 12 \times 18}{(12+18)} = \frac{72}{5} = 14\frac{2}{5}$ km/hr

12. (b); From the formula –

$\therefore$ Required ratio = $\sqrt{b} : \sqrt{a} = \sqrt{9} : \sqrt{4} = 3 : 2$

13. (b); Required ratio = $\sqrt{b} : \sqrt{a} = \sqrt{25} : \sqrt{16} = 5 : 4$

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14. (d); Let length of the platform = x m

$\therefore \quad 120 \times \frac{5}{18} = \frac{320 + x}{24}$

800 = 320 + x $\Rightarrow$ x = 480 m

$\therefore$ Speed of the man $= \frac{480}{4 \times 60} = \frac{120}{60}$ = 2.0 m/sec.

15. (c); Average speed $= \frac{39 + 25}{(45 + 35) \times \frac{1}{60}} = \frac{64 \times 60}{80}$ = 48 km/hr

16. (b); Let length of the platform = x

$\therefore \quad 108 \times \frac{5}{18} = \frac{(280 + x)}{12} \Rightarrow$ 360 = 280 + x

x = 80 metres

$\therefore$ Speed of Boy $= \frac{80}{10}$ = 8 m/sec

17. (b); Speed of the truck $= \frac{224}{4}$ = 56 km/hr

$\therefore$ average speed of the bike $= \frac{56}{4}$ = 14 km/hr

$\therefore$ Required distance = 14 × 7 = 98 km

18. (b); When person walks at 14 km/h

$\therefore \quad 14 = \frac{d}{t}$ ... (i)

Now speed = 10 km/h

$10 = \frac{(d + 20)}{t}$ ... (ii)

$\therefore$ From eqn(i) ÷ eqn(ii)

$$\frac{14}{10} = \frac{\frac{d}{t}}{\frac{(d+20)}{t}}$$

$$\frac{14}{10} = \frac{d}{d+20} \Rightarrow 14d + 280 = 10d \Rightarrow 4d = 280 \quad d = 70km$$

∴ Actual distance = 70 – 20 = 50 km

19. (a); Given adult fair = 102

∴ Child fair $= \frac{102}{3} = 34$

Required fair $= 2(102) + 3(34) = 204 + 102 = 306$

20. (a); Average speed

$$= \frac{\text{total distance}}{\text{total time}} = \frac{75+25+50}{\frac{75}{25}+\frac{25}{5}+\frac{50}{25}} = \frac{150}{3+5+2} = \frac{150}{10} = 15 \text{ km/hr}$$

21. (b); Speed $= \frac{\text{distance}}{\text{time}}$, $54 \times \frac{5}{18} = \frac{700+500}{t}$

$$t = \frac{1200}{15} \text{sec} \Rightarrow t = 80 \text{ sec.}$$

22. (c); Running time $= \frac{1000}{50} = 20$ hrs.

No. of times that he will rest $= \frac{20}{3} \approx 6$

∴ Rest time = 6 × 20 = 120 min = 2 hours

∴ Total time = (20 + 2) = 22 hrs.

23. (c); Time taken by car $= \frac{330}{55} = 6$ hrs.

∴ Average speed of bike $= \frac{(330-15)}{(6-1)} = \frac{315}{5} = 63 \text{ km/hr}$

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24. (a); distance = 40 × 9 = 360 km

Required time $= \frac{360}{60}$ = 6 hrs.

25. (c); Speed $= \frac{\text{distance}}{\text{time}} \Rightarrow 20 \times \frac{5}{18} = \frac{75}{t}$

$t = \frac{75 \times 18}{100} = \frac{54}{4}$ = 13.5 seconds

26. (a); Let Required time = t

$144 \times \frac{5}{18} = \frac{100}{t} \Rightarrow t = 2.5$ seconds

27. (c); Speed $= \frac{\text{distance}}{\text{time}}$

Let length of the platform = 2x m

$\frac{60 \times 5}{18} = \frac{x + 2x}{32.4} \Rightarrow 3x = 1.8 \times 60 \times 5$

3x = 90 × 6

x = 30 × 6 = 180 m

∴ Length of the platfrom = 2x = 360 m

28. (a); Speed $= \frac{\text{distance}}{\text{time}} \Rightarrow 66 \times \frac{5}{18} = \frac{d}{18}$ d = 330 m

29. (c); Speed of first train $(S_1) = \frac{120}{10}$ = 12 m/sec.

Speed of second train $(S_2) = \frac{120}{15}$ = 8 m/sec.

∴ Required time $= \frac{120 + 120}{(12 + 8)} = \frac{240}{20}$ = 12 m/sec

30. (a); Average speed $= \frac{2xy}{x+y} = \frac{2 \times 70 \times 55}{125}$

$= 61.6 \text{ km/hr}$

31. (a); Let distance = d, time = t

$\therefore \quad 10 = \frac{d}{t + \frac{15}{60}}$ ...(i)

$12 = \frac{d}{t + \frac{5}{60}}$ ...(ii)

From equation (i) ÷ equation (ii)

$$\frac{10}{12} = \frac{t + \frac{1}{12}}{t + \frac{1}{4}} \Rightarrow \frac{10}{12} = \frac{4 \times (12t + 1)}{12(4t + 1)} \Rightarrow t = \frac{3}{4} \text{hr}$$

$$d = 10 \times \left(\frac{3}{4} + \frac{15}{60}\right) = 10 \times \frac{60}{60} = 10 \text{km}$$

Short cut:

Let distance = d

$$\frac{d}{10} - \frac{d}{12} = \frac{10}{60} \Rightarrow d = 10 \text{ km}$$

32. (a); Average speed $= \frac{2xy}{x+y} = \frac{2 \times 21 \times 24}{45} = \frac{112}{5} \text{km / hr}$

$\therefore$ Distance $= \frac{112}{5} \times 10$ km = 224 km

33. (d); Relative speed = (3 + 3.5) km/hr = 6.5 km/hr time = 3 hrs

$\therefore$ required distance = (6.5×3) = 19.5 km

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34. (c); Let length of the bridge = x

$\therefore$ speed $= \frac{\text{distance}}{\text{time}} \Rightarrow 15 = \frac{x}{5} \times 60$

$x = \frac{75}{60}\text{km} = \frac{5}{4}\text{km} = \frac{5}{4} \times 1000 \Rightarrow x = 1250$ m

35. (d); Speed in metres per second

$= 180 \times \frac{5}{18} = 50$ m / sec.

36. (d); Speed $= \frac{\text{distance}}{\text{time}} \Rightarrow 60 \times \frac{5}{18} = \frac{d}{30} \Rightarrow d = 500$ m

37. (c); Relative speed of the trains

$= (50 - 30) = 20$ km / hr $= 20 \times \frac{5}{18}$ m / sec.

$\therefore$ length of the faster train $= 20 \times \frac{5}{18} \times 18 = 100$ m

38. (a); Let length of the train = l_1

$\therefore \quad (25+5) \times \frac{5}{18} = \frac{l_1}{12} \Rightarrow \frac{150}{18} = \frac{l_1}{12} \Rightarrow l_1 = 100$m

$\therefore \quad 25 \times \frac{5}{18} = \frac{100 + l_2}{18} \Rightarrow 100 + l_2 = 125 \Rightarrow l_2 = 25$m

$\therefore$ Required length (100 + 25) = 125 m

39. (b); Time $= \frac{4}{5} \times \frac{1}{45}$ hrs $= \frac{4}{5} \times \frac{1}{45} \times 60 \times 60$ sec = 64 seconds

40. (c); Speed of the train $= \frac{570 + 570}{15} = \frac{1140}{15} = 76$ m / sec.

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Moderate

1. (b); By the given statements

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \Rightarrow p - q = \frac{1}{r} \Rightarrow \frac{1}{r} = p - q$$

2. (a); Let distance = d

$$\frac{d}{2} + \frac{d}{3} = 5 \qquad \frac{5d}{6} = 5 \Rightarrow d = 6 \text{ km}$$

3. (b); Let distance = d

$$\frac{d}{5} - \frac{d}{6} = \frac{25}{60} \qquad \frac{d}{30} = \frac{25}{60} \Rightarrow d = 12.5 \text{ km}$$

4. (c); Let length of train = L

$$\therefore \quad \text{speed} = \frac{L + 162}{18} \quad \text{... (i)}$$

$$\text{speed} = \frac{L + 120}{15} \quad \text{...(ii)}$$

From equation (i) and equation (ii)

$$\frac{L + 162}{18} = \frac{L + 120}{15}$$

5L + 810 = 6L + 720 $\Rightarrow$ L = 90

5. (b); Relative speed of two train = (50 – 40)

$$= 10 \text{ kmph} = 10 \times \frac{5}{18} \text{ m/s}$$

$$\text{Required time} = \frac{120 + 80}{50} \times 18 = \frac{200}{50} \times 18 = 72 \text{ sec.}$$

6. (b); Let length of each train = x metres

$$\therefore \quad \text{speed of first train} = \frac{x}{4} \text{ m/sec}$$

$$\text{speed of second train} = \frac{x}{5} \text{ m/sec}$$

Relative speed $= \frac{x}{4} + \frac{x}{5} = \frac{9x}{20}$ m/sec

Time taken to cross each other = time train to cover 2x metres

at $\left(\frac{9x}{12}\right)$ m/sec $= 2x \times \frac{20}{9x} = \frac{40}{9}$ sec.

7. (c); Let the speed of the train = s km/hr

$(s+3) \times \frac{5}{18} = \frac{240}{10} \Rightarrow 24 \times 18 = 5s + 15$

$432 = 5s + 15 \Rightarrow 5s = 417$ $s = 83.4$ km/hr

8. (c); Let the time taken by train A when it meet = t

Let the time taken by train B when it meet = (t – 1)

$60 \times t + 75(t-1) = 330 \Rightarrow 60t + 75t - 75 = 330$

$135t = 405 \Rightarrow t = 3$ hr

∴ both train will meet at 11 A.M.

9. (b); Let they meet in t min.

$5t + 10t = 1200$ $15t = 1200$ $t = 80$ min

10. (b); Relative speed = (77 + 67) km/hr = 144 km/hr

$= \frac{144 \times 5}{18}$ m/sec = 8 × 5 = 40 m/sec.

∴ Required time $= \frac{(160+140)}{40} = \frac{300}{40}$ sec.= 7.5 sec.

11. (d); Speed of first train $(S_1) = \frac{120}{10}$ = 12 m/sec

Speed of second train $(S_2) = \frac{120}{15}$ = 8 m/sec

∴ Relative speed = $S_1 - S_2$ = 4 m/sec

∴ Required time $= \frac{120+120}{4} = \frac{240}{4}$ = 60 sec

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12. (a); Average speed $= \dfrac{\text{total distance}}{\text{total time}}$

$$= \frac{2000}{\dfrac{3000+8000+500+800}{400}}$$

$$= \frac{2000 \times 400}{12300} = \frac{8000}{123} = 65\frac{5}{123}\text{ km/hr}$$

13. (b); Let total distance = d km

$\therefore$ average speed $= \dfrac{\text{total distance}}{\text{total time}} = \dfrac{d}{\dfrac{d}{3}\times\dfrac{1}{25}+\dfrac{d}{4}\times\dfrac{1}{30}+\dfrac{5}{12}\times\dfrac{d}{50}}$

$$= \frac{1}{\dfrac{1}{75}+\dfrac{1}{120}+\dfrac{5}{600}} = \frac{1}{\dfrac{8+5+5}{600}} = \frac{600}{18} = \frac{300}{9} = \frac{100}{3} = 33\frac{1}{3}\text{ km/hr}$$

14. (c); Let speed of A = 3x
Let speed of B = 4x
distance covered by A in time 't'

$3x \times t = 4x\left(t - \dfrac{30}{60}\right) \Rightarrow 3t = 4t - 2 \Rightarrow t = 2$ hrs.

15. (c); In first two hours the distance covered by car = 70 + 70 = 140 km
In the four hours distance covered by car = 140 + 160 = 300
Remaining 45km is covered by car in

$= \dfrac{45}{90}\text{ hr} = \dfrac{1}{2}\text{ hr}$; $\therefore$ Total time $= 4\dfrac{1}{2}$ hrs.

16. (a); No. of stops that he rests $= \dfrac{150}{20} \approx 7$

$\therefore$ rest time = 7 × 10 = 70 min = 1 hr 10 min

$\therefore$ run time $= \frac{150}{15} = 10$ hrs

$\therefore$ Total time = 11 hr 10 min

17. (a); Let speed of bike = 15x
Speed of train = 27x

$\therefore$ speed of bus $= \frac{720}{9} = 80$ km/hr

$15x = \frac{3}{4}(80) \Rightarrow 15x = 60 \Rightarrow x = 4$

Speed of train = 108 km/hr

$\therefore$ Required distance = (108 × 7) km = 756 km

18. (d); Distance $= \frac{44}{60} \times 50$ km

$\therefore$ time when speed of bus increased by

5 km/hr $= \frac{44}{60} \times 50 \times \frac{1}{55} = \frac{4}{6}$ hrs $= \frac{4}{6} \times 60$ min.

= 40 min

19. (b); Let speed of bus = 2x

$\therefore$ speed of train = 3x

$$\frac{75}{2x} - \frac{75}{3x} = \frac{12.5}{60} \Rightarrow \frac{125}{600} = \frac{75}{x}\left(\frac{1}{2} - \frac{1}{3}\right) = \frac{75}{x}\left(\frac{1}{6}\right) \Rightarrow \frac{125}{100} = \frac{75}{x}$$

$$x = \frac{75 \times 100}{125} \Rightarrow x = 4 \times 15 \Rightarrow x = 60 \text{ km/hr}$$

$\therefore$ speed of bus = 2 × 60 = 120 km/hr

20. (c); Length of platform = 140 m
Let length of train = x m

$$x + x \times \frac{40}{100} = 140 \Rightarrow x = 100 \text{ m}$$

Speed $\frac{100}{10} = 10$ m/sec.

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21. (d); Let speed of train = x
Let speed of car = y

$$\frac{120}{x}+\frac{480}{y}=8 \quad \text{... (i)}$$

$$\frac{200}{x}+\frac{400}{y}=8\frac{1}{3} \quad \text{... (ii)}$$

equation (i) × 5 – equation (ii) × 3

$$\frac{600}{x}+\frac{2400}{y}=40 \Rightarrow \frac{600}{x}+\frac{1200}{y}=25$$

On subtracting (2) from (1)

$$\frac{1200}{y}=15 \Rightarrow y=80 \Rightarrow \frac{120}{x}+6=8$$

$$\frac{120}{x}=2 \Rightarrow x=60$$

∴ Require ratio = x : y = 60 : 80 = 6 : 8 = 3 : 4

22. (c); Let Aditya takes t hours when he travel at 10 km/hr

$$\frac{d}{10}-\frac{d}{15}=2 \qquad \frac{d}{30}=2 \Rightarrow d = 60 \text{ km}$$

$$\therefore \quad t=\frac{60}{10}=6\,\text{hr}$$

∴ to reach A at 1 pm, speed $=\frac{60}{5}=12$ kmph

23. (c); Let length of train = x m
∴ Let length of bridge = 3.5x m

$$\frac{x+3.5x}{40}-\frac{x}{40}=21 \Rightarrow x + 3.5x - x = 40 \times 21$$

$3.5x = 840 \Rightarrow x = \frac{840}{35} \times 10$

$\therefore$ Length of bridge $= \frac{840}{7} \times 2 \times \frac{7}{2} = 840$ m

24. (a); Let speed of train A = x km / hr
then speed of train B = (x + 27) km / hr
$\therefore$ 16x + 16(x + 27) = 1872
16x + 16x = 1872 – 432
32x = 1440 $\Rightarrow$ x = 45 km / hr

25. (d); Let length of train $N = x$

$\therefore$ Let length of train M $= \frac{x}{2}$

$\therefore$ speed of train M $= \frac{x}{2 \times 25} = \frac{x}{50}$ m / s

Speed of train N $= \frac{x}{75}$ m / s

Required ratio $= \frac{x}{50} : \frac{x}{75} = \frac{1}{50} : \frac{1}{75} = 3 : 2$

26. (a); Speed of truck $= \frac{396}{11} \times 2 = 36 \times 2 = 72$ km / hr

Speed of bike $= \frac{4}{3} \times 72 = 24 \times 4 = 96$km / hr

Required time $= \frac{396 - 12}{96} = \frac{384}{96} = \frac{32}{8} = 4$ hrs.

27. (c); Ratio of their speed = $\sqrt{b} : \sqrt{a} = \sqrt{121} : \sqrt{81} = 11 : 9$
Given A's speed = 44 km
$\therefore$ B's speed = 36 km / hr

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28. (c); Let distance travelled by second train = d

$$\frac{d}{65} = \frac{d+20}{85} \qquad 85d = 65d + 65\times20$$

$20d = 65\times20 \qquad d = 65$ km

$\therefore$ Total distance = 65 + 65 + 20 = 150 km

29. (c); Let time taken by first train = t hrs

$25t = 40(t-6)$

$25t = 40t - 240$

$15t = 240$

$t = 16$ hrs

$\therefore$ Required distance = 16 × 25 = 400

30. (d); Distance = 240 × 5 = 1200 km

$\therefore$ required speed $= \frac{1200}{5}\times3 = 240 \times 3 = 720$ km/hr

31. (d); Distance $= 3\times\frac{5}{2}$ km = 7.5 km

32. (c); $40 = \dfrac{d}{t+\frac{11}{60}}$ ... (i)

$50 = \dfrac{d}{t+\frac{5}{60}}$ ... (ii)

By (i) and (ii)

$$\frac{4}{5} = \frac{t+\frac{5}{60}}{t+\frac{11}{60}} \Rightarrow \frac{4}{5} = \frac{60(60t+5)}{60(60t+11)}$$

$240t + 44 = 300t + 25 \Rightarrow 60t = 19$

$t = \frac{19}{60}$ hr $\Rightarrow t = \frac{19}{60}\times60$ min $\Rightarrow t = 19$ min

33. (b); Let length of tunnel = L

$\therefore \quad 78 \times \frac{5}{18} = \frac{800 + L}{60} \Rightarrow 1300 = 800 + L \Rightarrow L = 500$

34. (a); Distance travelled by A in first day $= 4 \times \frac{70}{5}$ = 56 km

$\therefore$ Required ratio = 42 : 56 = 6 : 8 = 3 : 4

35. (a); Relative speed = (11 – 10) km / hr = 1 km / hr

in 6 min., distance between both $= \frac{1 \times 5}{18} \times 6 \times 60$ = 100 m

$\therefore$ Required distance = (200 – 100) m = 100 m

36. (c); At 1 : 30 PM., distance covered by boy

$= \frac{7}{2} \times 12$ = 42 km

Let speed of scooter = x km / hr

$42 = x \times \left(\frac{7}{2} - \frac{5}{4}\right) \Rightarrow 42 = x \times \frac{14 - 5}{4}$

$42 = x \times \frac{9}{4} \Rightarrow x = \frac{42 \times 4}{9} \Rightarrow x = \frac{56}{3} \quad x = 18\frac{2}{3}$ km / hr

37. (b); Let distance = x km

$\therefore \frac{x}{2} - \frac{x}{3} = \frac{12}{60} \qquad \frac{3x - 2x}{6} = \frac{1}{5} \Rightarrow x = \frac{6}{5}$ km

38. (c); Let length of train = L

$\therefore \quad s = \frac{L}{10}$ ... (i)

$s = \frac{L + 300}{25}$ ... (ii)

by equation (i) and equation (ii)

$\frac{L}{10} = \frac{L + 300}{25} \Rightarrow 25L = 10L + 3000$

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$15L = 3000 \Rightarrow L = 200$ m $\Rightarrow s = 20$ m/sec

$\therefore$ Required time $= \frac{200+200}{20} = \frac{400}{20} = 20$ seconds

39. (a); Time taken by A = 252 = 2 × 2 × 3 × 3 ×7
Time taken by B = 308 = 2 × 2 ×7 × 11
Time taken by C = 198 = 2 × 3 × 3 × 11
$\therefore$ L.C.M = 2772 sec = 46 min 12 sec

40. (c); A win by B in 25 sec
B win by C in 30 sec
A win by C in 55 sec
A win by C by 275 m

Speed of A $= \frac{275}{55} = 5$ m/s

Time taken to run a kilometre by A $= \frac{1000}{5} = 200$ = 3 min 20 sec

Difficult

1. (a); Let distance = d, usual speed = s km/h

$$\frac{d}{s} - \frac{d}{s+3} = \frac{40}{60}$$

2s (s + 3) = 9d ....(i)

$$\frac{d}{s-2} - \frac{d}{s} = \frac{40}{60}$$

s(s – 2) = 3d ...(ii)

Solving equation (i) and equation (ii) d = 40

2. (d); Average speed $= \frac{\text{total distance}}{\text{total time}}$ distance = speed × time

$= \frac{15}{3} \times 80 + 4 \times 70 + 4 \times 85 + 2 \times 100$ = 400 + 280 + 340 + 200 = 1220

3. (a); Let A takes x seconds in covering 1000m and B takes y seconds covering the same distance

$\therefore \quad x + 20 = \frac{900}{1000}y \Rightarrow \frac{10x}{9} + \frac{200}{9} = y$ ... (i)

$\frac{950}{1000}x + 25 = y$ ...(ii)

From equation (i) and (ii)

$\Rightarrow \frac{10x}{9} + \frac{200}{9} = \frac{950x}{1000} + 25$ (From Eq. (i))

$\frac{200x - 171x}{180} = \frac{225 - 200}{9}$

$x = \frac{25}{9} \times \frac{180}{29} = \frac{500}{29}$ seconds

4. (c); Let distance = x km

$\therefore \quad \frac{x}{30} - \frac{x}{40} = \frac{1}{4} \Rightarrow \frac{4x - 3x}{120} = \frac{1}{4} \Rightarrow x = 30$ km

5. (c); Let required time = t

$60\left(t - \frac{2}{3}\right) + 80t = 450 \Rightarrow 60t - 40 + 80t = 450 \Rightarrow 140t = 490$

$t = \frac{7}{2} \Rightarrow t = 3\frac{1}{2}$

$\therefore$ Required time = 3 : 20 + 3 : 30 = 6 : 50 PM

6. (b); Let the time to catch A for B = t

$\therefore$ 3 (t + 1) = 4t $\Rightarrow$ t = 3hrs.

$\therefore$ Distance covered by A = 3 × 4 = 12 km

distance covered by C in 2hr = 10 km

$\therefore \quad 2 = 3t + 5t \Rightarrow t = \frac{1}{4}$ hr = 15 min

$\therefore$ Required = 5 : 15 o'clock

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7. (a); $\frac{d}{20} = \frac{d+80}{25}$

25d = 20d + 1600 $\Rightarrow$ d = 320

$\therefore$ Total distance = 320 + 320 + 80 = 640 + 80 = 720 km

8. (b); Let length of good train = L_1, speed = S_1

length of passenger train = L_2, speed = S_2

$$(S_2 - S_1) = \frac{L_1 + L_2}{60} \quad \text{... (i)}$$

$$(S_2 - S_1) = \frac{L_1}{40} \quad \text{... (ii)}$$

On solving (i) and (ii)

$$\frac{L_1}{L_1 + L_2} = \frac{40}{60} = \frac{2}{3}$$

$$\frac{L_1}{L_2} = \frac{2}{1} = 2:1$$

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9. (d);

(i) When accident takes place at C than the distance covered after the accident = CB

(ii) When accident taken place at D then distance covered after the accident = DB

CB – DB = 72 km

CD = 72 km

Let normal speed = 4x

Speed after accdent = 3x

$$\frac{72}{3x} - \frac{72}{4x} = \frac{35}{60} - \frac{5}{60}, \quad x = 18$$

So, normal speed = 72 km / hr

10. (d); Let speed of two trains are S_1 and S_2

$\therefore$ $S_1 + S_2 = \frac{100+80}{9} = \frac{180}{9} = 20$ ... (i)

$S_1 - S_2 = \frac{100+80}{18} = \frac{180}{18} = 10$ ... (ii)

On solving (i) and (ii)

$\therefore$ $2S_1 = 30$

$S_1 = 15 \text{ m/sec} = 15 \times \frac{18}{5} = 54 \text{km/hr}$

$\therefore$ $S_2 = 5 \text{m/sec} = 5 \times \frac{18}{5} = 18 \text{ km/hr}$

11. (c); When the motorbike reached to the middle point
Distance = 150 m, relative speed
= (70 – 45) = 25 km/hr.

$\therefore$ Time $= \frac{150}{25 \times 5} \times 18$ sec.

$\therefore$ Distance covered by motorbike

$= \frac{150}{25 \times 5} \times 18 \times 70 \times \frac{5}{18} = 420$ m

When it reaches exactly middle point of the train after that distance to be covered = 150 m
relative speed = (65 – 60) = 5 km/hr

Time = $\frac{150}{5 \times 5} \times 18$

$\therefore$ Distance covered by bike $= \frac{150 \times 8}{5 \times 5} \times \frac{65 \times 5}{18} = 1950$ m

$\therefore$ total distance = 1950 + 420 = 2370 m = 2.37 km

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12. (b); $\frac{\text{Speed of Kanpur mail}}{\text{Speed of Delhi mail}} = \frac{\sqrt{3}}{\sqrt{12}}$

Speed of Delhi mail = $\frac{\sqrt{12} \times 48}{\sqrt{3}} = 2 \times 48 = 96\,\text{km / h}$

13. (c); Let initially speed of Heena = 4x

Let initially speed of Renu = 2x

∴ Time will be same when Renu catches Heena.

$$\frac{50}{4x} + \frac{d}{x} = \frac{50+d}{2x}$$

$$\frac{50+4d}{4x} = \frac{50+d}{2x} \Rightarrow 50 + 4d = 100 + 2d$$

$2d = 50 \Rightarrow d = 25$

∴ Required distance (N) = 100 – (50 + 25) = 25 m

14. (a); From the first case, $\frac{d}{s} - \frac{d}{s+6} = 4$ ... (i)

From the second case, $\frac{d}{s-6} - \frac{d}{s+6} = 10$ ... (ii)

If we solve equation(i) and (ii) then it is very long and tedious method. So here $\frac{d}{s}, \frac{d}{s-6}, \frac{d}{s+6}$ should be represent intgers to satisfy both equation

∴ D should be the value which have three divisors which are 6 units apart from each other.

So only 720 satisfy the condition which have 3, 9, 15 divisors which are 6 units apart.

15. (b);

From the figure it is clear that seeta is faster as she takes only (t + 2) hours while Geeta has taken (t + 9) hours to complete the journey.

Then, we get $= \frac{t-6}{9} = \frac{8}{t} \Rightarrow t^2 - 6t = 72$

$t^2 - 6t - 72 = 0 \Rightarrow t = 12, -6; \quad \therefore t = 12$

$\therefore$ ratio of the speed = 3 : 2

$\therefore$ $12 \times 2s - 6 \times 3s = 12; \quad s = 2$ km / hr

$\therefore$ Speed of faster person = 6 km / hr

16. (b); Since the two cyclist meet after = 200 minutes they cover 0.5% of the distance per minutes and 30% per hour. This condition is satisfied only if the slower cyclist takes 10 hour (there by covering 10% per hour) and faster cycle takes 5 hours (there by covering 20% per hour.

17. (a); Initial distance = 25 dogs leaps
Per minute dog makes 5 dog leaps
Per minute cat makes 6 cat leaps = 3 dog leaps
Relative speed = 2 dogs leaps per minutes
Thus, an initial distance of 25 dogs leaps would be covered in 12.5 minutes.

18. (a); Distance travelled by train in

$12\frac{1}{2}$ min = Distance travelled by sound in 30 sec

= 330 × 30 m/sec

$\therefore$ Speed of the train $= \frac{330 \times 30}{25 \times 60} \times 2$ m/sec

$= \frac{330 \times 30}{25 \times 60} \times 2 \times \frac{18}{5}$ km/hr $= \frac{1188}{25} = 47\frac{13}{25}$ km

19. (d); Let distance = x km

In the second case average speed $= \frac{2 \times 3 \times 4}{3+4} = \frac{24}{7}$

$\therefore \quad \frac{2x \times 7}{24} - \frac{2x \times 2}{7} = \frac{5}{60}$

$\frac{98x - 96x}{24 \times 7} = \frac{5}{60} \Rightarrow \frac{2x}{24 \times 7} = \frac{5}{60} \Rightarrow$ x = 7 km

20. (b); Distance travelled by man in 4 min.

$= \frac{4}{60} \times 3 = \frac{1}{5}$ km = 200 m

Distance travelled by carriage in
4 min. = (200 + 100) = 300 min.

$\therefore$ Speed of carriage $= \frac{300}{4 \times 60}$ m/sec = $\frac{5}{4}$ m/sec

$= \frac{5}{4} \times \frac{18}{5}$ km/hr $= \frac{9}{2} = 4\frac{1}{2}$ km per hour

21. (c); Let distance = d

Let A meet B after x hours from point P

Speed of the first man $= \frac{d}{4}$

Speed of the second man $= \frac{d}{4}$

$\therefore \quad \frac{d}{4} \times x + \frac{d}{4}(x+2) = d$

$\frac{x}{4} + \frac{x+2}{4} = 1 \Rightarrow x + x + 2 = 4 \qquad 2x = 2 \Rightarrow x = 1\text{hr}$

22. (b); Given,

total time = 4 hrs.

Let time travelled by aeroplane = x

$\therefore$ time travelled by train = (4 – x)

$\therefore 2 = \frac{4}{5}(4 - x) \Rightarrow 4 - x = \frac{10}{4} = \frac{5}{2} \qquad x = \frac{8-5}{2} = \frac{3}{2}$

$\therefore$ time travelled by aeroplane $= \frac{3}{2}$ hrs.

In 2 hrs, distance travelled by aeroplane = 360 km

When $\frac{3}{2}$ hrs. distance travelled by aeroplane $= \frac{360}{2} \times \frac{3}{2} = 270$ km

and distance travelled by train = (360 – 270) = 90 km

23. (a); Let it takes x hrs. in the second case

$\therefore \quad \text{Speed} = \frac{1500}{x} = \frac{1500}{x + \frac{1}{2}} + 250$

$$\frac{1500\left(x + \frac{1}{2}\right) - 1500x}{x\left(x + \frac{1}{2}\right)} = 250$$

$750x = 250x\left(x+\frac{1}{2}\right) \Rightarrow x^2 + \frac{x}{2} - 3 = 0$

$2x^2 + x - 6 = 0 \Rightarrow x = -\frac{4}{2}, \frac{3}{2}; \therefore x = \frac{3}{2}$

$\therefore$ aeroplane takes $\frac{3}{2}$ hrs. in second case.

There in normal case it will take $= \frac{3}{2} + \frac{1}{2} = 2$ hrs.

$\therefore$ speed $= \frac{1500}{2} = 750$ km/hr.

24. (a); Let it takes x hrs in the second case.

$\therefore$ speed $= \frac{120}{x} = \frac{120}{x-1} - 4 \Rightarrow \frac{120}{x-1} - \frac{120}{x} = 4$

$\frac{120(x-x+1)}{x(x-1)} = 4 \Rightarrow 120 = 4x^2 - 4x$

$x^2 - x - 30 = 0 \Rightarrow x = -5, 6; \quad \therefore x = 6$

$\therefore$ the train take 6 hrs. in second case

$\therefore$ the train will take time in normal case = (6 – 1) = 5 hrs.

$\therefore$ original speed $= \frac{120}{5} = 24$ km/hr

25. (d); In 1min. the hare will cover distance

$= 1 \times 60 \times 12 \times \frac{5}{18} = 200$ m

$\therefore$ total distance = (200 + 100) = 300 m

relative speed = (16 – 12) = 4 km/hr

$= 4 \times \frac{5}{18}$ m/sec. $\Rightarrow$ time to chase $= \frac{300}{4 \times 5} \times 18 = 15 \times 18 = 270$ sec.

In 270 sec. hare cover the distance

$= 270 \times \frac{12 \times 5}{18} = 900$ metres

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Previous Year (Memory Based)

1. (d); Distance = $30 \times 6\frac{12}{60}$ km $= 30 \times 6\frac{1}{5}$ = 186 km

Time taken $= \frac{186}{24}$ = 7 : 45 h

2. (a); Time taken to reach B = $\frac{999}{55.5} + 1\frac{1}{3}$

= 18 + 1 hr 20 min = 19 hr 20 min

It reaches B at 1 : 20 am

3. (a); Let the distance between A and B be x.

$$\frac{x \times 60}{45} - \frac{x \times 60}{48} = 5 \Rightarrow \frac{4x}{3} - \frac{5x}{4} = 5$$

$$\frac{16x - 15x}{12} = 5 \Rightarrow x = 60 \text{ km}$$

4. (a); Let the speed of a truck be x km / h

Relative speed = (45 – x) × $\frac{5}{18}$ m / s

$$\therefore \quad \frac{150 \times 18}{(45 - x)5} = 30 \Rightarrow x = 27 \text{ km/h}$$

5. (d); Speed of car $= 10 \times \frac{18}{5}$ = 36 km / h

6. (a); Average speed $= \frac{2 \times 100 \times 150}{100 + 150}$ [∴ using formula average speed = $\frac{2xy}{x + y}$] = 120 km / h

7. (a); Average speed $= \frac{2 \times 12 \times 18}{12 + 18} = \frac{2 \times 12 \times 18}{30}$ = 14.4 km / h

8. (b); Total time $= \frac{24}{6} + \frac{24}{8} + \frac{24}{12}$ = 4 + 3 + 2 = 9 h

Avrage speed $= \frac{\text{total distance}}{\text{total time}} = \frac{72}{9}$ = 8 km / h

9. (c); Average speed $= \frac{2 \times 12 \times 4}{16}$ = 6 km / h

10. (a); Let the speed of A be 3x and B be 4x
According to the question

$3x\left(t + \frac{20}{60}\right)$ = 4 x (t) $\Rightarrow$ t = 1 h

Time for A to reach the destination $= 1 + \frac{20}{60} = 1\frac{1}{3}$

11. (c); Speed of truck = $\frac{550 \times 60}{1000 \times 1}$ = 33 km / h

Speed of Bus $= \frac{33}{45} \times 60$ = 44 km / h

Required ratio = $\frac{33}{44}$ = 3 : 4

12. (b); Let the distance be x.
According to the question

$\frac{2x}{5} - \frac{x}{3} = \frac{16}{60} \Rightarrow \frac{6x - 5x}{15} = \frac{16}{60} \Rightarrow$ x = 4 km

13. (b); Let the distance be x.

$\frac{2x}{5} - \frac{2x}{7} = \frac{12}{60} \Rightarrow \frac{14x - 10x}{35} = \frac{12}{60}$

$x = \frac{12 \times 35}{60 \times 4} \Rightarrow x = \frac{7}{4}$ km

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14. (d); Let the distance be x and speed be y

Reduced speed $= y - \frac{y}{15} = \frac{14y}{15}$

According to the question

$\therefore \quad \frac{x}{y} = \frac{(x-10)15}{14y}$

$14x = 15x - 150 \Rightarrow x = 150$ km

$\therefore \quad \frac{x}{y} = 30$ h $\Rightarrow y = \frac{150}{30} = 5$ km/h

15. (a); Let the distance covered on foot be x km

$\therefore \quad \frac{x}{8} + \frac{80-x}{16} = 7 \Rightarrow \frac{2x+80-x}{16} = 7$

$x = 112 - 80 \Rightarrow x = 32$km

16. (b); Let the distance travelled on foot be x km

$\frac{x}{4} + \frac{61-x}{9} = 9 \Rightarrow \frac{9x+244-4x}{36} = 9$

$5x = 324 - 244 \Rightarrow x = \frac{80}{5} \Rightarrow x = 16$ km

17. (c); Let the time taken by Riding be R and walking be W

$R + W = 6\frac{1}{4} \Rightarrow 2W = 7\frac{3}{4} \Rightarrow W = \frac{31}{8}$

$R = \frac{25}{4} - \frac{31}{8} \Rightarrow R = \frac{19}{8} \qquad 2R = \frac{38}{8} = 4\frac{3}{4}$

Time taken in riding both ways = 4h 45min

18. (d); Time taken by all to complete 1 round of circular path

$= \frac{12}{4} = 3h \Rightarrow B = \frac{12}{3} = 4h \Rightarrow C = \frac{12 \times 2}{3} = 8h$

So by taking LCM of 3h, 4h and 8h we get 24h.

then they will meet at the starting point at the end of 24h.

19. (c); Let the speed of Ravi be x km/h
Speed of Ajay be (x+4) km/h
According to the question

$\therefore \quad \frac{48}{x} = \frac{72}{x+4} \Rightarrow 48x + 192 = 72x$

$24x = 192 \Rightarrow x = 8 km/h$

$\therefore$ Speed of Ravi be 8 km/h

20. (d); Let Distance be D km
Total distance covered between 11am to 4 : 30 pm

$= \frac{5D}{6} - \frac{3D}{8} = \frac{22D}{48}$

$\text{Speed} = \frac{\frac{22D}{48}}{\frac{11}{2}} = \frac{22D}{48} \times \frac{2}{11} = \frac{D}{12} km/h$

Time taken to cover a distance of $3\frac{D}{8}$

$\frac{3\frac{D}{8}}{\frac{D}{12}} = 4\frac{1}{2} h$

So, the journey started at 6 : 30 am.

21. (a); A : B = 800 : 760 = 20 : 19
B : C = 500 : 495 = 100 : 99

$\frac{A}{C} = \left(\frac{A}{B} \times \frac{B}{C}\right) = \frac{20}{19} \times \frac{100}{199}$

When A cover 200m C cover

$= \frac{19 \times 99}{20 \times 100} \times 200 = 188.1$

$\therefore$ A will beat C by 11.9 m

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22. (b); A : B = 1000 : 950 = 20 : 19

A : C = 1000 : 931

$$\frac{B}{C} = \left(\frac{B}{A} \times \frac{A}{C}\right) = \frac{19}{20} \times \frac{1000}{931}$$

In a km race B beat C by = $100 \times \frac{49}{50} = 980$

B can give a start of = 1000 – 980 = 20 m

23. (a); A and B run a kilometer and A wins by 25 seconds.

A = x $\Rightarrow$ B = x + 25 $\Rightarrow$ C = x + 55

A and C run a kilometer and A wins by 275m

We know B's time (from above) = x + 25 sec

B wins over C by 30 sec, C's time = x + 55 sec

A and C run a kilometer and A wins by 275m

it taks C to run 275 in 55 sec.

Speed of C $= \frac{275}{55} = 5 m/s$

time taken by C $= \frac{1000}{5} = 200$ sec

x + 55 = 200 $\Rightarrow$ x = 145 sec

Time taken by A is 2 min 25 seconds.

24. (c); Let the distance be x km

$$\therefore \quad \frac{x}{25} + \frac{x}{4} = 5.80 \Rightarrow \frac{4x + 25x}{100} = 5.80$$

$$x = \frac{580}{29} = 20 \Rightarrow x = 20 \text{ km}$$

25. (d); Let the time taken to walk = W

And ride = R $\Rightarrow$ W + R = 4.5 hr

2R = 3h $\Rightarrow$ R = 1.5h $\Rightarrow$ 2W = 2(4.5 – 1.5) = 6h

Time for man to walk both ways 6 h.

26. (c); Relative speed $=(84+6)\times\frac{5}{18}$ = 25 m/s

Length of the train = 25 × 4 = 100m

27. (d); Relative speed $=(36-9)\times\frac{5}{18}=27\times\frac{5}{18}=\frac{15}{2}$

Required time $=\frac{150}{15}\times 2$ = 20 s

28. (c); Let the speed of train be x km/h

Relative speed of first person with the train

= (x – 3) km/h

Relative speed of second person with the train

= (x – 5) km/h

According to the question

$\Rightarrow (x-3)\times\frac{5}{18}\times 10=(x-5)\times\frac{5}{18}\times 11$

$\Rightarrow$ 50x – 150 = 55x – 275

5x = 125 $\Rightarrow$ x = 25 km/h

29. (c); Distance covered by train in 30 seconds

$=60\times\frac{5}{18}\times 30$ = 500m

Length of the platform = (500 – 200)m = 300m

30. (b); Relative speed of train with respect to the person

$=(63-3)\times\frac{5}{18}$ m/s $=\frac{50}{3}$ m/s

Time taken $=\frac{500}{50}\times 3$ = 30 seconds

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Chapter

10

Boat and Stream

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Chapter 10

Boat and Stream

The chapter of boat and stream is based on the application of time and distance. There are two terms which are frequently used in this chapter are downstream and upstream.

1. Downstream → When boat is moving along the direction of the stream.
2. Upstream → When boat is moving against the direction of the stream.

Basic formula: If 'x' be the speed of boat in still water and 'y' be the speed of stream.

(i) Downstream speed (v) = (x + y) km/h

(ii) Upstream speed (u) = (x – y) km/h

Where Downstream Speed is 'v' and upstream speed is 'u'.

(iii) Speed of boat in still water, (x) = $\frac{1}{2}$ (u + v)

(iv) Speed of stream, (y) = $\frac{1}{2}$ (v – u)

Note: If the speed of water in river is zero, then the water is considered to be still.

Example: A man row with a speed of 8 km/h in still water. Find the downstream and upstream speed of boat, if the speed of stream is 4 km/h. ?

Sol. Downstream speed = (x + y)km/h = (8 + 4) = 12 km/ h

Upstream speed = (x – y) km/h = (8 – 4) = 4 km/h

Concept 1: If the speed of boat in still water is x km/h and speed of stream is y km/h. If time taken to go and come back from a point is T, the

distance between both points = $\frac{T\left(x^2 - y^2\right)}{2x}$ km

Example: A man can row 14 km/h in still water. When the stream is running at 2 km/h, it takes him 7 hour to row to a place and to come back. How far is the place ?

Sol. Required distance = $\frac{7\left(14^2-2^2\right)}{2\times 14}$ km = $\frac{7\times 192}{2\times 14}$ = 48 km

Concept 2: A person can row a certain distance downstream in t_1 h and returns upstream the same distance in t_2 h. When the stream flows at the rate of 's' km/h.

Then the speed of man = $\frac{s\left(t_1+t_2\right)}{t_2-t_1}$ km/h

Example: Sonu can row a certain distance is 8 h and can return the same distance is 12h. If the stream of flows at the rate of 8 km/h, then find the speed of Sonu is still water ?

Sol: Speed of man = $\frac{8(8+12)}{12-8}$ km/h = $\frac{8\times 20}{4}$ = 40 km/h

Concept 3: If the speed of boat in still water is x km/h and river is flowing with a speed of y km/h, then average speed in going to a certain place and coming back to starting point is given by $\frac{(x+y)(x-y)}{x}$ km/h.

Example: A man can row in still water with a speed of 6 km/h to go to a certain place and to come back. Find the average speed for the whole journey, if the river is flowing with a speed of 3 km/h ?

Sol. Average speed = $\frac{(6+3)(6-3)}{6}$ km/h = $\frac{9\times 3}{6}$ km/h = 4.5 km/h

Concept 4: If a man can row d_1 km upstream and e_1 km downstream in T_1 hours. Also, he can row d_2 km upstream and e_2 km downstream in T_2 hours. Then, the upstream speed of man

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$$= \left(\frac{d_1e_2 - d_2e_1}{e_2T_1 - e_1T_2}\right) km/h$$

$$\Rightarrow \quad \text{Downstream speed of man} = \left(\frac{d_1e_2 - d_2e_1}{d_1T_2 - d_2T_1}\right) km/h$$

Example: A man can row 30 km upstream and 44 km downstream is 10 hrs. Also, he can row 40 km upstream and 55 km downstream is 13 hrs. Find the rate of current and speed of man is still water ?

Sol. Upstream speed of man = $\frac{30 \times 55 - 40 \times 44}{55 \times 10 - 44 \times 13} = \frac{-110}{-22} = 5$ km/h

Downstream speed of man = $\frac{30 \times 55 - 40 \times 44}{30 \times 13 - 40 \times 10} = \frac{-110}{-10} = 11$ km/h

Speed of man = $\frac{5 + 11}{2} = 8$ km/h

Speed of stream = $\frac{11 - 5}{2} = 3$ km/h

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Types of Questions

1. A man can row upstream at 10 km/hr and downstream at 16 km/hr. Find the speed of man in still water ?

Sol. Let the speed of the man in still water be x km/hr and speed of the stream be y km/hr.

According to the question,

$x + y = 16$ ... (i)

and $x - y = 10$ ... (ii)

Adding eq. (i) with eq. (ii), we have

$2x = 26 \quad \therefore x = 13$ km/hr

$\therefore$ Speed of the man in still water = 13 km/hr.

2. A man can row upstream at 10 km / hr and downstream at 16 km / hr. Find the rate of the current?

Sol. Let the speed of the man in still water be x km / hr and the rate of the current be y km / hr

According to the question,

Downstream speed = x + y = 16 km / hr ... (i)

Upstream = x – y = 10 km / hr ... (ii)

Subtracting eq. (ii) from eq. (i), we have

2y = 6 km / hr or y = 3 km / hr

∴ Speed of the current = 3 km / hr

3. A stream running at 2 km / hr, a motorboat goes 10 km upstream and comeback to the starting point in 55 minutes. Find the speed of the motorboat in still water.

Sol. Let the speed of the motorboat in still water be x km / hr.

$$\frac{10}{x+2}+\frac{10}{x-2}=\frac{55}{60}$$

or, $240x = 11x^2 - 44$ or, $11x^2 - 240x - 44 = 0$

∴ $(x - 22)(11x + 2) = 0$

So, x = 22 km / hr (neglect the – ve value)

∴ Speed of the motorboat in still water = 22 km / hr.

4. Ramesh can row a certain distance downstream in 6 hours and return the same distance in 9 hours. If the stream flows at the rate of 3 km per hour find the speed of Ramesh in still water.

Sol. Let the speed of Ramesh in still water be x km / hr. Then his upstream speed = (x – 3) km / hr

Downstream speed = (x + 3) km / hr.

Now, we are given that up and down journey are equal, therefore,

$(x + 3)6 = (x - 3)9$ or, $6x + 18 = 9x - 27$

or, 3x = 45; ∴ x = 15 km / hr

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5. The speed of a boat in still water is 11 km/h and the speed of the stream is 3 km/h. The boat takes a total of 11 hours to cover a distance up and down of a fixed destination. What is the fixed distance ?

Sol. Let the fixed distance be l km.

Speed of the boat downstream = 11 + 3 = 14 km/h

Time taken to cover l km downstream = $\frac{l}{14}$ hours.

Now the speed of the boat upstream = 11 – 3 = 8 km/h

Time taken to cover l km upstream = $\frac{l}{8}$ hours

From the question :

$\frac{l}{14}+\frac{l}{8}=11$ or, $\frac{7l+4l}{56}=11$ or, $l = 11 \times \frac{56}{11} = 56$ km

6. A steamer takes one hour more to go 48 km upstream than the time to go 60 km downstream. If the steamer takes equal time to cover 30 km downstream and 18 km upstream then find the ratio of the speed of the boat in still water and the speed of the stream.

Sol. Let the speed of the boat in still water = x km/h.

Speed of the stream is y km/h

So, The speed of steamer downstream = x + y km/h

and the speed of the steamer upstream = x –y km/h

In first situation, $\frac{48}{x-y}-\frac{60}{x+y}=1$ ... (i)

and in second situation $\frac{30}{x+y}=\frac{18}{x-y}$

or, $\frac{60}{x+y}=\frac{36}{x-y}$ ... (ii)

from eq. (i) and (ii) $\frac{48}{x+y}-\frac{36}{x-y}=1$

or, $\frac{12}{x-y}=1$ or, $x - y = 12$ ... (iii)

Again from eq. (i), $\frac{48}{12}-\frac{60}{x+y}=1$

or, $4 - 1 = \frac{60}{x+y}$ or, $x + y = 20$ ... (iv)

Solving eq. (iii) and (iv), x = 16 and y = 4

So required ratio = $\frac{x}{y}=\frac{16}{4}=4:1$

Foundation

1. A boat goes 14 km upstream in 42 minutes. The speed of stream is 4 km / h. The speed of boat in still water is
   (a) 24 km / h (b) 25 km / h (c) 30 km / h
   (d) 23 km / h (e) None of these
2. The speed of a boat in still water is 7 km / h. If its speed in downstream is 10 km / h. Then the speed of stream is
   (a) 7 km / h (b) 3 km / h (c) 10 km / h
   (d) 6 km / h (e) None of these
3. Aditya can row with stream at 10 km / h and against the stream at 6 km / h. His speed in still water is
   (a) 16 km / h (b) 6 km / h (c) 8 km / h
   (d) 10 km / h (e) None of these
4. Speed of man is 12 km / h in still water. If the rate of current is 4 km / h, then the effective speed of the man upstream is
   (a) 6 km / h (b) 7 km / h (c) 5 km / h
   (d) 8 km / h (e) None of these

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5. A man moves downstream at a rate of 14 km/h and upstream at a rate of 6 km/h. Speed of boat in still water is
(a) 4 km/h (b) 10 km/h (c) 16 km/h
(d) 2 km/h (e) None of these

6. A man moves 20 km down stream in 5 hours and 10 km up stream in same time. The speed of stream
(a) 4 km/h (b) 1 km/h (c) 1.6 km/h
(d) done (e) None of these

7. A boat travels 18 km towards upstream in 6 hours. How long (In Hrs) will it take to cover the same distance downstream the speed current is one fourth the speed of boat in still water.
(a) 3 (b) 4 (c) 3.6
(d) 3.4 (e) None of these

8. A person can row with the stream at 8 km/h and against the stream at 4 km/h. The speed of the current is (In km/hr)
(a) 1 (b) 2 (c) 1.5
(d) 4 (e) None of these

9. When the speed of a boat in still water is 4 km/h and the rate of stream is 2 km/h, find upstream speed of the boat ?
(a) 6 km/h (b) 5 km/h (c) 2 km/h
(d) 7 km/h (e) None of these

10. If the speed of a swimmer in still water is 9 km/h. Find the downstream speed of the swimmer, when the river is flowing with the speed of 6 km/h ?
(a) 15 km/h (b) 18 km/h (c) 3 km/h
(d) 12 km/h (e) None of these

11. A swimmer's speed in downstream is 11 km/h and speed of the stream is 1.5 km/h. Find the upstream speed of swimmer ?
(a) 8 km/h (b) 9.5 km/h (c) 9 km/h
(d) 6.25 km/h (e) None of these

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12. A boatman rows 1 km in 5 min along the stream and 6 km in 1 h against the stream. The speed of the stream is
(a) 3 km / h (b) 6 km / h (c) 10 km / h
(d) 12 km / h (e) None of these

13. Keshav can row 60 km downstream and 36 km upstream, taking 10 h each time. What is the velocity of the current?
(a) 3 km / h (b) 2.2 km / h (c) 4 km / h
(d) 1.2 km / h (e) None of these

14. What time will be taken by a boat to cover a distance of 128 km along the stream, if speed of a boat in still water is 24 km / h and speed of stream is 8 km / h?
(a) 8 h (b) 4 h (c) 7 h
(d) 6 h (e) None of these

15. A man can row against the current three-fourth of a kilometre in 15 min and returns same distance in 10 min, then ratio of his speed to that of current is –
(a) 3 : 5 (b) 5 : 3 (c) 1 : 5
(d) 5 : 1 (e) None of these

16. A boat goes 48 km downstream in 20 h. It takes 4 h more to cover the same distance against the stream. What is the speed of the boat in still water ?
(a) 2.2 km / h (b) 2 km / h (c) 4 km / h
(d) 4.2 km / h (e) None of these

17. A man can row 15 km downstream in 3 hours and 5 km upstream in $2\frac{1}{2}$ hours. His speed in still water in (km / hr) is
(a) 4 km / hr (b) 4.5 km / hr (c) 3.5 km / hr
(d) 5 km / hr (e) None of these

18. A man can row 44 km downstream in 4 hours. If the man's rowing rate in still water is 8 km / hr, then find in what time will he cover 25 km upstream?

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(a) 5 hours (b) 6 hours (c) 4.5 hours
(d) 4 hours (e) None of these

19. A man can row 20 km / h in still water and speed of the stream is 5 m / sec. Ratio of speed of man to current speed is
(a) 9 : 10 (b) 4 : 1 (c) 1 : 4
(d) 10 : 9 (e) None of these

20. A man can swim in still water at 9.6 km / hr, but takes twice as long swim in upstream then in downstream. The speed of stream is
(a) 3.2 km / hr (b) 2.3 km / hr (c) 5.6 km / hr
(d) 6.5 km / hr (e) None of these

Moderate

1. Speed of motorboat in still water is 45 km / h. If the motorboat travels 80 km along the stream in 1 h 20 min, then the time taken by it to cover the same distance against the stream will be
(a) 4 h 20 min (b) 3 h 40 min (c) 2 h 40 min
(d) 2 h 55 min (e) None of these

2. Speed of boat in still water is 5 km / h. While river is flowing with a speed of 2 km / h and time taken to cover a certain distance upstream is 2 h more than time taken to cover the same distance downstream. Find the distance?
(a) 10.5 km (b) 11 km (c) 10.9 km
(d) 15 km (e) None of the above

3. A man can row at 10 km / h in still water. If he takes total 5 h to go to a place 24 km away and return, then the speed of the water current is –
(a) 2 km / h (b) 3 km / h (c) $\frac{1}{2}$ km / h
(d) 1 km / h (e) None of these

4. A steamer goes downstream from one port to another in 4 h. It covers the same distance upstream in 5 h. If the speed of the stream is 2 km / h, then find the distance between the two ports.

(a) 50 km (b) 60 km (c) 70 km
(d) 80 km (e) None of these

5. A boatman takes twice as long to row a distance against the stream as to row the same distance with the stream. Find the ratio of speeds of the boat in still water and the stream ?
(a) 2 : 1 (b) 3 : 1 (c) 1 : 2
(d) 1 : 3 (e) None of the above

6. A river is flowing with a steady speed of 4 km / h. One rows his boat downstream in the river and then returns by rowing upstream in the same river. When he returns to the starting point, the total distance covered by him is 42 km. If the return journey takes 2 h more than his outward journey, then the speed of his rowing in still water must be
(a) 12 km / h (b) 10 km / h (c) 9 km / h
(d) 8 km / h (e) None of these

7. The ratio of speeds of a motorboat to that of the current of water is 36 : 5. The motorboat goes along with the current in 5 h 10 min. Find the time to come back of motorboat.
(a) 5 h 50 min (b) 6 h (c) 6 h 50 min
(d) 12 h 10 min (e) None of these

8. In a river, the ratio of the speed of stream and speed of a boat in still water is 2 : 5. Again, ratio of the speed of stream and speed of an another boat in still water is 3 : 4. What is the ratio of the speeds of the first boat to the second boat in still water?
(a) 10 : 7 (b) 15 : 8 (c) 4 : 3
(d) 5 : 4 (e) None of the above

9. A man can row at the rate of 3.5 km / hr in still water. If the time taken to row a certain distance upstream is $2\frac{1}{2}$ times as much as to row the same distance downstream, find the speed of the current.

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(a) 2.5 km / hr (b) 1.5 km / hr (c) 3 km / hr
(d) 1.25 km / hr (e) None of these

10. A man can row at the rate of 4 km / hr in still water. If the time taken to row a certain distance upstream is 3 times as much as to row the same distance downstream, find the speed of the current ?
(a) 3 km / hr (b) 1.5 km / hr (c) 1 km / hr
(d) 2 km / hr (e) None of these

11. A man swimming in a stream which flows 1.5 km / hr finds that in a given time he can swim twice as far with the stream as he can against it, at what rate does he swim ?
(a) 4 km / hr (b) 4.5 km / hr (c) 5 km / hr
(d) 3.5 km / hr (e) None of these

12. A man can row upstream 36 km in 6 hours. If the speed of a man in still water is 8 km / hr, find how much he can go downstream in 10 hours ?
(a) 150 km (b) 80 km (c) 90 km
(d) 100 km (e) None of these

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13. The speed of a boat in still water is 4 km / hr and the speed of current is 2 km / hr. If the time taken to reach a certain distance upstream is 9 hours, find the time it will take to go to same distance downstream ?
(a) 2 hrs (b) 2.5 hrs (c) 3.5 hrs
(d) 3 hrs (e) None of these

14. A person can swim in still water at 4 km / hr. If the speed of water is 2 km / hr, how many hours will the man take to swim back against the current for 6 km ?
(a) 3 (b) 4 (c) $4\frac{1}{2}$
(d) 5 (e) None of these

15. A man can row at a speed of 4.5 km / hr in still water to a certain upstream point and back to the starting point in a river which flows at 1.5 km / hr. Find his average speed for total journey?

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(a) 4 km / hr (b) 6 km / hr (c) 4.5 km / hr
(d) 5 km / hr (e) None of these

16. A man can row at a speed of 15 km / hr in still water to a certain upstream point and back to the starting point in a river which flows at 3 km / hr. Find his average speed for total journey ?
(a) 9 km / hr (b) 6 km / hr (c) 3 km / hr
(d) 2 km / hr (e) None of these

17. A man can row 7 km / hr in still water. If the river is running at 3 km / hr, it takes 6 hours more in upstream than to go downstream for the same distance. How far is the place?
(a) 48 km (b) 36 km (c) 42 km
(d) 40 km (e) None of these

18. A man can row 9 km / hr in still water. If the river is running at 3 km / hr, it takes 3 hours more in upstream than to go downstream for the same distance. How far is the place?
(a) 30 km (b) 36 km (c) 24 km
(d) 42 km (e) None of these

19. A boat takes 3 hours to travel from place M to N downstream and back from N to M upstream. If the speed of boat in still water is 4 km / hr, what is the distance between the two places?
(a) 8 km (b) 12 km (c) 6 km
(d) Data inadequate (e) None of these

20. P, Q and R are the three towns on a river which flows uniformly. Q is equidistant from P and R. I row from P to Q and back in 10 hours and I can row downstream from P to R in 4 hours. Compare the speed of my boat in still water with that of the river.
(a) 5 : 3 (b) 4 : 3 (c) 6 : 5
(d) 7 : 3 (e) None of these

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Difficult

1. A motorboat travelling at some speed, can cover 25 km upstream and 39 km downstream in 8 h. At the same speed, it can travel 35 km upstream and 52 km downstream in 11 h. The speed of the stream is:
(a) 2 km/h (b) 3 km/h (c) 4 km/h
(d) 5 km/h (e) None of these

2. A man can row a boat at a speed of 8 kmph in still water. He was rowing the boat downstream from one point to another. After travelling half of the distance the motor of the boat failed and stopped working. He travelled on the boat along the stream and reached his destination taking six hours more than the usual time. The speed of the stream is 2 kmph. What is the distance between the two points?
(a) 20 km/h (b) 30 km/h (c) 24 km/h
(d) 28 km/h (e) None of these

3. A, B and C are situated at the bank of river which is flowing at a constant rate. B is at an equal distance with A and C. A swimmer Avinash takes 10 h to swim from A to B and B to A. Also, he takes 8 h to swim from A to C in downstream. What is the ratio of speed of Avinash in still water and speed of stream?
(a) 5 : 4 (b) 3 : 5 (c) 2 : 5
(d) 1 : 2 (e) None of these

4. The speed of a boat downstream is $\frac{16}{9}$ times the speed of the boat upstream. The speed of the current is what percent of the speed of the boat in still water?
(a) 28% (b) 24% (c) 56.25%
(d) 40% (e) None of these

5. A river is flowing at a speed of 5 km/h in a particular direction. A man, who can swim at a speed of 20 km/h in still water, starts swimming along the direction of flow of the river from point A and reaches another point B which is at a distance of 30 km from the

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starting point A. On reaching point B, the man turns back and starts swimming against the direction of flow of the river and stops after reaching point A. The total time taken by the man to complete his journey is

(a) 2 h 30 min (b) 3 h 12 min (c) 3 h 30 min
(d) 3 h 45 min (e) None of these

6. A boat covered a certain distance travelling downstream in 45 minutes, while it came back to the starting point in one hour 15 minutes. The speed of the stream is 2 kmph. What is the speed of the boat in still water?

(a) 8 kmph (b) 9 kmph (c) 10 kmph
(d) 11 kmph (e) None of these

7. In a stream running at 2 km / hr, a water scooter goes 10 km upstream and back again to the starting point in 55 minutes. Find the speed of the water scooter in still water.

(a) 22 km / hr (b) 26 km / hr (c) 28 km / hr
(d) 30 km / hr (e) None of these

8. A man can row 40 km upstream and 55 km downstream in 13 hours. Also, he can row 30 km upstream and 44 km downstream in 10 hours. Find the speed of the man in still water and the speed of the current.

(a) 8 kmph & 3 kmph (b) 6 kmph & 2 kmph
(c) 10 kmph & 4 kmph (d) Can not be determined
(e) None of these

9. A person takes total 5 hours to go the destination downstream and also comes back upstream by boat. If the speed of the boat in still water is 10 km / h and the speed of the stream is 4 km / h, then what is the distance of destination from the starting point ?

(a) 16 km (b) 18km (c) 21 km
(d) 25 km (e) None of these

10. A boat covers 24 km upstream and 36 km downstream in 6 hours while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hours. The velocity of the current is :

(a) 2 km / hr (b) 3 km / hr (c) 4 km / hr
(d) 5 km / hr (e) None of these

11. The speed of boat in still water is 10 km / hr. If it can travel 26 km downstream and 14 km upstream in the same time, the speed of the stream is?
(a) 2 km / hr (b) 2.5 km / hr (c) 3 km / hr (d) 4km / hr (e) None of these

12. In a stream running at 2 kmph, a motorboat goes 6 km upstream and back again to the starting point in 33 minutes. Find the speed of the motorboat in still water ?
(a) 22 (b) 23 (c) 20
(d) 25 (e) None of these

13. A man row $9\frac{1}{3}$ kmph in still water and finds that it takes him thrice as much time to row up than as to row down the same the same distance in the river. The speed of the current is :
(a) $3\frac{1}{3}$ km / hr (b) $3\frac{1}{9}$ km / hr (c) $4\frac{2}{3}$ km / hr
(d) $4\frac{1}{2}$ km / hr (e) 28 km / hr

14. A man can row 18 kmph in still water, it takes him thrice as long to row up as to row down the river. Find the rate of stream.
(a) 8 (b) 9 (c) 10
(d) 11 (e) none of these

15. Rohit can rows a certain distance downstream in 8 hours and return the same distance in 12 hours. If the stream flows at the rate of 5 km per hour. Find the speed of Rohit in still water ?
(a) 20 km / hr (b) 30 km / hr (c) 15 km / hr
(d) 25 km / hr (e) None of these

16. A man takes 3 hours 45 minutes to row a boat 15 km downstream of a river and 2hours30minutes to cover a distance of 5km upstream. find the speed of the river current in km / hr.

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(a) 1 (b) 2 (c) 3
(d) 4 (e) None of these

17. A boat goes 6 km upstream and back again to the starting point in 2 hours. If the velocity of the stream is 4 km / hr, what is the speed of the boat in still water?
(a) 6.5 km / hr (b) 7.5 km / hr (c) 8 km / hr
(d) 8.5 km / hr (e) None of these

18. Speed of a boat in standing water is 9 kmph and the speed of the stream is 1.5 kmph. A man rows to a place at a distance of 105 km and comes back to the starting point. The total time taken by him is:
(a) 16 (b) 18 (c) 20
(d) 24 (e) None of these

19. A boat covers 12 km upstreram and 18 km downstream in 3 hours while it covers 36 km upstream and 24 km downstream in $6\frac{1}{2}$ hours, what is the velocity of the stream?
(a) 1.5 km / hr (b) 1 km / hr (c) 2 km / hr
(d) 2.5 km / hr (e) None of these

20. A man rows to a place 48 km distance and come back in 14 hours. He finds that he can row 4 km with the stream in the same time as 3 km against the stream. The rate of the stream is:
(a) 1 (b) 1.5 (c) 2
(d) 2.5 (e) None of these

Previous Year (Memory Based)

1. The current of a stream runs at the rate of 4 km in an hour. A boat goes 6 km and comes back to the starting point in 2 h. The speed of the boat in still water is:
(a) 6km / h (b) 8km / h (c) 7.5km / h
(d) 6.8km / h (e) None of these

2. A man can row 15 km / h downstream and 9 km / h upstream. The speed of the boat in still water is:

(a) 8km/h (b) 10km/h (c) 15km/h
(d) 12km/h (e) None of these

3. A boat running downstream covers a distance of 20 km in 2 h while it covers the same distance upstream in 5h. Then, speed of the boat in still water is :
(a) 7km/h (b) 8km/h (c) 9km/h
(d) 10km/h (e) None of these

4. In a fixed time, a boy swims double the distance along the current that he swims against the current. If the speed of the current is 3 km/h, then find the rate of swimming in still water ?
(a) 6km/h (b) 9km/h (c) 10km/h
(d) 12km/h (e) None of these

5. A boat goes 20 km downstream in 1 h and the same distance upstream in 2h. The speed of the boat in still water is :
(a) 15km/h (b) 10km/h (c) 5km/h
(d) 7.5km/h (e) None of these

6. A man can row 30km downstream and return in a total of 8 h. If the speed of the boat in still water is 4 times the speed of the current, then speed of the current is :
(a) 1km/h (b) 2km/h (c) 4km/h
(d) 3km/h (e) None of these

7. A boatman rows 1km in 5 min, along the stream and 6km in 1 h against the stream. The speed of the stream is :
(a) 3 km/h (b) 6km/h (c) 10 km/h
(d) 12 km/h (e) None of these

8. A man rows a boat 18 km in 4 h downstream and returns upstream in 12h. The speed of the stream (in km/h) is:
(a) 1 (b) 1.5 (c) 2
(d) 2.5 (e) None of these

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9. A man can row at 5km / h in still water. If the velocity of current is 1 km / h and it takes him 1 h to row to a place and come back, how far is the place?
(a) 2.5 km (b) 3 km (c) 2.4 km
(d) 3.6 km (e) None of these

10. A man can swim at the rate of 4km / h in still water. If the speed of the water is 2km / h. Then, the time taken by him to swim 10 km upstream is :
(a) $2\frac{1}{2}$ h (b) $3\frac{1}{2}$ h (c) 5 h
(d) 4 h (e) None of these

11. The speed of a boat along the stream is 12 km / h and against the stream is 8 km / h. The time taken by the boat to sail 24 km in still water is:
(a) 2h (b) 3h (c) 2.4h
(d) 1.2h (e) None of these

12. Two boats A and B start towards each other from two places, 108 km apart. Speed of the boats A and B in still water are 12 km / h and 15 km / h, respectively. If A proceeds down and B up the stream, they will meet after:
(a) 4.5h (b) 4h (c) 5.4h
(d) 6h (e) None of these

13. The ratio speed of a motorboat to the current of water is 36 : 5. The boat goes along with the current in 5h 10min. It will come back in :
(a) 5h 50min (b) 6h (c) 6 h 50 min
(d) 12 h 10 min (e) None of these

14. A man swims downstream a distance of 15 km in 1h. If the speed of the current is 5 km / h, the time taken by the man to swim the same distance upstream is:
(a) 1 h 30 min (b) 45 min (c) 2 h 30 min
(d) 3 h (e) None of these

15. Speed of a boat is 5 km / h in still water and the speed of the stream is 3 km / h. If the boat takes 3 h to go to a place and come back, the distance of the place is:
(a) 3.75 km (b) 4 km (c) 4.8 km
(d) 4.25 km (e) None of these

16. Speed of motorboat in still water is 45 km / h. If the motorboat travels 80 km along the stream in 1 h 20 min, then the time taken by it to cover the same distance against the stream will be:
(a) 3 h (b) 1 h 20 min (c) 2 h 40 min
(d) 2 h 55 min (e) None of these

17. The speed of a boat in still water is 10 km / h. It covers upstream a distance of 45 km in 6h. the speed (in km / h) of the stream is:
(a) 2.5 (b) 3 (c) 3.5
(d) 4 (e) None of these

18. A man can row 6 km / h in still water. If the speed of the current is 2 km / h, it takes 3 h more in upstream than in the downstream for the same distance. The distance is:
(a) 30 km (b) 24 km (c) 20 km
(d) 32 km (e) None of these

19. A sailor goes 12 km downstream in 48 min and returns in 1 h 20 min. The speed of the sailor in still water is:
(a) 12 km / h (b) 12.5 km / h (c) 13 km / h
(d) 15 km / h (e) None of these

20. A boat goes 40 km upstream in 8 h and 36 km downstream in 6h. The speed of the boat in still water is:
(a) 6.5 km / h (b) 5.5 km / h (c) 6 km / h
(d) 5 km / h (e) None of these

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Foundation

1. (a); Let speed of boat in still water = x

Then, $\frac{14}{x-4} = \frac{42}{60} \Rightarrow x = 24$ km/h

2. (b); Let the speed of the stream is y km/h.
Then, $y + 7 = 10 \Rightarrow y = 3$ km/h

3. (c); Let speed of boat = x km/h
Speed of stream = y km/h
Then, $x + y = 10 \Rightarrow x - y = 6$
$\Rightarrow 2x = 16 \Rightarrow x = 8$ km/h

4. (d); Speed of the man upstream (v) = 12 – 4 = 8 km/h

5. (b); Let speed of boat in still water = x km/hr
Speed of stream = y km/hr
$x + y = 14 \Rightarrow x - y = 6 \Rightarrow 2x = 20 \Rightarrow x = 10$ km/h

6. (b); Let speed of boat in still water = x
Speed of stream = y

$\frac{20}{x+y} = 5 \Rightarrow x + y = 4$ ... (i)

$\frac{10}{x-y} = 5 \Rightarrow x - y = 2$ ... (ii)

From (i) and (ii), $2x = 6 \Rightarrow x = 3$
y = 1 km/h

7. (c); Let speed of boat in still water = x

From question, Given $y = \frac{1}{4}x$

Then $\frac{18}{x - \frac{x}{4}} = 6 \Rightarrow 3 = \frac{3x}{4} \Rightarrow x = 4$

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Then the time it take to cover the same distance downstream

$= \frac{18}{4+1} = \frac{18}{5} = 3.6$ hr.

8. (b); Let the speed of boat = x

Speed of stream = y

$x + y = 8$ km/h $\Rightarrow$ $x - y = 4$ km

$2x = 12 \Rightarrow x = 6 \Rightarrow y = 2$ km/h

9. (c); Given $x = 4$ km/h $y = 2$ km/h

Upstream rate = 4 – 2 = 2 km/h

10. (a); Given x = 9, y = 6

Then downstream speed of the swimmer

= 9 + 6 = 15 km/h

11. (a); Given, $x + y = 11 \Rightarrow y = 1.5$ then $x = 9.5$

$\therefore$ upstream speed of swimmer = 9.5 – 1.5 = 8 km/hr

12. (a); Let speed of boat = x, Speed of steam = y

$\frac{1}{x+y} = \frac{5}{60} \Rightarrow x + y = 12$ ... (i)

$\frac{6}{x-y} = 1 \Rightarrow x - y = 6$ ... (ii)

From (i) and (ii)

$2x = 18 \Rightarrow x = 9$

Speed of the stream = (12 – 9) = 3 km/h

13. (d); Let speed of boat = x, speed of current = y

$\frac{60}{x+y} = 10 \Rightarrow x + y = 6$ ... (i)

$\frac{36}{x-y} = 10 \Rightarrow x - y = 3.6$ ... (ii)

From (i) and (ii)

$2x = 9.6 \Rightarrow x = 4.8 \Rightarrow y = 1.2$ km/h

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14. (b); Time taken = $\frac{128}{24+8} = \frac{128}{32} = 4$ h

15. (d); Let speed of boat = x, speed of stream = y

$$\frac{3/4}{x-y} = \frac{15}{60} \Rightarrow x - y = 3 \text{ ... (1)}$$

$$\frac{3/4}{x+y} = \frac{10}{60} \Rightarrow \frac{3}{4(x+y)} = \frac{1}{6}$$

$$\Rightarrow \quad x + y = \frac{9}{2} \qquad \text{... (2)}$$

From (i) and (ii)

$$2x = 3 + \frac{9}{2} \Rightarrow 2x = \frac{15}{2} \Rightarrow x = \frac{15}{4}$$

and $y = \frac{15}{4} - 3 \Rightarrow y = \frac{15-12}{4} = y = \frac{3}{4}$

$$\therefore \quad \frac{x}{y} = \frac{15/4}{3/4} = \frac{15}{3} = \frac{5}{1} \quad \Rightarrow x : y = 5 : 1$$

16. (a); Let speed of boat = x, speed of stream = y

$$\frac{48}{x+y} = 20 \Rightarrow x + y = \frac{12}{5} \qquad \text{... (1)}$$

$$\frac{48}{x-y} = 24 \Rightarrow x - y = 2 \quad \text{... (2)}$$

From (1) and (2)

$$2x = \frac{12}{5} + 2 \Rightarrow x = \frac{11}{5}$$

$x = 2.2$ km/h

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17. (c); Let speed of boat = x, speed of stream = y

$$\frac{15}{x+y} = 3 \Rightarrow x + y = 5 \quad ... (1)$$

$$\frac{5}{x-y} = \frac{5}{2} \Rightarrow x - y = 2 \quad ... (2)$$

From (1) and (2)

$x = 3.5$ km/h

18. (a); Let speed of the current= y km/h

Given $\frac{44}{8+y} = 4 \Rightarrow y = 3$ km/h

Time taken in upstream = $\frac{25}{(8-3)} = 5$ h

19. (d); Speed in still water = 20 km/h

Speed of the stream = 5 m/sec = $5 \times \frac{18}{5}$ km

= 18 km/h $\Rightarrow$ Ratio = 20 : 18 = 10 : 9

20. (a); Given speed in still water (x) = 9.6 km/h

Let speed of stream = y km/h, distance = d

According to question $\frac{d}{(9.6-y)} = \frac{2d}{(9.6+y)}$

$2 \times 9.6 - 2y = 9.6 + y \Rightarrow 3y = 9.6$

$y = 3.2$ km/h

Moderate

1. (c); Speed of motor boat in still water = 45 km / h
Time taken to travel along the stream

$= 1 \text{ hr } 20 \text{ min} = 1\frac{20}{60} = 1\frac{1}{3} = \frac{4}{3}$ hr.

Let speed of current = y km / h
Then According to question,

$$\frac{80}{45+y} = \frac{4}{3} \Rightarrow 60 = 45 + y \Rightarrow y = 15 \text{ km/h}$$

Then required time $= \frac{80}{45-15} = \frac{80}{45-15} = \frac{80}{30} \times 60 \text{ min}$

= 160 min = 2 hr 40 min.

2. (a); Speed of boat in still water = 5 km / h
speed of current = 2 km / h
Let distance = d

$$\frac{d}{5-2} = 2 + \frac{d}{5+2} \Rightarrow \frac{d}{3} = 2 + \frac{d}{7}$$

$$\frac{d}{3} - \frac{d}{7} = 2 \Rightarrow d = 10.5 \text{ km.}$$

3. (a); Speed of boat in still water = 10 km / h
Let speed of current = y km / h

$$\frac{24}{10+y} + \frac{24}{10-y} = 5 \Rightarrow 24\left(\frac{10+y+10-y}{(10+y)(10-y)}\right) = 5$$

$$\frac{24 \times 20}{100-y^2} = 5 \Rightarrow 100 - y^2 = 96 \Rightarrow y^2 = 4$$

y = 2 (Neglect – ve sign)

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4. (d); Speed of the stream = 2 km / h

Let speed of the boat in still water = x km / h

And distance between two boats = d km

Then $\frac{d}{x+2} = 4 \Rightarrow d - 4x = 8$ ... (1)

$\frac{d}{x-2} = 5 \Rightarrow d - 5x = -10$ ... (2)

From eq. (1) and (2)

$d - 4x - d + 5x = 8 + 10 \Rightarrow x = 18$

From eq. (1)

$d - 18 \times 4 = 8 \Rightarrow d = 80$ km / h

5. (b); Let speed of boat in still water = x

speed of current = y $\Rightarrow$ distance = d

Then $\frac{d}{x-y} = \frac{2d}{x+y} \Rightarrow 2x - 2y = x + y$

$x = 3y \Rightarrow \frac{x}{y} = \frac{3}{1}$

Required ratio = 3 : 1

6. (b); Given speed of current = 4 km / h

Let speed of rowing in still water = x km / h

distance (d) = $\frac{42}{2}$ = 21 km

Then $\frac{21}{x-4} = 2 + \frac{21}{x+4}$

$21\left(\frac{1}{x-4} - \frac{1}{x+4}\right) = 2 \Rightarrow 21\left(\frac{8}{x^2 - 16}\right) = 2$

$21 \times 8 = 2x^2 - 32 \Rightarrow 200 = 2x^2$

$x^2 = 100 \Rightarrow x = 10$ km / h

7. (c); Let the speed of the motorboat = 36 x
Speed of current = 5x
let distance = d

$$\frac{d}{41x} = 5\frac{10}{60} = \frac{31}{6} \Rightarrow \frac{d}{31x} = \frac{41}{6}$$

Means, time to come back of motor boat $= \frac{41}{6}$ hr

$= \frac{41}{6} \times 60$ min = 410 min = 6 h 50 min

8. (b); Let speed of first boat = 5a, stream = 2a
Speed of stream = 3b, boat = 4b

Stream should be same $\Rightarrow$ 2a = 3b $\Rightarrow$ a = $\frac{3}{2}$b

Required Ratio = $\frac{5a}{4b} = \frac{5 \times 3}{2 \times 4} = \frac{15}{8}$

9. (b); x = 3.5 km / h Let speed of current = y

$$\frac{d}{x-y} = \frac{5}{2} \times \frac{d}{x+y} \Rightarrow 5x - 5y = 2x + 2y$$

3x = 7y $\Rightarrow$ 3 × 3.5 = 7y $\Rightarrow$ y = 1.5 km / h

10. (d); Given x = 4 km / h. Let speed of current = y

$$\frac{d}{x-y} = \frac{3d}{x+y} \Rightarrow 3x - 3y = x + y$$

2x = 4y $\Rightarrow$ 8 = 4y $\Rightarrow$ y = 2 km / h

11. (b); Given y = 1.5 km / h
Let speed of swimmer in still water = x

$$\frac{d}{x-y} = \frac{2d}{x+y} \Rightarrow x + y = 2x - 2y$$

x = 3y $\Rightarrow$ x = 3 × 1.5 $\Rightarrow$ x = 4.5 km / hr

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12. (d); x = 8 km / h, Let speed of current = y

$$\frac{36}{x-y} = 6 \Rightarrow \frac{36}{8-y} = 6 \Rightarrow 36 = 48 - 6y$$

$$6y = 12 \Rightarrow y = 2 \Rightarrow \frac{d}{8+2} = 10 \Rightarrow d = 100 \text{ km.}$$

13. (d); x = 4 km / h, y = 2 km / h

$$\frac{d}{4-2} = 9 \Rightarrow d = 18 \text{ km} \Rightarrow \frac{18}{4+2} = t \Rightarrow t = 3 \text{ hr}$$

14. (a); x = 4 km / h y = 2 km / hr

$$\frac{6}{4-2} = t \Rightarrow t = 3 \text{ hr}$$

15. (a); x = 4.5 km / hr y = 1.5 km / hr

upstream speed (u) = 4.5 – 1.5 = 3 km / h

downstream = (v) = 4.5 + 1.5 = 6 km / h

$$\text{Average speed} = \frac{2uv}{u+v} = \frac{2\times3\times6}{9} = 4 \text{ km / hr}$$

16. (e); x = 15 km / h, y = 3 km / hr

u = 12 km / v = 18 km / h

$$\text{Average speed} = \frac{2uv}{u+v} = \frac{2\times18\times12}{30}$$

= 14.4 km / hr

17. (d); x = 7 km / hr, y = 3 km / hr

$$\frac{d}{7-3} = 6 + \frac{d}{10} \Rightarrow \frac{d}{4} = 6 + \frac{d}{10} \Rightarrow \frac{3d}{20} = 6$$

d = 40 km

18. (b); x = 9, y = 3

$$\frac{d}{9-3} = 3 + \frac{d}{9+3} \Rightarrow \frac{d}{6} = 3 + \frac{d}{12} \Rightarrow d = 36 \text{ km}$$

19. (d); $x = 4$ km/h

$$\frac{d}{4+y}+\frac{d}{4-y} = 3$$

We can't solve this question.

20. (a); $\frac{d}{x+y}+\frac{d}{x-y} = 10$ ... (1)

$$\frac{2d}{x+y} = 4 \Rightarrow d = 2(x + y) \quad ... (2)$$

From equation (1)

$$d\left(\frac{x-y+x+y}{(x+y)(x-y)}\right) = 10 \Rightarrow 2xd = 10 (x + y) (x - y)$$

$xd = 5 (x + y) (x - y)$

From equation (2) put $(x + y) = \frac{d}{2}$

$$xd = 5\times\frac{d}{2}(x-y) \Rightarrow 2x = 5x - 5y \Rightarrow 3x = 5y$$

$$3x = 5y \Rightarrow \frac{x}{y} = \frac{5}{3}$$

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Difficult

1. (c); $\frac{25}{x-y}+\frac{39}{x+y}=8$ ... (i)

$\frac{35}{x-y}+\frac{52}{x+y}=11$ ... (ii)

Let x – y = A, x + y = B

$\frac{25}{A}+\frac{39}{B}=8$ ... (iii)

$\frac{35}{A}+\frac{52}{B}=11$ ... (iv)

Eq. (iii) × 7 – eq. (4) × 5

$\left(\frac{175}{A}+\frac{273}{B}=56\right)-\left(\frac{175}{A}+\frac{260}{B}=55\right)$

B = 13

Put it in eq. (iii)

$\frac{25}{A}+3=8 \Rightarrow A=5 \Rightarrow x-y=5$ ...(a)

x + y = 13

...(b)

From equation (a) and (b)

x = 9, y = 4

Speed of stream = 4 km/hr.

2. (b); Let d be the distance between two points

$\frac{(d/2)}{10}+\frac{(d/2)}{2}=\frac{d}{10}+6$

$\frac{d}{20}+\frac{d}{4}-\frac{d}{10}=6 \Rightarrow d=6\left(\frac{20}{4}\right)=30$ km

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3. (e); $\frac{d}{x+y}+\frac{d}{x-y} = 10$ ... (1)

$\frac{2d}{x+y} = 8 \Rightarrow 4(x + y) = d$ ... (2)

From (1) $d \times \frac{x-y+x+y}{(x+y)(x-y)} = 10$

$d \times 2x = 10 (x + y) (x - y)$

$xd = 5 (x + y) (x - y)$

From (2), $xd = 5 \times \frac{d}{4} \times (x - y) \Rightarrow x = \frac{5}{4}x - \frac{5}{4}y$

$x = 5y \Rightarrow \frac{x}{y} = \frac{5}{1}$

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4. (a); $(x + y) = \frac{16}{9}(x-y) \Rightarrow 9x + 9y = 16x - 16y$

$7x = 25y \Rightarrow y = \frac{7x}{25}$

Required percentage = $\frac{7x}{25x} \times 100 = 28\ \%$

5. (b); Given, $x = 20$ km/h $y = 5$ km/h

Total time taken = $\frac{30}{25}+\frac{30}{15} = 2+\frac{6}{5}$

$= \frac{16}{5}$ hr $= \frac{16}{5} \times 60$ min = 192 min = 3 h 12 min

6. (a); $\frac{d}{x+2} = \frac{3}{4} \Rightarrow 4d = 3x + 6$ ... (1)

$\frac{d}{x-2} = \frac{5}{4} \Rightarrow 4d = 5(x - 2)$

$\Rightarrow$ 4d = 5x –10 – (2) ... (2)

From (1) and (2)

3x + 6 = 5x – 10 $\Rightarrow$ x =8 km / h

7. (a); Given y = 2 km / hr

$$\frac{10}{x-y}+\frac{10}{x+y} = \frac{55}{60} \Rightarrow 10\left(\frac{x+y+x-y}{(x-y)(x+y)}\right) = \frac{11}{12}$$

$$\frac{20x}{x^2-y^2} = \frac{11}{12} \Rightarrow \frac{20x}{x^2-4} = \frac{11}{12}$$

$240x = 11x^2 - 44 \Rightarrow 11x^2 - 240x - 44 = 0$

$11x^2 - 242x + 2x - 44 = 0$

$11x(x - 22) + 2(x - 22) = 0$

$(11x + 2)(x - 22) = 0 \Rightarrow x = 22$ km / h

8. (a); Let speed in still water = x, speed of current = y

Then, $\frac{55}{x+y}+\frac{40}{x-y} = 13$ ... (1)

$\frac{44}{x+y}+\frac{30}{x-y} = 10$ ... (2)

v = x + y, u = x – y

$\frac{55}{v}+\frac{40}{u} = 13$ ... (3)

$\frac{44}{v}+\frac{30}{u} = 10$ ... (4)

From eq. (3) × 3 – eq. (4) × 4

$\frac{165}{v}+\frac{120}{u} = 39$

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$\frac{176}{v} + \frac{120}{u} = 40$

$\frac{11}{v} = -1 \Rightarrow v = 11, u = 5 \Rightarrow x + y = 11$

$x - y = 5$

Speed of man, $x = 8 \Rightarrow$ Speed of current, $y = 3$

9. (c); Speed of boat = 10 km / h

Speed of stream = 4 km / h

$\frac{d}{10+4} + \frac{d}{10-4} = 5, \ \frac{d}{14} + \frac{d}{6} = 5, \ \frac{3d+7d}{42} = 5, \ d = \frac{5 \times 42}{10} = 21\,km$

10. (a); $\frac{24}{u} + \frac{36}{v} = 6$ ... (i)

$\frac{36}{u} + \frac{24}{v} = \frac{13}{2}$ ... (ii)

From eq. (i) × 3 – From eq.(ii) × 2

$\frac{72}{u} + \frac{108}{v} = 18 \Rightarrow \frac{72}{u} + \frac{48}{v} = 13 \Rightarrow \frac{60}{v} = 5$

$v = 12, u = 8 \Rightarrow x + y = 12$

$x - y = 8 \Rightarrow x = 10, y = 2$

Velocity of current = 2 km / hr.

11. (c); Given, x = 10 km / hr

$\frac{26}{x+y} = \frac{14}{x-y} \Rightarrow 13x - 13y = 7x + 7y$

$6x = 20y \Rightarrow 20y = 6 \times 10 \Rightarrow y = 3$ km / hr

12. (a); Given y = 2 km / h

$\frac{6}{x-2} + \frac{6}{x+2} = \frac{33}{60} \Rightarrow 6\left(\frac{2x}{x^2 - 4}\right) = \frac{33}{60}$

$11x^2 - 27x - 44 = 0$

$11x^2 - 272x + 2x - 44 = 0$

$(x - 22)(11x + 2) = 0 \Rightarrow x = 22$ km / hr

13. (c); Given, $x = \frac{28}{3}$ km/h, speed of current = y km/h

$$\frac{d}{\frac{28}{3} - y} = \frac{3d}{\frac{28}{3} + y} \Rightarrow \frac{28}{3} + y = 28 - 3y$$

$$4y = \frac{56}{3},\ y = \frac{14}{3},\ y = 4\frac{2}{3} \text{ km/h}$$

14. (b); Given x = 18 km/h

$$\frac{d}{18 - y} = \frac{3d}{18 + y} \Rightarrow 18 + y = 3(18 - y)$$

$$18 + y = 54 - 3y \Rightarrow 4y = 36,\ y = 9 \text{ km/h}$$

15. (d); $\frac{d}{x + y} = 8$

$d = 8x + 8y$ ... (i)

$\frac{d}{x - y} = 12$

$d = 12x - 12y$ ... (ii)

On solving (1) & (2)

$8x + 8y = 12x - 12y \Rightarrow 4x = 20y,\ x = 5y$

Here $y = 5 \Rightarrow x = 5 \times 5 = 25$ km/h

16. (a); Speed of boat = x

Speed of river current = y

$$\frac{15}{x + y} = 3\frac{45}{60} = \frac{15}{4}$$

$x + y = 4$ ... (i)

$$\frac{5}{x - y} = 2\frac{1}{2} = \frac{5}{2}$$

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$x - y = 2$ ...(ii)

On solving (1) & (2)

$x = 3$ and $y = 1$ km / h

17. (c); $\frac{6}{x-y} + \frac{6}{x+y} = 2 \Rightarrow 6\left(\frac{2x}{x^2 - y^2}\right) = 2$

Put $y = 4$ km / hr

$\frac{6x}{x^2 - 16} = 1 \Rightarrow x^2 - 16 = 6x \Rightarrow x^2 - 6x - 16 = 0$

$x^2 - 8x + 2x - 16 = 0 \Rightarrow x(x - 8) + 2(x - 8) = 0$

$(x + 2)(x - 8) = 0 \Rightarrow x = 8$ km / hr

18. (d); Here $x = 9$ km / hr and $y = 1.5$ km / hr

$\frac{105}{9+1.5} + \frac{105}{9-1.5} = T \Rightarrow T = \frac{105}{10.5} + \frac{105}{7.5}$

$= 10 + 14 = 24$ hrs

19. (c); $\frac{12}{x-y} + \frac{18}{x+y} = 3$ ... (i)

$\frac{36}{x-y} + \frac{24}{x+y} = \frac{13}{2}$ ... (ii)

Let $x - y = A$, $x + y = B$

$\frac{12}{A} + \frac{18}{B} = 3$ ... (3)

$\frac{36}{A} + \frac{24}{B} = \frac{13}{2}$ ... (4)

Eq. (1) × 3 – eq. (2)

$\frac{36}{A} + \frac{54}{B} = 9 \Rightarrow \frac{36}{A} + \frac{24}{B} = \frac{13}{2}$

$$\frac{30}{B} = 9 - \frac{13}{2} \Rightarrow \frac{30}{B} = \frac{5}{2} \Rightarrow B = 12$$

From eq. (4)

$$\frac{36}{A} = \frac{9}{2} \Rightarrow A = 8 \Rightarrow x - y = 8 \Rightarrow x + y = 12$$

$$2x = 20 \Rightarrow x = 10 \text{ km/hr} \Rightarrow y = 2 \text{ km/hr}$$

20. (a); $\frac{48}{u} + \frac{48}{v} = 14$ ... (1)

$$\frac{3}{4} = \frac{u}{v} \Rightarrow u = \frac{3v}{4}$$

Put it in eq. (1)

$$\frac{4 \times 48}{3v} + \frac{48}{v} = 14 \Rightarrow \frac{7 \times 48}{3v} = 14$$

$$v = 8 \Rightarrow u = \frac{3}{4} \times 8 = 6 \Rightarrow x - y = 6, x + y = 8$$

$$x = 7 \Rightarrow y = 7 - 6 = 1 \text{km/hr}$$

rate of stream = 1 km/hr

Previous Year Memory Based

1. (b); Let the speed of the boat in still water be x km / h
Given, speed of the stream = 4 km / h

Now, Time taken by the boat to cover 6 km in upstream $= \frac{6}{x-4}$ h

Time taken by the boat to cover 6 km in down stream $= \frac{6}{x+4}$ h

According to the question

$$\frac{6}{x+4} + \frac{6}{x-4} = 2 \Rightarrow 6\left[\frac{x-4+x+4}{(x+4)(x-4)}\right] = 2$$

$6x = x^2 - 16 \Rightarrow x^2 - 6x - 16 = 0$

$x^2 + 8x - 2x - 16 = 0 \Rightarrow x(x+8) - 2(x+8) = 0$

$(x-2)(x+8) = 0 \Rightarrow x = 8$ km / h

Shortcut:

$$\frac{6}{x+4} + \frac{6}{x-4} = 2$$

Now, check by option; x = 8

2. (d); Speed of the boat in still water $= \frac{1}{2}$ (speed of boat in downstream + speed of boat in upstream)

$= \frac{1}{2}(15+9) = \frac{1}{2} \times 24 = 12$ km / h

3. (a); Let the speed of boat in still water be x km / h and speed of the stream be y km / h.
According to the question

$$\frac{20}{x+y} = 2 \Rightarrow x + y = 10 \text{ km / h} \quad \text{... (i)}$$

Similarly $\frac{20}{x-y} = 5$

$x - y = 4$ km/h ... (ii)

On adding Eq. (i) and (ii) we get

$2x = 14$ km/h $\Rightarrow$ $x = 7$ km/h

4. (b); Let the rate of the swimming in still water be x km/h

$\therefore$ speed of downstream = $(x + 3)$ km/h

speed of upstream = $(x - 3)$ km/h

According to the question

$(x + 3)t = 2(x - 3) \times t \Rightarrow x + 3 = 2x - 6$

$x = 9$ km/h

5. (a); Speed of boat in downstream = $\frac{20}{1} = 20$ km/h

Speed of boat in upstream = $\frac{20}{2} = 10$ km/h

$\therefore$ speed of boat in still water = $\frac{1}{2} \times (20 + 30) = 15$ km/h

6. (b); Let the speed of the stream be x km/h

speed of boat in still water be 4x km/h

speed of downstream = $4x + x = 5x$ km/h

speed of upstream = $4x - x = 3x$ km/h

According to the question

$$\frac{30}{3x} + \frac{30}{5x} = 8 \Rightarrow \frac{10}{x} + \frac{6}{x} = 8$$

Speed of the current $x = 2$ km/h

7. (a); Speed of boat in downstream = $\frac{1}{5} \times 60 = 12$km/h

Speed of upstream = $\frac{6}{1} = 6$ km/h

Speed of current = $\frac{1}{2}(12 - 6) = 3$ km/h

8. (b); Speed of boat in downstream = $\frac{18}{4} = \frac{9}{2}$ km/h

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speed of boat in upstream = $\frac{18}{12} = \frac{3}{2}$ km / h

speed of current = $\frac{1}{2}\left(\frac{9}{2} - \frac{3}{2}\right)$ km / h = 1.5 km / h

9. (c); Let the distance be x km
speed upstream = 5 – 1 = 4 km / h
Speed down stream = 5 + 1 = 6 km / h
According to the question

$\frac{x}{6} + \frac{x}{4} = 1 \Rightarrow 5x = 12$

Distance, x = 2.4 km

10. (c); Speed of man in upstream = 4 – 2 = 2 km / h

Time taken to swim 10 km upstream = $\frac{10}{2}$ = 5 h

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11. (c); Speed of boat in still water = $\frac{12+8}{2}$ = 10 km / h

Time = $\frac{\text{Distance}}{\text{Speed}} = \frac{24}{10}$ = 2.4 h

12. (b); Let the speed of the stream be x km / h and both boats meet after t h.
According to the question
(12 + x)t + (15 – x)t = 108 $\Rightarrow$ 27t = 108

t = $\frac{108}{27}$ = 4h.

13. (c); Let the speed of Motorboat be 36 x km / h
and speed of current be 5x km / h
The boat goes along with the current in 5h 10 min

i.e $= 5 + \frac{10}{60} = \frac{31}{6}$ h

Distance = (36x + 5x) $\times \frac{31}{6} = \frac{41x \times 31}{6}$

Speed of Motarboat in upstream = 36x – 5x
= 31x km / h

$\therefore$ Time taken $= \frac{41x \times \frac{31}{6}}{31x} = \frac{41}{6}$ h

$= 6 + \frac{5}{6}$ h = 6 h 50 min

14. (d); Speed of man in downstream $= \frac{15}{1}$ = 15 km / h

Speed of a man in still water = 15 – 5 = 10 km / h

$\therefore$ Time taken in swimming upstream

$= \frac{15}{10-5}$ = 3h

15. (c); Let the distance of the place is x km

According to the question

$$\frac{x}{5+3} + \frac{x}{5-3} = 3 \Rightarrow \frac{x}{8} + \frac{x}{2} = 3 \Rightarrow 5x = 24$$

Distance, x = 4.8 km

16. (c); Let the speed of stream be x km / h

According to the question

$$\frac{80}{45+x} = 1 + \frac{20}{60} \Rightarrow \frac{80}{45+x} = \frac{4}{3}$$

240 = 180 + 4x $\Rightarrow$ x = $\frac{60}{4}$ = 15 km / hr

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Time taken in upstream = $\frac{80}{45-15} = \frac{80}{30} \times 60$

= 160 min = 2 h 40 min

17. (a); Let speed of the stream be x km / h
According to the question

$\therefore \frac{45}{10-x} = 6 \Rightarrow 45 = 60 - 6x$

$x = \frac{15}{6} = \frac{5}{2} = 2.5$ km / h

18. (b); Let the distance be x km
According to the question

$\frac{x}{6-2} - \frac{x}{6+2} = 3 \Rightarrow \frac{x}{4} - \frac{x}{8} = 3 \Rightarrow \frac{2x-x}{8} = 3$

Distance, x = 24 km

19. (a); Speed of sailor in downstream

$= \frac{12}{48} \times 60 = 15$ km / h

Speed of sailor in upstream $= \frac{12}{80} \times 60 = 9$ km / h

Speed of sailor in still water $= \frac{1}{2}(15+9)$ km / h

= 12 km / h

20. (b); Speed of boat in upstream $= \frac{40}{8} = 5$ km / h

Speed of boat in downstream $= \frac{36}{6} = 6$ km / h

Speed of boat in still water $= \frac{1}{2}(6+5)$

$= \frac{11}{2}$ km / h = 5.5 km / h

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Chapter 11

Mixture and Alligation

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Chapter 11

Mixture and Alligation

Mixture: When two or more then two substances are mixed in any ratio to produce a product is known as Mixture.

Mean price: The cost price of a unit quantity of the mixture is called the mean price.

Concept 1. Alligation Rule

Let the cost price of a unit of cheaperS article is Rs. c and that of a unit of costly article is d and the average (mean) price of mixture is m, then

$$\frac{\text{Quantity of cheaper article}}{\text{Quantity of costly article}} = \frac{\text{Cost price of a unit of costly article} - \text{Mean price}}{\text{Mean price} - \text{Cost price of a unit of a cheaper article}}$$

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The above relation is represended as

Hence, $$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = (d-m):(m-c) = \frac{d-m}{m-c}$$

Alligation rule is also used to find the ratio in which two or more ingredients at their respective prices should be mixed to produce a mixture at a given price.

Example: In what proportion must tea at Rs. 14 per kg be mixed with tea at Rs. 18 per kg, so that the mixture be worth Rs. 17 a kg?

Sol. CP of 1 kg cheaper tea CP of 1 kg dearer tea

$$\frac{\text{Quantity of cheaper}}{\text{Quantity of dearer}} = \frac{18-17}{17-14} = \frac{1}{3} = 1:3$$

Concept 2. A container has milk and water in the ratio a:b, a second container of some capacity as first are has milk and water in the ratio c:d. If both the mixture are emptied into a third container, then the ratio of milk to water in third container is given by

$$\left[\frac{a}{a+b}+\frac{c}{c+d}\right]:\left[\frac{b}{a+b}+\frac{d}{c+d}\right]$$

Example: There are two containers of equal capacity. The ratio of milk to water in the first container is 3 : 1, in the second container is 5 : 2. If they are mixed up, then the ratio of milk to water in the mixture will be?

Sol. Part of milk in first container $= \frac{3}{3+1} = \frac{3}{4}$

Part of water in first container $= \frac{1}{3+1} = \frac{1}{4}$

Similarly, part of milk in second container $= \frac{5}{5+2} = \frac{5}{7}$

Part of water in second container $= \frac{2}{5+2} = \frac{2}{7}$

$\therefore$ Required $= \frac{3}{4}+\frac{5}{7} : \frac{1}{4}+\frac{2}{7} = \frac{41}{28} : \frac{15}{28} = 41:15$

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Concept 3: Suppose a container contains 'x' units of a liquid from which 'y' units are taken out and replaced by water. After n operation, quantity of pure liquid $= x\left(1-\frac{y}{x}\right)^n$ units

Example: A container contains 40 litres of milk. From this container 4 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?

Sol. Amount of milk left after 3 operations

$$=\left[40\left(1-\frac{4}{40}\right)^3\right]\text{litres}=\left(40\times\frac{9}{10}\times\frac{9}{10}\times\frac{9}{10}\right)=29.16\text{ litres.}$$

Types of Questions

1. In what ratio must water be mixed with milk to gain 20% by selling the mixture at cost price?

Sol. Let CP of milk be Rs. 1 per litre.

Then; SP of 1 litre of mixture = Rs. 1, Gain = 20%.

$\therefore$ CP of 1 litre of mixture $=\text{Rs.}\left(\frac{100}{120}\times 1\right)=\text{Rs.}\frac{5}{6}$.

By the rule of alligation, we have:

CP of 1 litre of water CP of 1 litre of milk

0 Rs. 1

$\left(\text{Rs.}\frac{5}{6}\right)$

$\left(1-\frac{5}{6}\right)=\frac{1}{6}$ $\left(\frac{5}{6}-0\right)=\frac{5}{6}$

$\therefore$ Ratio of water and milk $=\frac{1}{6}:\frac{5}{6}=1:5.$

Shortcut: Ratio = Profit% : 100 = 20 : 100 = 1 : 5

2. In what ratio must tea at Rs. 62 per kg be mixed with tea at Rs. 72 per kg so that the mixture must be worth Rs. 64.50 per kg?

Sol.

$\therefore$ Required ratio = 750 : 250 = 3 : 1.

3. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is:

Sol. Let CP of 1 litre milk be Rs. 1.

Then, SP of 1 litre of mixture = Rs. 1, Gain = 25%.

$$\text{CP of 1 litre mixture} = \text{Rs.}\left(\frac{100}{125}\times 1\right) = \text{Rs.}\frac{4}{5}.$$

$$\therefore \text{ Ratio of milk to water} = \frac{4}{5} : \frac{1}{5} = 4 : 1.$$

$$\text{Hence, percentage of water in the mixture} = \left(\frac{1}{5}\times 100\right)\% = 20\%.$$

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4. One quality of wheat at Rs. 9.30 per kg is mixed with another quality at a certain rate in the ratio 8:7. If the mixture so formed be worth Rs. 10 per kg, what is the rate per kg of the second quality of wheat?

Sol. Let the rate of the second quality be Rs. x per kg.

By the rule of alligation, we have:

CP of 1 kg wheat of 1st kind	CP of 1 kg wheat of 2nd kind
930 p	(100x)p

Mean price
1000 p

(100x – 1000) p 70 p

$$\therefore \quad \frac{100x - 1000}{70} = \frac{8}{7} \Rightarrow 700x - 7000 = 560$$

$$700x = 7560 \Rightarrow x = \text{Rs. } 10.80.$$

5. A container contains 100 litres of spirit. From this container 10 litres of spirit was taken out and replaced by water. This process was repeated further two times. How much spirit is now contained by the container?

Sol. Amount of milk left after 3 operations $= \left[100\left(1 - \frac{40}{100}\right)^3\right]$ litres

$$= \left(100 \times \frac{9}{10} \times \frac{9}{10} \times \frac{9}{10}\right) = 72.9 \text{ litres.}$$

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Foundation

1. In a mixture of milk and water of the volume of 60 litre the ratio of milk to water is 7 : 5. How much quantity of water will be added to make mixture of equal ratio?
   (a) 8 Litre (b) 10 Litre (c) 15 Litre
   (d) 20 Litre (e) None of these
2. In a mixture of milk and water of the volume of 30 Litre, the ratio of milk and Water is 8 : 7. How much water should be added in mixture to make ratio 4 : 5?
   (a) 6 Litre (b) 4.5 Litre (c) 5 Litre
   (d) 5.5 Litre (e) None of these
3. In what ratio must oil at Rs. 62 per kg be mixed with oil of Rs. 72 per kg, so that the mixture must be worth Rs. 64.50 per Kg?
   (a) 1 : 3 (b) 1 : 2 (c) 3 : 1
   (d) 4 : 1 (e) None of these
4. A mixture of milk and water measures 60 ltr. It contains 20% water. How many litres of water should be added to it so that water may be 25%?
   (a) 6 ltr (b) 4 ltr (c) 8 gallons
   (d) 10 ltr (e) None of these
5. In what ratio must a grocer mix two varieties of pulses costing Rs. 15 and Rs. 20 per kg respectively so as to get a mixture worth Rs. 16.5 per kg?
   (a) 3 : 7 (b) 5 : 7 (c) 7 : 3
   (d) 7 : 5 (e) None of these
6. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25%. The percentage of water in the mixture is?
   (a) 4% (b) 6% (c) 20%
   (d) 25% (e) None of these

7. Find the ratio in which rice at Rs. 7.20 a kg be mixed with rice at Rs. 5.70 a kg to produce a mixture worth Rs. 6.30 a kg?
(a) 1 : 3 (b) 2 : 3 (c) 3 : 4
(d) 4 : 5 (e) None of these

8. Aditya and Sanjay started a business investing 45000 and 30000 respectively. What will be the ratio between their profit?
(a) 2 : 3 (b) 3 : 2 (c) 4 : 9
(d) Can be determined (e) None of these

9. In what ratio must sugar at Rs. 2 per kg be mixed with sugar at Rs. 3.50 per kg so that the mixture be worth Rs. 2.50 per kg?
(a) 2 : 1 (b) 1 : 5 (c) 3 : 1
(d) 2 : 3 (e) None of these

10. 600 gm of Sugar solution has 40% sugar in it. How much sugar should be added to make it 50% in the solution?
(a) 60 gm. (b) 90 gm. (c) 120 gm.
(d) 150 gm. (e) None of these

11. Gold is 21 times heavy as compared to water and copper is 11 times heavy as compared to water. In what ratio should these metal be mixed so that the mixture may be 17 times as heavy as water?
(a) 1 : 2 (b) 2 : 1 (c) 3 : 1
(d) 3 : 2 (e) None of these

12. I have 100 books of English. I sold some of these at a profit of 12% and rest at 8% loss. On the whole I got a profit of 11%. How many books were sold at 12% profit by me?
(a) 50 (b) 56 (c) 57
(d) 60 (e) 95

13. There are 3 tub which contains mixtures of Milk and Water in the ratio of 5 : 2, 4 : 3 and 3 : 1 respectively. If the mixtures be poured in a single tub. Find the Ratio Milk and Water?
(a) 13 : 3 (b) 19 : 9 (c) 17 : 9
(d) Can't be determine (e) None of these

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14. In what proportion must be Sugar of Rs. 17 per kg mixed with Sugar of Rs. 29 per kg to make mixture of Rs. 20 per kg?
(a) 2 : 3 (b) 17 : 29 (c) 29 : 17
(d) 3 : 1 (e) None of these

15. In what proportion must pulse of Rs. 70 per kg be mixed with pulse of Rs. 45 per kg to get a mixture of Rs. 60 per Kg?
(a) 9 : 13 (b) 13 : 9 (c) 14 : 9
(d) 3 : 2 (e) None of these

16. A shopkeeper has Rs. 50 kg of rice, of part of which he sells at 10% profit and the rest at 5% loss. He gains 7% on the whole. What is the quantity sold at 10% gain?
(a) 50 (b) 40 (c) 10
(d) Can't be determined (e) None of these

17. A man buys 2 Cow for Rs. 2700 and sells one for loss of 6% and on other he gain 7.5%. On the whole he neither gained nor lost. What does 2 nd Cow cost?
(a) 1100 (b) 1000 (c) 1200
(d) 6075 (e) None of these

18. Aditya, Sonal and Nutan contributed Rs. 50,000 for business. Aditya contributed Rs. 4000 more than Sonal and Sonal contributed Rs. 5,000 more than Nutan. Out of total profit of Rs. 70,000 how much did Aditya receive?
(a) Rs. 16,000 (b) Rs. 18,000 (c) Rs. 20,000
(d) Rs. 29400 (e) None of these

19. The ratio in which two sugar solutions of the concentrations 15% and 40% are to be mixed to get a solution of concentration 30% is:
(a) 2 : 3 (b) 3 : 2 (c) 8 : 9
(d) 9 : 8 (e) None of these

20. Nikita bought 30 kg of wheat at the rate of Rs. 9.50 per kg and 40 kg of wheat at the rate of Rs. 8.50 per kg and mixed them. She sold the mixture at the rate of Rs. 8.90 per kg. Her total profit or loss in the transaction was:
(a) Rs. 2 loss (b) Rs. 2 profit (c) Rs. 7 loss
(d) Rs. 7 profit (e) None of these

21. A mixture of a certain quantity of milk with 16 litres of water is worth 90 P per litre. If pure milk be worth Rs. 1.08 per litre. How much milk is there in the mixture?
(a) 40 litres (b) 50 litres (c) 60 litres
(d) 80 litres (e) None of these

22. A person has a chemical of Rs. 25 per litre. In what ratio should water be mixed in the mixture so that by selling it at Rs. 20 per litre he may get a profit of 25%?
(a) 14 : 9 (b) 16 : 9 (c) 9 : 14
(d) 9 : 16 (e) None of these

23. A mixture of 40 litres of milk and water contains 10% water. How much water must be added to make 20% water in the new mixture?
(a) 3 litres (b) 4 litres (c) 5 litres
(d) 6 litres (e) None of these

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24. If 2 kg of metal, of which $\frac{1}{3}$ is zinc and the rest is copper, be mixed with 3 kg of metal, of which $\frac{1}{4}$ is zinc and the rest is copper, what is the ratio of zinc to copper in the mixture?
(a) 13 : 42 (b) 17 : 43 (c) 19 : 43
(d) 15 : 42 (e) None of these

25. 50 g of an alloy of gold and silver contains 80% gold (by weight). The quantity of gold, that is to be mixed up with this alloy, so that it may contain 95% gold, is:
(a) 200 g (b) 150 g (c) 50 g
(d) 10 g (e) None of these

26. A sum of Rs. 6.40 is made up of 80 coins which are either 10-paise or 5-paise coins. How many are coins of 5-paise are there?
(a) 24 (b) 28 (c) 32
(d) 36 (e) None of these

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27. How much tea at Rs. 4 a kg should be added to 15 kg of tea at Rs. 10 per kg so that the mixture be worth Rs.6.50 a kg?
(a) 15 kg (b) 35 kg (c) 25 kg
(d) 21 kg (e) None of these

28. Gold is 19 times as heavy as water and copper is 9 times as heavy as water. In what ratio should these metals be mixed so that the mixture may be 15 times as heavy as water?
(a) 2 : 3 (b) 3 : 2 (c) 2 : 4
(d) 4 : 2 (e) None of these

29. A pot contains 81 litres of pure milk. $\frac{1}{3}$ of the milk is replaced by the same amount of water. Again $\frac{1}{3}$ of the mixture is replaced by that amount of water. The ratio of the milk and water in the new mixture is?
(a) 1 : 2 (b) 1 : 1 (c) 2 : 1
(d) 4 : 5 (e) None of these

30. A man has 60 pens. He sells some of these at a profit of 12% and the rest at 8% loss. On the whole, he gets a profit of 11%. How many pens were sold at 12% profit:
(a) 47 (b) 52 (c) 55
(d) 57 (e) None of these

Moderate

1. In what ratio must water be mixed with milk to gain 16% on selling the mixture at cost price?
(a) 1 : 6 (b) 4 : 25 (c) 2 : 3
(d) 4 : 3 (e) None of these

2. In what ratio must a grocer mix two varieties of tea worth Rs. 60 per kg and Rs. 65 per kg so that by selling the mixture at Rs. 68.20 per kg he may gain 10%?

(a) 3 : 2 (b) 3 : 4 (c) 3 : 5
(d) 4 : 5 (e) None of these

3. A milk vendor has 2 cans of milk. The first contains 25% water and the rest milk. The second contains 50% water. How much milk should he mix from each of the containers so as to get 12 litres of milk such that the ratio of water to milk is 3 : 5?
(a) 4 litres, 8 litres (b) 6 litres, 6 litres (c) 5 litres, 7 litres
(d) 7 litres, 5 litres (e) None of these

4. How many kilogram of sugar costing Rs. 9 per kg must be mixed with 27 kg of sugar costing Rs. 7 per kg so that there may be a gain of 10% by selling the mixture at Rs. 9.24 per kg?
(a) 36 kg (b) 42 kg (c) 54 kg
(d) 63 kg (e) None of these

5. A container contains 50 litres of milk. From this container 5 litres of milk was taken out and replaced by water. This process was repeated further two times. How much milk is now contained by the container?
(a) 26.34 litres (b) 27.36 litres (c) 28 litres
(d) 36.45 litres (e) None of these

6. In a mixture of milk and water of volume 30 Litre the ratio of water and milk is 3 : 7. How much quantity of water will be added to the mixture to make the ratio of milk and water 1 : 2
(a) 23 Litre (b) 21 Litre (c) 12 Litre
(d) 33 Litre (e) None of these

7. The cost of Type 1 rice is Rs. 15 per kg and Type 2 rice is Rs. 20 per kg. If both Type 1 and Type 2 are mixed in the ratio of 2 : 3, then the price per kg of the mixed variety of rice is?
(a) Rs. 18 (b) Rs. 18.50 (c) Rs. 19
(d) Rs. 19.50 (e) None of these

8. A merchant has 1000 kg of sugar, part of which he sells at 8% profit and the rest at 18% profit. If he gains 14% on the whole then the quantity sold at 18% profit is:
(a) 400 kg (b) 560 kg (c) 600 kg
(d) 640 kg (e) None of these

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9. In an Examination out of 900 students 85% of the boys and 70% of girls passed. How many girls appeared in the examination, if total pass percentage was 75%?
(a) 400 (b) 500 (c) 600
(d) 700 (e) None of these

10. 400 gm of salt solution has 40% salt in it. How much salt should be added to make it 50% in the solution?
(a) 60 (b) 70 (c) 65
(d) 80 (e) None of these

11. Chocolates at Rs. 12.00 per dozen is mixed with chocolate at Rs. 10.00 per dozen in the ratio 3 : 5. Find the price per dozen of the mixture?
(a) Rs. 11.00 (b) Rs. 9.90 (c) Rs. 11.50
(d) Rs. 10.75 (e) None of these

12. Pencils at Rs. 4.20 per dozen is mixed with pencils at Rs. 5.40 per dozen in the ratio 3 : 5. Find the price per dozen of the mixture?
(a) Rs. 4.95 (b) Rs. 4.50 (c) Rs. 5.00
(d) Rs. 5.05 (e) None of these

13. A mixture of 48 litre of milk and water contains 10% of water. How much water must be added to make 20% water in the new mixture?
(a) 2 (b) 6 (c) 4
(d) 5 (e) None of these

14. A vessel of 160 litre is filled with Milk and Water. 70% of Milk and 30% of Water is taken out of the vessel. After this task, it is found that vessel is now filled by 55% quantity of Milk and Water. What is the original quantity of milk and water in the vessel respectively?
(a) 60, 100 (b) 100, 60 (c) 70, 90
(d) 90, 70 (e) None of these

15. A mixture of 80 litre of milk and water contains 10% water. How much water must be added to make 20% water in the new mixture?
(a) 5 litre (b) 8 litre (c) 10 litre
(d) 15 litre (e) None of these

16. A tub contains a mixture of two liquid P and Q in the ratio of 4 : 1. When 10 Litre of the mixure is taken out and 10 Litre of Liquid Q is poured in the jar, the ratio becomes 2 : 3. How many litre of liquid P was contained in the jar?
(a) 10 litre (b) 15 litre (c) 20 litre
(d) 16 litre (e) None of these

17. A bottle contains 81 litres of pure milk. $\frac{1}{3}$ of the milk is replaced by the same amount of water. Again $\frac{1}{3}$ of the mixture is replaced by that amout of water. The ratio of the milk and water in the new mixture is:
(a) 1 : 2 (b) 1 : 1 (c) 2 : 1
(d) 4 : 5 (e) None of these

18. Aditya and Manish continued in a joint business for 36 months. Aditya contribute Rs. 300 for certain time and Manish invested Rs. 500 for remaining time. If out of total profit of Rs. 1020, Aditya gets Rs. 495, then for how long Aditya kept his money?
(a) 16 months (b) 14 months (c) 8 months
(d) 22 months (e) None of these

19. A jar contained a mixture of two liquids A and B in the ratio 3 : 2. When 5 litres of the mixture was taken out and 5 litres of liquid B was poured in the jar, this ratio became 2 : 3. The quantity of liquid A contained in the jar initially was:
(a) 4 litres (b) 8 litres (c) 9 litres
(d) 32 litres (e) None of these

20. A man has 40 kg of tea, a part of which he sells at 5% loss and the rest at the cost price. In this business he incurs a loss 3%. Find the quantity which he sells at the cost price?
(a) 12 kg (b) 14 kg (c) 16 kg
(d) 18 kg (e) None of these

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21. In a mixture of 75 litres, the ratio of milk to water is 2:1. The amount of water to be further added to the mixture so as to make the ratio of the milk to water 1 : 2 will be:
(a) 45 litres (b) 60 litres (c) 75 litres
(d) 80 litres (e) None of these

22. How many kg. of salt at 42 P per kg. must a man mix with 25 kg of salt at 24 P per kg, so that he may, on selling the mixture at 40 P per kg, gain 25% on the outlay?
(a) 20 (b) 30 (c) 40
(d) 50 (e) None of these

23. 300 gm of sugar solution has 40% sugar in it. How much. sugar should be added to make it 50% in the solution?
(a) 40 gm (b) 50 gm (c) 60 gm
(d) 80 gm (e) None of these

24. A dishonest milkman professes to sell his milk at cost price but he mixes it with water and thereby gains 25% The percentage of water in the mixture is:
(a) 25% (b) 35% (c) 45%
(d) 50% (e) None of these

25. 200 litres of mixture contains 15% water and the rest is milk. The amount of milk that must be added so that the resulting mixture contains 87.5% milk is:
(a) 30 litre (b) 35 litre (c) 40 litre
(d) 45 litre (e) None of these

26. In a zoo, there are rabbits and pigeons. If the heads are counted, there are 200 and if legs are counted, there are 580. How many pigeons are three?
(a) 105 (b) 110 (c) 115
(d) 120 (e) None of these

27. The ratio of milk and water in 66 litre of adulterated milk is 5 : 1. Water is added to it to make the ratio 5 : 3. The quantity of water added is:

(a) 20 litres (b) 22 litres (c) 24 litres
(d) 28 litres (e) None of these

28. A sum of Rs. 41 was divided among 50 children. Each boy gets 90 paise and each girl 65 paise. The number of boys is?
(a) 32 (b) 34 (c) 36
(d) 38 (e) None of these

29. Milk and water are mixed in vessel A in the ratio of 5:2 and in vessel B in the ratio of 8 : 5. In what ratio should quantities be taken from the two vessels so as to form a mixture in which milk and water will be in the ratio of 9 : 4?
(a) 7 : 2 (b) 5 : 2 (c) 2 : 7
(d) 2 : 5 (e) None of these

30. In a bag, there are three types of coins 1 rupee, 50-paise and 25-paise in the ratio 3 : 8 : 20. There total value is Rs. 372. The total number of coins is:
(a) 1200 (b) 961 (c) 744
(d) 612 (e) None of these

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Difficult

1. 8 litres are drawn from a cask full of wine and is then filled with water. This operation is performed three more times. The ratio of the quantity of wine now left in cask to that of water is 16 : 65. How much wine did the cask hold originally?
(a) 18 litres (b) 24 litres (c) 32 litres
(d) 42 litres (e) None of these

2. A can contains a mixture of two liquids A and B in the ratio 7 : 5. When 9 litres of mixture are drawn off and the can is filled with B with same amount the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially?
(a) 10 (b) 20 (c) 21
(d) 25 (e) None of these

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3. A container contained 80 litre of milk. From this container 8 litre of milk was taken out and replaced by water. This process was further repreated 3 times. How much of milk is now contained by the container?
(a) 54.23 litre (b) 54.26 litre (c) 56.26 litre
(d) 52.48 litre (e) None of these

4. Vessels A and B contain mixtures of milk and water in the ratios 4 : 5 and 5 : 1 respectively. In what ratio should quantities of mixture be taken from A and B to form a mixture in which milk to water is in the ratio 5:4?
(a) 2 : 5 (b) 4 : 3 (c) 5 : 2
(d) 2 : 3 (e) None of these

5. A can contains a mixture of two liquids A and B in proportion 4 : 7. When 6 litres of mixture are drawn off and the can is filled with B, the proportion of A and B becomes 3 : 7. How many litres of liquids A was contained in the can initially?
(a) 15.4 litres (b) 12.46 litres (c) 15.7 litres
(d) 16.4 litres (e) None of these

6. 100 litres of mixture contains 20% water and the rest is milk. The amount of milk that must be added so that the resulting mixture contains 87.5% milk is:
(a) 30 litres (b) 35 litres (c) 60 litres
(d) 45 litres (e) None of these

7. In what ratio must a person mix three kinds of wheat costing him Rs. 1.20, Rs. 1.44 and Rs. 1.74 per kg so that the mixture may be worth Rs. 1.41 per kg?
(a) 11 : 77 : 7 (b) 25 : 45 : 8 (c) 27 : 23 : 6
(d) 11 : 45 : 7 (e) None of these

8. Chaiwala mixes three qualities of tea T_1, T_2 and T_3 priced at Rs. 74 per kg, Rs. 68 per kg, and Rs. 63 per kg in the ratio of 1 : 2 : 4. He added some more quantity of T_1 to 4 kg of this mixture. He sold this new mixture for Rs. 84 per kg, there by making a profit of 20%. How much of T_1 did he mix with the mixture?

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(a) 1 kg (b) 0.5 kg (c) 0.35 kg
(d) 4 kg (e) None of these

9. Nine litres of water are drawn from a container full of water and it is then filled with milk. Nine litres of mixture are drawn and the container is again filled with milk. The quantity of water now left in the container is to that of the milk in it is 16 : 9. How much liquid does the container hold?
(a) 34 litres (b) 38 litres (c) 43 litres
(d) 45 litres (e) None of these

10. A cylinder which has the capacity of eight litres contains a mixture of oxygen and nitrogen. The volume of oxygen in the cylinder is 16% of total volume. A few litres of the mixture is released and an equal amount of nitrogen is added. Then the same amount of the mixture as before is released and replaced by nitrogen for the second time. As a result, the oxygen content becomes 9% of total volume. Find the amount of mixture released each time?
(a) 2 litres (b) 2.5 litres (c) 1 litres
(d) 0.5 litres (e) None of these

11. Two liquids are mixed in the ratio of 3 : 2 and the mixture is sold at Rs. 11 per litre at a 10% profit. If the 1st liquid cost Rs. 2 more per litre than the second, what is the cost per litre of the second liquid?
(a) Rs. 8.80 (b) Rs. 10.80 (c) Rs. 12.80
(d) Rs. 14.80 (e) None of these

12. If 5 kg of potato costing Rs. 5 per kg and 3 kg of potato costing Rs. 4 per kg are mixed, find the average cost of the mixture per kg?
(a) Rs. 4.40 (b) Rs. 4.45 (c) Rs. 4.63
(d) Rs. 4.95 (e) None of these

13. A 20 litre mixture of milk and water contains milk and water in the ratio 3 : 2. 10 litres of the mixture is removed and replaced with pure milk and the operation is repeated once more.
At the end of the two removals and replacement, what is the ratio of milk and water in the resultant mixture?
(a) 17 : 3 (b) 9 : 1 (c) 3 : 17
(d) 5 : 3 (e) None of these

14. A merchant mixes three varieties of rice costing Rs. 20 per kg, Rs. 24 per kg and Rs. 30 per kg and sells the mixture at a profit of 20% at Rs. 30 per kg. How many kgs of the second variety will be in the mixture if 2 kgs of the third variety is there in the mixture?
(a) 1 kg (b) 3 kgs (c) 5 kgs
(d) 6 kgs (e) None of these

15. In what ratio must a person mix three kinds of tea costing Rs. 60 per kg, Rs. 75 per kg and Rs. 100 per kg so that the resultant mixture when sold at Rs. 96 per kg yields a profit of 20%?
(a) 1 : 2 : 4 (b) 3 : 7 : 6 (c) 1 : 4 : 2
(d) 1 : 3 : 5 (e) None of these

16. 4 kg of potato at Rs. 5 per kg is mixed with 8 kg of potato at Rs. 6 per kg. Find the average price of the mixture?
(a) Rs. 5.66 per kg (b) Rs. 6.50 per kg (c) Rs. 7.25 per kg
(d) None of these

17. A shopkeeper bought 20 kg of onion at Rs. 6.50 per kg and 30 kg of onion at Rs. 7 per kg. He sold the mixture at a profit of Rs. 60. At what price did he sell per kg of the mixture of onions?
(a) Rs. 12 (b) Rs. 8 (c) Rs. 7.50
(d) Rs. 11 (e) None of these

18. Two casks of 48 and 42 litres are filled with mixtures of wine and water, the proportions in the two casks being respectively 13 : 7 and 18 : 17. If the contents of the two casks be mixed, and 20 litres of water added to the whole what will be the proportion of wine to water in the resultant mixture?
(a) 13 : 12 (b) 12 : 13 (c) 21 : 31
(d) 31 : 21 (e) None of these

19. Three glasses of capacity 2 litres, 5 litres and 9 litres contain mixture of milk and water with milk concentrations 90%, 80% and 70% respectively. The contents of three glasses are emptied into a large vessel. Find the ratio of milk to water in the resultant mixture?
(a) 121 : 39 (b) 131 : 49 (c) 39 : 121
(d) 49 :131 (e) None of these

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20. A 12-litres cylinder contains a mixture of oxygen and nitrogen, the volume of oxygen being 40% of total volume. A few litres of the mixture is released and an equal amount of nitrogen is added. Then the same amount of the mixture as before is released and replaced by nitrogen for the second time. As a result, the oxygen content becomes 10% of the total volume. How many litres of mixture is released each time?

(a) 3 litres (b) 9 litres (c) 6 litres
(d) 4 litres (e) None of these

Previous Year (Memory Based)

1. There are two containers of equal capacity. The ratio of milk to water in the first container is 3 : 1, in the second container is 5 : 2. If they are mixed up, then the ratio of milk to water in the mixture will be:

(a) 28 : 41 (b) 41 : 28 (c) 15 : 41
(d) 41 : 15 (e) None of these

2. In a mixture of 60 L the ratio of acid and water is 2 : 1. If the ratio of acid and water is to be 1 : 2, then the amount of water (in litres) to be added in mixture is:

(a) 55 (b) 60 (c) 50
(d) 45 (e) None of these

3. In a mixture of 25 L, the ratio of acid to water is 4 : 1. Another 3 L of water is added to the mixture. The ratio of acid to water in the new mixture is:

(a) 5 : 2 (b) 2 : 5 (c) 3 : 5
(d) 5 : 3 (e) None of these

4. In a 729 L mixture of milk and water, the ratio of milk to water is 7 : 2. To get a new mixture containing milk and water in the ratio 7 : 3, the amount of water to be added is:

(a) 81 L (b) 71 L (c) 56 L
(d) 50 L (e) None of these

5. In a mixture of 75 L, the ratio of milk to water is 2 : 1. The amount of water to be further added to the mixture so as to make the ratio of the milk to water 1 : 2 will be:
(a) 45 L (b) 60 L (c) 75 L
(d) 80 L (e) None of these

6. A barrel contains a mixture of wine and water in the ratio 3 : 1. How much fraction of the mixture must be drawn off and substituted by water so that the ratio of wine and water in the resultant mixture in the barrel becomes 1 : 1?
(a) $\frac{1}{4}$ (b) $\frac{1}{3}$ (c) $\frac{3}{4}$
(d) $\frac{2}{3}$ (e) None of these

7. A mixture contains spirit and water in the ratio 3 : 2. If it contains 3 L more spirit than water, the quantity of spirit in mixture is:
(a) 10L (b) 12 L (c) 8 L
(d) 9 L (e) None of these

8. Two vessels contain milk and water in the ratio 3 : 2 and 7 : 3. Find the ratio in which the contents of the two vessels have to be mixed to get a new mixture in which the ratio of milk and water 2 : 1?
(a) 2 : 1 (b) 1 : 2 (c) 4 : 1
(d) 1 : 4 (e) None of these

9. A can contains a mixture of two liquids A and B in the ratio 7 : 5 . When 9 L of mixture is drained off and the can is filled with B, the ratio of A and B becomes 7 : 9. How many litres of liquid A was contained by the can initially?
(a) 10 (b) 20 (c) 21
(d) 25 (e) None of these

10. The vessels A and B contains acid and water in the ratio 4 : 3 and 5 : 3 respectively. Then, the ratio in which these mixtures to be mixed to obtain a new mixture in vessel C containing acid and water in the ratio 3 : 2 is:

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(a) 5 : 8 (b) 7 : 8 (c) 7 : 5
(d) 4 : 7 (e) None of these

11. Acid and water are mixed in a vessel A in the ratio of 5 : 2 and in the vessel B in the ratio 8 : 5. In what proportion should quantities be taken out from the two vessels so as to form a mixture in which the acid and water will be in the ratio of 9 : 4?
(a) 7 : 2 (b) 2 : 7 (c) 7 : 4
(d) 2 : 3 (e) None of these

12. The acid and water in two vessels A and B are in the ratio 4 : 3 and 2 : 3. In what ratio should the liquids in both the vessels be mixed to obtain a new mixture in vessel C containing half acid and half water?
(a) 7 : 5 (b) 5 : 7 (c) 7 : 3
(d) 5 : 3 (e) None of these

13. A mixture contains wine and water in the ratio 3 : 2 and another mixture contains them in the ratio 4 : 5. How many litres of the latter must be mixed with 3 L of the former so that the resulting mixture may contain equal quantities of the wine and water?
(a) $5\frac{2}{5}$ L (b) $5\frac{2}{3}$ L (c) $4\frac{1}{2}$ L
(d) $3\frac{3}{4}$ L (e) None of these

14. In the first alloy, zinc and copper are in the ratio 1 : 2. In the second alloy the same elements are in the ratio 2 : 3. If these two alloys be mixed to form a new alloy in which two elements are in the ratio 5 : 8, the ratio of these two alloys in the new alloy is:
(a) 3 : 10 (b) 3 : 7 (c) 10 : 3
(d) 7 : 3 (e) None of these

15. A and B are two alloys of gold and copper prepared by mixing metals in the ratio 5 : 3 and 5 : 11, respectively. Equal quantities of these alloys are melted to form a third alloy C. The ratio of gold and copper in the alloy C is:
(a) 25 : 33 (b) 33 : 25 (c) 15 : 17
(d) 17 : 15 (e) None of these

16. Two types of alloys contain gold and silver in the ratio of 7 : 22 and 21 : 37. In what ratio should these alloys be mixed, so as to have a new alloy in which gold and silver would exist in the ratio 25 : 62?
(a) 13 : 8 (b) 8 : 13 (c) 13 : 12
(d) 6 : 9 (e) None of these

17. Pure milk costs 16 / L. After adding water the milkman sells the mixture 15 / L and thereby makes a profit of 25%. In what respective ratio does he mix milk with water?
(a) 3 : 1 (b) 4 : 3 (c) 3 : 2
(d) 5 : 3 (e) None of these

18. The ratio in which two sugar solutions of the concentrations 15% and 40% are to be mixed to get a solution of concentration of 30% is:
(a) 2 : 3 (b) 3 : 2 (c) 8 : 9
(d) 9 : 8 (e) None of these

19. Milk and water in a mixture are in the ratio 7 : 5. When 15 L of water is added to it, the ratio of milk and water in the new mixture becomes 7 : 8. The total quantity of water in the new mixture is:
(a) 35 L (b) 40 L (c) 60 L
(d) 96 L (e) None of these

20. The ratio of milk and water in mixtures of four containers are 5 : 3, 2 : 1, 3 : 2 and 7 : 4, respectively. In which container is the quantity of milk, relative to water, minimum?
(a) First (b) Second (c) Third
(d) Fourth (e) None of these

21. 60 kg of a certain variety of rice at Rs. 32 per kg is mixed with 48 kg of another variety of rice and the mixture is sold at the average price of Rs. 28 per kg. If there is no profit or loss due to the new sale price, the price of second veriety of rice per kg is:
(a) Rs. 25.60 per kg (b) Rs. 25 per kg (c) Rs. 23 per kg
(d) Rs. 30 per kg (e) None of these

22. The ratio, in which tea costing Rs. 192 per kg is to be mixed with tea costing Rs. 150 per kg so that the mixed tea, when sold for Rs. 194.40 kg gives a profit of 20% is:

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(a) 2 : 5 (b) 3 : 5 (c) 5 : 3
(d) 5 : 2 (e) None of these

23. There are 81 L pure milk in a container. One third of milk is replaced by water in the container. Again, one third of mixture is extracted and equal amount of water is added. What is the ratio of milk to water in the new mixture?
(a) 1 : 2 (b) 1 : 1 (c) 2 : 1
(d) 4 : 5 (e) None of these

24. In 50 g alloy of gold and silver, the gold is 80% by weight. How much gold should be mixed to this alloy, so that the weight of gold would become 95%?
(a) 200 g (b) 150 g (c) 50 g
(d) 10g (e) None of these

25. An alloy contains copper, zinc and nickel in the ratio of 5 : 3 : 2. The quantity of nickel in kg that must be added to 100 kg of this alloy to have the new ratio 5 : 3 : 3 is:
(a) 8 (b) 10 (c) 12
(d) 15 (e) None of these

26. A shopkeeper bought 15 kg of rice at the rate of Rs. 29 per kg and 25 kg of rice at the rate of Rs. 20 per kg. He sold the mixture of both types of rice at the rate of Rs. 27 per kg. His profit in this transaction is:
(a) Rs. 125 (b) Rs. 150 (c) Rs. 140
(d) Rs. 145 (e) None of these

27. In 40 L mixture of milk and water, the ratio of milk to water is 7 : 1. In order to make the ratio of milk and water 3 : 1, the quantity of water (in litres) that should be added to the mixture will be:
(a) 6 (b) $6\frac{1}{2}$ (c) $6\frac{2}{3}$
(d) $6\frac{3}{4}$ (e) None of these

28. A mixture of 30 L contain milk and water in the ratio of 7 : 3. How much water should be added to it so that the ratio of milk and water becomes 3 : 7?
(a) 40 L (b) 49 L (c) 56 L
(d) 63 L (e) None of these

29. Two vessels A and B contain milk and water mixed in the ratio 8 : 5 and 5 : 2, respectively. The ratio in which these two mixtures be mixed to get a new mixture containing $69\frac{3}{13}\%$ milk is
(a) 3 : 5 (b) 5 : 2 (c) 5 : 7
(d) 2 : 7 (e) None of these

30. Zinc and copper are in the ratio 5 : 3 in 400 g of an alloy. How much of copper (in g) should be added to make the ratio 5 : 4?
(a) 72 (b) 200 (c) 50
(d) 66 (e) None of these

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Foundation

1. (b); In the mixture quantity of milk are $\frac{7}{12} \times 60 = 35$ L

In mixture quantity of water are $\frac{5}{12} \times 60 = 25$ litre

Quantity of water is added by = 35 – 25 = 10 L.

2. (a); Quantity of milk & water be $\left(\frac{30}{15} \times 8\right), \left(\frac{30}{15} \times 7\right)$

Milk = 16 Litre, Water = 14 Litre

Let x litre water be added

$$\frac{16}{14+x} = \frac{4}{5} \Rightarrow 56 + 4x = 80 \Rightarrow x = 6$$

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3. (c); By mixture Alligation method:

62 kg 72 kg

64.50

7.50 2.50

3 : 1

4. (b); Quantity of water in a mixture of 60 litre is $= \frac{20}{100} \times 60 = 12$ litre

quantity of milk = 60 lt. – 12 lt. = 48 lt.
In new mixture Water = 25%, Milk = 75%
Let total quatity of new mixture be x litre

$x \times \frac{75}{100} = 48 \Rightarrow x = 64$

So, quantity of water = 64 – 48 = 16 litre
So, 4 ltr. water must be added

5. (c); By the rule of alligation:

Cheaper price Dearer price

15 20

16.50
Mean price

x = 3.50 y = 1.50

∴ Required Ratio = 3.50 : 1.50 = 70 : 30 = 7 : 3

6. (c); Let CP of milk be 1 per litre.
Then SP of 1 litre of mixture = 1 Rs.
Gain obtained = 25%

CP of 1 litre of mixture $= \frac{100}{125} \times 1 = \frac{4}{5}$

By the rule of alligation, we have

$\therefore$ Ratio of water and milk $=\frac{1}{5}:\frac{4}{5}=1:4$

Required percentage $=\frac{1}{5}\times 100\%=20\%$

7. (b); By the rule of alligation

Required Ratio = 6 : 9 = 2 : 3

8. (b); The recquired ratio will be same as the ratio of amount of their investment.

$\therefore$ Required Ratio = 45000 : 30000 = 3 : 2

9. (a); By the rule of alligation

$\therefore$ Required ratio = 1 : 0.50 = 2 : 1

10. (c); Quantity of sugar in solution = 240 gram

Let quantity added = x gram

$$\therefore \frac{240+x}{360} = \frac{1}{1} \Rightarrow x = 120 \text{ grams}$$

11. (d); By the rule of alligation

Gold Copper

21 11

17

6 4

Required ratio = 6 : 4 = 3 : 2

12. (e);

12% (–8%)

11%

19% 1%

$$\frac{\text{books sold at 12\% profit}}{\text{books sold at 8\% loss}} = \frac{19}{1}$$

$$\therefore \text{Required quantity of Book} = \frac{19}{20} \times 100 = 19 \times 5 = 95$$

13. (b); $\text{Milk} = \frac{5}{7} + \frac{4}{7} + \frac{3}{4} = \frac{20+16+21}{28} = \frac{57}{28}$

$$\text{Water} = \frac{2}{7} + \frac{3}{7} + \frac{1}{4} = \frac{8+12+7}{28} = \frac{27}{28}$$

$$\text{milk : water} = \frac{57}{28} : \frac{27}{28} = 57 : 27 = 19 : 9$$

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14. (d);

∴ Required proportion = 9 : 3 = 3 : 1

15. (d);

Required ratio = 15 : 10 = 3 : 2

16. (b);

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$$\frac{\text{quantity of rice sells at 10\% profit}}{\text{quantity of rice sells at 5\% loss}} = \frac{12}{3} = \frac{4}{1}$$

∴ Required quantity $= \frac{4}{5} \times 50$ = 40 kg.

17. (c);

∴ Ratio = 7.5 : 6 = 75 : 60 = 5 : 4

∴ 2nd cow cost $= \frac{4}{9} \times 2700 =$ Rs. 1200

18. (d); Let Nutan invested x Rs.

$\therefore$ Sonal's contribution = 5000 + x

$\therefore$ Aditya's contribution = 9000 + x

$\therefore$ x + (5000 + x) + (9000 + x) = 50000

3x + 14000 = 50000

3x = 36000 $\Rightarrow$ x = 12000

$\therefore$ Ratio = 21000 : 17000 : 12000 = 21 : 17 : 12

Amount that Aditya receive $= \frac{21}{50} \times 70000 = 21 \times 1400 = 29400$

19. (a);

$\therefore$ Required ratio = 10 : 15 = 2 : 3

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20. (a); CP of 30 kgs = 30 × 9.50 = 285

CP of 40 kgs = 40 × 8.50 = 340

Total CP of 70 kgs = 285 + 340 = 625

SP of 70 kgs = 70 × 8.90 = 623

$\therefore$ Loss = 625 – 623 = Rs. 2

21. (d); The mean value is 90 paisa and the price of water is zero paisa

Ratio of milk and water = 5 : 1

Quantity of milk in the mixture = 16 × 5 = 80 ltr.

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22. (b); CP of mixture $= \frac{100}{(100+25)} \times 20 = \frac{100}{125} \times 20 = 16$

chemical water

25 0

16

16 9

$\therefore$ Required ratio = 16 : 9

23. (c); Quantity of milk in the mixture $= \frac{90}{100} \times 40 = 36$ ltr.

Quantity of water in the mixture $= \frac{10}{100} \times 40 = 4$ ltr.

Let x ltr. of water be added

$\frac{36}{4+x} = \frac{80}{20} \Rightarrow (36) = 4\,(4 + x)$

$36 = 16 + 4x \Rightarrow 4x = 20 \Rightarrow x = 5$ ltr.

24. (b); Quantity of zinc in metal 1st $= \frac{1}{3} \times 2 = \frac{2}{3}$

Quantity of copper in metal 1st $= \frac{2}{3} \times 2 = \frac{4}{3}$

Quantity of zinc in mixture $= \frac{2}{3} + \frac{3}{4} = \frac{8+9}{12} = \frac{17}{12}$

Quantity of copper in mixture $= \frac{2}{3} \times 2 + \frac{3}{4} \times 3 = \frac{4}{3} + \frac{9}{4} = \frac{16+27}{12} = \frac{43}{12}$

$\therefore$ Required ratio $= \frac{17}{12} : \frac{43}{12} = 17 : 43$

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25. (b); Let quantity of gold to be mixed = x g

$$\frac{\frac{80}{100}\times 50 + x}{\frac{20}{100}\times 50} = \frac{95}{5} \Rightarrow \frac{40+x}{10} = \frac{19}{1}$$

40 + x = 190 $\Rightarrow$ x = 150 g

26. (c); Let, 5–paise coin = x, 10–paise coin = y

x + y = 80 ... (i)

$$\frac{5}{100}\times x + \frac{10}{100}\times y = 6.40 \Rightarrow \frac{x}{20} + \frac{y}{10} = 6.40$$

$$\frac{x+2y}{20} = 6.40 \Rightarrow x + 2y = 128 \quad \text{... (ii)}$$

From (i) and (ii)

x + y – x – 2y = 80 – 128

– y = – 48 $\Rightarrow$ y = 48 $\Rightarrow$ x = 80 – 48 = 32

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27. (d); By the rule of alligation

∴ Ratio of tea = 7 : 5 $\Rightarrow$ 5 $\Rightarrow$ 15 kg

So, Required quantity = 7 × 3 = 21 kg.

28. (b); By the rule of alligation

Required ratio = 6 : 4 = 3 : 2

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29. (d); By alligation formula:

Quantity of milk left after 2 operations

$$= x\left(1-\frac{y}{x}\right)^2 = 81\left(1-\frac{27}{81}\right)^2 = 81\times\frac{2}{3}\times\frac{2}{3} = 4 \times 9 = 36 \text{ ltr.}$$

and water quantity in mixture = 81 – 36 = 45 ltr.

recquired ratio = 36 : 45 = 4 : 5

30. (d);

profit		loss
112		92
	111	
19		1

no. of pens were sold at 12% profit $= \frac{19}{20} \times 60 = 57$

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Moderate

1. (b); Let cost price of 1 litre of milk = Rs. 1

SP of 1 litre of mixture = Rs. 1; Gain = 16%

CP of 1 litre of mixture $= \left(\frac{100}{100+16}\right) \times 1 = \frac{25}{29}$

water		milk
0		1
	$\frac{25}{29}$	
$\left(1-\frac{25}{29}\right) = \frac{4}{29}$	:	$\frac{25}{29}$

Recquired ratio $= \frac{4}{29} : \frac{25}{29} = 4 : 25$

Shortcut:

Ratio = Profit% : 100 = 16 : 100 = 4 : 25

2. (a); CP of mixture $= \frac{100}{110} \times 68.20 = 62$

Required ratio = 3 : 2

3. (b); Let cost of 1 litre of milk be Rs. 1

Milk in 1 litre mix in Ist can $= \frac{3}{4}$

Milk in 1 litre mix in 2nd can $= \frac{1}{2}$

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Milk in 1 litre of mix solution $= \frac{5}{8}$

Mean price $= \frac{5}{8}$

Ratio $= \frac{1}{8} : \frac{1}{8} = 1 : 1$

Quantity of milk from each car $= \frac{1}{2} \times 12 = 6$ litre

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4. (d); CP of mixture $= \frac{100}{110} \times 9.24 = \frac{42}{5} = 8.4$

(By rule of alligation)

∴ Ratio = 14 : 6 = 7 : 3

Quantity to be added = 9 × 7 = 63 kg.

5. (d); By rule:

Quantity of milk $= x\left(1 - \frac{y}{x}\right)^n$

$= 50\left(1 - \frac{5}{40}\right)^3 = 50\left(\frac{9}{10}\right)^3 = \frac{50 \times 9 \times 9 \times 9}{10 \times 10 \times 10}$ = 36.45 litres

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6. (d); Let quantity to be added = x litre

$\therefore \frac{9 + x}{21} = \frac{2}{1} \Rightarrow 9 + x = 42 \Rightarrow x = 42 - 9$

x = 33 litre

7. (a); Let the price per kg of the mixture = x

∴ By the rule of Alligation

$\therefore \frac{x - 15}{20 - x} = \frac{3}{2} \Rightarrow 2x - 30 = 60 - 3x$

$5x = 90 \Rightarrow x = 18$

8. (c); By the rule of alligation

$\therefore$ ratio = 4 : 6 = 2 : 3

recquired quantity $= \frac{3}{5} \times 1000 = 600$ kg

9. (c); By the rule of alligation

$\therefore$ ratio of boys and girls = 1 : 2

$\therefore$ no. of girls passed $= \frac{2}{3} \times 900 = 2 \times 300 = 600$

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10. (d); Quantity of salt in 400 gm of salt solution $= \frac{40}{100} \times 400 = 160$ gm

Let quantity added = x

$\therefore \frac{160 + x}{(400 - 160)} = \frac{1}{1} \Rightarrow 160 + x = 240 \Rightarrow x = 80$

11. (d); Let price per dozen of the mixture = x

$\therefore$ By the rule of alligation

$\therefore \frac{12 - x}{x - 10} = \frac{5}{3} \Rightarrow 36 - 3x = 5x - 50 \Rightarrow 8x = 86 \Rightarrow x = 10.75$

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12. (a); Let mean price = x

$$\frac{x-4.2}{5.4-x}=\frac{5}{3} \Rightarrow 8x = 39.60 \Rightarrow x = 4.95$$

13. (b); Let quantity to be added = x

$$\therefore \frac{43.2}{4.8+x}=\frac{80}{20}$$

$$86.4 = 38.4 + 8x \Rightarrow 8x = 48 \Rightarrow x = 6$$

14. (b); By the rule of alligation

ratio = 25 : 15 = 5 : 3

$$\therefore \text{Quantity of milk} = \frac{5}{8}\times 160 = 100 \text{ ltr.}$$

$$\text{and, Quantity of water} = \frac{3}{8}\times 160 = 60 \text{ ltr.}$$

15. (c); Let amount of water to be added = x

$$\therefore \frac{72}{8+x}=\frac{80}{20} \Rightarrow 72 = 32 + 4x$$

$$4x = 40 \Rightarrow x = 10$$

16. (d); Let initially the amount of liquid P in the tub = 4x
initially the amount of liquid Q in the tub = x

$$\therefore \frac{4x-\frac{4}{5}\times 10}{x-\frac{1}{5}\times 10+10}=\frac{2}{3} \Rightarrow \frac{4x-8}{x-2+10}=\frac{2}{3}$$

12x – 24 = 2x + 16 $\Rightarrow$ 10x = 40 $\Rightarrow$ x = 4

$\therefore$ Quantity of liquid P = 4 × 4 = 16 litre

17. (d); Qantity of milk in new mixture

$$= x\left(1-\frac{y}{x}\right)^x = 27\left(1-\frac{9}{27}\right)^2 = 27\times\frac{2}{3}\times\frac{2}{3} = 12 \text{ litre.}$$

Quantity of water in new mixture
= 27 – 12 = 15 litre
Required Ratio = 12 : 15 = 4 : 5

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18. (d); Share in profit $=\frac{495}{1020-495}=\frac{495}{525}=\frac{33}{35}$

Let Aditya invested his money for x month then Manish will invest (36 – x).

$$\therefore \frac{300\times x}{500(36-x)}=\frac{33}{35} \Rightarrow \frac{x}{36-x}=\frac{11}{7} \Rightarrow x=22$$

19. (c); Let Initial quantity of A and B = 3x and 2x

$$\therefore \frac{3x-\frac{3}{5}\times 5}{2x-\frac{2}{5}\times 5+5}=\frac{2}{3} \Rightarrow \frac{3x-3}{2x+3}=\frac{2}{3}$$

9x – 9 = 4x + 6 $\Rightarrow$ 5x = 15 $\Rightarrow$ x = 3
12x – 4 = 2x + 16 $\Rightarrow$ 10x = 40 $\Rightarrow$ x = 4
$\therefore$ quantity of A Initialy= 3 × 3 = 9 litres.

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20. (c); At loss At cost

95 100

97

3 2

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

Quantity sold at cost price = $\frac{2}{5} \times 40 = 16$kg.

21. (c); Let amount of water to be added = x

$\therefore \frac{50}{25+x} = \frac{1}{2} \Rightarrow 100 = 25 + x \Rightarrow x = 75$ ltr.

22. (a); CP of the mixture $= \frac{100}{125} \times 40 = \frac{4}{5} \times 40 = 32$

By the rule of alligation

42 24

32

8 10

ratio of salts = 4 : 5

So, required quantity = 5 × 4 = 20

23. (c); Let sugar to be added = x

$\therefore \frac{120+x}{180} = \frac{1}{1} \Rightarrow x = 60$

24. (e); When mix 25 litres of water with 100 litres of milk.

$\therefore$ Required proportion = 25 : 100 = 1 : 4

$\therefore$ % water = $\frac{1}{1+4} = \frac{1}{5} \times 100 = 20$ %

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25. (c); Water in 200 litre mixture = $\frac{15}{100} \times 200 = 30$ L

milk in 200 litre mixture = (200 – 30) = 170 litre

$170 + x = \frac{875}{100 \times 10} \times (200 + x)$

$170 + x = \frac{7}{8}(200 + x) \Rightarrow 1360 + 8x = 1400 + 7x$

x = 40 litre

26. (b); Let no. of rabbits = x, no. of pigeons = y

$\therefore x + y = 200$ ... (i)

$4x + 2y = 580$ ... (ii)

equation (i) × (ii) – equation (ii)

$2x + 2y = 400$

$\underline{4x + 2y = 580}$

$-2x = -180$

$x = 90 \Rightarrow y = 110.$

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27. (b); Let x be the quantity to added; $\frac{55}{11 + x} = \frac{5}{3}$

$165 = 55 + 5x \Rightarrow 5x = 110 \Rightarrow x = 22$

28. (b); average sum $= \frac{4100}{50} = 82$ paisa

Let no. of boy = x, no. of girls = y

By the rule of alligation

$\therefore \frac{x}{y} = \frac{17}{8} \Rightarrow$ no. of boys $= \frac{17}{25} \times 50 = 34$

29. (a);

Required Ratio = $\frac{1}{13} : \frac{2}{91} = 7 : 2$

30. (b); Let no. of coins of 1 rupee = 3x

no. of coins of 50 paisa = 8x

no. of coins of 25 paisa = 20x

$\therefore\ 3x + \frac{8x}{2} + \frac{20x}{4} = 372 \quad \Rightarrow \quad 3x + 4x + 5x = 372$

$12x = 372 \quad \Rightarrow \quad x = 31$

$\therefore$ Total no. of coins = 31 × 31 = 961

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Difficult

1. (b); Let original quatity = x ltr.

Amount of wine left after 4 operations

$$\frac{16}{81} = \frac{x\left(1-\frac{8}{x}\right)^4}{x} \quad \Rightarrow \quad \left(1-\frac{8}{x}\right)^4 = \left(\frac{2}{3}\right)^4$$

$$1-\frac{8}{x} = \frac{2}{3} \quad \Rightarrow \quad \frac{8}{x} = 1-\frac{2}{3} = \frac{1}{3} \quad \Rightarrow \quad x = 24 \text{ Ltr.}$$

2. (c); Let us suppose that the Can initially contains 7x and 5x litres of mixture A and B respectively

$\therefore$ Quantity of A in mixture left = $\left(7x - \frac{7}{12} \times 9\right) = 7x - \frac{21}{4}$ ltr.

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Quantity of B in mixture left $= \left(5x - \frac{5}{12} \times 9\right) = 5x - \frac{15}{4}$ ltr.

$$\therefore \frac{7x - \frac{21}{4}}{\left(5x - \frac{15}{4}\right) + 9} = \frac{7}{9} \Rightarrow \frac{28x - 21}{20x + 21} = \frac{7}{9}$$

$252x - 189 = 140x + 147 \Rightarrow 112x = 336 \Rightarrow x = 3$

$\therefore$ quantity contained by A initially = 7x = 21 ltr.

3. (d); Milk contained in container $= 80\left(1 - \frac{8}{80}\right)^4$

$$= 80 \times \left(\frac{72}{80}\right)^4 = 80\left(\frac{9}{10}\right)^4 = 80 \times (0.9)^4 = 80 \times 0.6561 = 52.48 \text{ ltr.}$$

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4. (c); Quantity of milk in vessel A $= \frac{4}{9}$

Quantityof milk in vessel B $= \frac{5}{6}$

Quantity of milk in mixture $= \frac{5}{9}$

$\therefore$ required ratio $= \frac{5}{18} : \frac{9}{1} = 5 : 2$

5. (b); According to question

$$\frac{4x-\frac{4}{11}\times 6}{7x-\frac{7}{11}\times 6+6}=\frac{3}{7} \quad \Rightarrow \quad x=\frac{240}{77}$$

$$4x=\frac{960}{77}=12.46$$

6. (c); Milk in 100 ltr. of mixture = $\frac{80}{100}\times 100$ = 80 ltr.

Water quantity = 20 ltr.

$$\therefore \frac{80+x}{20}=\frac{87.5}{12.5}$$

$$\frac{80+x}{20}=7 \Rightarrow 80+x=140 \Rightarrow x=60 \text{ ltr.}$$

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7. (a); Let the three kinds of wheat be W_1, W_2 and W_3.
By the rule of Alligation:

So, $W_1 : W_2 \Leftrightarrow 1:7$

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So, $W_2 : W_3 \Leftrightarrow 11 : 1$

$W_1 : W_2 = (1 : 7) \times 11 = 11 : 77$

$W_2 : W_3 = (11 : 1) \times 7 = 77 : 7$

So, $W_1 : W_2 : W_3 = 11 : 77 : 7$

8. (d); Let first take T_1 and T_2

$\therefore \quad \frac{74 - x}{x - 68} = \frac{2}{1} \quad \Rightarrow 74 - x = 2x - 136$

$3x = 210 \quad \Rightarrow \quad x = 70$

Now take T_3

$\frac{70 - y}{y - 63} = \frac{4}{3} \Rightarrow 210 - 3y = 4y - 252$

$7y = 462 \quad \Rightarrow \quad y = 66$

Now Let us assume that z quantity of T_1 is mixed with mixture

$CP = 84 \times \frac{100}{120} = 70$

$$\frac{74-70}{70-66}=\frac{4}{z} \Rightarrow \frac{4}{4}=\frac{4}{z} \Rightarrow z = 4 \text{ kg.}$$

9. (d); Let initially container contain x litre of water

$$\therefore \frac{x\left(1-\frac{9}{x}\right)^2}{x}=\frac{16}{25} \Rightarrow \left(1-\frac{9}{x}\right)^2=\left(\frac{4}{5}\right)^2$$

$$1-\frac{9}{x}=\frac{4}{5} \Rightarrow \frac{9}{x}=1-\frac{4}{5}=\frac{1}{5} \Rightarrow x = 45 \text{ litres}$$

10. (a); Let each time y amount of mixture releases

$$\therefore \frac{8\left(1-\frac{y}{8}\right)^2}{8}=\frac{0.09}{0.16} \Rightarrow \left(1-\frac{y}{8}\right)^2=\left(\frac{3}{4}\right)^2$$

$$\frac{y}{8}=\frac{1}{4} \Rightarrow y = 2 \text{ litres.}$$

11. (a); Let second liquid costs = x per litre
Let first liquid costs = (x + 2) per litre

$$CP = 11 \times \frac{100}{110} = \text{Rs. } 10$$

$$\therefore \frac{x+2-10}{10-x}=\frac{2}{3} \Rightarrow \frac{x-8}{10-x}=\frac{2}{3}$$

$3x - 24 = 20 - 2x \Rightarrow 5x = 44 \Rightarrow x = 8.8$ per litre.

12. (c); Let average cost = x per kg.

$$\frac{5-x}{x-4}=\frac{3}{5} \Rightarrow 25-5x=3x-12$$

$8x = 37 \Rightarrow x = 4.625 = 4.63$ (Approximate)

13. (b); The 20 litre mixture contains milk and water in the ratio of 3 : 2. Therefore, there will be 12 litres of milk in the mixture and 8 litres of water in the mixtrue

Step 1: When 10 litres of the mixture is removed, 6 litres of milk is removed and 4 litres of water is removed. Therefore, there will be 6 litres of milk and 4 litres of water left in the container. It is then replaced with pure milk of 10 litres. Now the container will have 16 litres of milk and 4 litres of water.

Step 2: When 10 litres of the new mixture is removed, 8 litres of milk and 2 litres of water is removed. The container will have 8 litres of milk and 2 litres of water in it. Now 10 litres of pure milk is added. Therefore, the container will have 18 litres of milk and 2 litres of water in it at the end of the second step.

So, required ratio = 18 : 2 or 9 : 1.

14. (c); If the selling price of mixture is Rs. 30/kg and the merchant makes a profit of 20%, then the cost price of the mixture $=\frac{30}{1.2}=$ Rs. 25 / kg.

We need to find out the ratio in which the three varieties are mixed to obtain a mixture costing Rs. 25/kg.

Let Variety A costs Rs. 20/kg, Variety B costs Rs. 24/kg and variety C costs Rs. 30/kg. The mean desired price falls between B and C.

Find out the ratio $Q_A : Q_C$ using alligation rule

$$\frac{Q_A}{Q_C} = \frac{30-25}{25-20} = \frac{1}{1}$$

Find out the ratio $Q_B : Q_C$ using alligation rule

$$\frac{Q_B}{Q_C} = \frac{30-25}{25-24} = \frac{5}{1}$$

Q_C is found by adding the value of Q_C in the above two cases, i.e; $Q_C = 1 + 1 = 2$

Therefore, the required ratio = 1 : 5 : 2

If there are 2 kgs of the third variety in the mixture, then there will be 5 kgs. of the second variety in the mixture.

15. (c); The resultant mixture is sold at a profit of 20% at Rs. 96 / kg.

$$\Rightarrow \quad \text{Cost price} = \frac{96}{1.2} = \text{Rs. } 80 \text{ / kg.}$$

Let the three varieties be A, B and C costing Rs. 60, Rs. 75 and Rs. 100 respectively.

The mean price falls between B and C

Hence the following method should be used:

Step 1: Find out the ratio of $Q_A : Q_C$ using alligation rule

$$\frac{Q_A}{Q_C} = \frac{100-80}{80-60} = \frac{1}{1}$$

Step 2: Find out the ratio of $Q_B : Q_C$ using alligation rule

$$\frac{Q_B}{Q_C} = \frac{100-80}{80-75} = \frac{4}{1}$$

Step 3: Q_C can be found by adding the value of Q_C in step 1 and step 2 = 1 + 1 = 2.

So, $Q_A : Q_B : Q_C = 1 : 4 : 2$

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16. (a); Let average price = x per kg.

$\therefore \frac{x-5}{6-x} = \frac{8}{4}$

4x – 20 = 48 – 8x $\Rightarrow$ 12x = 68 $\Rightarrow$ x = 5.66

17. (b); 6.5

$\frac{x-6.5}{7-x} = \frac{30}{20} \Rightarrow$ 2x – 13 = 21– 3x

5x = 34 $\Rightarrow$ x = 6.8 per kg.

$\therefore$ Total value after mixture = 6.8 × 50 = 340 Rs.

Sold the mixture in (340 + 60) = 400 rs.

$\therefore$ required value per kg $= \frac{400}{50}$ = 8 per kg.

18. (b); Water quantity in first case = $\frac{7}{20} \times 48$ litre

water quantity in second case = $\frac{17}{35} \times 42$ litre

Total water quantity in 90 litre of mixture $= \frac{7 \times 48}{20} + \frac{17 \times 42}{35}$

$= \frac{186}{5}$ litre

After adding of 20 litre of water the quantity will be

$$= \frac{186}{5} + 20 = \frac{286}{5}$$

quantity of wine in 110 litre of mixture $= 110 - \frac{286}{5} = \frac{264}{5}$

$\therefore$ required ratio = $\frac{264}{5} : \frac{286}{5}$ = 12 : 13

19. (a); The quantity of milk in the (2 + 5 + 9 = 16) ltr. of mixture

$$= \frac{90}{100} \times 2 + \frac{80}{100} \times 5 + \frac{70}{100} \times 9 = 1.8 + 4 + 6.3 = 12.1$$

Water quantity = 16.0 – 12.1 = 3.9

$\therefore$ Required Ratio $= \frac{121}{39}$ = 121 : 39

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20. (c); Let y litre of mixture is released every time

$$\therefore \frac{12\left(1 - \frac{y}{12}\right)^2}{12} = \frac{0.10}{0.40} \Rightarrow \left(1 - \frac{y}{12}\right)^2 = \frac{1}{4}$$

$$\left(1 - \frac{y}{12}\right)^2 = \left(\frac{1}{2}\right)^2 \Rightarrow \frac{y}{12} = \frac{1}{2} \Rightarrow y = 6 \text{ litres}$$

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Previous Year (Memory Based)

1. (d); I container

M		W
3	:	1
21	:	7

$\underbrace{\quad}_{4\times7}$

II container

M		W
5	:	2
20	:	8

$\underbrace{\quad}_{7\times4}$

Ratio in mixture = 21 + 20 : 7 + 8 = 41 : 15

2. (b); Quantity of acid in the mixture $= \frac{2}{3} \times 60 = 40$ litres

Quantity of water = 60 – 40 = 20 litre

Let the required quantity of water be x litre

$\frac{40}{20+x} = \frac{1}{2}$, 80 = 20 + x $\Rightarrow$ x = 60 litre

3. (a); Total mixture = 25 L

Acid = $\frac{4}{5} \times 25 = 20$ L $\Rightarrow$ Water = 5 L

After addtion of 3L of water

New ratio = 20 : 8 = 5 : 2

4. (a); Quantity of milk = $\frac{7}{9} \times 729 = 567$ L

Quantity of water = (729 – 567) = 162 L

Let the amount of water be added be x L.

$\frac{567}{162+x} = \frac{7}{3}$ $\Rightarrow$ 1701 = 7x + 1134

7x = 1701 – 1134 $\Rightarrow$ x = $\frac{567}{7}$ = 81 L

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5. (c); Milk = $\frac{2}{3} \times 75 = 50$ L and, Water = $\frac{1}{3} \times 75 = 25$ L

Let x L of water be added

$$\frac{50}{x+25} = \frac{1}{2} \Rightarrow x + 25 = 100 \Rightarrow x = 75 \text{ L}$$

6. (b); Let the barrel contain 4 L of mixture.
Wine = 3 L and water = 1 L
Let x L mixture is taken out.
According to question

$$\frac{3-\frac{3x}{4}}{1-\frac{x}{4}+x} = \frac{1}{1} \Rightarrow 3-\frac{3x}{4} = 1+\frac{3x}{4} \Rightarrow \frac{3x}{2} = 2 \Rightarrow x = \frac{4}{3}$$

Required fraction = $\frac{\frac{4}{3}}{4} = \frac{1}{3}$

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7. (d); Let the quantity of spirit be x.
Quantity of water = x – 3

$$\frac{x}{x-3} = \frac{3}{2} \Rightarrow 2x = 3x - 9 \Rightarrow x = 9$$

8. (b);

Required ratio = $\frac{1}{30} : \frac{1}{15} = 1 : 2$

9. (c); Liquid A = $\frac{7}{12}\times 9 = \frac{21}{4}$ L, Liquid B = $\frac{5}{12}\times 9 = \frac{15}{4}$ L

$$\frac{7x-\frac{21}{4}}{5x-\frac{15}{4}+9} = \frac{7}{9} \Rightarrow \frac{28x-21}{20x-15+36} = \frac{7}{9}$$

$$\frac{28x-21}{20x+21} = \frac{7}{9} \Rightarrow \frac{4x-3}{20x+21} = \frac{1}{9}, x = 3$$

Original quantity of liquid A = 7x = 7 × 3 = 21 L

10. (b);

Required ratio = $\frac{1}{40} : \frac{1}{35}$ = 35 : 40 = 7 : 8

11. (a);

Required ratio = $\frac{1}{13} : \frac{2}{91}$ = 7 : 2

12. (a);

Vessel A Vessel B

Acid = $\frac{4}{7}$ Acid = $\frac{2}{5}$

$\frac{1}{2}$

$\frac{1}{2} - \frac{2}{5} = \frac{5-4}{10} = \frac{1}{10}$ $\frac{4}{7} - \frac{1}{2} = \frac{8-7}{14} = \frac{1}{14}$

Required ratio = 7 : 5

13. (a);

Mixture I Mixture II

wine = $\frac{3}{5}$ wine = $\frac{4}{9}$

$\frac{1}{2}$

$\frac{1}{2} - \frac{4}{9} = \frac{9-8}{18} = \frac{1}{18}$ $\frac{3}{5} - \frac{1}{2} = \frac{6-5}{10} = \frac{1}{10}$

Required ratio = $\frac{1}{18} : \frac{1}{10}$ = 5 : 9

Here, 5 $\rightarrow$ 3 L then 9 $\rightarrow$ $\frac{3}{5} \times 9 = \frac{27}{5} = 5\frac{2}{5}$ L

14. (a);

Required ratio = $\frac{1}{65} : \frac{2}{39} = \frac{1}{5} : \frac{2}{3} = 3 : 10$

15. (c);

A	B
5 : 3	5 : 11
$\underbrace{\quad}_{8\times2}$	$\underbrace{\quad}_{16\times1}$
10 : 6	5 : 11

Ratio of gold and copper = 10 + 5 : 6 + 11= 15 : 17

16. (a);

Required ratio = $\frac{13}{174} : \frac{4}{87} = 13 : 8$

17. (a); cost price of mixture $= \frac{15}{125} \times 100$ = Rs. 12 / L

Milk Water

16 0

12

12 4

Required ratio = 3 : 1

18. (a); Solution I Solution II

Concentration of Sugar = 15 40

30

10 15

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Required ratio = 10 : 15 = 2 : 3

19. (b); Let the quantity of milk and water be 7x & 5x

According to question

$$\frac{7x}{5x+15} = \frac{7}{8} \Rightarrow 56x = 35x + 105 \Rightarrow x = 5$$

quantity of water = 8 × 5 = 40 L (5 × 5 + 15 = 40)

20. (c); Milk in first vessel = $\frac{5}{8}$ = 0.62

Milk in second vessel = $\frac{2}{3}$ = 0.66

Milk in third vessel = $\frac{3}{5}$ = 0.60

Milk in fourth vessel = $\frac{7}{11} = 0.636$

Therefore, third vessel has minimum milk relative to water.

21. (c); Let the price of second variety of rice be Rs. x per kg.

Total cost of first variety of rice = Rs. 60 × 32 = Rs. 1920

Total cost of second variety = 48 × x = Rs. 48x

Selling price of both variety of rice = 108 × 28 = Rs. 3024

Since there is neither profit nor loss

$\therefore$ 1920 + 48x = 3024

$48x = 1104 \Rightarrow x = \frac{1104}{48} = 23$

Cost price of 2nd variety of rice in Rs. 23 per kg.

22. (a); Cost price of mixture = $\frac{194.40}{120} \times 100$ = Rs. 162 per kg

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Type I Tea		Type II Tea
192		150
	162	
12		30

Required ratio = 12 : 30 = 2 : 5

23. (d); Pure milk in container = 81 L

First by replacing $\frac{1}{3}$ part by water.

Remaining milk = $81 - \frac{81}{3} = 54$ L

Again, replacing $\frac{1}{3}$ part by water

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Remaining milk = $54 - 54 \times \frac{1}{3} = 36$ L

Quantity of water last = 81 – 36 = 45 L

Required ratio = $\frac{36}{45} = \frac{4}{5} = 4 : 5$

Shortcut:

Pure milk = $81\left(1-\frac{1}{3}\right)^2 = 36$

Water = 81 – 36 = 45; Ratio = 36 : 45 = 4 : 5

24. (b); Quantity of gold = $\frac{80}{100} \times 50 = 40$ g

Quantity of silver = 10 g

$\frac{40+x}{10} = \frac{95}{5} \Rightarrow 40 + x = 190$

x = 190 – 40, x = 150 g

Shortcut:

1 = 50 $\Rightarrow$ 3 = 150

25. (b); Quantity of nickel = $\frac{2}{10} \times 100 = 20$ kg

Let x kg of nickel be mixed

$\frac{20+x}{100+x} = \frac{3}{11} \Rightarrow 220 + 11x = 300 + 3x$

8x = 80, x = 10 kg

26. (d); Cost price of (15 + 25) kg of rice = 15 × 29 + 25 × 20
= 435 + 500 = Rs. 935
Selling price of 40 kg of mixture = 27 × 40 = Rs. 1080
Gain = 1080 – 935 = Rs. 145

27. (c); Quantity of milk = $\frac{7}{8} \times 40 = 35$ L
Quantity of water = 5 L

$$\frac{35}{5+x} = \frac{3}{1} \Rightarrow 35 = 15 + 3x$$

$$3x = 20, \quad x = \frac{20}{3} = 6\frac{2}{3} \text{ L}$$

28. (a); Quantity of milk = $\frac{7}{10} \times 30 = 21$ L, Quantity of water = 9 L

$$\frac{21}{9+x} = \frac{3}{7} \Rightarrow 147 = 27 + 3x \Rightarrow 3x = 120, x = 40$$

29. (d);

Required ratio = $\frac{2}{13 \times 7} : \frac{1}{13} = 2 : 7$

30. (c); Quantity of zinc = $\frac{5}{8} \times 400 = 250$ g

Quantity of copper = $\frac{3}{8} \times 400 = 150$ g

$$\frac{250}{150+x} = \frac{5}{4} \Rightarrow 1000 = 750 + 5x \Rightarrow 5x = 250, x = 50 \text{ gm}$$

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Chapter 12

Mensuration

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Chapter 12

Mensuration

SQUARE

- Area = side × side = $(S)^2$
- $S = \sqrt{\text{Area}}$
- Perimeter = 4 (Side)
- Diagonal = (side) × $\sqrt{2}$

RECTANGLE

- Area = l × b
- Perimeter = 2 (l + b)
- Diagonal $= \sqrt{l^2 + b^2}$

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- Area of track = $l_1b_1 - l_2b_2$

TRIANGLE

- Area $= \frac{1}{2} \times \text{base} \times \text{height}$
- Area $= \sqrt{s(s-a)(s-b)(s-c)}$

  Where, s = semi-perimeter

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

Area and perimeter of Right angled Isosceles Triangle

- Area $= \frac{1}{2}a^2$
- Perimeter $= (2a + \sqrt{2}a)$
- Height $= \frac{a}{\sqrt{2}}$

Area of equilateral Triangle

- Area $= \frac{\sqrt{3}}{4} \times (\text{side})^2 = \frac{\sqrt{3}}{4}a^2$
- Altitude $= \frac{\sqrt{3}}{2} \times \text{side} = \frac{\sqrt{3}}{2}a$
- Perimeter = 3 × side = 3a

CIRCLE

- Circumference = $2\pi r = \pi D$
- Area $= \frac{\pi}{4}D^2$

Semi circle

- Area of semi-circle $= \frac{1}{2}\pi r^2$
- Perimeter of semi-circle = $\pi r + 2r = \pi r + D$

Area of Sector

- If θ be the angle at the centre of a circle of radius r
- Length of the arc PQ $= 2\pi r \times \frac{\theta}{360°}$
- Area of sector OPRQO $= \pi r^2 \times \frac{\theta}{360°}$

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Volume

CUBE

- edge of cube=length=breadth=height=a
- Volume of a cube = (edge)3 = a3
- Total surface Area = 6 × (edge)2 = 6a2
- Diagonal of a cube = $\sqrt{3}$ × edge $= \sqrt{3}a$

CUBOID

- V = l × b × h
- Surface area = 2 (lb + bh + hl)
- Diagonal $= \sqrt{l^2 + b^2 + h^2}$

Right Circular Cylinder

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Volume = πr2h
Curved Surface Area = 2πrh
Total surface Area=2πrh+2πr2 = 2πr(r + h)

Right Circular Cone

Volume $= \frac{1}{3}\pi r^2 h$

Curved Surface Area = πrl
Total surface Area = πrl + πr^2 = πr(l + r)

Sphere

$$\text{Volume} = \frac{4}{3}\pi r^3$$

Surface Area = $4\pi r^2$

Hemi-sphere

$$\text{volume} = \frac{2}{3}\pi r^3$$

Curved Surface Area = $2\pi r^2$

Total surface Area = $2\pi r^2 + \pi r^2 = 3\pi r^2$

S. No.	Name	Figure	Nomenclature	Area	Perimeter
1	Rectangle		$l \longrightarrow$ length $b \longrightarrow$ breadth	$1\times b=1b$	$21+2b=2(1+b)$
2.	Square		$a \longrightarrow$ side $d \longrightarrow$ diagonal $d = a\sqrt{2}$	(i) $a \times a = a^2$ (ii) $\frac{d^2}{2}$	$a+a+a+a=4a$
3.	Triangle (Scalene)		a, b and c are three side of triangle and s is the semiperi-meter, where $s = \left(\frac{a+b+c}{2}\right)$ b is the base and h is the altitude of triangle	(i) $\frac{1}{2}\times b \times h$ (ii) $\sqrt{s(s-a)(s-b)(s-c)}$ (Hero's formula)	$a+b+c=2s$

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S. No.	Name	Figure	Nomenclature	Area	Perimeter
4	Equilateral triangle		$a \rightarrow$ sides $h \rightarrow$ height or altitude $h = \frac{\sqrt{3}}{2}a$	(i) $\frac{1}{2} \times a \times h$ (ii) $\frac{\sqrt{3}}{4}a^2$	3a
5.	Isosceles triangle		$a \rightarrow$ equal sides $b \rightarrow$ base $h = \frac{\sqrt{4a^2 - b^2}}{2}$ $h \rightarrow$ height or altitude	(i) $\frac{1}{2} \times b \times h$ (ii) $\frac{1}{4} \times b \times \sqrt{4a^2 - b^2}$	2a + b
6.	Right angle triangle		$b \rightarrow$ base $h \rightarrow$ altitude / height $d \rightarrow$ hypotenuse $d = \sqrt{b^2 + h^2}$	$\frac{1}{2} \times b \times h$	b + h + d
7.	Isosceles right angled triangle		$a \rightarrow$ equal sides $d \rightarrow$ hypotenuse $d = a\sqrt{2}$	$\frac{1}{2}a^2$	2a+d
8.	Quadri-lateral		AC is the diagonal and h_1, h_2 are the Altitudes on AC from the vertices D and B respectively	$\frac{1}{2} \times AC \times (h_1 + h_2)$	AB+BC+CD+AD
9.	Parallelog-ram		a and b are sides adjacent to other. $h \rightarrow$ distance between the parallel sides	a × h	2(a + b)

S. No.	Name	Figure	Nomenclature	Area	Perimeter
10.	Rhombus		a → each equal side of Rhombus d_1 And d_2 are the diagonals $d_1 \rightarrow BD$ $d_2 \rightarrow AD$	$\frac{1}{2} \times d_1 \times d_2$	4a
11.	Trapezium		a and b are parallel sides to each other and h is the perpendicular distance between parallel sides	$\left(\frac{a+b}{2}\right) \times h$	AB+BC+CD+AD
12.	Regular hexagon		a ⟶ each of the equal side	$\frac{3\sqrt{3}}{2}a^2$	6a
13.	Regular Octagon		a ⟶ each of equal side	$2a^2\left(1+\sqrt{2}\right)$	8a
14.	Circle		r ⟶ radius of the circle $\pi = \frac{22}{7} = 3.1416$ (approx)	πr^2	$2\pi r$ (called as circumference)

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S. No.	Name	Figure	Nomenclature	Area	Perimeter
15.	Semicircle		a ⟶ radius of the circle	$\frac{1}{2}\pi r^2$	$\pi r + 2r$
16.	Quadrant		r ⟶ radius	$\frac{1}{4}\pi^2$	$\frac{1}{2}\pi r + 2r$
17.	Ring of circular path (shaded region)		R ⟶ outer radius r ⟶ inner radius	$\pi(R^2 - r^2)$	(outer) ⟶ $2\pi R$ (inner) ⟶ $2\pi r$
18.	Sector of a circle		O ⟶ centre of the circler r ⟶ radius l ⟶ length of the arc θ ⟶ angle of the sector $l = 2\pi\left(\frac{\theta}{360°}\right)$	(i) $\pi r^2\left(\frac{\theta}{360°}\right)$ (ii) $r \times l$	$l + 2r$
19.	Segment of a circle		θ ⟶ angle of the sector r ⟶ radius AB ⟶ chord ACB ⟶ arc of the circle	Area of segment ACB (Minorsegment) $= r^2\left(\frac{\pi\theta}{360°} - \frac{\sin\theta}{2}\right)$	$\left[\frac{\theta}{360°} \times 2\pi r + 2r\sin\left(\frac{\theta}{2}\right)\right]$

S. No.	Name	Figure	Nomenclature	Area	Perimeter
20.	Pathways running across the middle of a rectangle		l ⟶ length b ⟶ breadth w ⟶ width of the path (road)	(1+b–w)w	[2(l + b –4w+4w
21.	Outer pathways		l ⟶ length b ⟶ breadth w ⟶ widthness of the path	(1+b–w)w	(inner)→ 2(1+b) (inner)→ 2(1+b +4w)
22.	Inner path		l ⟶ length b ⟶ breadth w ⟶ widthness of the path	(1+b–2w) 2w	(outer)→ 2(1+b) (inner)→ 2(1+b +4w)

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Foundation

1. A rectangular plot is 180 m2 in area. If its length is 18m then, its perimeter is?
   (a) 28 m (b) 56 m (c) 360 m
   (d) 60 (e) None of these
2. The side of a square exceeds the side of the another square by 4 cm and the sum of the areas of the two squares is 400 cm2. The dimensions of the square are?
   (a) 8 cm and 12 cm (b) 6 cm and 10 cm
   (c) 12 cm and 16 cm (d) 10 cm and 18 cm
   (e) None of these
3. The area of the floor of a rectangular hall of length 40 m is 960 m^2. Carpets of size 6 m × 4 m are available. Then, how many carpets are required to cover the hall?
   (a) 20 (b) 30 (c) 40
   (d) 45 (e) None of these

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4. A lawn is in the shape of rectangle of length 60 m and width 40 m. Inside the lawn there is a footpath of uniform width 1 m bordering the lawn. The area of the path is

(a) 194 m^2 (b) 196 m^2 (c) 198 m^2
(d) 200 m^2 (e) None of these

5. ABCD is a parallelogram as shown in figure, then its area is?

(a) 12 cm^2 (b) 14 cm^2 (c) 15 cm^2
(d) 660 cm^2 (e) None of these

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6. What is the area of a triangle whose sides are 9 cm, 12 cm and 15 cm?

(a) 45 cm^2 (b) 54 cm^2 (c) 56 cm^2
(d) 64 cm^2 (e) None of these

7. What is the perimeter of an equilateral triangle whose area is $4\sqrt{3}$ cm^2?

(a) 4 cm (b) 3 cm (c) 12 cm
(d) 7 cm (e) None of these

8. The circumference of a circle whose area is 24.64 m^2 is

(a) 17.2 m (b) 17.4 m (c) 17.6 m
(d) 18.0 m (e) None of these

9. If the radius of a circle is decreased by 20%, then the percentage decrease in its area is?

(a) 26% (b) 32% (c) 36%
(d) 53% (e) None of these

10. If the perimeter of a semi-circular protractor is 36 cm, then its diameter is?
(a) 6 cm (b) 7 cm (c) 7.5 cm
(d) 14 cm (e) None of these

11. The ratio of the area of the incircle and circumcircle of a square are?
(a) 1 : 1 (b) 2 : 1 (c) 1 : 2
(d) 3 : 1 (e) None of these

12. The diagonal of a square field measures 50 m. The area of square field is?
(a) 1250 m^2 (b) 1200 m^2 (c) 1205 m^2
(d) 1025 m^2 (e) None of these

13. The circumference of a circle is 176 m. Then, its area is
(a) 2464 m^2 (b) 2164 cm^2 (c) 2346 cm^2
(d) 2246 cm^2 (e) None of these

14. In a circle of radius 42 cm, an arc subtends an angle of 72° at the centre. The length of the arc is?
(a) 52.8 cm (b) 53.8 cm (c) 72.8 cm
(d) 79.8 cm (e) None of these

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15. An isosceles right angle triangle has area 200 cm2. Then length of its hypotenuse is
(a) $15\sqrt{2}$ cm (b) $\frac{10}{\sqrt{2}}$ cm (c) $10\sqrt{2}$ cm
(d) $20\sqrt{2}$ cm (e) None of these

16. The least number of square slabs that can be fitted in a room of 10.5 m long and 3 m wide, is?
(a) 12 tiles (b) 13 tiles (c) 14 tiles
(d) 15 tiles (e) None of these

17. The length of a rectangle is 2 cm more than its breadth. The perimeter is 48 cm. The area of the rectangle (in cm2) is?
(a) 96 cm^2 (b) 128 cm^2 (c) 143 cm^2
(d) 144 cm^2 (e) None of these

18. The cost of levelling a rectangular ground at Rs. 1.25 per sq. metre is Rs. 900. If the length of the ground is 30 metres, then the width is?
(a) 330 metres (b) 34 metres (c) 24 metres
(d) 18 metres (e) None of these

19. The length of a rectangle is twice its breadth. If its length is decreased by 5 cm and breadth is increase by 5 cm, the area of the rectangle is increased by 75 cm^2. then the length of the rectangle is:
(a) 20 cm (b) 30 cm (c) 40 cm
(d) 50 cm (e) None of these

20. The dimensions of the floor of a rectangular hall are 4m × 3m. The floor of the hall is to be tiled fully with 8 cm × 6 cm rectangular is without breaking tiles to smaller size. The number of tiles required:
(a) 4800 (b) 2600 (c) 2500
(c) 2400 (e) None of these

21. The number of marble slabs of size 20 cm × 30 cm required to pave the floor of a square room of side 3 m, is:
(a) 150 (b) 100 (c) 25
(d) 225 (e) None of these

22. If the perimeter of a rectangular field is 200 m and its breadth is 40 m then its area is (in m^2):
(a) 1200 (b) 2400 (c) 4800
(d) 6000 (e) None of these

23. Find the area of a triangle in which base is 1.5 m and height is 75 cm?
(a) 5625 sq. cm. (b) 5265 sq. cm. (c) 5635 sq. cm
(d) 5525 sq. cm. (e) None of these

24. Find the area of a triangle in which each side measures 8 cm?
(a) $2\sqrt{3}$ sq. cm. (b) $8\sqrt{3}$ sq. cm. (c) $16\sqrt{3}$ sq. cm.
(d) $12\sqrt{3}$ sq. cm. (e) None of these

25. The perimeter of an isosceles triangle is equal to 14 cm; the lateral side and the base are in the ratio 5 to 4. The area in cm2 of the triangle is:

(a) $\frac{1}{2}\sqrt{21}$ (b) $\sqrt{21}$ (c) $\frac{3}{2}\sqrt{21}$

(d) $2\sqrt{21}$ (e) None of these

26. Height of an equilateral triangle is 6 cm. Find its side?

(a) 4 cm (b) $3\sqrt{3}$ cm (c) $4\sqrt{3}$ cm

(d) $5\sqrt{3}$ cm (e) None of these

27. Height of an equilateral triangle is 9 cm. Find its area?

(a) $27\sqrt{3}$ sq cm (b) $36\sqrt{3}$ sq cm (c) $54\sqrt{3}$ sq cm

(d) Data inadequate (e) None of these

28. Perimeter of a square and an equilateral triangle is equal. If the diagonal of the square is $12\sqrt{2}$ cm, then find the area of equilateral triangle?

(a) $64\sqrt{3}$ cm^2 (b) $32\sqrt{3}$ cm^2 (c) $16\sqrt{3}$ cm^2

(d) $128\sqrt{3}$ cm^2 (e) None of these

29. A lawn in the form of a rectangle has length twice its width. The area of the lawn is $\frac{2}{3}$ hectares. The length of lawn is:

(a) 100 m (b) $33\frac{1}{3}$ m (c) $66\frac{2}{3}$ m

(d) $\left(\frac{200}{\sqrt{3}}\right)$ m (e) None of these

30. Two roads XY and YZ of 15 metres and 20 metres length respectively are perpendicular to each other. What is the distance between X and Z by the shortest route?

(a) 35 metres (b) 30 metres (c) 24 metres

(d) 25 metres (e) None of these

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Moderate

1. The base of triangular field is three times its altitude. If the cost of cultivating the field at 50 per hectare be Rs. 675, then its base and height are?
   (a) 900 m and 300 m (b) 600 m and 300 m
   (c) 500 m and 200 m (d) Can't to be determined
   (e) None of these
2. The perimeter of a right triangle is 12 cm. The hypotenuse is 5 cm. The other two sides and area of the triangle are?
   (a) 3, 4 and 6 cm^2 (b) 4, 3 and 12 cm^2
   (c) 6, 2 and 6 cm^2 (d) Can't to be determined
   (e) None of these
3. The area of a ring whose outer and inner radii are respectively 20 cm and 15 cm is?
   (a) 440 cm^2 (b) 550 cm^2 (c) 565 cm^2
   (d) 675 cm^2 (e) None of these
4. The minute-hand of a clock is 14 cm long. The area covered by the minute hand in 30 min is?
   (a) 308 cm^2 (b) 312 cm^2 (c) 412 cm^2
   (d) 416 cm^2 (e) None of these
5. Two circle touch internally. The sum of their area is 116 π cm^2 and distance between their centre is 6 cm. Then, the radii of the circles are?
   (a) 4 cm and 9 cm (b) 5 cm and 10 cm (c) 4 cm and 8 cm
   (d) 4 cm and 10 cm (e) None of these
6. A bed of roses is like the figure given below. In the centre is a square and on each side there is a semi-circle. The side of the square is 21 m. If each rose plant needs 6m^2 of space, then the number of plants in the bed is?

(a) 190 plants (b) 199 plants (c) 201 plants
(d) 200 plants (e) None of these

7. If 'x' is the median of an equilateral triangle, then its area is?

(a) $\frac{x^2}{2}$ (b) x^2 (b) $\frac{\sqrt{3}x^2}{2}$

(d) $\frac{x^2}{\sqrt{3}}$ (e) None of these

8. A wire is in the form of a circle of radius 42 cm. It is bent into a square. The side of the square is?

(a) 33 cm (b) 66 cm (c) 78 cm
(d) 112 cm (e) None of these

9. How many times will a wheel of diameter 105 cm rotate in covering a distance of 330 m?

(a) 100 revolutions (b) 110 revolutions (c) 90 revolutions
(d) 105 revolutions (e) None of these

10. The length of a rectangle is increased by 60%. By what per cent would the width have to be decreased to maintain the same area?

(a) $37\frac{1}{2}\%$ (b) 60% (c) 75%

(d) 120% (e) None of these

11. If the length and breadth of a rectangular plot are increased by 50% and 20% respectively, then the new area is how many times the original area?

(a) $\frac{5}{9}$ (b) 10 (c) $\frac{9}{5}$

(d) $\frac{7}{9}$ (e) None of these

12. Two cubes each of 10 cm edge are joined end-to-end. Then, the surface area of the resulting cuboid is

(a) 100 cm^2 (b) 1000 cm^2 (c) 2000 cm^2
(d) 1500 cm^2 (e) None of these

13. The areas of three adjacent faces of a cuboid are x, y and z. If its volume is V, then which is true?
(a) $V = x^3 y^2 z^2$ (b) $V^2 = xyz$ (c) $V = \sqrt[3]{xyz}$
(d) $V = \frac{x^2 y}{z}$ (e) None of these

14. The volume of a cylinder is 448 π cm^3 and height 7 cm. Then, its lateral surface area and total surface area are?
(a) 349 cm^2 and 753.286 cm^2
(b) 352 cm^2 and 754.286 cm^2
(c) 353 cm^2 and 755.286 cm^2
(d) 351 cm^2 and 754.682 cm^2
(e) None of these

15. The radius and vertical height of a cone are 5 cm and 12 cm, respectively. Then its lateral surface area is?
(a) 202 cm^2 (b) 203.1 cm^2 (c) 204 cm^2
(d) 204.3 cm^2 (e) None of these

16. Given that the volume of a metal sphere is 38808 cm^3. Then, its radius and its surface area are?
(a) 7 cm and 616 cm^2 (b) 21 cm and 5544 cm^2
(c) 14 cm and 2464 cm^2 (d) 28 cm and 5555 cm^2 (e) None of these

17. The volume of two hemisphere in the ratio 8 : 27. What is the ratio of their radii?
(a) 2 : 3 (b) 3 : 2 (c) 1 : 2
(d) 2 : 1 (e) None of these

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18. A copper sphere of diameter 18 cm is drawn into a wire of diameter 40 mm. Then, the length of the wire is?
(a) 243 cm (b) 343 cm (c) 443 cm
(d) 972 cm (e) None of these

19. Each edge of a cube is increased by 50%. Then, the percentage increase in its surface area is?
(a) 125% (b) 150% (c) 175%
(d) 180% (e) None of these

20. How many bricks each measuring 25 cm × 15 cm × 8 cm will be required to build a wall 10 m × 4 dm × 5 m when $\frac{1}{10}$ of its volume is occupied by mortar?
(a) 5000 (b) 5500 (c) 6000
(d) 6500 (e) None of these

21. An equilateral triangle is cut up into smaller equilateral triangles with side 1/6 of the original. Find the number of triangles thus formed?
(a) 216 (b) 6 (c) 36
(d) 3 (e) Can't say

22. A square sheet of paper is converted into a cylinder by rolling it along its length. What is the ratio of the base radius of cylinder to the side of the square?
(a) $7\sqrt{2} : 22$ (b) 7 : 22 (c) 7 : 44
(d) 22 : 7 (e) None of these

23. A wire when bent in the form of a circle encloses an area of 1386 sq cm. What will be the enclosed area when the same wire is bent into the form of an equilateral triangle?
(a) $484\sqrt{3}$ cm^2 (b) $616\sqrt{3}$ cm^2 (c) $308\sqrt{3}$ cm^2
(d) 512 cm^2 (e) None of these

24. The surface area of a spherical part of a bowl with a flat circular detachable cover, excluding the cover, is 616 sq cm. The area of the cover is 38.5 sq cm. What is the volume of the bowl?
(a) 1339 cm^3 (b) 1430 cm^3 (c) 1570 cm^3
(d) Cannot be determined (e) None of these

25. A hemispherical bowl of internal diameter 54 cm contains a liquid. The liquid is to be filled in cylindrical bottles of radius 3 cm and height 9 cm. How many bottles are required to empty the bowl?
(a) 221 (b) 343 (c) 81
(d) 243 (e) None of these

26. If half the diagonal of square is 5 cm, then the area of the square is:
(a) $20\sqrt{2}$ cm^2 (b) 25 cm^2 (c) 50 cm^2
(d) 100 cm^2 (e) None of these

27. If the side of a square be increased by 50%, the percent increase in area is:
(a) 50 (b) 100 (c) 125
(d) 150 (e) None of these

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28. The ratio of the area of a square to that of the square drawn on its diagonal is:
(a) 1 : 1 (b) 1 : 2 (c) 1 : 3
(d) 1 : 4 (e) None of these

29. The diameter of a circle circumscribing a square is 10cm. Its sides will be:
(a) 5 cm (b) $5\sqrt{2}$ cm (c) 10 cm
(d) $10\sqrt{2}$ cm (e) None of these

30. If a square is inscribed in a circle, the ratio of the area of the circle and the square is:
(a) 2 : 1 (b) π : 2 (c) π : 1
(d) 11 : 7 (e) None of these

Difficult

1. Find the number of bricks, each measuring 25 cm × 12.5 cm × 7.5 cm, required to construct a wall 12 m long, 5 m high and 0.25 m thick, while the sand and cement mixture occupies 5 % of the total volume of wall?
   (a) 6080 (b) 3040 (c) 1520
   (d) 12160 (e) 9200
2. In a swimming pool measuring 90 m by 40 m, 150 men take a dip. If the average displacement of water by a man is 8 cubic metres, what will be rise in water level?
   (a) 30 cm (b) 50 cm (c) 20 cm
   (d) 25 cm (e) 33.33 cm
3. A hollow spherical shell is made of a metal of density 4.9 g / cm^3. If its internal and external radii are 10 cm and 12 cm respectively, find the weight of the shell. (Take π = 3.1416)
   (a) 5016 gm (b) 1416.8 gm (c) 14942.28 gm
   (d) 5667.1 gm (e) None of these
4. The dimensions of a field are 20 m by 9 m. A pit 10 m long, 4.5 m wide and 3 m deep is dug in one corner of the field and the earth removed has been evenly spread over the remaining area of the field. What will be the rise in the height of field as a result of this operation?
   (a) 1.5 m (b) 2 m (c) 3 m
   (d) 4 m (e) 1m
5. If the curved surface area of a cone is thrice that of another cone and slant height of the second cone is thrice that of the first, find the ratio of the area of their base.
   (a) 81 : 1 (b) 9 : 1 (c) 3 : 1
   (d) 27 : 1 (e) 11 : 1
6. Find the area of the shaded region if the radius of each of the circles is 1 cm.

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(a) $2-\frac{\pi}{3}$ (b) $\sqrt{3}-\pi$ (c) $\sqrt{3}-\frac{\pi}{2}$

(d) $\sqrt{3}-\frac{\pi}{4}$ (e) None of these

7. Three equal cubes are placed adjacently in a row. Find the ratio of total surface area of the new cuboid to that of the sum of the surface areas of the three cubes?

(a) 7 : 9 (b) 49 : 81 (c) 9 : 7

(d) 27 : 23 (e) None of these

8. The radius of a right circular cylinder is increased by 50%. Find the percentage increase in volume?

(a) 120% (b) 75% (c) 150%

(d) 130% (e) 125%

9. Water flows out at the rate of 10 m/min from a cylindrical pipe of diameter 5 mm. Find the time taken to fill a conical tank whose diameter at the surface is 40 cm and depth 24 cm?

(a) 50 min (b) 102.4 min (c) 51.2 min

(d) 25.6 min (e) 60 min

10. Find the perimeter and area of the shaded portion of the adjoining diagram:

(a) 90.8 cm, 414 cm^2 (b) 181.6 cm, 423.7 cm^2
(c) 90.8 cm, 827.4 cm^2 (d) 181.6 cm, 827.4 cm^2
(e) None of these

11. A cylindrical container whose diameter is 12 cm and height is 15 cm, is filled with ice cream. The whole ice-cream is distributed to 10 children in equal cones having hemispherical tops. If the height of the conical portion is twice the diameter of its base, find the diameter of the ice-cream cone?
(a) 6 cm (b) 12 cm (c) 3 cm
(d) 18 cm (e) 15 cm

12. A tank 4 m long and 2.5 m wide and 6 m deep is dug in a field 10 m long and 9 m wide. If the earth dugout is evenly spread over the field, the rise in level of the field will be:
(a) 80 cm (b) 75 cm (c) 60 cm
(d) 30 cm (e) None of these

13. An open box is made of wood 2 cm thick. Its internal length is 86 cm, breadth 46 cm and height is 38 cm. The cost of painting the outer surface of the box at Rs. 10 per m^2 is?
(a) Rs. 18.5 (b) Rs. 8.65 (c) Rs. 11.65
(d) Rs. 17.50 (e) None of these

14. A rectangular tin sheet is 22 m long and 8 m broad. It is rolled along its length to form a cylinder by making the opposite edges just to touch each other. The volume of the cylinder (in m^3) is:
(a) 385 (b) 204 (c) 280 π
(d) 308 (e) None of these

15. What is the area of the shaded portion if each side of the square measures 21 cm?

(a) 86.5 cm^2 (b) 102 cm^2 (c) 94.5 cm^2
(d) 81.5 cm^2 (e) None of these

16. A circle is inscribed in an equilateral triangle of side 8 cm. The area of the portion between the triangle and the circle is?
(a) 11 cm^2 (b) 10.95 cm^2 (c) 10 cm^2
(d) 10.50 cm^2 (e) None of these

17. Mid-points of a triangle containing sides 12 cm, 18 cm and 26 cm are joined to each-other. Find the area of triangle formed by joining the mid-points?
(a) $4\sqrt{5}$ cm^2 (b) $2\sqrt{7}$ cm^2 (c) $4\sqrt{35}$ cm^2
(d) $8\sqrt{35}$ cm^2 (e) None of these

18. An oblong piece of ground measures 19 meters 2.5 dm by 12 metres 5 dm. From the centre of each side a path 2 meters wide goes across to the centre of the opposite side. Find the cost of paving these paths at the rate of Rs. 12.32. per sq meter.
(a) Rs. 7430.68 (b) Rs. 713.04 (c) Rs. 753.26
(d) Rs. 733.04 (e) None of these

19. In the given figure, OP = PQ = 14 cm and semicircles are drawn on OP, PQ and OQ as diameters. Then, the perimeter of the shaded area is:

(a) 88 cm (b) 176 cm (c) 264 cm
(d) 352 cm (e) None of these

20. The circumference of a circular field is 440 m. A circular path of 10 metre width runs around the outside of the field. Find the cost of gravelling the path at the rate of 70 paise per square metre?
(a) Rs. 2200 (b) Rs. 3300 (c) Rs. 264
(d) Can't to be determined (e) None of these

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Previous Year (Memory Based)

1. A rectangular field costs Rs. 110 for levelling at 50 paise per square metre. If the ratio of length : breadth is 11 : 5. Find the length of the field:
   (a) 16 m (b) 21 m (c) 22 m
   (d) 23 (e) None of these
2. The length of a rectangular plot of ground is four times its breadth and its area is 4 hectares. How long will it take to a dog to walk round it at the rate of 3 km/hr?
   (a) 12 min (b) 20 min (c) 21 min
   (d) 18.5 min (e) None of these
3. A rectangular garden 63 m long and 54 m broad has a path 3 m wide inside it. Find the cost of paving the path at Rs. 37/2 per square metre:
   (a) Rs. 12321 (b) Rs. 11100 (c) Rs. 74000
   (d) Rs. 12301 (e) None of these
4. A drawing room is 7.5 m long 6.5 m broad and 6 m high. Find the length of paper 2.5 dm wide to cover its walls allowing 8 sq. m for doors:
   (a) 368 m (b) 640 m (c) 625 m
   (d) 888 m (e) None of these
5. The area of a rectangular foot ball field is 24200 sq. m. It is half broad as it is long. What is the approx minimum distance a man will cover if he wishes to go from one corner to the opposite one?
   (a) 283 m (b) 246 m (c) 576 m
   (d) 289 m (e) None of these
6. How many cubes of edge 3 cm can be cut out of a wooden cube of edge 9 cm?
   (a) 216 (b) 81 (c) 27
   (d) Can't be determined (e) None of these
7. A sphere of 30 cm radius is dropped into a cylindrical vessel of 80 cm diameter, which is partly filled with water, then its level rises by x cm, find x:

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(a) 27.5 cm (b) 22.5 cm (c) 18.5 cm
(d) 21.5 cm (e) None of these

8. Around a circular garden a circular road is to be repaired which costs Rs. 22176 at the rate of Rs. 1 per sq. m. If the inner radius is 112 m, find the width of the circular road:
(a) 18 m (b) 28 m (c) 14 m
(d) 26 m (e) None of these

9. In the adjacent figure, find the area of the shaded region. (Use=22/7)

(a) 15.28 cm^2 (b) 61.14 cm^2 (c) 30.57 cm^2
(d) 40.76 cm^2 (e) None of these

10. A wire is looped in the form of a circle of radius 28 cm. It is bent again into a square form. What will be the length of the diagonal of the largest square possible thus?
(a) 44 cm (b) $44\sqrt{2}$ (c) $176/2\sqrt{2}$
(d) $88\sqrt{2}$ (e) None of these

11. In a right angled triangle, find the hypotenuse if base and perpendicular are respectively 36015 cm and 48020 cm?
(a) 69125 cm (b) 60025 cm (c) 391025 cm
(d) 60125 cm (e) None of these

12. The perimeter of an equilateral triangle is $72\sqrt{3}$ cm. Find its height?
(a) 63 metres (b) 24 metres (c) 18 metres
(d) 36 metres (e) 32 metres

13. The inner circumference of a circular track is 440 cm. The track is 14 cm wide. Find the diameter of the outer circle of the track?
(a) 84 cm (b) 168 cm (c) 336 cm
(d) 77 cm (e) 80 cm

14. The volume of a cube is 216 cm^3. Part of this cube is then melted to form a cylinder of length 8 cm. Find the volume of the cylinder?
(a) 342 cm^3 (b) 216 cm^3 (c) 36 cm^3
(d) 156 cm^3 (e) Data inadequate

15. Three metal cubes with edges 6 cm, 8 cm and 10 cm respectively are melted together and formed into a single cube. Find the side of the resulting cube?
(a) 11 cm (b) 12 cm (c) 13 cm
(d) 24 cm (e) 20 cm

16. Find curved and total surface area of a conical flask of radius 6 cm and height 8 cm?
(a) 60π, 96π (b) 20π, 96π (c) 60π, 48π
(d) 30π, 48π (e) None of these

17. A silver wire when bent in the form of a square, encloses an area of 484 cm^2. Now if the same wire is bent to form a circle, the area enclosed by circle would be?
(a) 308 cm^2 (b) 196 cm^2 (c) 616 cm^2
(d) 88 cm^2 (e) 96 cm^2

18. How many metres of cloth 5 m wide will be required to make a conical tent, the radius of whose base is 7 m and height is 24 m?
(a) 55 m (b) 330 m (c) 220 m
(d) 120 m (e) 110 m

19. Seven equal cubes each of side 5 cm are joined end to end. Find the surface area of the resulting cuboid?
(a) 750 cm^2 (b) 1500 cm^2 (c) 2250 cm^2
(d) 700 cm^2 (e) 800 cm^2

20. A cuboid of dimension 24 cm × 9 cm × 8 cm is melted and smaller cubes are of side 3 cm is formed. Find how many such cubes can be formed?

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(a) 27 (b) 64 (c) 54
(d) 32 (e) 36

21. The largest cone is formed at the base of a cube of side measuring 7 cm. Find the ratio of volume of cone to cube?
(a) 20 : 21 (b) 22 : 21 (c) 21 : 22
(d) 42 : 11 (e) 11 : 42

22. The whole surface of a rectangular block is 8788 square cm. If length, breadth and height are in the ratio of 4 : 3 : 2, find length?
(a) 26 cm (b) 52 cm (c) 104 cm
(d) 13 cm (e) 16 cm

23. In a shower, 10 cm of rain falls. What will be the volume of water that falls on 1 hectare area of ground?
(a) 500 m^3 (b) 650 m^3 (c) 1000 m^3
(d) 750 m^3 (e) 800 cm^3

24. A steel sphere of radius 4 cm is drawn into a wire of diameter 4 mm. Find the length of wire?
(a) 10,665 mm (b) 42,660 mm (c) 21,333 mm
(d) 14,220 mm (e) None of these

25. A vessel is in the form of a hollow cylinder mounted on a hemispherical bowl. The diameter of the sphere is 14 cm and the total height of the vessel is 13 cm. Find the capacity of the vessel? (Take $\pi = 22/7$)

(a) 321.33 cm^3 (b) 1642.67 cm^3 (c) 1232 cm^3
(d) 1632.33 cm^3 (e) None of these

26. In the given figure, circle P has diameter 2 m and circle Q has diameter 1 m. Find the area of the shaded region?

(a) $\frac{3}{4}\pi$ (b) $\frac{3}{7}\pi$ (c) $\frac{3}{5}\pi$
(d) 4π (e) None of these

27. In the given figure, QRST is a square. If the area of each circle is 2π, then find the area of square QRST?

(a) $\sqrt{4}\pi^2$ (b) $\sqrt{4}\pi$ (c) 32
(d) 16 (e) None of these

28. In given figure, y is both the radius of the larger circle and the diameter of the smaller circle. Find the area of shaded region?

(a) $\frac{3}{7}\pi y^2$ (b) $\frac{3}{4}\pi y^2$ (c) $\frac{1}{4}\pi y^2$

(d) $\frac{1}{3}\pi y^2$ (e) None of these

29. In the given figure, if O is the centre of the circle, then find the value of y?

(a) 78° (b) 77° (c) 76°
(d) 75° (e) None of these

30. The length of a rectangular plot is thrice of its breadth. If the area of the rectangular plot is 7803 sq m, what is the breadth of the rectangular plot?
(a) 51 m (b) 153 m (c) 104 m
(d) 88 m (e) None of these

31. The ratio of length and breadth of a rectangular plot is 8 : 5 respectively. If the breadth is 60 m less than the length, what is the perimeter of the rectangular plot?
(a) 260 m (b) 1600 m (c) 500 m
(d) Cannot be determined (e) None of these

32. Length of a rectangle is twice of its breadth. Area of the rectangle is 18 m^2. What would be its perimeter?
(a) 9 m (b) 18 m (c) 25 m
(d) 28 m (e) None of these

33. The length of a rectangular floor is twice of its breadth. If Rs. 256 is required to paint the floor at the rate of Rs. 2 per square meters, then what would be the length of floor?

(a) 16 m (b) 8 m (c) 12 m
(d) 31 m (e) 20 m

34. The perimeter of a square is double the perimeter of a rectangle. The area of the rectangle is 240 sq cm. What is the area of the square?
(a) 100 sq cm (b) 36 sq cm (c) 81 sq cm
(d) Cannot be determined (e) None of these

35. What will be the area of a circle with circumference equal to 88 cm?
(a) 154 sq cm (b) 44 sq cm (c) 616 sq cm
(d) Cannot be determined (e) None of these

36. What will be the area of a circle with circumference equal to 22 cm?
(a) 41.2 sq cm (b) 26.4 sq cm (c) 38.5 sq cm
(d) Cannot be determined (e) None of these

37. The circumference of two circles is 132 m and 176 m respectively. What is the difference between the area of the larger circle and the smaller circle?
(a) 1048 sq m (b) 1076 sq m (c) 1078 sq m
(d) 1090 sq m (e) None of these

38. Cost of fencing a circular plot at the rate of Rs. 15 per m is Rs. 3300. What will be the cost of flooring the plot at the rate of Rs. 100 per square metre?
(a) Rs. 385000 (b) Rs. 220000 (c) Rs. 350000
(d) Cannot be determined (e) None of these

39. The perimeter of a square is equal to twice the perimeter of a rectangle of length 8 cm and breadth 7 cm. What is the circumference of a semicircle whose diameter is equal to the side of the square? (rounded off to the two decimal place)
(a) 38.57 cm (b) 23.57 cm (c) 41.46 cm
(d) 47.47 cm (e) None of these

40. The breadth of a rectangular plot is 75% of its length. It the perimeter of the plot be 1050 m, what is its area?
(a) 12500 (b) 57500 (c) 62500
(d) 67500 (e) None of these

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Foundation

1. (b); Breadth $= \frac{\text{Area}}{\text{length}} = \frac{180}{18} = 10$ m

$\therefore$ Perimeter = 2(length + breadth) = 2(18 + 10)
= 56 m

2. (c); Let side of square = x cm
Side of another square = (x + 4) cm

$\therefore$ $x^2 + (x + 4)^2 = 400$
$x^2 + x^2 + 16 + 8x = 400$
$2x^2 + 8x - 384 = 0 \Rightarrow x^2 + 4x - 192 = 0$
$x^2 + 16x - 12x - 192 = 0$
$x(x + 16) - 12(x + 16) = 0$
$(x - 12)(x + 16) = 0$

$\therefore$ x = 12 (– 16 not possible)

$\therefore$ side of one square = 12 cm
side of another square = 16 cm

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3. (c); Given,

Area of the floor = 960 m^2
Area of one carpet = 6 × 4 = 24 m^2

$\therefore$ No. of carpet required $= \frac{\text{Area of floor}}{\text{Area of one carpet}}$

$= \frac{960}{24} = 40$

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4. (b); Length of the outer rectangle = 60 m

Breadth of the outer rectangle = 40 m

∴ Area = 60 × 40 = 2400 m^2.

Width of path = 1 m

Length of the inner rectangle = 60 m – (1 + 1) m

= 58 m

Breadth of the inner rectangle = 40 – 2 = 38 m

∴ Area = 58 × 38 = 2204 m^2

Area of path

= [Area of outer rectangle] – [Area of inner rectangle]

= 2400 – 2204 = 196 m^2

5. (a); Area of parallelogram,

ABCD = (Area of ΔABD + Area of ΔBDC)

= 2 (Area of ΔABD)

$= 2 \times \frac{1}{2} \times 3 \times 4 = 12\ cm^2$

6. (b); Here, $s = \frac{9+12+15}{2} = 18$ cm

$$\text{Area} = \sqrt{s(s-a)(s-b)(s-c)}$$

$$= \sqrt{18(18-9)(18-12)(18-15)}$$

$$= \sqrt{18 \times 9 \times 6 \times 3} = 54\ cm^2$$

7. (c); By formula

$$\text{Area} = \frac{\sqrt{3}}{4} \times (\text{side})^2 \Rightarrow \frac{\sqrt{3}}{4} \times (\text{side})^2 = 4\sqrt{3}$$

$(\text{side})^2 = 16 \Rightarrow \text{side} = 4 \text{ cm}$

$\therefore$ perimeter = 3 × side = 3 × 4 = 12 cm

8. (c); Let, the radius of the circle = r m

$\therefore \pi r^2 = 24.64$

$$\frac{22}{7} \times r^2 = 24.64 \Rightarrow r^2 = \frac{7 \times 24.64}{22}$$

$$r = \sqrt{\frac{7 \times 24.64}{22}} = 2.8$$

Thus, circumference = $2\pi r$

$$= 2 \times \frac{22}{7} \times 2.8 = 17.6 \text{ m}$$

9. (c); Let initial radius of circle = r

Now new radius = 80% of r $= r \times \frac{80}{100} = \frac{4r}{5}$

initial area = πr^2

$$\text{New area} = \pi\left(\frac{4r}{5}\right)^2 = \frac{16}{25}\pi r^2$$

$$\text{Decrease in Area} = \left(\pi r^2 - \frac{16}{25}\pi r^2\right) = \frac{9}{25}\pi r^2$$

$$\therefore \text{percentage decrease} = \frac{\frac{9}{25}\pi r^2}{\pi r^2} \times 100$$

$$= \frac{9}{25} \times 100 = 9 \times 4 = 36\%$$

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Shortcut:

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

$$= -20 - 20 + \frac{(-20)(-20)}{100}$$

$= -40 + 4 = -36\%$ (–ve sign show % decrease)

10. (d); Let the radius of the protractor = r cm

perimeter = $(\pi r + 2r) = (\pi + 2)r = 36$

$\therefore \quad \frac{36}{7} r = 36 \Rightarrow r = 7$ cm

$\therefore$ diameter of the protractor = $2 \times 7 = 14$ cm

11. (c); Let side of square = x

Diagonal = $\sqrt{2}x$

Radius of incircle $= \frac{x}{2}$

Radius of circumcircle $= \frac{\sqrt{2}x}{2} = \frac{x}{\sqrt{2}}$

Required Ratio $= \left(\frac{\pi x^2}{4} : \frac{\pi x^2}{2}\right) = 2 : 4 = 1 : 2$

12. (a); Given diagonal of square = 50 m

$\sqrt{2} \times$ side = 50 $\Rightarrow$ side = $\frac{50}{\sqrt{2}}$

Area = side^2 $= \left(\frac{50}{\sqrt{2}}\right)^2 = \frac{2500}{2} = 1250$ m^2

13. (a); Given, circumference $(2\pi r) = 176$

$r = \frac{176}{2 \times 22} \times 7 \Rightarrow r = \frac{8 \times 7}{2} \Rightarrow r = 28$ m

Area = $\pi r^2 = \frac{22}{7} \times 28 \times 28 = 2464$ m^2

14. (a); Length of the arc = $2\pi r \times \frac{\theta}{360}$

$= 2\pi \times 42 \times \frac{72}{360} = 2 \times \frac{22}{7} \times 42 \times \frac{72}{360}$ = 52.8 cm

15. (d); Area of isosceles triangle with side (a) = $\frac{1}{2}a^2$

$\therefore$ $200 = \frac{1}{2}a^2 \Rightarrow a^2 = 400 \Rightarrow a = 20$ cm

$\therefore$ Hypotenuse $= \sqrt{a^2 + a^2} = \sqrt{2}.a$

$= \sqrt{2} \times 20 = 20\sqrt{2}$ cm

16. (c); Side of greatest square tile
= GCM of length and breadth of the room
= GCM of 10.5 and 3 = 1.5 cm
Area of room = 10.5 × 3 m

No. of tiles needed $= \frac{10.5 \times 3}{1.5 \times 1.5} = \frac{10.5 \times 3}{2.25}$ = 14 tiles

17. (c); Let breadth = x cm
$\therefore$ length = (x + 2) cm
$\therefore$ 2 (x + x + 2) = 48 $\Rightarrow$ 2(2x + 2) = 48
2x + 2 = 24 $\Rightarrow$ 2x = 22 $\Rightarrow$ x = 11 cm
$\therefore$ Area = 11 × (11 + 2) = 11 × 13 = 143 cm^2

18. (c); Area of ground $= \frac{900}{1.25}$ = 720 m^2

$\therefore$ length × width = 720 $\Rightarrow$ width $= \frac{720}{30}$ = 24 m

19. (c); Let breadth = x $\Rightarrow$ length = 2x
Area = x × 2x = $2x^2$

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New length = (2x – 5) cm

New breadth = (x + 5) cm

∴ New Area = (2x – 5) (x + 5)

∴ $(2x - 5)(x + 5) = 2x^2 + 75$

$2x^2 + 10x - 5x - 25 = 2x^2 + 75$

$5x = 100 \Rightarrow x = 20$ cm

∴ length = 2 × 20 = 40 cm

20. (c); Area of wall = 4m × 3m = 12 m^2

= 12 × 10000 cm^2

Area of tile = 8 cm × 6 cm = 48 cm

∴ No. of tiles required $= \frac{12 \times 10000}{48} = 2500$

21. (a); Area of square room = 3 m × 3 m = 9 m^2

= 9 × 10000 cm^2

Area of marble slab = 20 × 30 = 600 cm^2

No. of marble slabs required $= \frac{9 \times 10000}{600} = 150$

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22. (b); Given, perimeter of rectangle = 200

$2(l + b) = 200 \Rightarrow l + b = 100 \Rightarrow l = 100 - b$

$l = 100 - 40 \Rightarrow l = 60$ m $\Rightarrow$ Area = lb

= 40 × 60 = 2400 m^2

23. (a); Area $= \frac{1}{2} \times \text{base} \times \text{height} = \frac{1}{2}(1.5) \times 100 \times 75$

= 75 × 75 = 5625 cm^2

24. (c); Area of equilateral triangle $= \frac{\sqrt{3}}{4} \times \text{side}^2 = \frac{\sqrt{3}}{4} \times 8^2 = 16\sqrt{3}$ cm^2

25. (d); Let lateral side = 5x, and base = 4x

∴ primeter = 5x + 5x + 4x = 14x

$14x = 14 \Rightarrow x = 1$ So, the sides are 5 cm, 5cm and 4 cm

Now, $s = \frac{1}{2}(5 + 5 + 4) = 7$cm

Area = $\sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{7 \times 2 \times 2 \times 3} = 2\sqrt{21}\,cm^2$

26. (c); Let side = x cm

$$x^2 = 6^2 + \left(\frac{x}{2}\right)^2 \Rightarrow x^2 - \frac{x^2}{4} = 36 \Rightarrow 3x^2 = 144$$

$$x^2 = \frac{144}{3} \Rightarrow x = \frac{12}{\sqrt{3}} \Rightarrow x = 4\sqrt{3}\text{ cm}$$

Shortcut:

$$\text{Altitude} = \frac{\sqrt{3}}{2} \times \text{side}$$

$$\text{Side} = \frac{2 \times \text{Altitude}}{\sqrt{3}} = \frac{2 \times 6}{\sqrt{3}} = 4\sqrt{3}\text{ cm}$$

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27. (a); $\text{side} = \frac{2 \times \text{Altitude}}{\sqrt{3}} = \frac{2 \times 9}{\sqrt{3}} = 6\sqrt{3}\text{ cm}$

$$\text{Area} = \frac{\sqrt{3}}{4} \times (\text{side})^2 = \frac{\sqrt{3}}{4} \times \left(6\sqrt{3}\right)^2 = \frac{\sqrt{3}}{4} \times 36 \times 3$$

$$= 27\sqrt{3}\text{ cm}^2$$

28. (a); For square, diagonal = $\sqrt{2} \times$ side

$12\sqrt{2} = \sqrt{3} \times \text{side} \Rightarrow$ side (x) = 12 cm

perimeter = 4x = 48 cm

perimeter of triangle = 48 cm

side of triangle = $\frac{48}{3}$ = 16 cm

$$\text{Required Area} = \frac{\sqrt{3}}{4} \times (\text{side})^2 = \frac{\sqrt{3}}{4} \times 16 \times 16$$

$$= 64\sqrt{3}\text{ cm}^2$$

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29. (d); Let length = x $\Rightarrow$ breadth $= \frac{x}{2}$

$$\text{Area} = \frac{2}{3} \times 10000 \text{ m}^2 \Rightarrow x \times \frac{x}{2} = \frac{2}{3} \times 10000$$

$$x^2 = \frac{4}{3} \times 10000 \Rightarrow x = \frac{200}{\sqrt{3}}, \quad \text{length} = \frac{200}{\sqrt{3}} \text{m}$$

30. (d);

Shortest route between x and z $= \sqrt{15^2 + 20^2}$

$= \sqrt{400 + 225} = \sqrt{625}$ = 25 m

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Moderate

1. (a); $\text{Area} = \frac{\text{Total cost}}{\text{Rate}} = \frac{675}{50}$ = 13.5 hectares

= 13.5 × (10000) m^2 = 135000 m^2

Let Altitude = x m

$\therefore$ base = 3x m $\Rightarrow$ $\text{Area} = \frac{1}{2} \times \text{base} \times \text{altitude}$

$$= \frac{1}{2} \times 3x \times x \Rightarrow \frac{3x^2}{2} = 135000$$

$x^2 = 90000 \Rightarrow x = 300$

Base = 3x = 900 m, Altitude = x = 300 m

2. (a);

Perimeter = 12 cm, a + b + 5 = 12, a + b = 7 cm

Also, $a^2 + b^2 = 25$

$(a + b)^2 + (a - b)^2 = 2(a^2 + b^2)$

$(a - b)^2 = 2(a^2 + b^2) - (a + b)^2$

$2(25) - (7)^2 = 50 - 49 = 1 \Rightarrow a - b = \pm 1$

$\therefore$ a + b = 7 and a – b = 1 or a – b = –1

$\Rightarrow$ a = 4 cm and b = 3 cm

or a = 3 cm and b = 4 cm

Area of triangle $= \frac{1}{2} \times a \times b = \frac{1}{2} \times 3 \times 4 = 6\ cm^2$

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3. (b); Radius of outer circle (R) = 20 cm

Radius of inner circle (r) = 15 cm

$\therefore$ Area of ring

= (Area of outer circle – Area of inner circle)

$= \pi R^2 - \pi r^2 = \pi(R^2 - r^2) = \frac{22}{7}(20^2 - 15^2)$

$= \frac{22}{7}(20 + 15)(20 - 15) = \frac{22}{7}(35)(5) = 25 \times 22$

$= 550\ cm^2$

4. (a); Angle covered by the minute hand in 60 min = 360°

Angle covered by the minute hand in 30 min = 180 °

$\therefore$ $\theta = 180°$, r = 14 cm

Required area = $\pi r^2 \times \frac{\theta}{360}$

$= \frac{180}{360} \times \frac{22}{7} \times 14 \times 14 = \frac{1}{2} \times \frac{22}{7} \times 14 \times 14 = 308\ cm^2$

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5. (d); Let the radius of inner circle = r

Let the radius of outer circle =R

$\therefore$ $\pi R^2 + \pi r^2 = 116\pi \Rightarrow R^2 + r^2 = 116$

distance between their centre = 6 cm

R – r = 6 cm

$\therefore$ $(R + r)^2 + (R - r)^2 = 2(R^2 + r^2)$

$(R + r)^2 = 2(116) - 36 = 196$

$R + r = 14 \Rightarrow R - r = 6$

$\therefore$ R = 10 cm, r = 4 cm

6. (e); Given

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Side of square = 21 m

$\therefore$ Radius of each semi-circle $= \frac{21}{2} = 10.5$ m

$\therefore$ Area = $(21 \times 21) + 4 \times \frac{1}{2} \times \frac{22}{7} \times 10.5 \times 10.5$

$= 441 + 693 = 1134\ m^2$

Area of one rose plant = 6 m^2

No. of required Rose plant = $\frac{1134}{6} = 189$

7. (d);

$$\text{Altitude} = \frac{\sqrt{3}}{2} \times (\text{side}) \quad \Rightarrow \quad x = \frac{\sqrt{3}}{2} \times \text{side}$$

$$\text{side} = \frac{2x}{\sqrt{3}} \quad \Rightarrow \quad \text{Area} = \frac{\sqrt{3}}{4} \times (\text{side})^2$$

$$= \frac{\sqrt{3}}{4} \times \frac{4x^2}{3} = \frac{x^2}{\sqrt{3}}$$

8. (b); Circumference of circle = $2\pi r = 2 \times \frac{22}{7} \times 42$

= 264 cm

length of wire = 264 cm

∴ perimeter of square = 264

∴ side of square $= \frac{264}{4}$ = 66 cm

9. (a); Circumference of wheel = $2\pi r = \pi \times d$

$$= \frac{22}{7} \times 105 = 330 \text{ cm}$$

Distance covered in 1 revolution = 330 cm

As 330 m = 330 × 100 cm

∴ No. of revolution required $= \frac{33000}{330}$ = 100

10. (a); Let length = l, breadth = b

∴ New length = l + $\frac{60}{100} \times l = \frac{8l}{5}$

New breadth = a $\Rightarrow$ $lb = \frac{8l}{5} \times a \Rightarrow a = \frac{5b}{8}$

$$\text{Decrease percent} = \frac{\left(b - \frac{5b}{8}\right)}{b} \times 100 = \frac{3}{8} \times 100 = 37\frac{1}{2}\%$$

11. (c); Let length = x and the breadth = y

Original Area = xy

New length = 150 % of x $= \frac{3x}{2}$

New breadth = 120% of y $= \frac{6y}{5}$

New Area = $\frac{3x}{2} \times \frac{6y}{5} = \frac{9}{5}xy = \frac{9}{5}$(Original Area)

12. (b); Length of resulting cuboid = 10 + 10 = 20 cm

Breadth = 10 cm, Height = 10 cm

Surface Area = 2(lb + bh + hl)

= 2 (20 × 10 + 10 × 10 + 20 × 10)

= 2(200 + 100 + 200) = 1000 cm^2

13. (b); Let the dimensions be l, b, h then

Volume (V) = lbh

x = lb, y = bh, z = hl $\Rightarrow$ V = lbh

$V^2 = l^2 b^2 h^2 = (lb)(bh)(hl) \Rightarrow V^2 = xyz$

14. (b); Volume = 448π cm^3 $\Rightarrow$ Height = 7 cm

Let radius = r cm $\Rightarrow$ $\pi r^2 h = 448\pi$

$r^2 = \frac{448}{h} = \frac{448}{7} = 64 \Rightarrow r = 8$ cm

Leteral Surface Area = $2\pi rh$

$= 2 \times \frac{22}{7} \times 8 \times 7 = 352$ cm^2

Total surface Area = $2\pi rh + \pi r^2 = 2\pi r(h + r)$

$= 2 \times \frac{22}{7} \times 8 \times (7 + 8)$

$= \frac{5280}{7} = 754.286$ cm^2

15. (d); Radius (r) = 5 cm $\Rightarrow$ Height (h) = 12 cm

Slant height (l)= $\sqrt{h^2+r^2} = \sqrt{5^2+12^2} = \sqrt{169}$

= 13 cm

Lateral / Curved Surface Area = πrl

$= \frac{22}{7} \times 5 \times 13 = \frac{1430}{7}$ = 204.3 cm^2

16. (b); Volume of sphere = 38808 cm^3

$\frac{4}{3}\pi r^3 = 38808$

$r^3 = 38808 \times \frac{3}{4} \times \frac{7}{22} = 9261 \Rightarrow r = 21$ cm

Surface Area of sphere = $4\pi r^2 = 4 \times \frac{22}{7} \times 21 \times 21$

= 5544 cm^2

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17. (a); Let volumes be V_1 and V_2

$V_1 : V_2 = 8 : 27 \Rightarrow \frac{2}{3}\pi r_1^3 : \frac{2}{3}\pi r_2^3 = 8 : 27$

$r_1^3 : r_2^3 = 8 : 27 \Rightarrow r_1 : r_2 = 2 : 3$

18. (a); Let length of wire = h cm

Volume of sphere = volume of wire

$\frac{4}{3}\pi \times 9 \times 9 \times 9 = \pi \times \frac{20}{10} \times \frac{20}{10} \times h$

$4 \times 3 \times 9 \times 9 = 4h \Rightarrow h = 243$ cm

19. (a); Let edge = x cm

increased edge $= x + \frac{x}{2} = \frac{3x}{2}$

initial surface Area = $6x^2$

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New surface Area = $6\left(\frac{3x}{2}\right)^2$

increased in Surface Area = $6\left[\frac{9x^2}{4} - x^2\right]$

$= \frac{6 \times 5x^2}{4} = \frac{30x^2}{4}$

Percent increased $= \frac{\frac{30x^2}{4}}{6x^2} \times 100 = \frac{5}{4} \times 100$ = 125%

Shortcut:

$x + y + \frac{xy}{100} \Rightarrow 50 + 50 + \frac{50 \times 50}{100} = 125\%$

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20. (c); Volume of the wall = 10 m × $\frac{4}{10}$ m × 5m = 20 m^3

Volume occupied by mortor $= \frac{1}{10} \times 20$ = 2 m^3

Volume occupied by brick = (20 – 2) = 18 m^3

Volume of each brick = $\frac{25}{100}m \times \frac{15}{100}m \times \frac{8}{100}m = \frac{3}{1000}m^3$

No. of bricks required = $\frac{18}{\frac{3}{1000}} = \frac{18 \times 1000}{3}$ = 6000

21. (c); Let side of original equilateral triangle = x

$\therefore$ Area = $\frac{\sqrt{3}}{4} \times x^2 \Rightarrow$ Now, New side = $\frac{x}{6}$

$\therefore$ Area of smaller equilateral triangle = $\frac{\sqrt{3}}{4} \times \frac{x^2}{36}$

$\therefore$ No. of triangle thus formed $= \dfrac{\frac{\sqrt{3}}{4}x^2}{\frac{\sqrt{3}}{4} \times \frac{x^2}{36}} = 36$

22. (c); Let side of square = x

Let radius = r

$\therefore$ $2\pi r = x \Rightarrow r = \dfrac{x}{2\pi}$

$\therefore$ Required Ratio = $\dfrac{\frac{x}{2\pi}}{x}$

$= \dfrac{1}{2\pi} = \dfrac{1}{2 \times 22} \times 7 = \dfrac{7}{44} = 7 : 44$

23. (a); Area of circle = 1386 cm^2

$\pi r^2 = 1386$

$\dfrac{22}{7} \times r^2 = 1386 \Rightarrow r^2 = \dfrac{7 \times 1386}{22} = 441 \Rightarrow r = 21$

$\therefore$ length of the wire = $2\pi r$

$= 2 \times \dfrac{22}{7} \times 21 = 132$ cm

Now, perimeter of the equilateral triangle = length of the wire

3 × side of triangle (a) = 132

$\therefore$ a = 44

$\therefore$ Required Area = $\dfrac{\sqrt{3}}{4} \times 44 \times 44 = 11 \times 44 \times \sqrt{3} = 484\sqrt{3}\ cm^2$

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24. (e); Let radius of the bowl = r cm

$\therefore$ $2\pi r^2 = 616$

$$r^2 = \frac{616}{2\times 22}\times 7 = \frac{308}{22}\times 7 = 14 \times 7 = 98 \text{ cm}^2$$

$r = 7\sqrt{2}$ cm

$$\therefore \text{ Volume } = \frac{2}{3}\times\frac{22}{7}\times 7\sqrt{2}\times 7\sqrt{2}\times 7\sqrt{2}$$

$$= \frac{2}{3}\times\frac{22}{7}\times 49\times 2\times 7\sqrt{2} = \frac{98\sqrt{2}\times 44}{3}$$

$= 2032.69 \text{ cm}^2$

25. (e); Volume of hemi-sphere $= \frac{2}{3}\times\pi\times(27)^3 \text{ cm}^3$

Volume of cylindrical bottle = $\pi r^2 h = \pi \times (3)^2 \times 9$

$\therefore$ Required no. of bottles

$$= \frac{\frac{2}{3}\pi\times(27)^3}{\pi\times(3)^2\times 9} = \frac{2}{3}\times\frac{27\times 27\times 27}{3\times 3\times 9}$$

$= 2 \times 3 \times 27 = 162$ bottles

26. (c); Given,

diagonal = 5 × 2 = 10 cm

$\therefore$ diagonal = $\sqrt{2}$ × side

$\therefore$ side = $\frac{10}{\sqrt{2}}$

$$\text{Area} = (\text{side})^2 = \left(\frac{10}{\sqrt{2}}\right)^2 = \frac{100}{2} \Rightarrow \text{Area} = 50 \text{ cm}^2$$

27. (c); Let side = x, Area = x^2

$$\text{New side} = x + \frac{x}{2} = \frac{3x}{2} \Rightarrow \text{New Area} = \frac{9x^2}{4}$$

$$\therefore \text{ \% increase } = \frac{\frac{9x^2}{4} - x^2}{x^2}\times 100$$

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$$= \frac{5x^2}{4x^2} \times 100 = 5 \times 25 = 125\%$$

Shortcut:

$$x + y + \frac{xy}{100} \Rightarrow 50 + 50 + \frac{50 \times 50}{100} = 125\%$$

28. (b); Let side of square = x, Area = x^2
Now, diagonal = $\sqrt{2}x$

$\therefore$ Area of new square formed = $\left(\sqrt{2}x\right)^2 = 2x^2$

Required Ratio = $\frac{x^2}{2x^2} = 1 : 2$

29. (b); Given diameter = 10 cm

diagonal of square = diameter = 10 cm
Let side = x cm

$\therefore$ $10 = x\sqrt{2} \Rightarrow x = \frac{10}{\sqrt{2}} \Rightarrow x = 5\sqrt{2}$ cm

30. (b); Let diameter of circle = 2x

$\therefore$ radius = x

$\therefore$ Area of circle = πx^2

Now, diagonal of square = diameter of circle = 2x

Let side of square = a

$\therefore$ $2x = a\sqrt{2} \Rightarrow a = \frac{2x}{\sqrt{2}} = x\sqrt{2}$

Area of square = $\left(x\sqrt{2}\right)^2 = 2x^2$

$\therefore$ Required ratio = $\pi x^2 : 2x^2 = \pi : 2$

Difficult

1. (a); Total volume of the wall

$(12 \times 5 \times 0.25 \times 100 \times 100 \times 100)cm^3$

Sand and cement mixture occupies 5% of the total volume of wall.

So, Volume of wall occupied by brick = 95% of total volume

$$= \frac{95 \times 12 \times 5 \times 0.25 \times 100 \times 100 \times 100}{100} cm^3$$

Volume of each brick $= (25 \times 12.5 \times 7.5)cm^3$

So, number of bricks required

$$= \frac{95 \times 12 \times 5 \times 0.25 \times 100 \times 100 \times 100}{100 \times 25 \times 12.5 \times 7.5} = 6080$$

2. (e); Average displaccement of water by one man $= 8m^3$

Displacement of water by 150 men $= 150 \times 8m^3 = 1200m^3$

Let rise in water level by 'h' m

Then $(90 \times 40 \times h)m^3 = 1200$

$$h = \frac{1200}{3600} m = \frac{1}{3} \times 100 = 33.33cm$$

3. (c); Internal radius, r = 10 cm.

External radius, R = 12 cm.

Volume of metal in the shell $= \frac{4}{3}\pi\left(R^3 - r^3\right)$

$= \frac{4}{3} \times 3.1416\left(12^3 - 10^3\right) = \frac{4}{3} \times 3.1416 \times 728 cm^3$

Weight of the shell = (Volume of metal in the shell) ×(Density of metal)

$= \frac{4}{3} \times 3.1416 \times 728 \times 4.9 = 14942.28 gm$

4. (e); Volume of earth removed $= 10 \times 4.5 \times 3 m^3 = 135 m^3$

Remaining area $= [20 \times 9 - 10 \times 4.5] m^2 \quad = 180 - 45 = 135 m^2$

Let, rise in height = h

$h \times 135 = 135 \quad \Rightarrow \quad h = 1m$

5. (a); Let radius of base and slant height of the two cones be r_1, l_1 and r_2, l_2

$\pi r_1 l_1 = 3\pi r_2 (3l_1)$ (according to question)

$r_1 = 9r_2 \quad \Rightarrow \quad \frac{r_1}{r_2} = 9$

Ratio of area of their bases $= \frac{r_1^2}{r_2^2} = 9^2 = 81 : 1$

6. (c)

6. (c);

Δ ABC is an equilateral triangle with each side 2cm.

Area of Δ ABC $= \frac{\sqrt{3}}{4}a^2 = \frac{\sqrt{3}}{4} \times (2)^2 = \sqrt{3}cm^2$

Now, each angle in an equilateral triangle is $60^0 = \frac{\pi}{3}$ radians

So, area of each sector is = $\frac{\frac{\pi}{3}}{2\pi} \times \pi(1)^2$

So, total area of there sectors $= 3 \times \frac{\pi}{6}cm^6 = \frac{\pi}{2}cm^2$

Area of the shaded region = area of $\Delta ABC -$ Area of the sectors

$= \left(\sqrt{3} - \frac{\pi}{2}\right)cm^2$

7. (a); Let edge of cube be a
Length of the new cuboid = 3a
Bredth of the new cuboid = a
Height of the new cuboid = a
total surface area of the new cuboid

$= 2(lb + bh + lh) = 2(3a^2 + a^2 + 3a^2) = 14a^2$

Sum of surface areas of 3 cubes = $3 \times 6a^2 = 18a^2$

Required ratio $= \frac{14a^2}{18a^2} = 7:9$

8. (e); Let the initial radius be 10

So, initial volume $= \pi \times (10)^2 \times H$

increased radius = 10 +5 = 15

New volume $= \pi \times (15)^2 \times H$

Percentage increase in volume

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$$= \left(\frac{\pi \times (15)^2 \times H - \pi (10)^2 H}{\pi \times (10)^2 \times H} \right) \times 100$$

$$= \frac{\pi H (225 - 100) \times 100}{100 \pi H} = 125\%$$

Shortcut:

$$x + y + \frac{xy}{100} \Rightarrow 50 + 50 + \frac{50 \times 50}{100} = 125\%$$

9. (c); Radius of cylindrical pipe = 0.25cm.
Length of water column in one minute = 10 m.
= 1000 cm.
So, volume of water flowing out in one minute

$$= \pi (0.25)^2 (1000) cm^3 = 62.5 \pi cm^3$$

Radius of base of conical tank = 20 cm.
depth = 24 cm.

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So, volume of tank $= \frac{1}{3} \pi r^2 h = \frac{1}{3} \pi .(20)^2 \times (24)$

So, time taken to fill the conical tank

$$= \frac{\frac{1}{3} \pi .(400 \times 24)}{62.5 \pi} min = \frac{3200}{62.5} min = 51.2 \text{ min}$$

10. (a); Area of the shaded portion
= (Area of the rectangle) - (Area of the circle)
[The four sectors form a circle of radius 10 cm]
Area of shaded portion

$$= [28 \times 26 - \pi (10)^2] cm^2$$

$$= 728 - 314.16 cm^2 = 413.84 \approx 414 cm^2$$

Perimeter of the shaded portion

$= 2\pi r + 2 \times 8 + 2 \times 6$

$= (2 \times 3.1416 \times 10 + 16 + 12)$ cm

$= 90.832 \approx 90.8$cm

11. (a); Volume of ice cream
= volume of cylindrical container

$= \pi \times (6)^2 \times 15 cm^3$

This ice cream is distributed in 10 equal cones having hemispherical tops.

So, volume of one cone $= \frac{\pi \times 6^2 \times 15}{10} = \frac{\pi \times 36 \times 3}{2} = 54\pi cm^3$

Let diameter of base of cone be 'D'
So, height of conical portion = 2D
Volume of cone and hemispherical top together

$$= \frac{1}{3}\pi.\left(\frac{D}{2}\right)^2.(2D) + \frac{2}{3}.\pi.\left(\frac{D}{2}\right)^3$$

$$= \frac{\pi D^3}{6} + \frac{\pi D^3}{12} = \frac{2\pi D^3 + \pi D^3}{12} = \frac{\pi D^3}{4}$$

$$54\pi = \frac{\pi D^3}{4} \Rightarrow D^3 = 54 \times 4 \Rightarrow D = 6cm$$

12. (b); Volume of the earth dug out $= 4 \times 2.5 \times 6 m^3 = 60 m^3$
Area of the remaining portion

$= (10 \times 9 - 4 \times 2.5) m^2 = 90 - 10 = 80 m^2$

Let the rise in level of field be h.

$$80 \times h = 60 \quad \Rightarrow \quad h = \frac{60}{80} = \frac{3}{4} m \quad \Rightarrow \quad 75 \text{ cm.}$$

13. (e); Internal length = 86 cm.

So, external length $= (86 + 2 + 2) = 90$ cm

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internal breadth = 46 cm.
external breadth = (46+2+2) = 50 cm.
internal height = 38 cm.
external height = (38+2) = 40 cm.
outer surface area
$= 2\times 90\times 40 + 2\times 50\times 40 + 90\times 50$
= 7200 + 4000 + 4500 = 15,700 cm^2 = 1.57 m^2
Cost of painting the outer surface at Rs. 10 per m^2 = $1.57\times 10 = 15.7$ Rs.

14. (d); The sheet is rolled along its length
Let the radius of the cylinder be 'r'

$$2\pi r = 22m \Rightarrow 2\times\frac{22}{7}\times r = 22 \Rightarrow r = \frac{7}{2}m$$

Height of the cylinder = 8 m.

Volume of the cylinder = $\frac{22}{7}\times\frac{7}{2}\times\frac{7}{2}\times 8m^3$

$= 308m^3$

15. (c); Area of the shaded portion
= (Area of the square - Area of the circle)

$= 21\times 21 - \pi\times 10.5\times 10.5$

$= \left(21\times 21 - \frac{22}{7}\times(10.5)^2\right)cm^2 = 94.5\ cm^2$

16. (b); In radius of an equilateral triangle $= \frac{a}{2\sqrt{3}}$

where 'a' is the side of the triangle

So, inradius $= \frac{8}{2\sqrt{3}} = \frac{4}{\sqrt{3}}$ cm

Area of incircle = $\pi r^2 = \pi\left(\frac{4}{\sqrt{3}}\right)^2$

Area of equilateral triangle $= \frac{\sqrt{3}}{4}(8)^2$

The area of the portion between the triangle and the circle is:

$\frac{\sqrt{3}}{4}(8)^2 - \pi \times \left(\frac{4}{\sqrt{3}}\right)^2 = \frac{\sqrt{3}}{4} \times 64 - \frac{22}{7} \times \frac{16}{3}$ = 10.95 cm^2

17. (c); Semi-perimeter of the given triangle,

$s = \frac{12+18+26}{2} = 28$ cm

Area $= \sqrt{s(s-a)(s-b)(s-c)}$

$= \sqrt{28(28-12)(28-18)(28-26)} = \sqrt{28 \times 16 \times 10 \times 2} = 16\sqrt{35}$

Area of the triangle formed by joining the mid-points = $\frac{1}{4} \times$ Area of given triangle = $4\sqrt{35}$ cm^2

18. (d); Area of paths to be paved

$= [19.25 \times 2 + 12.5 \times 2 - 2 \times 2]m^2$ = 59.5 m^2

Cost of paving these paths = Rs. 59.5×12.32 = Rs. 733.04

19. (a); OP = 14 cm

Perimeter of semicircle on OP = $\pi r = \pi \times 7$

PQ = 14 cm.

Perimeter of semi-Circle on PQ = $\pi r = \pi \times 7$

Perimeter of semi-circle on OQ = πr = $\pi \times 14$

So, Perimeter of the shaded area

$= (7\pi + 7\pi + 14\pi)$ cm = 28_π cm = 88 cm.

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20. (b); Circumference of the circular field = $2\pi r = 440$ m

$2 \times \frac{22}{7} \times r = 440$ m $\Rightarrow$ r = 70 m.

width of path = 10 m.

Radius of outer circle, R = 80 m.

Area of path $= \pi(R^2 - r^2) = \frac{22}{7}(80^2 - 70^2)$

Cost of cultivating the path

$= \frac{22}{7} \times 150 \times 10 \times 0.7 \Rightarrow$ Rs. 3300

Previous Year (Memory Based)

1. (c); Ratio of length and breadth is 11 : 5

Let the length be 11x $\Rightarrow$ breadth be 5x

According to the question

$\therefore$ Area of the rectangular field $= \frac{110}{0.50}$ sq. meter = 220 sq. meter

$\therefore$ 11x × 5x = 220 $\Rightarrow$ $55x^2 = 220 \Rightarrow x = 2$

So, the length of the rectangle is = 11 × 2 = 22 m

2. (b); Let the breadth of a rectangle is x

$\therefore$ length of a rectangle is 4x.

According to the question

$4x^2 = 4 \times 10000m^2$ [1 hectares = $10000m^2$]

x = 100 m

length = 400, Breadth = 100

Perimeter = 2 (400 + 100) = 1000 m = 1 km

Time taken $= \frac{\text{Distance}}{\text{Speed}} = \frac{1}{3}$ hr = 20 min

3. (a); Area of the path = 63 × 54 – 57 × 48 = 666

$\therefore$ Rate $= \frac{37}{2} \times 666$ = Rs. 12321

4. (b); Net area = Area of the 4 walls – 8 sq. m.
= 2(l + b) h – 8 = 2 × 84 – 8 = 168 – 8 = 160 m^2

Length of the paper $= \frac{160}{0.25}$ ($\therefore$ 2.5 dm = 0.25 m)

= 640 m

5. (b); L : B = 2 : 1 $\Rightarrow$ $2x^2 = 24200$ $\Rightarrow$ x = 110
Length = 110 × 2 = 220 $\Rightarrow$ breadth = 110

Shortest distance $= \sqrt{(110)^2 + (220)^2}$

$= 110 \times \sqrt{5}$ = 110 × 2.236 = 246 m

6. (c); No. of cubes $= \frac{9 \times 9 \times 9}{3 \times 3 \times 3}$ = 27

7. (b); Volume of water displaced = Volume of sphere

$\pi \times (40)^2 \times h = \frac{4}{3}\pi \times (30)^3$ $\Rightarrow$ h = 22.5 cm

Thus, the level of water rises by 22.5 cm.

8. (b); Area of path $= \frac{22176}{1} = 22176\ m^2$

$\pi(R^2 - r^2) = 22176$ $\Rightarrow$ $R^2 - r^2 = \frac{22176}{22} \times 7$

$R^2 - (112)^2 = 7056$
$R^2 = 7056 + 12544 = 19600$ $\Rightarrow$ $R = 140$
Width of the Path = 140 – 112 = 28 m.

9. (c); Radius of a circle $= \frac{\sqrt{6^2 + 8^2}}{2} = \frac{10}{2}$ cm $= 5$ cm

Area of the shaded Region

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= area of circle – area of rectangle

$= \frac{22}{7} \times 5 \times 5 - 48 = 78.57 - 48 = 30.57 \text{ cm}^2$

10. (b); Perimeter of circle = perimeter of square

$2\pi r = 4a \Rightarrow 2 \times \frac{22}{7} \times 28 = 4a$

$\therefore$ a = 44

$\therefore$ Length of the largest diagonal $= a\sqrt{2} = 44\sqrt{2}$

11. (b); Hypotenuse $= \sqrt{(36015)^2 + (48020)^2} = 60025$ cm

12. (d);

Let one side of the Δ be = a

Perimeter of equilateral triangle = 3a

$3a = 72\sqrt{3} \Rightarrow a = 24\sqrt{3}$ cm

Height = AD; by Pythagorus theorem

$AD^2 = a^2 - \left(\frac{a}{2}\right)^2 = \frac{3a^2}{4} = \frac{3}{4} \times 24 \times 24 \times 3 = 1296$ cm

$\therefore$ a = 36 cm.

13. (b); Radius to the inner circle

$2\pi r = 440 \Rightarrow r = \frac{440}{2 \times 22} \times 7 = 70$ cm

Diameter of the outer circle = 2 (70 + 14) = 168 cm

14. (e); Part of the cube is not given hence data Inadequate

15. (b); Side of the resulting cube

$a^3 = 216 + 512 + 1000 \Rightarrow a = 12$ cm

16. (a); Slant height (l) $= \sqrt{6^2 + 8^2} = 10$ cm

Then curved surface area = $\pi rl = \pi \times 6 \times 10 = 60\pi$

and total surface area = $\pi rl + \pi r^2$

$= \pi((6 \times 10) + 6^2) = 96\pi$

17. (c); Perimeter would remain the same in any case

Let one side of a square be = a cm

Then $a^2 = 484 \Rightarrow a = 22$ cm

Perimeter = 4 a = 88 cm

Let the radius of the circle be = r cm

Then $2\pi r = 88 \Rightarrow r = 14$ cm

Then area = $\pi r^2 = 616$ cm^2

18. (e); Slant height $l = \sqrt{7^2 + 24^2} = 25$m

Area of cloth required = curved surface area of cone = πrl

$$= \frac{22}{7} \times 7 \times 25 = 550 \text{ m}^2$$

Length of cloth required $= \frac{550}{5} = 110$ m

19. (a); So the length of the cuboid = 7 × 5 = 35 cm

Breadth = 5 cm, height = 5 cm

Surface area of the cubiod = 2 (lb + bh + hl)

= 2(35 × 5 + 5 × 5 + 35 × 5)

= 2(175 + 25 + 175) = 750 cm

20. (b); Total volume of the cuboid and all the cubes are equal

$\therefore$ No. of cubes $= \frac{24 \times 9 \times 8}{3 \times 3 \times 3} = 64$

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21. (e); Volume of cube = $(7)^3$ = 343 cm^3

Radius of cone $= \frac{7}{2}$ = 3.5 cm

Height of cone = 7cm

Ratio of volumes $= \frac{\pi r^2 h}{\frac{3}{343}} = \frac{22 \times 3.5 \times 3.5 \times 7}{7 \times 3 \times 343}$ = 11 : 42

22. (b); Let the common ratio be = x

Then length = 4x; breadth = 3x and height = 2x

As per question

$2(4x \times 3x + 3x \times 2x + 2x \times 4x) = 8788$

$2(12x^2 + 6x^2 + 8x^2) = 8788$

$x^2 = \frac{8788}{52} \Rightarrow x^2 = 169 \Rightarrow x = 13$

Length = 4x = 13 × 4 = 52 cm

23. (c); 1 hectare = 10000 m^2

Height = 10 cm $= \frac{1}{10}$ m

Volume $= 10000 \times \frac{1}{10}$ = 1000 m^3

24. (c); The volume in both the cases would be the same

Therefore $\Rightarrow \frac{4}{3}\pi r^3 = \pi R^2 h$

$\frac{4 \times 3.14 \times (4 \times 10)^3}{3} = 3.14 \times 2^2 \times h$

$h = \frac{64000}{3} = 21333.33$ mm

25. (b); Height of the cylinder = 13 – 7 = 6 cm
Radius of the cylinder and the hemisphere = 7cm
Volume of the vessel
= Volume of cylinder + Volume of hemisphere.

$$\Rightarrow \pi r^2 h + \frac{2\pi r^3}{3}$$

$$\Rightarrow 3.14 \times 7 \times 7 \times 6 + \frac{2 \times 3.14 \times 7 \times 7 \times 7}{3}$$

$$\Rightarrow 1642.67 \text{ cm}^3$$

26. (a); Area of shaded region $= \pi\left(\frac{2}{2}\right)^2 - \pi\left(\frac{1}{2}\right)^2 = \pi - \frac{\pi}{4} = \frac{3\pi}{4}$

27. (c); Let radius of a circle = r

$\pi r^2 = 2\pi \Rightarrow r = \sqrt{2} \Rightarrow d = 2r = 2\sqrt{2}$

Side of a square = 2d $= 4\sqrt{2}$

Area of a square $= 4\sqrt{2} \times 4\sqrt{2}$ = 32 unit

28. (b); Radius of the smaller circle $= \frac{y}{2}$

$\therefore$ Area of the shaded region $= \pi y^2 - \pi \frac{y^2}{4} = \frac{3}{4}\pi y^2$

29. (a); OP and OQ are equal side they are radii of the circle. Hence, Δ POQ is isosceles.
$\angle P = \angle Q = 51°$
Since, the sum of angles of a triangle is 180°,
y = 180 – (51 + 51) = 78°

30. (a); Let the breadth of a rectangle be b.
$\therefore$ length = 3b

$b \times 3b = 7803 \Rightarrow b^2 = \frac{7803}{3} = 2601 \Rightarrow b = 51$ m

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31. (e); length = 8x, breadth = 5x
$8x - 5x = 3x = 60 \Rightarrow x = 20$ m
perimeter = 2 (8x + 5x) = 26 × 20 = 520 m

32. (b); Let the breadth of the rectangle = b
length = 2b $\Rightarrow$ 2b × b = 18
$2b^2 = 18 \Rightarrow b = 3$ m
Perimeter = 2(b + 2b) = 18 m

33. (a); Area of the floor $= \frac{256}{2} m^2 = 128\ m^2$
Let the breadth of the rectangle = b
length = 2b
According to the question
$\therefore 2b^2 = 128 \Rightarrow b^2 = 64 \Rightarrow b = 8$ m
length = 2b = 16 m

34. (d); Here data is not sufficient to answer the question.

35. (c); Let the radius of a circle be r.

$\therefore 2\pi r = 88 \Rightarrow r = \frac{88}{2 \times 22} \times 7 = 14$ cm

Area = $\pi r^2 = \frac{22}{7} \times 14 \times 14 = 616$ sq. cm.

36. (c); Let the radius of a circle be r.

$\therefore 2\pi r = 22 \Rightarrow r = \frac{22}{2 \times 22} \times 7 \Rightarrow r = \frac{7}{2}$

Area = $\pi r^2 = \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = 38.5$ sq. cm.

37. (c); Let the radius of a circle be r_1 and r_2.

$r_1 = \frac{132}{2 \times 22} \times 7 = 21 \Rightarrow r_2 = \frac{176}{2 \times 22} \times 7 = 28$

difference in area $= \frac{22}{7}(28^2 - 21^2)$

$= \frac{22}{7} \times (28+21)(28-21) = 22 \times 49 = 1078$

38. (a); circumference of a circle $= \frac{3300}{15} = 220$ m

radius $= \frac{220}{2 \times 22} \times 7 = 35$

Area of the circle $= \frac{22}{7} \times 35 \times 35 = 3850$

Cost of flooring = 3850 × 100 = Rs. 385000

39. (a); Perimeter of a rectangle = 2 (8 + 7) = 30 cm

perimeter of a square = 60 cm

Side of a square $= \frac{60}{4} = 15$ cm

radius of a circle $= \frac{15}{2}$ cm

Circumference of a semicircle = $\pi r + 2r$

$= r\left(\frac{22}{7} + 2\right) = \frac{15}{2}\left(\frac{36}{7}\right) = 38.57$ cm

40. (d); Let the length be l

breadth = l × $\frac{75}{100} = \frac{3l}{4}$

According to the question

$2\left(l + \frac{3l}{4}\right) = 1050 \Rightarrow l = 300, b = 300 \times \frac{3}{4} = 225$

Area of the rectangle = 300 × 225 = 67500

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Bank Quantitative Aptitude

Chapter 13

Permutation, Combination and Probability

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Chapter 13

Permutation, Combination and Probability

Permutation Combination

Rule of Sum (OR): If an experiment has n possible outcomes and another has m possible outcomes, then there are (n + m) possible outcomes when exactly one of these experiments is performed.

Rule of Product (And): If several process can be performed in the following manner; the first process in N ways, the second in M ways, the third in O ways and so on, then the total number of ways in which the whole process can be performed, in the order indicated, is given by their product i.e N.M.O. .....

Factorial: The continuous product of the first n natural numbers is called factorial n and is denoted by n! or $\lfloor n$

n! = n (n – 1) (n – 2) (n – 3)..... 3. 2. 1 = 1. 2. 3 .....n

(i) $(m + n)! \neq m! + n!$ (ii) $(m - n)! \neq m! - n!$

(iii) $(mn)! \neq (m!)\,(n!)$ (iv) $\left(\frac{m}{n}\right)! \neq \frac{m!}{n!}$

Ex. 3! = 3 × 2 × 1 = 6

4! = 4 × 3 × 2 × 1 = 24

5! = 5 × 4 × 3 × 2 × 1 = 120

0! = 1

Permutations: The word permutations refers to 'arrangements'

The number of permutations of n objects, taken r at a time, is the total number of arrangements of n objects, in group of r, where the order of the arrangement is important.

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

(i) Without repetition: Arranging n objects, taking r at a time in every arrangement, is equivalent to filling r places from n objects.

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r-places	1	2	3	4	– –	r
No. of choices	n	n – 1	n – 2	n – 3	– –	n – r + 1

number of ways of arranging = No. of ways of filling

Example: In how many ways can letters of the word PENCIL be arranged so that E and N are always together.

Sol.: Keep EN together and consider as one letter. Now, we have 5 letters which can be arranged in $^5p_5 = 5! = 120$ ways. But E & N can be put together in 2! ways. Hence, total number of ways = 2! × 5! = 2 × 120 = 240 ways.

(ii) With Repetition: Number of arrangements of n objects, taken r at a time, When each object may occur once, twice, thrice & So on upto r times in any arrangement is equivalent to the number of ways of filling r places, each out of n objects.

r-places	1	2	3	4	– –	r
No. of choices	n	n	n	n	– –	n

Number of ways of arrangements = No. of ways to fill r places = $(n)^r$

Example: A telegraph has 5 arms and each arm is capable of 4 distinct positions, including the position of rest. Find the total number of signals that can be made.

Sol.: No. of distinct positions = 4

No. of Arms = 5

Therefore, number of signals = $4^5 = 1024$

But in one case, when all the 5 arms will be in rest position, no signal will be made.

Hence required number of signals = 1024 – 1 = 1023.

Circular Permutations: Let n persons (a_1, a_2, a_3 .....a_n) are to be seated in a row. There are total n! ways. If n persons are to be seated in circle, there are total (n – 1)! ways. Since position of one will be fixed.

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There may be two different circular arrangements clockwise and anti-clockwise.

(i) When distinction is made between the clockwise and the anti-clockwise arrangements of n different objects around the circle. then the number of arrangements is (n – 1)!

(ii) On the other hand, if no distinction is made between the clockwise and anticlockwise arrangement of n different objects around a circle, then the number of arrangements is $\frac{(n-1)!}{2}$

Example: Find the number of ways in which 10 different beads can be arranged to form a necklace.

Sol. Ten different beads can be arranged in circular form in (10 – 1)! = 9! ways. Since, there is no distinction between the clockwise and anticlockwise arrangements, the required number of arrangements = 9! / 2

Some Important points regarding ${}^nc_r$

(a) The number of selections from n distinct objects, taking at least one at a time is given by

${}^nc_1 + {}^nc_2 + {}^nc_3 + \ldots\ldots\ldots\ldots {}^nc_n = 2^n - 1$

(b) The number of selections of r objects out of n identical objects is 1

(c) Total number of selections of zero or more objects from n identical objects is (n + 1)

Example: In how many ways, can 20 identical apples be divided among 5 persons?

Sol. Here, the objects are identical and any person may get any number of apple

Required number of ways = ${}^{n+P-1}C_{P-1}$

$$= {}^{(20+5-1)}C_{5-1} = 24C_4 = \frac{24!}{4!\,20!} = \frac{24 \times 23 \times 22 \times 21}{4 \times 3 \times 2}$$

$$= 6 \times 23 \times 11 \times 7 = 10626$$

Combinations: The meaning of combination is selection of objects & it is like permutation except that it is unordered. It is denoted by ${}^{n}C_{r}$.

$${}^{n}C_{r} = \frac{n!}{r!(n-r)!} = \frac{n(n-1)(n-2).....3.2.1}{r!(n-r)!}$$

Selection of objects without repetition

(i) ${}^{n}C_{r} = \frac{n!}{r!(n-r)!}$ (ii) $r = 0,\ {}^{n}C_{0} = \frac{n!}{0!\,n!} = 1$

(iii) $r = 1,\ {}^{n}C_{1} = \frac{n!}{1!(n-1)!} = n$ (iv) $r = n,\ {}^{n}C_{n} = \frac{n!}{n!(n-n)!} = 1$

Selection of objects with repetition: The number of combination of n distinct objects taken r at a time when each may occur once, twice, thrice, and so on upto r times, in any combination is given by ${}^{(n+r-1)}C_{r}$.

Example: What is the number of ways of choosing 4 cards from a pack of 52 playing cards? in how many of these

(i) Four cards are of the same suit,
(ii) Four cards belong to four different suits,
(iii) are face cards,
(iv) two are red cards and two are black cards.
(v) cards are of the same colour?

Explanation:

(i) There are ${}^{13}C_{4}$ ways of choosing 4 clubs, ${}^{13}C_{4}$ ways of choosing 4 spades, ${}^{13}C_{4}$ ways of choosing 4 hearts and ${}^{13}C_{4}$ ways of choosing 4 diamonds.

Therefore, the required number of ways

$$= 4 \times {}^{13}C_{4} = \frac{4 \times (13)!}{4!\,9!} = \frac{4 \times 10 \times 11 \times 12 \times 13}{2 \times 3 \times 4} = 2860$$

(ii) One card is to be selected from each suit.

This can be done in : ${}^{13}C_{1} \times {}^{13}C_{1} \times {}^{13}C_{1} \times {}^{13}C_{1} = (13)^{4}$ ways.

(iii) There are 12 face cards and 4 are to be selected out of these 12 cards.

Therefore, $^{12}C_4 = \frac{12!}{4!\,8!} = \frac{9 \times 10 \times 11 \times 12}{2 \times 3 \times 4} = 495$

Cards:

(i) There are four suits Diamond, Club, Spade, heart.

(ii) Each suit contains 13 cards, so total number of cards = 13 × 4 = 52

(iii) Each suit contains 3 face cards, (Jack, Queen, King) so total Number of face cards = 3 × 4 = 12

(iv) Each suit contains 9 number cards (2, 3, 4, 5, 6, 7, 8, 9, 10), so total numbers of cards = 9 × 4 = 36.

(v) There are 26 red cards and 26 black cards.

(vi) Each suit contains 4 honor cards (Jack, Queen, King & Ace) so total No. of honor cards = 4 × 4 = 16

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(iv) The required number of ways

$$= {}^{26}C_2 \times {}^{26}C_2 = \left(\frac{26!}{2! \times 24!}\right)^2 = \left(\frac{25 \times 26}{2}\right)^2 = (325)^2 = 105625$$

(v) 4 red cards can be selected out of 26 red cards in ${}^{26}C_4$ ways. 4 black cards can be selected out of 26 black cards in ${}^{26}C_4$ ways, therefore, the required number of ways

$$= {}^{26}C_4 + {}^{26}C_4 = 2 \times \frac{26!}{22!\,4!} = 2 \times \frac{23 \times 24 \times 25 \times 26}{2 \times 3 \times 4} = 29900$$

Probability: If a random experiment has n possible outcomes, which are mutually exclusive, exhaustive & equally likely, and m of these are favourable to an event A, then the probability of the event is defined as the ratio m / n & is denoted by

$$P(A) = \frac{m}{n} = \frac{\text{Number of favourable cases to A}}{\text{Total number of possible cases}}$$

Probability of an event always lies between 0 & 1; i.e $0 \le P \le 1$

Addition Theorem of Probability: If two events A and B are mutually exclusive, then the probability of occurence of either A or B is given by the sum of their probability , i.e,

$$P(A \text{ or } B) = P(A) + P(B)$$

(1) For only two events A and B, the probability of occurence of at least one of the two given events is given by

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

(2) For any three events A, B and C, the probability of occurence of at least one of the three events is given by

$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(A \cap C) + P(A \cap B \cap C)$

(3) Conditional Probability: The probability that the event A will occur, it being known that B has occured, is called the conditional probability of A

$$P(A/B) = \frac{P(A \cap B)}{P(B)} = \frac{n(A \cap B)}{n(B)}$$

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Types of Questions

1. Two unbiased coins are tossed. What is the probability of getting one head and one tail?

Sol. For one coin total number of possible outcomes = 2 (Head or Tail)

For two coins, the total number of possible outcomes

= 4 $\Rightarrow$ n(S) = (HT, HH, TH, TT)

n(E) = (HT, TH) $\Rightarrow$ P(E) = $\frac{2}{4} = \frac{1}{2}$

2. Two dices are thrown at a time. What is the probability that the sum of the two numbers is 6 or 9?

Sol. Here the events are 6 as sum or 9 as sum and these events are mutually exclusive

for event A (for 6 as sum) = {(1, 5), (2, 4), (3, 3), (4, 2), (5, 1)} = 5

for event B (for 9 as sum) = {(6, 3), (5, 4), (4, 5), (3, 6)} = 4

n(S) = 6^2 = 36 $\Rightarrow$ P(A) = 5/36 & P(B) = 4/36

since A and B are mutually exclusive events, so,

P(A + B) = P(A) + P(B) = 5/36 + 4/36 = 9/36 = 1/4

3. A bag contains 4 red & 3 black balls. A second bag contains 2 red & 4 black balls. One bag is selected at random & from the selected bag one ball is drawn. Find the probability that the ball is drawn is red.

Sol. Probability of selecting a bag = 1/2

Probability of getting red ball from the first bag = 4/7

Probability of getting red ball from the second bag = 2/6

Hence, required probability $= \frac{1}{2} \times \frac{4}{7} + \frac{1}{2} \times \frac{2}{6} = \frac{2}{7} + \frac{1}{6}$

$= \frac{2}{7} + \frac{1}{6} = \frac{12+7}{42} = \frac{19}{42}$

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4. If the odds in favour of an event A are 3 : 4 and the odds against another independent event B are 7 : 4 find the probability that at least one of the event will happen.

Sol. The odds in favour of an event A are 3 : 4

Probability of A = P(A) $= \frac{3}{3+4} = 3/7$

The odds against an event B are 7 : 4

Probability of B = P(B) $= \frac{4}{7+4} = 4/11$

The probability of occurence of atleast one of the events A and B is given by

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= P(A) + P(B) - P(A) \times P(B) = \frac{3}{7} + \frac{4}{11} - \frac{3}{7} \times \frac{4}{11}$.

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Foundation

1. In how many different ways can the letters of the word "TABLE" be arranged?
   (a) 24 (b) 48 (c) 120
   (d) 60 (e) None of these
2. In how many different ways can the letters of the word "MATHEMATICS" be arranged?
   (a) $\frac{10!}{2}$ (b) $\frac{11!}{2}$ (c) $\frac{11!}{4}$
   (d) $\frac{11!}{8}$ (e) None of these
3. In how many ways can 6 letters be posted in 5 letter boxes available in the locality?
   (a) 5^6 (b) 6^5 (c) 6^6
   (d) 625 (e) None of these

4. How many 3-digit numbers are there, with distinct digits, with each digit odd?
(a) 120 (b) 200 (c) 60
(d) 45 (e) None of these

5. In how many ways can the letters of the word 'UNIVERSAL' be arranged when E, R, S are always together?
(a) 31240 (b) 32240 (c) 30240
(d) 29240 (e) None of these

6. In how many ways can the letters of the word 'ALGEBRA' be arranged when both A do not come together?
(a) 1800 (b) 1600 (c) 1500
(d) 2160 (e) None of these

7. In how many ways can the letters of the word 'NUTAN' be arranged when consonants occupy odd places and vowels come on even places?
(a) 120 (b) 60 (c) 24
(d) 12 (e) None of these

8. There are seven candidates for 3 posts. In how many ways can the posts be filled?
(a) 210 (b) 120 (c) 7^3
(d) 3^7 (e) None of these

9. How many 3-digit numbers can be formed using 0, 2, 3, 5, 7 when repetition is allowed?
(a) 40 (b) 21 (c) 120
(d) 24 (e) None of these

10. There are 6 items in column A and 6 items in column B. A student is asked to match each item in column A with an item in column B. How many possible (correct or incorrect) answers are there to this question?
(a) 720 (b) 450 (c) 6^6
(d) 200 (e) None of these

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11. Find the number of all even 2-digit numbers, not having 0 at the unit's place?
(a) 50 (b) 21 (c) 36
(d) 48 (e) None of these

12. How many 3-digit numbers are there with no digit repeated?
(a) 720 (b) 648 (c) 256
(d) 580 (e) None of these

13. How many 2- digit numbers are there with distinct digits?
(a) 90 (b) 91 (c) 80
(d) 81 (e) None of these

14. How many 4-digit numbers are there with distinct digits?
(a) 4536 (b) 5182 (c) 4886
(d) 5800 (e) None of these

15. In how many different ways can the letters of the word 'DETAIL' be arranged in such a way that the vowels occupy only the odd positions?
(a) 32 (b) 48 (c) 36
(d) 60 (e) 120

16. A single die is tossed. What is the probability of a 2 turning up?
(a) $\frac{1}{6}$ (b) $\frac{2}{6}$ (c) 0
(d) 1 (e) None of these

17. Two cards are drawn from a well-shuffled ordinary deck of 52 cards. What is the probability that they are both aces if the first card is replaced?
(a) $\frac{4}{52}$ (b) $\frac{4}{52} \times \frac{4}{51}$ (c) $\frac{4}{52} \times \frac{4}{52}$
(d) $\frac{4}{51} \times \frac{4}{51}$ (e) None of these

18. Two cards are drawn from a well-shuffled ordinary deck of 52 cards. What is the probability that they are both aces if the first card is not replaced?

(a) $\frac{3}{52}$ (b) $\frac{4}{52} \times \frac{3}{51}$ (c) $\frac{4}{52 \times 52}$

(d) $\frac{4}{52} \times \frac{3}{52}$ (e) None of these

19. A ball is drawn at random from a box containing 6 red balls, 4 white balls and 5 blue balls. What is the probability that it is red?

(a) $\frac{2}{5}$ (b) $\frac{2}{13}$ (c) $\frac{5}{7}$

(d) $\frac{5}{2}$ (e) None of these

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20. Find the probability of a 4 turning up at least once in two tosses of a fair die

(a) 1 (b) $\frac{1}{36}$ (c) 11

(d) $\frac{11}{36}$ (e) None of these

21. One bag contains 4 white balls and 2 black balls; another contains 3 white balls and 5 black balls. If one ball is drawn from each bag, find the probability that both are white.

(a) $\frac{1}{4}$ (b) $\frac{1}{36}$ (c) $\frac{4}{11}$

(d) $\frac{11}{36}$ (e) None of these

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22. A die is rolled, find the probability that an even number is obtained.

(a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{1}{2}$

(d) $\frac{1}{3}$ (e) None of these

23. Two coins are tossed, find the probability that two heads are obtained.

(a) $\frac{1}{4}$ (b) $\frac{1}{6}$ (c) $\frac{1}{2}$

(d) $\frac{1}{5}$ (e) None of these

24. A dice is rolled and a coin is tossed, find the probability that the die shows an odd number and the coin shows a head.

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

(d) $\frac{1}{12}$ (e) None of these

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25. A card is drawn at random from a deck of cards. Find the probability of getting the 3 of diamond.

(a) $\frac{1}{52}$ (b) $\frac{3}{52}$ (c) $\frac{1}{26}$

(d) $\frac{3}{26}$ (e) None of these

26. A person draws a card from a pack of playing cards, replaces it and shuffles the pack. He continues doing this until he draws a spade. The chance that he will fail in first two times is

(a) $\frac{9}{64}$ (b) $\frac{1}{64}$ (c) $\frac{1}{16}$

(d) $\frac{9}{16}$ (e) None of these

27. A speaks truth in 60 percent cases and B speaks truth in 70 percent cases. The probability that they will say the same thing while describing a single event is

(a) 0.56 (b) 0.54 (c) 0.38
(d) 0.94 (e) None of these

28. In a box there are 2 red, 3 black and 4 white balls. Out of these three balls are drawn together. The probability of these being of the same color is

(a) $\frac{1}{84}$ (b) $\frac{1}{21}$ (c) $\frac{5}{84}$
(d) $\frac{3}{84}$ (e) None of these

29. If two regular six-sided dice are thrown, the probability that the sum will be a prime number is

(a) $\frac{5}{36}$ (b) $\frac{1}{6}$ (c) $\frac{5}{12}$
(d) $\frac{1}{2}$ (e) None of these

30. Two coins are tossed. Find the probability that at least one head and one tail are obtained?

(a) $\frac{5}{18}$ (b) $\frac{1}{3}$ (c) $\frac{4}{9}$
(d) $\frac{1}{2}$ (e) None of these

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Moderate

1. How many 3-digit even numbers can be formed using 0, 2, 3, 5, 7 when repetition is not allowed?
(a) 40 (b) 21 (c) 120
(d) 24 (e) None of these

2. There are 6 multiple choice questions in an examination, How many sequences of answers are possible, if the first three questions have 4 choices each and the next three have 5 each?
(a) 6000 (b) 5000 (c) 8000
(d) 1200 (e) None of these

3. From a group of 7 men and 6 women, five persons are to be selected to form a committee so that at least 3 men are there in the committee. In how many ways can it be done?
(a) 564 (b) 645 (c) 735
(d) 756 (e) None of these

4. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?
(a) 360 (b) 480 (c) 720
(d) 5040 (e) None of these

5. Out of 7 consonants and 4 vowels, how many words of 3 consonants and 2 vowels can be formed?
(a) 210 (b) 1050 (c) 25200
(d) 21400 (e) None of these

6. In a group of 6 boys and 4 girls, four children are to be selected. In how many different ways can they be selected such that at least one boy should be there?
(a) 159 (b) 194 (c) 205
(d) 210 (e) None of these

7. How many 3-digit numbers can be formed from the digits 2, 3, 5, 6, 7 & 9 which are divisible by 5 and none of the digits is repeated?
(a) 5 (b) 10 (c) 15
(d) 20 (e) None of these

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8. In how many ways a committee, consisting of 5 men and 6 women can be formed from 8 men and 10 women?

(a) 266 (b) 5040 (c) 11760
(d) 86400 (e) None of these

9. How many different four letter words can be formed (the words need not be meaningful) using the letters of the word "MEDITERRANEAN" such that the first letter is E and the last letter is R?

(a) 59 (b) 11! /(2!*2!*2!) (c) 56
(d) 23 (e) 11!/ (3!*2!*2!*2!)

10. In how many ways can the letters of the word 'MATHEMATICS'be arranged, When all vowels come together?

(a) 120960 (b) 130240 (c) 14125
(d) 15230 (e) None of these

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Directions (11-15): There are 6 Men and 8 Women in a club in which a committee of 5 people has to be made. What will be the number of ways to select 5 people if:

11. 2 men and 3 women are selected

(a) 830 (b) 840 (c) 630
(d) 660 (e) None of these

12. Only men are selected

(a) 6 (b) 56 (c) 30
(d) 3 (e) None of these

13. Atleast one woman is selected

(a) 56 (b) 420 (c) 476
(d) 846 (e) None of these

14. Atmost one man is selected

(a) 56 (b) 420 (c) 476
(d) 484 (e) None of these

15. Two dice are thrown. Find the probability that the sum is even number?

(a) $\frac{1}{9}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$

(d) $\frac{7}{36}$ (e) None of these

16. If from each of the three boxes containing 3 white and 1 black, 2 white and 2 black, 1 white and 3 black balls, one ball is drawn at random, then the probability that 2 white and 1 black ball will be drawn is

(a) $\frac{13}{32}$ (b) $\frac{1}{4}$ (c) $\frac{1}{32}$

(d) $\frac{3}{16}$ (e) None of these

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Directions (17-19): An URN contains 10 Green, 12 Yellow and 11 White balls. What is the probability that:

17. When 2 balls are selected, both are green

(a) $\frac{7}{16}$ (b) $\frac{15}{176}$ (c) $\frac{14}{228}$

(d) $\frac{3}{4}$ (e) None of these

18. When 2 balls are selected, none is white

(a) $\frac{5}{16}$ (b) $\frac{7}{16}$ (c) $\frac{6}{19}$

(d) $\frac{4}{7}$ (e) None of these

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19. When 2 balls are selected, at least one is white

(a) $\frac{368}{528}$ (b) $\frac{423}{528}$ (c) $\frac{373}{528}$

(d) $\frac{4}{9}$ (e) None of these

Directions (20-22): A box contains 15 black and 20 white balls. What is the probability that

20. When 2 balls are selected, both are white

(a) $\frac{38}{119}$ (b) $\frac{60}{119}$ (c) $\frac{81}{119}$

(d) $\frac{84}{19}$ (e) None of these

21. When 2 balls are selected, one is white

(a) $\frac{81}{119}$ (b) $\frac{84}{119}$ (c) $\frac{60}{119}$

(d) $\frac{38}{119}$ (e) None of these

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22. When 2 balls are selected, at most one is white

(a) $\frac{81}{119}$ (b) $\frac{84}{119}$ (c) $\frac{60}{109}$

(d) $\frac{38}{119}$ (e) None of these

Direction (23-27): An URN contains 6 blue, 4 red, 3 green and 2 yellow marbles.

23. If two marbles are picked at random what is the probability that both are blue?

(a) $\frac{1}{6}$ (b) $\frac{1}{3}$ (c) $\frac{2}{15}$

(d) $\frac{2}{5}$ (e) None of these

24. If three marbles are picked at random what is the probability that 2 are red and 1 is green?

(a) $\frac{3}{91}$ (b) $\frac{1}{5}$ (c) $\frac{18}{455}$

(d) $\frac{5}{15}$ (e) None of these

25. If four marbles are picked at random what is the probability that at least one is red?

(a) $\frac{22}{91}$ (b) $\frac{11}{15}$ (c) $\frac{69}{91}$

(d) $\frac{4}{15}$ (e) None of these

26. If two marbles are picked at random what is the probability that either both are yellow or both are green?

(a) $\frac{5}{91}$ (b) $\frac{1}{35}$ (c) $\frac{4}{105}$

(d) $\frac{2}{3}$ (e) None of these

27. If four marbles are picked at random, what is the probability that one is yellow, two are red and one is blue?

(a) $\frac{7}{91}$ (b) $\frac{13}{35}$ (c) $\frac{11}{15}$

(d) $\frac{24}{455}$ (e) None of these

Directions (28-29): A basket contains 4 red, 5 blue and 3 green marbles

28. If three marbles are picked at random what is the probability that either all are green or all are red?

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(a) $\frac{7}{44}$ (b) $\frac{7}{12}$ (c) $\frac{5}{12}$

(d) $\frac{1}{44}$ (e) None of these

29. If three marbles are picked at random what is the probability that at least one is blue?

(a) $\frac{7}{12}$ (b) $\frac{37}{44}$ (c) $\frac{5}{12}$

(d) $\frac{7}{44}$ (e) None of these

30. If three marbles are picked at random what is the probilitity that 2 are red and one is green?

(a) $\frac{6}{55}$ (b) $\frac{12}{220}$ (c) $\frac{9}{110}$

(d) $\frac{18}{110}$ (e) None of these

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Difficult

1. How many even numbers of four digits can be formed with the digits 0, 1, 2, 3, 4, 5 and 6 no digit being used more than once?
(a) 300 (b) 400 (c) 420
(d) 500 (e) None of these

2. A person X_s has four notes of 1, 2, 5 and 10 denominations. The number of different sums of money she can form from them is
(a) 16 (b) 15 (c) 12
(d) 8 (e) None of these

3. In a party, 12 persons are to be arranged around a round table. If two particular persons are not to be seated side by side, then the total no. of arrangements is:

(a) 9 × 10! (b) 2 × 10 ! (c) 45 × 8!
(d) 10! (e) None of these

4. The no. of words that can be formed out of the letters of the word ARTICLE, so that the vowels occupy even places, is
(a) 574 (b) 36 (c) 754
(d) 144 (e) None of these

5. How many numbers greater than 24,000 can be formed by using the digits 1, 2, 3, 4, 5, when no digit is repeated?
(a) 36 (b) 60 (c) 84
(d) 120 (e) None of these

6. The total number of numbers greater than 100 and divisible by 5, that can be formed from the digits 3, 4, 5, 6, if no digit is repeated is
(a) 24 (b) 48 (c) 30
(d) 12 (e) None of these

7. Let n be the number of different 5 digit numbers, divisible by 4 formed with the digits 1, 2, 3, 4, 5, and 6, such that no digit is repeated in the numbers. What is the value of n?
(a) 144 (b) 168 (c) 192
(d) 156 (e) None of these

8. In how many ways is it possible to choose a white square and a black square on a chess board so that the squares do not lie in the same row or column?
(a) 56 (b) 896 (c) 60
(d) 768 (e) None of these

9. A bag contains 30 balls of which 10 are red, 5 are blue and 15 are white. Find the probability of drawing a coloured ball at random.
(a) $\frac{1}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{4}$
(d) $\frac{4}{5}$ (e) None of these

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10. From a pack of 52 playing cards, three cards are drawn at random. Find the probability of drawing a king, a queen and a jack.

(a) $\frac{64}{5225}$ (b) $\frac{16}{5525}$ (c) $\frac{32}{5225}$

(d) $\frac{128}{5225}$ (e) None of these

11. Three dice are thrown. The sum of the numbers is 15. What is the chance of getting 4 on the first die?

(a) $\frac{1}{5}$ (b) $\frac{2}{5}$ (c) $\frac{3}{5}$

(d) $\frac{4}{5}$ (e) None of these

12. Three dice are thrown. Find the chance of getting a sum of 16.

(a) $\frac{11}{108}$ (b) $\frac{5}{108}$ (c) $\frac{7}{108}$

(d) $\frac{1}{36}$ (e) None of these

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13. One bag contains 5 white and 3 black balls and a second bag contains 2 white and 4 black balls. One ball is drawn from the first bag and placed unseen in the second bag. What is the probability that a ball now drawn from the second bag is black?

(a) $\frac{2}{7}$ (b) $\frac{5}{8}$ (c) $\frac{37}{56}$

(d) $\frac{25}{48}$ (e) None of these

14. In a lottery, 16 tickets are sold and 4 prizes are awarded. If a person buys 4 tickets, then what is the probability of his winning a prize?

(a) $\frac{4}{16^4}$ (b) $\frac{175}{256}$ (c) $\frac{1}{4}$

(d) $\frac{81}{256}$ (e) None of these

15. A card is drawn from a pack of 52 cards and a gambler bets that it is a spade or an ace. Which one of the following is the odds against his winning this bet?
(a) 13 to 4 (b) 4 to 13 (c) 9 to 4
(d) 4 to 9 (e) None of these

16. A can hit a target 4 times in 5 shots, B can hit a target 3 times in 4 shots and C can hit a target 2 times in 3 shots.
All the three fire a shot each. What is the probability that two shots are at least hit?
(a) $\frac{1}{6}$ (b) $\frac{3}{5}$ (c) $\frac{5}{6}$
(d) $\frac{1}{3}$ (e) None of these

17. What is the probability, that a leap year selected at random will contain 53 Sundays?
(a) $\frac{1}{7}$ (b) $\frac{3}{7}$ (c) $\frac{4}{7}$
(d) $\frac{2}{7}$ (e) None of these

Direction (18-20): Three 6 faced dice are thrown together. The probability that

18. All the three show the same number on them is
(a) $\frac{1}{216}$ (b) $\frac{1}{36}$ (c) $\frac{5}{9}$
(d) $\frac{5}{12}$ (e) $\frac{7}{12}$

19. No two dice show the same number on them is –
(a) $\frac{7}{12}$ (b) $\frac{5}{9}$ (c) $\frac{1}{36}$
(d) $\frac{5}{12}$ (e) $\frac{8}{9}$

20. Exactly two dice show the same number on them is

(a) $\frac{5}{9}$ (b) $\frac{5}{12}$ (c) $\frac{1}{36}$

(c) $\frac{7}{12}$ (d) $\frac{4}{9}$

Previous Year (Memory Based)

1. A bag contains balls of two colours, 3 black and 3 white. What is the minimum number of balls which must be drawn from the bag, without looking, so that among these there are two of the same colour?

(a) 2 (b) 3 (c) 4
(d) 5 (e) None of these

2. A box contains 10 identical elctronic components of which 4 are defective. If 3 components are selected at random from the box in succession, without replacing the units already drawn, what is the probability that two components of the selected components are defective?

(a) $\frac{1}{5}$ (b) $\frac{5}{24}$ (c) $\frac{3}{10}$

(d) $\frac{1}{40}$ (e) None of these

3. How many numbers of four digits can be formed with the digits 1, 2, 3, 4 and 5?
(If repetition of digits is not allowed)

(a) 100 (b) 720 (c) 120
(d) 24 (e) None of these

4. A question paper had ten questions. Each question could only be answered as True (T) or False (F). Each candidate answered all the questions.Yet, no two candidates wrote the answer in an identical sequence. How many different sequences of answers are possible?

(a) 20 (b) 40 (c) 512
(d) 1024 (e) None of these

5. When ten persons shake hands with one another, in how many ways is it possible?
(a) 20 (b) 25 (c) 40
(d) 45 (e) None of these

6. In how many ways can four children be made to stand in a line such that two of them, A and B are always together?
(a) 6 (b) 12 (c) 18 (d) 24
(e) None of these

7. In how many ways 6 persons can stand in a queue at a time?
(a) 120 (b) 240 (c) 480 (d) 720 (e) None of these

8. A card is drawn from a well-shuffled deck of cards. Find the probability of drawing a face card.
(a) $\frac{1}{52}$ (b) $\frac{4}{13}$ (c) $\frac{3}{13}$
(d) $\frac{16}{53}$ (e) None of these

9. One card is drawn from a well shuffled deck of 52 cards. Calculate the probability that the card will not be a black card
(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$
(d) $\frac{5}{8}$ (e) None of these

10. One ticket is drawn at random out of 30 tickets numbered from 1 to 30. Find the probability that the number on the ticket is a multiple of 5 or 7.
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$
(d) $\frac{1}{5}$ (e) None of these

11. 10 coins are tossed. What is the probability that exactly 5 heads appear?

(a) $\frac{63}{256}$ (b) $\frac{126}{256}$ (c) $\frac{186}{256}$

(d) $\frac{65}{256}$ (e) None of these

12. If P(A) = $\frac{2}{3}$, P(B) = $\frac{4}{9}$ and P(A $\cap$ B) = $\frac{14}{45}$, then find P(A $\cup$ B)

(a) $\frac{4}{5}$ (b) $\frac{1}{5}$ (c) $\frac{2}{5}$

(d) $\frac{7}{9}$ (e) None of these

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13. Find the chance of throwing 6 at least once in six throws with a single die.

(a) $\left(\frac{5}{6}\right)^6$ (b) $\left[1-\left(\frac{5}{6}\right)^6\right]$ (c) $\left(\frac{1}{6}\right)^6$

(d) $\left[1-\left(\frac{1}{6}\right)^6\right]$ (e) None of these

14. If a number of two digits is formed with the digits 2, 3, 5, 7, 9 without repetition of digits, what is the probability that the number formed is 35?

(a) $\frac{1}{10}$ (b) $\frac{1}{20}$ (c) $\frac{1}{5}$

(d) $\frac{1}{2}$ (e) None of these

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15. What is the probability of getting a total of less than 12 in the throw of two dice?

(a) $\frac{1}{36}$ (b) $\frac{1}{18}$ (c) $\frac{35}{36}$

(d) $\frac{33}{36}$ (e) None of these

16. From 21 tickets numbered 1, 2, 3.....21 one ticket is drawn at random. Find the probability that the ticket drawn has a number divisible by 3.

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

(d) $\frac{1}{5}$ (e) None of these

17. A bag contains 4 white balls and 2 black balls. Another bag contains 3 white balls and 5 black balls. If one ball is drawn from each bag, then the probability that both the balls are black, is

(a) $\frac{1}{24}$ (b) $\frac{3}{24}$ (c) $\frac{5}{24}$

(d) $\frac{9}{24}$ (e) None of these

18. A bag contains 3 red and 7 black balls. Two balls are taken out at random, without replacement. If the first ball is red, then what is the probability that the second ball is also red?

(a) $\frac{1}{10}$ (b) $\frac{1}{15}$ (c) $\frac{3}{10}$

(d) $\frac{2}{21}$ (e) None of these

19. A bag contains 5 white, 7 black and 4 red balls. Three balls are drawn from the bag at random, then the probability that all the three balls are white, is

(a) $\frac{3}{16}$ (b) $\frac{3}{5}$ (c) $\frac{1}{60}$

(d) $\frac{1}{56}$ (e) None of these

20. In a box, there are 2 red, 3 black and 4 white balls. Out of these, three balls are drawn together, then the probability that the balls drawn are of the same colour is

(a) $\frac{1}{84}$ (b) $\frac{1}{27}$ (c) $\frac{5}{84}$

(d) $\frac{1}{27}$ (e) None of these

21. An urn contains 9 red, 7 white and 4 black balls. If two balls are drawn at random, then the probability that one is white and the other is red is

(a) $\frac{18}{95}$ (b) $\frac{18}{190}$ (c) $\frac{63}{190}$

(d) $\frac{91}{190}$ (e) None of these

22. A bag contains '6' red, 4 white and 8 blue balls. If three balls are drawn at random, find the probability, that '1' is red and '2' are white

(a) $\frac{3}{69}$ (b) $\frac{3}{68}$ (c) $\frac{3}{65}$

(d) $\frac{4}{67}$ (e) None of these

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23. How many 3-digit numbers can be formed using 0, 1, 3, 5, 7 when repetition is allowed?
(a) 5^5 (b) 100 (c) 5^4
(d) 120 (e) None of these

24. A jar contains 3 red marbles, 7 green marbles and 10 white marbles. If a marble is drawn from the jar at random, what is the probability that this marble is white?
(a) 1/3 (b) 3/20 (c) 7/20
(d) 1/2 (e) None of these

25. Probability of getting heads in all the three trials, when a balanced coin is tossed thrice, will be
(a) 1/4 (b) 1/2 (c) 1
(d) 1/8 (e) None of these

26. Two dice are thrown. Find the probability that the sum is at least 10?
(a) 1/6 (b) 5/36 (c) 1/9
(d) 7/36 (e) None of these

27. In how many different ways can the letters of the word 'CORPORATION' be arranged so that the vowels always come together?
(a) 810 (b) 1440 (c) 2880 (d) 50400 (e) 5760

28. There are 6 men and 8 women in a club in which a committee of 5 people has to be formed. What will be the number of ways to select 5 people if:
No man is selected.
(a) 6 (b) 30 (c) 56
(d) 40 (e) None of these

29. There are 7 men and 8 women, in a club. A commitee is formed using these person. What will be the number of ways to select 6 persons such that at least one is woman?
(a) 4998 (b) 5006 (c) 5005
(d) 4999 (e) None of these

30. Tickets numbered 1 to 20 are mixed up and then a ticket is drawn at random. What is the probability that the ticket drawn has a number which is a multiple of 3 or 5 ?

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{8}{15}$

(d) $\frac{9}{20}$ (e) None of these

31. A bag contains 2 red, 3 green and 2 blue balls. Two balls are drawn at random. What is the probability that none of the balls drawn is blue?

(a) $\frac{10}{21}$ (b) $\frac{11}{21}$ (c) $\frac{2}{7}$

(d) $\frac{5}{7}$ (e) None of these

32. In a box there are 8 red, 7 blue and 6 green balls. One ball is picked up random. What is the probability that it is neither red nor green?

(a) $\frac{1}{3}$ (b) $\frac{3}{4}$ (c) $\frac{7}{19}$

(d) $\frac{8}{21}$ (e) $\frac{3}{7}$

33. Three unbiased coins are tossed thrice. What is the probability of getting at most two heads?

(a) $\frac{3}{4}$ (b) $\frac{1}{4}$ (c) $\frac{3}{8}$

(d) $\frac{7}{8}$ (e) None of these

34. Two dice are thrown simultaneously. What is the probability of getting two numbers whose product is even?

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(a) $\frac{1}{2}$ (b) $\frac{3}{4}$ (c) $\frac{3}{8}$

(d) $\frac{5}{16}$

(e) None of these

35. In a class, there are 15 boys and 10 girls. Three students are selected at random. The probability that 1 girl and 2 boys are selected, is:

(a) $\frac{21}{46}$ (b) $\frac{25}{117}$ (c) $\frac{1}{50}$

(d) $\frac{3}{25}$ (e) None of these

Foundation

Solutions

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1. (c); No of ways in which the letters of the word 'TABLE' can be arranged = 5! = 120

2. (d); No. of ways of arranging the letters of the word MATHEMATICS $= \frac{11!}{2! \times 2! \times 2!} = \frac{11!}{8}$

3. (a); No. of ways in which 6 letters can be posted in 5 letter boxes = $5 \times 5 \times 5 \times 5 \times 5 \times 5 = 5^6$

4. (c); There are 5 odd digits in total

No. of ways to form 3-digit numbers with distinct digits $= 5 \times 4 \times 3 = 60$

5. (c); UNIVERSAL has 9 letters,

$\therefore$ No of ways E R S can be arranged= 3!

Taking E R S as 1 letter, then no of letters is 7

Required no. of ways = $7! \times 3!$ = 5040 × 6 = 30240.

6. (a); Total no. of ways in which the letters of the word 'ALGEBRA' can be arranged $= \frac{7!}{2!} = 2520$

Total No. of ways such that both A's are together = $6! = 720$

Required No. of ways $= 2520 - 720 = 1800$

7. (e); In the word 'NUTAN' there are 3 odd places and 2 even places so

No. of ways in which consonants occupy at odd place $= \frac{3!}{2!} = 3$

(2! because of Repetition of N)

No. of ways in which vowels occupy at even places $= 2! = 2$

Total no. of ways $= 3 \times 2 = 6$

8. (a); No. of ways in which the posts can be filled = 7 × 6 × 5 = 210

9. (e); At the 100th place '0' is not allowed.

So, number of ways to form 3 digit numbers:

$$\underset{4}{\square} \times \underset{5}{\square} \times \underset{5}{\square} = 100$$

No. of ways = 100

10. (a); 1st item in column A can be matched with 6 items in column B

2nd item in column A can be matched with 5 items in column B

3rd item in column A can be matched with 4 items in column B

4th item in column A can be matched with 3 items in column B

5th item in column A can be matched with 2 items in column B

6th item in column A can be matched with 1 item in column B

So total $= 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720$

11. (c); 2-digit even number where '0' can't come at unit place and at ten's place.

So, the possible number at 10 ten's place = 9

at unit place = 4 (2, 4, 6, 8)

Total no. of ways $= 9 \times 4 = 36$

12. (b); In 3-digit no '0' can't come at hundreds place
So, possible no. of digits at hundreds place = 9
no. of digits at ten's place = 9
no. of digits at unit place = 8
$\therefore$ Total No. of ways $= 9 \times 9 \times 8 = 648$

13. (d); In 2 digit no. zero can't come at ten's place
So, total possible no. of digits at ten's place = 9
total possile no. of digits at unit place = 9
total no. of ways = $9 \times 9 = 81$

14. (a); In 4 digit no. zero can't come at 1000s place
Total no. of ways

$$= \frac{9}{1000\text{s place}} \times \frac{9}{100\text{s place}} \times \frac{8}{10\text{s place}} \times \frac{7}{\text{Units place}} = 4536$$

15. (c); In the word 'DETAIL' there are three vowels (AEI) and 3 consonants (D, T, L)
No. of ways vowels can be arranged at odd place = 3! = 6
and number of ways consonants can be arranged at even places = 3! = 6
$\therefore$ Total no. of ways in which letters of the word DETAIL can be arranged = $6 \times 6 = 36$

16. (a); Numbers of favourable out comes = 1 {2}
Total number of possible out comes = 6 {1, 2, 3, 4, 5, 6}.

$\therefore$ Probability of a 2 turning up $= \frac{1}{6}$

17. (c); Total no. of aces in a deck of 52 cards = 4

probability of getting ace $= \frac{4}{52}$

Probability of getting both the aces with replacement $= \frac{4}{52} \times \frac{4}{52}$

18. (b); Probability of getting first ace $= \frac{4}{52}$

getting second ace without replacement $= \frac{3}{51}$

(one card already down)

Required Probability $= \frac{4}{52} \times \frac{3}{51}$

19. (a); Total No. of Red balls = 6
Total No. of balls = 6 + 4 + 5 = 15

Required Probability $= \frac{6}{15} = \frac{2}{5}$

20. (d); Probability of not getting 4 in a single toss $= \frac{5}{6}$

Probability of not getting 4 in two tosses $= \frac{5}{6} \times \frac{5}{6} = \frac{25}{36}$

Proability of getting 4 atleast once $= 1 - \frac{25}{36} = \frac{11}{36}$

21. (a); Probability of getting white ball from 1st bag $= \frac{4}{4+2} = \frac{4}{6} = \frac{2}{3}$

Probability of getting white ball from 2nd bag $= \frac{3}{8}$

$\therefore$ Probability that both balls are white $= \frac{2}{3} \times \frac{3}{8} = \frac{1}{4}$

22. (c); Even numbers in a die = (2, 4, 6)
Sample space = (1, 2, 3, 4, 5, 6)

$\therefore$ Probabilityof getting an even number $= \frac{3}{6} = \frac{1}{2}$

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23. (a); Total sample space when two coins are tossed
= {HH, HT, TH, TT}
No of favourable outcomes of getting two heads = {HH}

Required probability $= \frac{1}{4}$

24. (a); There are 3 odd numbers out of 6 i.e. (1, 3, 5)

Probability of getting odd number $= \frac{3}{6} = \frac{1}{2}$

Probability of getting head $= \frac{1}{2}$

Required Probability $= \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

25. (a); Total sample space of a deck of cards = 52
There is only one 3 of diamond

So, required Probability $= \frac{1}{52}$

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26. (d); The probability of not getting a spade first time $= \frac{39}{52} = \frac{3}{4}$

The probability of not getting a spade second time $= \frac{39}{52} = \frac{3}{4}$

Required probability $= \frac{3}{4} \times \frac{3}{4} = \frac{9}{16}$

27. (b); Let A = Event that A speaks the truth
B = Event that B speaks the truth

then, $P(A) = \frac{60}{100} = 0.6$

$P(B) = \frac{70}{100} = 0.7$

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Probability that A speaks lie is $P(\bar{A}) = 1 - P(A) = 0.4$

Probability that B speak lie is $P(\bar{B}) = 1 - P(B) = 0.3$

Probability of saying the same thing in a single Event

$= P(A) \times P(B) + P(\bar{A}) \times (\bar{B}) = 0.6 \times 0.7 + 0.4 \times 0.3 = 0.54$

Required probability = 0.54

28. (c); Given : No. of Red balls = 2

No. of Black balls = 3

No. of White balls = 4

Therefore total no. of balls = 2 + 3 + 4 = 9

No. of ways to draw 3 balls out of 9 = ${}^{9}C_3$

$$= \frac{9!}{3!(9-3)!} = \frac{9 \times 8 \times 7}{3 \times 2 \times 1} = 84$$

Since the red balls are only 2, therefore it is not possible to draw 3 red balls.

We also know that no of ways to draw 3 black balls out of 3 balls = ${}^{3}C_3 = 1$

Similarly, no. of ways to draw 3 white balls out of 4 white balls

$$= {}^{4}C_3 = \frac{4!}{3!1!} = 4$$

Therefore probability that 3 balls are of the same color (P)

$$= \frac{{}^{3}C_3 + {}^{4}C_3}{{}^{9}C_3} = \frac{1+4}{84} = \frac{5}{84}$$

29. (c); Minimum number obtained from 2 dice = 2

Maximum number obtained from 2 dice = 12

Prime nos. between 2 and 12 = {2, 3, 5, 7, 11}

$\therefore$ Different combinations of the two dice such that the above prime numbers are obtained are: {2} = {1, 1}

{3} = {1, 2} {2, 1}
{5} = {2, 3} {3, 2} {4, 1} {1, 4}
{7} = {6, 1} {1, 6} {2, 5} {5, 2} {3, 4} {4, 3}
{11} = {6, 5} {5, 6}

Total sample space of 2 dice = $6^2 = 36$

$\therefore$ Required probability $= \frac{15}{36} = \frac{5}{12}$

30. (d); Sample space of two coins
= {TT, HT, TH, HH} = 4
No. of favourable events {HT, TH} = 2

Required probability $= \frac{2}{4} = \frac{1}{2}$

Moderate

1. (b); From the digits (0, 2, 3, 5, 7) we can form even numbers by using 0, 2 at the units place.
Case 1: Placing 0 at unit place

100th	10th	Unit
		0
no. of ways=3	No. of ways=4	Fixed

Total no. of combinations = $4 \times 3 = 12$
Case 2: Placing 2 at units place

100th	10th	Unit
		2
no. of ways=3	No. of ways = 3	Fixed

For 3 digit no '0' not allowed at 100th place

Total no. of combination = $12 + 9 = 21$

2. (c); First 3 question be answered as $4 \times 4 \times 4 = 64$

Last three question be answered as $5 \times 5 \times 5 = 125$

So total combination $64 \times 125 = 8000$

3. (d); Total numbers of persons = 7 + 6 = 13

It is given that out of 5 at least 3 men are there

So,

No. of Men	No. of Women	No. of committees	
3	2	${}^{7}C_3 \times {}^{6}C_2 = 35 \times 15 =$	525
4	1	${}^{7}C_4 \times {}^{6}C_1 = 35 \times 6 =$	210
5	0	${}^{7}C_5 \times {}^{6}C_0 = 21 \times 1 =$	21

Possible No. of ways = 756

4. (c); In the a word 'LEADING' No. of vowels = 3(A, E, I)

Taking AEI as one,

No. of ways in which vowels always come together $= 5! \times 3!$

= 120 × 6 = 720

5. (c); No. of ways to choose 3 consonants out of

7 = ${}^{7}C_3$ = 35

No. of ways to choose 2 vowels out of 4 = ${}^{4}C_2$ = 6

Now, these 5 letters can be arranged in 5! ways so, total number of such words = 35 × 6 × 5! = 35 × 6 × 120 = 25200

6. (e); Total no. of children = 6 + 4 = 10

Total no. of ways to select 4 children $= {}^{10}C_4$ = 210

No. of ways to select no boys $= {}^{4}C_4$ = 1

Total no. of ways to select at least one boy

$= {}^{10}C_4 - {}^{4}C_4$ = 210 – 1 = 209

7. (d); We have to form 3 digit nos. which are divisible by 5. So number at units place must be 5.

Given digits → (2, 3, 5, 6, 7 & 9)

		5
4 No. of ways (Repetition Not allowed)	5 No. of ways	Fixed

Total required no. of ways = $4 \times 5 \times 1$ = 20

8. (c); No. of ways to select 5 men = ${}^{8}C_{5}$ = 56

No. of ways to select 6 women = ${}^{10}C_{6}$ = 210

Total No. of ways to select 5 men and 6 women

= 56× 210 = 11760

9. (a); The first letter is E and the last one is R. Therefore one has to find other letters from the remaining 11 letters. Of the 11 letters, there are 2 Ns, 2Es and 2 As and one each of the remaining 5 letters.

The second and third positions can either have two different letters or have both the letters to be the same.

Case1: When the two letters are different. One has to choose two different letters from the 8 available different choices. This can be done in 8 × 7 = 56 ways

Case 2: When the two letters are same. There are 3 options the three can be either Ns on Es or As.

Therefore, 3 ways

Total number of possibilities = 56 + 3 = 59

10. (a); No. of vowels in the word MATHEMATICS = 4 (A, A ,E ,I)

Taking vowels as one we have 8 different letters.

$$\therefore \text{ Required no. of ways} = \frac{8! \times 4!}{2! \times 2! \times 2!} = 120960$$

11. (b); No. of ways to select 2 men out of 6 $= 6C_2 = 15$

No. of ways to select 3 women out 8 $= 8C_3 = 56$

Total no. of ways = 56 × 15 = 840

12. (a); Only men are selected means 5 men are selected out of 6.

No. of ways = $^6C_5 = 6$

13. (e); Total no. of people = 8 + 6 = 14

Total no. of ways to select 5 people out of 14 $= {}^{14}C_5 = 2002$

No. of ways such that no woman is selected $= {}^6C_5 = 6$

Required no. of ways $= {}^{14}C_5 - {}^6C_5 = 2002 - 6 = 1996$

14. (c); At most one man means either no man is selected or one man is selected.

$\therefore$ No. of ways such that no man is selected= $^8C_5 = 56$

No. of ways to select one man and 4 women

$= {}^6C_1 \times {}^8C_4 = 6 \times 70 = 420$

required number of ways = 420 + 56 = 476

15. (b); The range of sum of possible out comes of 2 dice is (2 to 12)

$\therefore$ even numbers between two and twelve are (2, 4, 6, 8, 10, 12)

{2} = {1, 1}

{4} = {2, 2} {1, 3} {3, 1}

{6} = {2, 4} {3, 3} {4, 2} {1, 5} {5, 1}

{8} = {2, 6} {6, 2} {3, 5} {5, 3} {4, 4}

{10} = {4, 6} {6, 4} {5, 5}

{12} = {6, 6}

Total sample space = $6^2 = 36$

Required Probability $= \frac{18}{36} = \frac{1}{2}$

16. (a); Box A contains 3 white and 1 black balls
Box B contains 2 white and 2 black balls
Box C contains 1 white and 3 black balls
So, WWB, WBW, BWW

$$=\frac{3}{4}\times\frac{2}{4}\times\frac{3}{4}+\frac{3}{4}\times\frac{2}{4}\times\frac{1}{4}+\frac{1}{4}\times\frac{2}{4}\times\frac{1}{4}=\frac{9}{32}+\frac{3}{32}+\frac{1}{32}=\frac{13}{32}$$

required probability = $\frac{13}{32}$

17. (b); Total no. of balls = 10 + 12 + 11 = 33 balls

No. of ways to draw 2 balls out of 33 $= {}^{33}C_2$

$$=\frac{33!}{(33-2)!\times 2!}=\frac{32\times 33}{2}=528$$

No. of ways to draw 2 green balls $= {}^{10}C_2 = 45$

Required Probability $=\frac{45}{528}=\frac{15}{176}$

18. (b); Probability of getting no white ball $=\frac{22}{33}\times\frac{21}{32}=\frac{7}{16}$

19. (e); Probability of getting atleast one white ball $=1-\frac{7}{16}=\frac{9}{16}$

20. (a); Total No. of balls = 15 + 20 = 35

Total no. of ways to select 2 balls $= {}^{35}C_2$

Probability of getting both white $=\frac{{}^{20}C_2}{{}^{35}C_2}=\frac{20\times 19}{35\times 34}=\frac{38}{119}$

21. (c); Probability that when 2 balls are selected, one is white

$$=2\times\frac{{}^{15}C_1\times{}^{20}C_1}{{}^{35}C_2}=2\times\frac{15\times 20}{34\times 35}=\frac{60}{119}$$

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22. (a); 1st condition → both are black

2nd condition → first is white and second is black

3rd condition → first is black and second is white

Required Probability

$$= \frac{15}{35} \times \frac{14}{34} + \frac{20}{35} \times \frac{15}{34} + \frac{15}{35} \times \frac{20}{34} = \frac{3}{17} + \frac{30}{119} + \frac{30}{119} = \frac{81}{119}$$

23. (e); Total No. of marbles $= 6 + 4 + 3 + 2 = 15$

Probability of getting both blue marbles $= \frac{{}^{6}C_2}{{}^{15}C_2} = \frac{5 \times 6}{14 \times 15} = \frac{1}{7}$

24. (c); Probability of getting 2 red and 1 green

$$= \frac{{}^{4}C_2 \times {}^{3}C_1}{{}^{15}C_3} = \frac{6 \times 3}{\frac{15 \times 14 \times 13}{3 \times 2 \times 1}} = \frac{18}{455}$$

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25. (c); Probability of getting no red marble

$$= \frac{{}^{11}C_4}{{}^{15}C_4} = \frac{8 \times 9 \times 10 \times 11}{12 \times 13 \times 14 \times 15} = \frac{66}{273}$$

Required probability of getting atleast one red marble

$$= 1 - \frac{66}{273} = \frac{207}{273} = \frac{69}{91}$$

26. (c); Probability of getting both yellow $= \frac{{}^{2}C_2}{{}^{15}C_2} = \frac{2}{14 \times 15} = \frac{1}{105}$

Probability of getting both green $= \frac{{}^{3}C_2}{{}^{15}C_2} = \frac{3}{105} = \frac{1}{35}$

Required Probability $= \left(\frac{1}{105} + \frac{1}{35}\right) = \frac{4}{105}$

27. (d); Required Probability $= \dfrac{{}^{2}C_1 \times {}^{4}C_2 \times {}^{6}C_1}{{}^{15}C_4}$

$$= \frac{2 \times 6 \times 6 \times 4 \times 3 \times 2 \times 1}{12 \times 13 \times 14 \times 15} = \frac{24}{455}$$

28. (d); Probability that all are green $= \dfrac{{}^{3}C_3}{{}^{12}C_3} = \dfrac{1 \times 3 \times 2}{10 \times 11 \times 12} = \dfrac{1}{220}$

Probability that all are red $= \dfrac{{}^{4}C_3}{{}^{12}C_3} = \dfrac{4 \times 3 \times 2 \times 1}{10 \times 11 \times 12} = \dfrac{1}{55}$

Required probability = $\left(\dfrac{1}{220} + \dfrac{1}{55}\right) = \dfrac{5}{220} = \dfrac{1}{44}$

29. (b); Probability that none is blue $= \dfrac{{}^{7}C_3}{{}^{12}C_3} = \dfrac{5 \times 6 \times 7}{12 \times 11 \times 10} = \dfrac{7}{44}$

Required Probability $= 1 - \dfrac{7}{44} = \dfrac{37}{44}$

30. (c); Required Probability $= \dfrac{{}^{4}C_2 \times {}^{3}C_1}{{}^{12}C_3} = \dfrac{6 \times 3}{220} = \dfrac{9}{110}$

Difficult

1. (c); Each even number must have 0, 2, 4 or 6 in its units place. Total number of digits = 7

			0, 2, 4 or 6

case 1 when 0 occurs at units place

			0

${}^{6}p_3$ 1 way

Unit place can be filled up by 0 in 1 ways and remaining three places can be filled up by remaining 6 digits in ${}^6p_3$ way.

$\therefore$ Number of ways in this case

$$= 1 \times {}^6P_3 = \frac{6!}{3!} = 120$$

case II when 0 does not occur at unit place

Any of the remaining six digits except zero			2, 4 or 6
5 ways		${}^5p_2$ ways	3 ways

Unit place can be filled up by any one of the three digits 2, 4 or 6 in 3 ways. Thousands place can be filled up by any one of the remaining six digits (except zero) in 5 ways. Remaining two places can be filled up by remaining five digit in ${}^5p_2$ ways.

$\therefore$ Number of ways numbers can be formed in this case

$$= 5 \times 3 \times {}^5p_2 = 15 \times \frac{5!}{3!} = 300$$

Required number = 120 + 300 = 420

2. (b); Different sums of money can be formed by taking one, two, three or all the four notes together.

No. of different sums = ${}^4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4$

$= 4 + 6 + 4 + 1 = 15$

3. (a); Number of ways to arrange 12 persons around the table

$= (12 - 1)! = 11!$

And no. of ways in which 2 particular perons sit side by side

$= 10! \times 2!$

Therefore total No. of arrangement in which two particular persons are not to sit side by side

$= 11! - (10! \times 2!) = (11 \times 10!) - (10! \times 2 \times 1) = (11 - 2) \times 10! = 9 \times 10!$

4. (d); Given no of letters in the word ARTICLE = 7.
We know that no. of vowels in the given word (i.e. A, I, E) = 3
And no of even places in the given word (second, fourth, sixth) = 3
Therefore no. of ways of arranging the vowels at even places = ${}^3p_3$
And the no of ways of arranging 4 letters = ${}^4p_4$ therefore total no. of words which can be formed

$$= {}^3p_3 \times {}^4p_4 = \frac{3!}{(3-3)!} \times \frac{4!}{(4-4)!} = 3! \times 4! = 6 \times 24 = 144$$

5. (c); If the number is greater than 24000 than 1st digit can never be 1, but it can be 2. When 1st digit is 2 then second digit can not be 1 & 3. So when 1st digit is 2:

2				
Fixed	2 x	3 x	2 x	1 = 12

When 1st digit is other than 2 then

3 x	4 x	3 x	2 x	1 = 72

Total number = 72 + 12 = 84

6. (d); Numbers greater than 100 can be either 3 digit or 4 digit numbers. If the numbers are divisible by 5, 5 must come at units place.

		5
No. of ways=2 (Repetition not allowed)	No. of ways=3	Fixed

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Total No. of ways = 3 × 2× 1 = 6

Condition II ⟶ 4 digit numbers greater than 100

☐	☐	☐	5
↓	↓	↓	Fixed
3 ×	2 ×	1 =	6

So total number of required numbers = 6 + 6 = 12

7. (c); We know that a number, divisible by 4 with the digits 1, 2, 3, 4, 5 and 6 should have last two digits divisible by 4.

i.e., 12, 16, 24, 32, 36, 52, 56, 64

Thus 5 digit numbers where last two digit is 12 can be made in $^4C_3 \times 3! = 24$ ways.

Similarly, all the the other numbers whose last two digits are 16, 24, 32, 36, 52, 56, 64 can be formed in 24 ways each.

Thus total number n = 24 × 8 = 192

8. (d); There are 32 black and 32 white squares on a chess board.

Therefore, number of ways of choosing one white and one black square on the chess board

$= {}^{32}C_1 \times {}^{32}C_1 = 32 \times 32 = 1024$

There are 8 rows and in a row 4 white squares and 4 black squares.

No of ways in which squares lie in the same row

$= {}^4C_1 \times {}^4C_1 \times 8 = 128$

No. of ways in which squares lie in the same column

$= {}^4C_1 \times {}^4C_1 \times 8 = 128$

Thus total number of ways in which squares lie in the same row or in same column = 128 + 128 = 256

Therefore required no of ways = 1024 – 256 = 768

9. (b); Let E = The event of drawing a coloured ball

E_1 = The event of drawing a red ball

E_2 = The event of drawing a blue ball

Clearly $E = E_2 \cup E_2$

But E_1 and E_2 are mutually exclusive events.

$$P(E) = \frac{10}{30} + \frac{5}{30} = \frac{15}{30} = \frac{1}{2}$$

10. (b); The total number of ways of selecting 3 cards from 52 cards $= {}^{52}C_3$

Let E = The event of getting a king, a queen and a jack

n(E) = The number of ways of selecting a king out of 4 kings, a queen out of 4 queens and a jack out of 4 jacks

$= {}^4C_1 \times {}^4C_1 \times {}^4C_1 = 4 \times 4 \times 4 = 64$

$$\therefore \quad P(E) = \frac{N(E)}{N(S)} = \frac{64}{22100} = \frac{16}{5525}$$

11. (a); The total number of ways in which a sum of 15 is abtained with 3 dice is 10. The number of ways in which 4 turns on the first die is given by 2 i.e. (4, 6, 5) and (4, 5, 6) Hence the required probability $= \frac{2}{10} = \frac{1}{5}$.

12. (d); The total number of outcomes if three dice are thrown is $(N) = 6^3 = 216$. The favourable combinations of numbers are (6, 6, 4) and (6, 5, 5)

The total permutations are $= \frac{3!}{2!}$ and $\frac{3!}{2!}$

Hence the required probility $= \frac{6}{216} = \frac{1}{36}$

13. (b); Case 1 $\rightarrow$ Let a white ball is drawn from the first bag and placed useen in the second bag,

in this case probability $= \frac{{}^5C_1}{{}^8C_1} \times \frac{{}^4C_1}{{}^7C_1} = \frac{20}{56}$

Case 2 $\rightarrow$ Let a black ball is drawn from the first bag and placed useen in the second bag

in this case, probability = $\frac{{}^3C_1}{{}^8C_1} \times \frac{{}^5C_1}{{}^7C_1} = \frac{15}{56}$

$\therefore$ Required probability = $\frac{20}{56} + \frac{15}{56} = \frac{35}{56} = \frac{5}{8}$.

14. (b); Probability of the person getting rewarded

P = $\frac{4}{16} = \frac{1}{4}$

Then, the probability of not getting the reward

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

$\therefore$ Required probability

$= {}^4C_1\left(\frac{1}{4}\right) \times \left(\frac{3}{4}\right)^3 + {}^4C_2\left(\frac{1}{4}\right)^2\left(\frac{3}{4}\right)^2 + {}^4C_3\left(\frac{1}{4}\right)^3\left(\frac{3}{4}\right) + {}^4C_4\left(\frac{1}{4}\right)^4$

$= \left(\frac{1}{4}\right)^4 \{{}^4C_1 \times 3^3 + {}^4C_2 \times 3^2 + {}^4C_3 \times 3^1 + {}^4C_4\}$

$= \frac{1}{256}(108 + 54 + 12 + 1) = \frac{175}{256}$

15. (d); Probability of a spade = $\frac{13}{52}$

Probability of an ace = $\frac{4}{52}$

and probability of an ace of spade = $\frac{1}{52}$

$\therefore$ Required probability = $\frac{13}{52} + \frac{4}{52} - \frac{1}{52} = \frac{16}{52} = \frac{4}{13}$

Odds against his winning = $\frac{1 - \frac{4}{13}}{\frac{4}{13}} = \frac{\frac{9}{13}}{\frac{4}{13}} = \frac{9}{4} = 4$ to 9

16. (c); Required probability

$$= \frac{4}{5}\times\frac{3}{4}\times\frac{1}{3}+\frac{1}{5}\times\frac{3}{4}\times\frac{2}{3}+\frac{4}{5}\times\frac{1}{4}\times\frac{2}{3}+\frac{4}{5}\times\frac{3}{4}\times\frac{2}{3}=\frac{5}{6}$$

17. (d); A leap year has 366 days, therefore 52 weeks i.e. 52 sundays and 2 days left.

For having 53 sundays in a year, one of the remaining 2 days must be a sunday.

$\Rightarrow$ Required probability = $\frac{1}{7}+\frac{1}{7}=\frac{2}{7}$

18. (b); Total no of passible outcomes = 6^3 = 216

No of favourable out comes = 6

{(1, 1, 1), (2, 2, 2) (3, 3, 3) (4, 4, 4) (5, 5, 5), (6, 6, 6)}

Required probability = $\frac{6}{216}=\frac{1}{36}$

19. (b); The first die can show any number $\Rightarrow$ 6 possibilites

The second die can show any other number $\Rightarrow$ 5 possibilites

The third die can show any number different from the first two $\Rightarrow$ 4 possibilites

Therefore the required probability = $\frac{6\times5\times4}{6^3}=\frac{5}{9}$

20. (b); First die can show any number $\Rightarrow$ 6 possibilites

Second die will be the same as the first $\Rightarrow$ 1 possibility

Third die can show any number other than the first or second $\Rightarrow$ 5 possibilites .

$\boxed{6}\times\boxed{1}\times\boxed{5}$ [will be multiplied by 3 because of total 3 cases]

Total no of favourable out comes = 3 × 6 × 1 × 5

Required probability = $\frac{3\times6\times1\times5}{216}=\frac{5}{12}$

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Previous Year (Memory Based)

1. (b); The minimum possible no. of balls which must be drawn so that among these there are two of the same color = 3

2. (c); Required probability $= \frac{{}^{6}C_1 \times {}^{4}C_2}{{}^{10}C_3} = \frac{6 \times 6 \times 6}{10 \times 9 \times 8} = \frac{3}{10}$

3. (c); No. of digits = 5
No. of places = 4

Required number $= {}^{5}P_4 = \frac{5!}{1!} = 5 \times 4 \times 3 \times 2 = 120$

4. (d); Each question can be answered in 2 ways.
Hence, total No. of sequences = 2 × 2 × 2 ..... 10 times = 2^{10} = 1024

5. (d); Total no. of possible ways = ${}^{10}C_2 = \frac{9 \times 10}{2}$ = 45

6. (b); If A and B are always together, then total no. of children is 3
∴ No. of ways = 3!
and A and B also interchange their places. So no. of ways = 2!
⇒ Total no. of ways = 3! × 2! = 12

7. (d); No. of ways in which 6 persons can stand in a queue at a time = 6! = 720

8. (b); Total no. of face cards (Ace, King, Queen and Jack of all suits) = 4 × 4 = 16

Required Probability $= \frac{16}{52} = \frac{4}{13}$

9. (b); No. of black cards = 26
No. of cards which are not black = 52 – 26 = 26

Required Probability $= \frac{26}{52} = \frac{1}{2}$

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10. (b); Sample space S = {1, 2, 3, ... 30}; n(s) = 30

Let A = The event of drawing a ticket having a number which is multiple of 5

B = The event of drawing a ticket having a number which is a multiple of 7

Then, A = {5, 10, 15, 20, 25, 30} n{A} = 6

B = {7, 14, 21, 28} n{B} = 4

Hence $P(A \cup B) = P(A) + P(B) = \frac{n(A)}{n(S)} + \frac{n(B)}{n(S)} = \frac{6}{30} + \frac{4}{30} = \frac{10}{30} = \frac{1}{3}$

11. (a); Total no. of outcomes = 2^{10}

Again, the number of favourable cases of getting exactly 5 heads = ${}^{10}C_5$

$\therefore$ Required probability $= \frac{{}^{10}c_5}{2^{10}} = \frac{63}{256}$

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12. (a); Given, $P(A) = \frac{2}{3}$, $P(B) = \frac{4}{9}$, and $P(A \cap B) = \frac{14}{45}$

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$

$= \frac{2}{3} + \frac{4}{9} - \frac{14}{45} = \frac{30 + 20 - 14}{45} = \frac{36}{45} = \frac{4}{5}$

13. (b); Probability of not getting 6 in one throw $= 1 - \frac{1}{6} = \frac{5}{6}$

The chance of not getting six in six throws is given by $\left(\frac{5}{6}\right)^6$

Hence the chance of throwing six at least once in six throws is given by $\left[1 - \left(\frac{5}{6}\right)^6\right]$

14. (b); Formation of two digit numbers with the digits 2, 3, 5, 7, 9 without repetition:
Let S = The sample space
and E = The event that the number formed is 35 Now n(E) = 1
and n(S) = total numbers of two digit formed with the digits 2, 3, 5, 7, 9 without repetition.= $5p_2 = 5\times 4 = 20$

$$\text{Required probability } P(E) = \frac{n(E)}{n(S)} = \frac{1}{20}$$

15. (c); Total sample space n(S) = 6 × 6 = 36
E = The even that the sum of numbers coming up is 12 (6, 6); n(E) = 1

$$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{1}{36}$$

Required Probability = $P(\bar{E}) = 1 - P(E) = 1 - \frac{1}{36} = \frac{35}{36}$

16. (b); S = {1, 2, 3, ... 21} n(S) = 21
E = {3, 6, 9, 12, 15, 18, 21} n(E) = 7

$$\therefore \quad P(E) = \frac{n(E)}{n(S)} = \frac{7}{21} = \frac{1}{3}$$

17. (c); Given: In the first bag no. of white balls = 4 and no. of black balls = 2
And in second bag, no. of white balls = 3 and no. of black balls = 5
We know that probability of drawing one black ball from the first bag out of 6 balls $= \frac{2}{6} = \frac{1}{3}$
Similarly, probability of drawing one black ball from the second bag out of 8 balls $= \frac{5}{8}$
Therefore probability that both balls are black $= \frac{1}{3} \times \frac{5}{8} = \frac{5}{24}$

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18. (b); Given no. of red balls = 3, No. of black balls = 7
No. of balls taken out at random = 2
we know that total balls in the bag = 3 + 7 = 10
we also know that probability for taking out one red ball out of 10 balls $= \frac{3}{10}$

Similarly, probability for taking out one red ball out of the remaning 9 balls $= \frac{2}{9}$

Therefore, required probability $= \frac{3}{10} \times \frac{2}{9} = \frac{1}{15}$

19. (d); Total no. of balls = 5 + 7 + 4 = 16
No. of balls drawn = 3

Required probability $= \frac{{}^{5}C_3}{{}^{16}C_3} = \frac{3 \times 4 \times 5}{16 \times 15 \times 14} = \frac{1}{56}$

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20. (c); Total no. of balls = 2 + 3 + 4 =9
Since the red balls are only 2, therefore it is not possible to draw 3 red balls.
we know that no. of ways to draw 3 black balls = ${}^{3}C_3$
no. of ways to draw 3 white balls out of 4 = ${}^{4}C_3$
Therefore required probability

$$= \frac{{}^{3}C_3 + {}^{4}C_3}{{}^{9}C_3} = \frac{1+4}{84} = \frac{5}{84}$$

21. (c); Total no. of balls = 7 + 9 + 4 = 20
No. of ways to draw one white ball out of 7 = $7c_1$
No. of ways to draw one red ball out of 9 = $9c_1$

Required probability $= \frac{{}^{7}C_1 \times {}^{9}C_1}{{}^{20}C_2} = \frac{63}{190}$

22. (b); Total no. of balls = 6 + 4 + 8 = 18 balls

Balls drawn = 3

No. of ways to draw 1 red ball out of 6 = ${}^{6}C_1$

No. of ways to draw 2 white ball out of 4 = ${}^{4}C_2$

$$\text{Required probability} = \frac{{}^{6}C_1 \times {}^{4}C_2}{{}^{18}C_3} = \frac{3}{68}$$

23. (b); $\boxed{A}$ $\boxed{B}$ $\boxed{C}$

For 3 digit number '0' can never come on A's place so rest 4 digits can be filled in it. On B's place all 5 digits can come while on C's place all 5 digits can come. So total number of arrangements = 4 × 5 × 5 = 100

24. (d); Total no. of marbles = 3 + 7 + 10 = 20

No. of ways to choose 1 marble out of 10 = ${}^{10}C_1$

$$\text{Required probability} = \frac{{}^{10}C_1}{{}^{20}C_1} = \frac{10}{20} = \frac{1}{2}$$

25. (d); Total no. of outcomes when 3 coins are tossed = $2^3 = 8$

(TTT, THH, TTH, HHT, HTT, THT, HTH, HHH)

$$\text{Required probability} = \frac{1}{8}$$

26. (a); Sum is at least 10 means sum can be 10, 11 and 12.

For {10} = {4, 6} {5, 5} {6, 4}

{11} = {5, 6} {6, 5}

{12} = {6, 6}

Total out comes = $6^6 = 36$

$$\text{Required probility} = \frac{6}{36} = \frac{1}{6}$$

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27. (d); No of vowels in the word "CORPORATION" is 5 (O, O, A, I, O)
Taking all the vowels together, number of letters is 7

$\therefore$ Required no of ways = $\frac{7! \times 5!}{3! \times 2!} = 50400$

28. (c); Total No of people in the club = 8 + 6 = 14
Number of ways to select 5 people when no man is seclected =

$^{8}C_5 = \frac{8!}{3!\,5!} = 56$

29. (a); Total no. of ways to select 6 persons out of 15 = $^{15}C_6$
Total no. of people in the club = 8 + 7 = 15
No of ways to select 6 persons out of 15 = $^{15}C_6$
No of ways to select no woman out of 6 = $^{7}C_6$

Required No of ways = $^{15}C_6 - {}^{7}C_6 = \frac{15!}{9! \times 6!} - 7$

$= \frac{15 \times 14 \times 13 \times 12 \times 11 \times 10}{6 \times 5 \times 4 \times 3 \times 2} - 7 = 5005 - 7 = 4998$

30. (d); Total No of tickets = 20
Tickets which are multiples of 3 between 1 to 20 = 3, 6, 9, 12, 15, 18
Tickets which are multiples of 5 between 1 to 20 = 5, 10, 15, 20
15 is common to both the sets therefore 15 is taken once.

$\therefore$ Required probability = $\frac{9}{20}$

31. (a); Total No of balls = 2 + 3 + 2 = 7
Let S be the sample space
Then, N(S) = Number of ways of drawing 2 balls out of 7 = $^{7}C_2$.
Let E = Event of drawing two balls, none of which is blue.

$\therefore$ N(E) = number of ways of drawing 2 balls out of (2 + 3) balls $= {}^5C_2 = 10$

$$P(E) = \frac{n(E)}{n(S)} = \frac{{}^5C_2}{{}^7C_2} = \frac{10}{21}$$

32. (a); Total No. of balls = 8 + 7 + 6 = 21
Let E = Event that the ball drawn is neither red non green
= event that the ball drawn is blue.

$$\therefore \quad N(E) = 7 \Rightarrow \quad P(E) = \frac{N(E)}{N(S)} = \frac{7}{21} = \frac{1}{3}$$

33. (d); Here, S = {TTT, TTH, THT, HTT, THH, HTH, HHT, HHH}
Let E = Event of getting at most two heads.
Then E = {TTT, TTH, THT, HTT, HTH, HHT}

$$\therefore \quad P(E) = \frac{N(E)}{N(S)} = \frac{7}{8}$$

34. (b); In a simultaneous throw of two dice, we have n(S) = 6 × 6
Then,
E = {(1, 2) (1, 4) (1, 6) (2, 1) (2, 2) (2, 3) (2, 4) (2, 5) (2, 6) (3, 2) (3, 4) (3, 6) (4, 1) (4, 2) (4, 3) (4, 4) (4,5) (4, 6) (5, 2) (5, 4) (5, 6) (6, 1) (6, 2) (6, 3) (6, 4) (6, 5) (6, 6)}
$\therefore$ N(E) = 27

$$\therefore \quad P(E) = \frac{N(E)}{N(S)} = \frac{27}{36} = \frac{3}{4}$$

35. (a); Required probability $= \dfrac{{}^{10}C_1 \times {}^{15}C_2}{{}^{25}C_3} = \dfrac{1050}{2300} = \dfrac{21}{46}$.

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Chapter 14

Number Series

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Chapter 14

Number Series

Let us begin by observing the following series:

2, 4, 6, 8, 10, ...

clearly, it is an even number series.

Now, let us observe the following series:

62, 127, 214, 345, 510, ...

This series is obtained by alternatively substracting and adding 2 to the cubes of natural numbers beginning with 4.

i.e.,	62,	127,	214,	345,	510,	.....
	↓	↓	↓	↓	↓	
	$(4^3 - 2)$	$(5^3 + 2)$	$(6^3 - 2)$	$(7^3 + 2)$	$(8^3 - 2)$	

The pattern of the first series can be more easily understood as compared to the second one because we are more familier with the first pattern, i.e; even numbers.

So, let us familiarise ourselves with more such patterns.

Type 1: Even/odd number series

Example 1: 2, 4, 6, 8, 10, ...

The above series is an even number series. The next term in this series is 12.

Example 2: 1, 3, 5, 7, 9,.....

This is an odd number series. The next term will be 11.

Type 2: Prime number series

Example 1: 2, 3, 5, 7, ...

The next term will be 11.

Example 2: 3, 7, 13, 19, ...

This series is formed by picking up alternate terms from the prime number series beginning with 3.

<u>3</u>, 5, <u>7</u>, 11, <u>13</u>, 17, <u>19</u>, 23, <u>29</u>

So, the next term will be 29.

Example 3: 3, 7 17, ...

This series is formed by picking up terms from the prime number series beginning with 3 and leaving out one term, two terms, three terms and so on successively in between.

3, 5, 7, 11, 13, 17, 19, 23, 29, 31

So, the next term will be 31.

Type 3: Series formed by squares of numbers

Example 1: 4, 9, 16, 25, 36, ...

This series is formed by squares of successive numbers beginning with 2

2^2, 3^2, 4^2, 5^2, 6^2, 7^2

So, the next term will be 49.

Example 2: 1, 9, 25, 49, 81, ...

These are squares of odd numbes.

1^2, 3^2, 5^2, 7^2, 9^2, 11^2

So, the next term will be 121.

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Type 4: Series formed by Cubes of numbers

Example 1: 64, 125, 216, 343, ...

These are cubes of successive numbers beginning with 4.

So, the next term will be 512.

Example 2: 8, 27, 125, 343, ...

These are cubes of prime numbers.

So, the next term will be $11^3 = 1331$.

Type 5 : Series formed by addition

Example 1: 12, 13, 15, 17, ...

This series is formed by adding 10 to each term of the prime number series beginning with 2.

(2 + 10), (3 + 10), (5 + 10), (7 + 10)

So, the next term will be (11 + 10) = 21.

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Example 2: 1, 3, 4, 8, 15, 27, ...

Previous three terms are added to find the terms beginning from 8.

1 + 3 + 4 = 8, 3 + 4 + 8 = 15, 4 + 8 + 15 = 27, 8 + 15 + 27 = 50

So, the next term will be 50.

Type 6: Series formed by multiplication

Example 1: 0.5, 1.5, 4.5, 13.5, ...

Here, each term is formed by multiplying the previous term by 3. So, the next will be 40.5.

Example 2: 1, 3, 7, 15, 31, 63, ...

Each term is formed by multiplying the previous term by 2 and adding 1

So, the next term will be → 63 × 2 + 1 = 127.

Type 7: Series formed by division

Example 1: 840, 168, 42, 14, 7, ...

(840 ÷ 5) = 168, (168 ÷ 4) = 42, (42 ÷ 3) = 14, (14 ÷ 2) = 7, (7 ÷ 1) = 7.

So, the next term will be 7.

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Example 2: 240, ...?..., 120, 40, 10, 2.

240 ÷ 1 = 240, 240 ÷ 2 = 120, 120 ÷ 3 = 40, 40 ÷ 4 = 10, 10 ÷ 5 = 2.

So, the missing term is 240.

Type 8: Series formed by subtracting or adding something to squares of successive terms.

Example 1: 12, 20, 30, 42, ...

This series is formed by squaring a term and adding the same term to the square.

$3^2 + 3 = 12$, $4^2 + 4 = 20$, $5^2 + 5 = 30$, $6^2 + 6 = 42$, $7^2 + 7 = 56$.

So, the next term will be 56.

Example 2: 3, 7, 13, 21, ...

$1^2 + 2$, $2^2 + 3$, $3^2 + 4$, $4^2 + 5$, $5^2 + 6$.

So, the next term will be 31.

Type 9: Series formed by subtracting or adding something to cubes of successive terms.

Example 1: 0, 6, 24, 60, 120, ...

$1^3 - 1 = 0$, $2^3 - 2 = 6$, $3^3 - 3 = 24$, $5^3 - 5 = 120$, $6^3 - 6 = 210$

So, the next term will be 210.

Example 2: 10, 24, 68, 120, ...

$2^3 + 2 = 10$, $3^3 - 3 = 24$, $4^3 + 4 = 68$, $5^3 - 5 = 120$, $6^3 + 6 = 222$.

So, the next term will be 222.

Type 10: Combination of two different series.

Example 1: $\frac{1}{2}, \frac{3}{4}, \frac{5}{8}, \frac{7}{16}$, ...

The numerators term a series of odd numbers. The series of denominators is formed by multiplying the previous number by 2.

Numerators: 1, 3, 5, 7, 9 ; Denominators : 2, 4, 8, 16, 32

So, the next term will be $\frac{9}{32}$.

Example 2: 512, 16, 343, 25, ...

It is a combination of two series.

$\underline{8}^3, 4^2, \underline{7}^3, 5^2$, ...

So, the next term will be $6^3 = 216$.

Type 11: Series formed by adding terms at more than one level

Example: 5, 12, 27, 58, 121, ...

Sol.

5, 12, 27, 58, 121, 248

+7 +15 +31 +63 +127

+8 +16 +32 +64

So, the next term will be 248.

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Some Important Series

(i) 8, 4, 4, 6, 12, ...

$8\times\frac{1}{2}=4$, 4 × 1 = 4, $4\times\frac{3}{2}=6$, 6 × 2 = 12, $12\times\frac{5}{2}=30$

So, the next term will be 30.

(ii) 6, 9, 18, 45, ...

$6\times\frac{3}{2}=9$, 9 × 2 = 18, $18\times\frac{5}{2}=45$, 45 × 3 = 135.

Some point to remember

(i) If a series increases abruptly then it may be a case of series formed by multiplication.

Example: 2, 3, 6, 18, 108, 1944.

Here, each term is formed by multiplying previous two terms.

(ii) if a series decreases abruptly, then it may be a case of series formed by division.

Example: 6120, 1020, 204, 51, 17.

6120 ÷ 6 = 1020, 1020 ÷ 5 = 204, 204 ÷ 4 = 51 and so on.

(iii) if a series decreases in the beginning and then goes on increasing, it may be a case of multiplication by fractional values.

Example: 8, 4, 4, 6, 12, ...

$8\times\frac{1}{2}=4$, 4 × 1 = 4, $4\times\frac{3}{2}=6$, 6 × 2 =12, and so on.

(iv) The given series may be a combination of two different series in the following cases:

(a) Fractional terms are given in the question with numerators forming one series and denominators forming another series.

(b) Series increases and then decreases and again increases and then decreases and so on.

Example: 15, 14, 19, 11, 23, 8, 27, ...
1st series ÷ 15, 19, 23, 27, ... 2nd series ÷ 14, 11, 8, ...

(c) When more terms are given in the question as compared to normal cases.
for example in case (b) above we have 7 terms given in the question. in such a situation check for the case of two different series being mixed.

Foundation

Directions (1 - 40): What will come in place of question mark (?) in the following number series?

1. 2, 3, 5, 7, ?
(a) 9 (b) 10 (c) 8
(d) 11 (e) None of these

2. 1, 3, 6, 10, 15, ?
(a) 17 (b) 18 (c) 20
(d) 21 (e) None of these

3. 4, 9, 16, 25, ?
(a) 49 (b) 30 (c) 36
(d) 42 (e) None of these

4. 7, 11, 13, 17, 19, 23, ?
(a) 18 (b) 28 (c) 27
(d) 22 (e) None of these

5. 41, 43, 47, 53, 59, ?
(a) 61 (b) 67 (c) 64
(d) 65 (e) None of these

6. 3, 6, 11, 18, 27, ?
(a) 29 (b) 35 (c) 38
(d) 36 (e) None of these

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7. 4, 9, 19, 34, 54, ?
(a) 64 (b) 74 (c) 78
(d) 79 (e) None of these

8. 2, 3, 5, 8, 12, ?
(a) 13 (b) 14 (c) 15
(d) 16 (e) None of these

9. 100, 81, 64, 49, ?
(a) 48 (b) 46 (c) 40
(d) 36 (e) None of these

10. 8, 27, 64, 125, 216, 343, ?
(a) 443 (b) 612 (c) 512
(d) 543 (e) None of these

11. 56, 63, 70, 77, ?
(a) 84 (b) 91 (c) 80
(d) 85 (e) None of these

12. 36, 48, 60, 72, ?
(a) 80 (b) 78 (c) 84
(d) 85 (e) None of these

13. 54, 72, 90, 108, ?
(a) 110 (b) 115 (c) 120
(d) 126 (e) None of these

14. 2, 4, 8, 16, 32, ?
(a) 64 (b) 48 (c) 42
(d) 45 (e) None of these

15. 3, 6, 12, 24, 48, ?
(a) 64 (b) 70 (c) 94
(d) 96 (e) None of these

16. 10, 14, 18, 22, ?
(a) 23 (b) 25 (c) 30
(d) 26 (e) None of these

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17. 100, 99, 97, 94, 90, ?
(a) 92 (b) 95 (c) 85
(d) 93 (e) None of these

18. 3, 9, 27, 81, ?
(a) 243 (b) 343 (c) 414
(d) 425 (e) None of these

19. 24, 48, 72, 96, ?
(a) 100 (b) 108 (c) 120
(d) 140 (e) None of these

20. 78, 88, 99, 111, ?
(a) 112 (b) 115 (c) 118
(d) 124 (e) None of these

21. 512, 256, 128, 64, 32, ?
(a) 26 (b) 30 (c) 16
(d) 24 (e) 20

22. 1, 12, 123, 1234, ?
(a) 123 (b) 12346 (c) 12345
(d) 1235 (e) None of these

23. 123456, 23456, 2345, 345, ?
(a) 34 (b) 45 (c) 35
(d) 344 (e) None of these

24. 35, 49, 63, 77, ?
(a) 91 (b) 93 (c) 95
(d) 99 (e) None of these

25. 46, 52, 60, 70, ?
(a) 83 (b) 82 (c) 81
(d) 80 (e) None of these

26. 1, 11, 111, 1111, ?
(a) 12 (b) 22 (c) 22222
(d) 11111 (e) None of these

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27. 1015, 508, 255, 129, 66.5, ?
(a) 34.50 (b) 35 (c) 35.30
(d) 35.75 (e) None of these

28. 4, 10, 33, 136, 685, ?
(a) 3430 (b) 4110 (c) 4116
(d) 3435 (e) None of these

29. 1, 9, 25, 49, ?, 121
(a) 64 (b) 81 (c) 91
(d) 100 (e) None of these

30. 4, 7, 12, 19, 28, ?
(a) 30 (b) 36 (c) 39
(d) 49 (e) None of these

31. 11, 13, 17, 19, 23, 25, ?
(a) 26 (b) 27 (c) 29
(d) 37 (e) None of these

32. 6, 12, 21, ?, 48
(a) 33 (b) 38 (c) 40
(d) 45 (e) None of these

33. 2, 5, 9, ?, 20, 27
(a) 14 (b) 16 (c) 18
(d) 24 (e) None of these

34. 6, 11, 21, 36, 56, ?
(a) 42 (b) 51 (c) 81
(d) 24 (e) None of these

35. 10, 18, 28, 40, 54, 70, ?
(a) 85 (b) 86 (c) 87
(d) 88 (e) None of these

36. 120, 99, 80, 63, 48, ?
(a) 35 (b) 38 (c) 39
(d) 40 (e) None of these

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37. 22, 24, 28, ?, 52, 84
(a) 36 (b) 38 (c) 42
(d) 46 (e) None of these

38. 125, 80, 45, 20, ?
(a) 5 (b) 8 (c) 10
(d) 12 (e) None of these

39. 1, 5, 13, 25, 41, ?
(a) 51 (b) 57 (c) 61
(d) 63 (e) None fo these

40. 2, 15, 41, 80, ?
(a) 111 (b) 120 (c) 121
(d) 132 (e) None of these

Moderate

Directions (1 - 40): What will come in place of question mark (?) in the following number series?

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1. 1, 2, 5, 10, 17, ?
(a) 25 (b) 24 (c) 23
(d) 26 (e) None of these

2. 4, 9, 25, 49, 121, ?
(a) 144 (b) 169 (c) 139
(d) 193 (e) None of these

3. 34, 36, 40, 48, 64, ?
(a) 82 (b) 92 (c) 96
(d) 98 (e) None of these

4. 9, 19, 40, 83, 170, 345, ?
(a) 687 (b) 696 (c) 663
(d) 645 (e) None of these

5. 980, 484, 236, 112, 50, ?
(a) 25 (b) 17 (c) 21
(d) 29 (e) None of these

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6. 8, 9, 20, 63, 256, 1285, ?
(a) 6430 (b) 7450 (c) 7716
(d) 7746 (e) None of these

7. 4832, 5840, 6848, ?
(a) 7815 (b) 7846 (c) 7856
(d) 7887 (e) None of these

8. 10, 100, 200, 310, ?
(a) 400 (b) 410 (c) 420
(d) 430 (e) None of these

9. 6, 17, 39, 72, ?
(a) 83 (b) 94 (c) 116
(d) 127 (e) None of these

10. 325, 259, 204, 160, 127, 105, ?
(a) 94 (b) 96 (c) 98
(d) 100 (e) None of these

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11. 1, 4, 10, 22, 46
(a) 64 (b) 86 (c) 94
(d) 122 (e) None of these

12. 0.5, 0.55, 0.65, 0.8, ?
(a) 0.9 (b) 0.82 (c) 1
(d) 0.95 (e) None of these

13. 5, 6, 9, 15, ?, 40
(a) 21 (b) 25 (c) 27
(d) 33 (e) None of these

14. 1, 9, 25, 49, 81, ?
(a) 100 (b) 112 (c) 121
(d) 144 (e) None of these

15. 1, 1, 4, 8, 9, 27, 16, ?
(a) 32 (b) 64 (c) 81
(d) 256 (e) None of these

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16. 4, 12, 36, 108, ?
(a) 144 (b) 216 (c) 304
(d) 324 (e) None of these

17. 1, 1, 2, 6, 24, ?, 720
(a) 100 (b) 104 (c) 108
(d) 120 (e) None of these

18. 120, ?, 60, 20, 5, 1
(a) 60 (b) 120 (c) 240
(d) 180 (e) None of these

19. 4, 6, 9, ?
(a) 13 (b) 19 (c) 11
(d) 12 (e) None of these

20. 5760, 960, ?, 48, 16, 8
(a) 120 (b) 160 (c) 192
(d) 240 (e) None of these

21. 1, 2, 6, 7, 21, 22, 66, 67, ?
(a) 70 (b) 134 (c) 201
(d) 301 (e) None of these

22. 48, 24, 96, 48, 192, ?
(a) 76 (b) 90 (c) 96
(d) 98 (e) None of these

23. 1, 2, 3, 6, 9, 18, ?, 54
(a) 18 (b) 27 (c) 36
(d) 81 (e) None of these

24. 165, 195, 255, 285, 345, ?
(a) 375 (b) 390 (c) 420
(d) 435 (e) None of these

25. 9, 27, 31, 155, 161, 1127, ?
(a) 316 (b) 1135 (c) 1288
(d) 2254 (e) None of these

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26. 2, 3, 3, 5, 10, 13, ?, 43, 172, 177
(a) 23 (b) 38 (c) 39
(d) 40 (e) None of these

27. 3, 15, ?, 63, 99, 143
(a) 27 (b) 35 (c) 45
(d) 56 (e) None of these

28. 7, 26, 63, 124, 215, 342, ?
(a) 391 (b) 421 (c) 481
(d) 511 (e) None of these

29. 3, 7, 15, ?, 63, 127
(a) 30 (b) 31 (c) 47
(d) 52 (e) None of these

30. 4, 10, ?, 82, 244, 730
(a) 24 (b) 28 (c) 77
(d) 218 (e) None of these

31. 3, 12, 27, 48, 75, 108, ?
(a) 147 (b) 162 (c) 183
(d) 192 (e) None of these

32. 563, 647, 479, 815, ?
(a) 672 (b) 386 (c) 279
(d) 143 (e) None of these

33. 5, 2, 7, 9, 16, 25, ?
(a) 41 (b) 45 (c) 48
(d) 52 (e) None of these

34. 10, 14, 26, 42, 70, ?
(a) 100 (b) 102 (c) 106
(d) 114 (e) None of these

35. 2, 8, 16, 128, ?
(a) 2042 (b) 2046 (c) 2048
(d) 2056 (e) None of these

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36. 3, 10, 101, ?
(a) 10101 (b) 10201 (c) 10202
(d) 11012 (e) None of these

37. 589654237, 89654237, 8965423, 965423, ?
(a) 58965 (b) 65423 (c) 89654
(d) 96542 (e) None of these

38. 5824, 5242, ?, 4247, 3823
(a) 4467 (b) 4718 (c) 4856
(d) 5164 (e) None of these

39. 1, 3, 4, 8, 15, 27, ?
(a) 37 (b) 44 (c) 50
(d) 55 (e) None of these

40. 66, 36, 18, ?
(a) 3 (b) 6 (c) 8
(d) 9 (e) None of these

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Difficult

1. 0, 4, 6, 3, 7, 9, 6, ?, 12
(a) 8 (b) 10 (c) 11
(d) 12 (e) None of these

2. 8, 9, 8, 7, 10, 9, 6, 11, 10, ?, 12
(a) 5 (b) 7 (c) 8
(d) 11 (e) None of these

3. 7, 4, 5, 9, ?, 52.5, 160.5
(a) 18 (b) 19.5 (c) 20
(d) 20.5 (e) None of these

4. 5, 348, 564, 689, ?, 780, 788
(a) 348 (b) 689 (c) 753
(d) 780 (e) 788

5. 4.5, 16, ?, 33, 38.5, 42, 43.5
(a) 16 (b) 25.5 (c) 33
(d) 38.5 (e) 42

6. 14, 18, 82, 118, 630, ?
(a) 730 (b) 692 (c) 711
(d) 682 (e) None of these

7. 35, 76, 253, 488, 911, ?
(a) 1210 (b) 1325 (c) 1460
(d) 1575 (e) 1680

8. 19, 97, 162, 214, 253, ?
(a) 277 (b) 279 (c) 224
(d) 280 (e) None of these

9. 9, 15, 26, 42, 63, ?
(a) 79 (b) 87 (c) 89
(d) 77 (e) None of these

10. 6, 10, 37, 53, 178, ?
(a) 210 (b) 212 (c) 214
(d) 226 (e) None of these

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Directions (11 – 14): In each of the following questions a number series is given. After the series a number is given followed by (a), (b), (c), (d) and (e). You have to complete the series starting with the number given, following the sequence of the original series and answer the questions that follow the series.

11. 12 30 120 460 1368 2730
16 (a) (b) (c) (d) (e)
What will come in place of (d)?
(a) 1384 (b) 2642 (c) 2808
(d) 1988 (e) None of these

12. 7 91 1001 7007 35035 105105
14.5 (a) (b) (c) (d) (e)
What will come in place of (c) ?
(a) 21132.5 (b) 14514.5 (c) 20020.5
(d) 13864.5 (e) None of these

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13. 582 574 601 537 662 446
204 (a) (b) (c) (d) (e)
What will come in place of (d)?
(a) 284 (b) 68 (c) 174
(d) 331 (e) None of these

14. 85 43 44 67.5 137 345
125 (a) (b) (c) (d) (e)
What will come in place of (c) ?
(a) 86 (b) 107.5 (c) 112.5
(d) 97.5 (e) None of these

Directions (15 - 25): What will come in place of the question mark (?) in the following number series?

15. 1 6 36 240 1960 ?
(a) 19660 (b) 3680 (c) 36800
(d) 19600 (e) None of these

16. 949 189.8 ? 22.776 11.388 6.8328
(a) 48.24 (b) 53.86 (c) 74.26
(d) 56.94 (e) None of these

17. 14 43.5 264 ? 76188
(a) 3168 (b) 3176 (c) 1587
(d) 1590 (e) None of these

18. 41 164 2624 ? 6045696
(a) 104244 (b) 94644 (c) 94464
(d) 102444 (e) None of these

19. 12 12 18 45 180 1170 ?
(a) 12285 (b) 10530 (c) 11700
(d) 12870 (e) 7605

20. 40280625 732375 16275 465 18.6 1.24 ?
(a) 0.248 (b) 0.336 (c) 0.424
(d) 0.512 (e) 0.639

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21. 14 12 21 59 231 1149 ?
(a) 6987 (b) 6787 (c) 6887
(d) 6687 (e) 6587

22. 1728 2744 4096 5832 8000 10648 ?
(a) 12167 (b) 13824 (c) 15625
(d) 9261 (e) 17576

23. 120 15 105 17.5 87.5 ?
(a) 18.5 (b) 19.5 (c) 21.875
(d) 17.5 (e) 90

24. 3 6 21 28 55 66 ? 120
(a) 103 (b) 104 (c) 108
(d) 106 (e) 105

25. 529 841 961 1369 1681 1849 ?
(a) 2809 (b) 2601 (c) 3249
(d) 3481 (e) 2209

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Directions (26 – 29): In the following number series only one number is wrong. Find out the wrong number.

26. 3 35 226 1160 4660 13998
(a) 13998 (b) 4660 (c) 226
(d) 1160 (e) None of these

27. 18 119 708 3534 14136 42405
(a) 708 (b) 3534 (c) 14136
(d) 42405 (e) None of these

28. 4 6 18 49 201 1011
(a) 1011 (b) 201 (c) 18
(d) 49 (e) None of these

29. 2 54 300 1220 3674 7350
(a) 3674 (b) 1220 (c) 300
(d) 54 (e) None of these

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Directions (30 - 40): What should come in place of the question mark (?) in the following number series?

30. 0 5 18 43 84 145 ?
(a) 220 (b) 240 (c) 260
(d) 280 (e) None of these

31. 10 17 48 165 688 3475 ?
(a) 27584 (b) 25670 (c) 21369
(d) 20892 (e) None of these

32. 1 3 24 360 8640 302400 ?
(a) 14525100 (b) 154152000 (c) 14515200
(d) 15425100 (e) None of these

33. 12 14 32 102 416 2090 ?
(a) 15522 (b) 12552 (c) 13525
(d) 17552 (e) None of these

34. 10 15 15 12.5 9.375 6.5625 ?
(a) 4.375 (b) 3.2375 (c) 4.6275
(d) 3.575 (e) None of these

35. 3 22 ? 673 2696 8093
(a) 133 (b) 155 (c) 156
(d) 134 (e) None of these

36. 6 13 38 ? 532 2675
(a) 129 (b) 123 (c) 172
(d) 164 (e) None of these

37. 17 9 ? 16.5 35 90
(a) 5 (b) 15 (c) 10
(d) 20 (e) None of these

38. 3 4 12 ? 196
(a) 45 (b) 40 (c) 41
(d) 49 (e) None of these

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39. 16 8 12 30 ?
(a) 75 (b) 105 (c) 95
(d) 115 (e) None of these

40. 7 12 32 105 ?
(a) 428 (b) 214 (c) 218
(d) 416 (e) None of these

Previous Year (Memory Based)

Directions (1 – 21): What will come in place of question mark (?) in the following series?

1. 4, 9, 25, ?, 121, 169, 289, 361
(a) 49 (b) 64 (c) 81
(d) 87 (e) None of these

2. 3, 8, 13, 24, 41, ?
(a) 70 (b) 75 (c) 80
(d) 85 (e) None of these

3. 45, 54, 47, ?, 49, 56, 51, 57, 53
(a) 48 (b) 50 (c) 55
(d) 45 (e) None of these

4. 6, 18, 3, 21, 7, 56, ?
(a) 8 (b) 9 (c) 63
(d) 64 (e) None of these

5. 2, 15, 4, 12, 6, 7, ?, ?
(a) 8, 8 (b) 8, 0 (c) 3, 8
(d) 8, 4 (e) None of these

6. 20, 20, 19, 16, 17, 13, 14, 11, ?, ?
(a) 10, 10 (b) 10, 11 (c) 13, 14
(d) 13, 16 (e) None of these

7. 0, 2, 3, 5, 8, 10, 15, 17, 24, 26, ?
(a) 28 (b) 30 (c) 32
(d) 35 (e) None of these

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8. 13, 35, 57, 79, 911, ?
(a) 1110 (b) 1112 (c) 1113
(d) 1315 (e) None of these

9. 625, 5, 125, 25, 25, ?, 5
(a) 5 (b) 25 (c) 125
(d) 625 (e) None of these

10. 3, 4, 7, 7, 13, 13, 21, 22, 31, 34, ?
(a) 42 (b) 43 (c) 51
(d) 52 (e) None of these

11. 11, 10, ?, 100, 1001, 1000, 10001
(a) 101 (b) 102 (c) 103
(d) 104 (e) None of these

12. 13, 32, 24, 43, 35, ?, 46, 65, 57, 76
(a) 45 (b) 52 (c) 54
(d) 55 (e) None of these

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13. 2, 1, 2, 4, 4, 5, 6, 7, 8, 8, 10, 11,?
(a) 9 (b) 10 (c) 11
(d) 12 (e) None of these

14. $\frac{2}{3}$, $\frac{4}{7}$, ?, $\frac{11}{21}$, $\frac{16}{31}$
(a) $\frac{5}{9}$ (b) $\frac{6}{11}$ (c) $\frac{7}{13}$
(d) $\frac{9}{17}$ (e) None of these

15. 960 924 852 744 600 420 ?
(a) 202 (b) 203 (c) 204
(d) 205 (e) 206

16. 1800, 540, 162, 48.6, ?
(a) 14.3 (b) 14.68 (c) 14.58
(d) 14.39 (e) None of these

17. 280, 284, 300, ?, 400, 500
(a) 335 (b) 366 (c) 336
(d) 338 (e) 340

18. 4, 5, 14, 51, ?, 1125
(a) 216 (b) 218 (c) 220
(d) 227 (e) None of these

19. 8, 47, 234, 935, ?, 5607
(a) 2804 (b) 2802 (c) 2808
(d) 2801 (e) 2807

20. 6, 9, 15, 27, 51, ?
(a) 84 (b) 75 (c) 99
(d) 123 (e) None of these

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21. 7, 8, 18, ?, 232, 1165
(a) 84 (b) 42 (c) 36
(d) 57 (e) None of these

Directions (22 – 26): In the following number series, a wrong number is given. Find out that wrong number.

22. 11, 18, 29, 42, 59, 80, 101
(a) 18 (b) 29 (c) 42
(d) 59 (e) 80

23. 2, 9, 32, 105, 436, 2195
(a) 9 (b) 32 (c) 105
(d) 436 (e) 2195

24. 5, 55, 495, 3465, 17325, 34650, 51975
(a) 55 (b) 495 (c) 3465
(d) 17325 (e) 34650

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25. 2, 10, 18, 54, 162, 486, 1458

(a) 10 (b) 18 (c) 54
(d) 162 (e) 486

26. 8, 12, 24, 46, 72, 108, 152

(a) 12 (b) 24 (c) 46
(d) 72 (e) 108

Directions (27 – 29): What will come in place of question mark (?) in the following number series?

27. 16, 22, 40, 78, 144, ?

(a) 244 (b) 241 (c) 254
(d) 246 (e) None of these

28. 2, 6, 14, 30, ?, 126, 254

(a) 81 (b) 65 (c) 62
(d) 69 (e) None of these

29. 10, 14, 25, 55, 140, ?

(a) 386 (b) 398 (c) 388
(d) 396 (e) None of these

Directions (30 – 34): In the following number series, a wrong number is given. Find out that wrong number.

30. 2 11 38 197 1172 8227 65806

(a) 11 (b) 2 (c) 197
(d) 1172 (e) 8227

31. 16 19 21 30 46 71 107

(a) 19 (b) 21 (c) 30
(d) 46 (e) 71

32. 7 9 16 25 41 68 107 173

(a) 107 (b) 16 (c) 41
(d) 68 (e) 25

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33. 4 2 3.5 7.5 26.25 118.125
(a) 118.125 (b) 26.25 (c) 3.5
(d) 2 (e) 7.5

34. 16 4 2 1.5 1.75 1.875
(a) 1.875 (b) 1.75 (c) 1.5
(d) 2 (e) 4

Directions (35 – 40): What will come in place of the question mark (?) in the following number series?

35. 3 10 32 100 ?
(a) 345 (b) 460 (c) 308
(d) 440 (e) None of these

36. 5 3 4 ? 38
(a) 8.5 (b) 6 (c) 7.5
(d) 8 (e) None of these

37. 5 6 ? 57 244
(a) 21 (b) 16 (c) 17
(d) 15 (e) None of these

38. 3 10 21 ? 51
(a) 34 (b) 32 (c) 33
(d) 37 (e) None of these

39. 5 11 ? 55 117
(a) 21 (b) 27 (c) 23
(d) 25 (e) None of these

40. 12 14 17 13 8 14 21 13 4 ?
(a) 14 (b) 13 (c) 15
(d) 2 (e) None of these

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Foundation

Solutions

1. (d); It is prime number series. next prime number is 11.
2. (d); 1 + 2 = 3, 3 + 3 = 6, 6 + 4 = 10,
   10 + 5 = 15, 15 + 6 = 21
3. (c); 2^2, 3^2, 4^2, 5^2. Next number is 6^2 = 36.
4. (e); 7, 11, 13, 17, 19, 23
   Prime numbers. Next prime number is 29.
5. (a); 41, 43, 47, 53, 59, ? ; Next prime number is 61.
6. (c); 3 + 3 = 6, 6 + 5 = 11, ...
   + 3, + 5, + 7, + 9, + 11
   So, the next number is 27 + 11 = 38
7. (d); + 5, + 10, + 15, + 20
   So, the next number is 54 + 25 = 79
8. (e); + 1, + 2, + 3, + 4
   So, the next number is 12 + 5 = 17
9. (d); 10^2, 9^2, 8^2, 7^2 ; The next number is 6^2 = 36
10. (c); 2^3, 3^3, 4^3, 5^3, 6^3, 7^3 ; Next is 8^3 = 512
11. (a); + 7, +7, +7, ...
    So, next in the series is 77 + 7 = 84
12. (c); + 12, + 12, + 12, ...
    So, the next number is 72 + 12 = 84
13. (d); Each number increases by 18.
    So, the next one is : 108 + 18 = 126
14. (a); 2^1, 2^2, 2^3, 2^4, 2^5, ...
    So, the next one is 2^6 = 64.
15. (d); The previous number is multiplied by 2 to obtain the next number.
    So, the next number is : 48 × 2 = 96

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16. (d); 4 is being added to each number.
So, the next number is 22 + 4 = 26
17. (c); – 1, – 2, – 3, – 4, ...
The next number is 90 – 5 = 85
18. (a); $3^1, 3^2, 3^3, 3^4$; Next $\rightarrow 3^5 = 243$
19. (c); 24 × 1, 24 × 2, 24 × 3, 24 × 4 ; Next is 24 × 5 = 120
20. (d); 78 + 10, 88 + 11, 99 + 12 ; Next is 111 + 13 = 124
21. (c); Each term is divided by 2 to obtain the next term
so, the next term is : 32 ÷ 2 = 16.
22. (c); 1, 12, 123, 1234 ; Next is 12345
23. (a); Remove one digit alternatively from left and right
Next is 34
24. (a); 7 × 5, 7 × 7, 7 × 9, 7 × 11 ; Next is 7 × 13 = 91
25. (b); + 6, + 8, + 10 ; Next is 70 + 12 = 82
26. (d); 1, 11, 111, 1111 ; Next is 11111
27. (d); $\frac{1015+1}{2} = 508, = \frac{508+2}{2} = 255 \Rightarrow \frac{255+3}{2} = 129, \frac{129+4}{2} = 66.5,$

Next term is $\frac{66.5+5}{2} = 35.75$

28. (c); 4 × 2 + 2 = 10
10 × 3 + 3 = 33
33 × 4 + 4 = 136
136 × 5 + 5 = 685
685 × 6 + 6 = 4116
29. (b); $1^2, 3^2, 5^2, 7^2, 9^2, 11^2 \rightarrow$ Squares of consecutive odd numbers.
$9^2 = 81$
30. (c); + 3, + 5, + 7, + 9 ; Next is 28 + 11 = 39
31. (c); + 2, + 4, + 2, + 4, + 2 ; Next is 25 + 4 = 29
32. (a); + 6, + 9, + 12, + 15 ; 21 + 12 = 33

33. (a); + 3, + 4, + 5, + 6, + 7 ; ? = 9 + 5 = 14
34. (c); + 5, + 10, + 15, + 20 ; Next is + 25, 56 + 25 = 81
35. (d); + 8, + 10, + 12, + 14, + 16 ; Next is 70 + 18 = 88
36. (a); – 21, – 19, – 17, – 15 ; Next is 48 – 13 = 35
37. (a); $+ 2^1, + 2^2, + 2^3, + 2^4, + 2^5$
The missing number is → 36
38. (a); 125 – 45 = 80, 80 – 35 = 45
45 – 25 = 20, 20 – 15 = 5
39. (c); 1 + 4 = 5, 5 + 8 = 13, + 12 = 25,
25 + 16 = 41, 41 + 20 = 61
40. (d); 2 + 13 = 15, 15 + 26 = 41,
41 + 39 = 80, 80 +52 = 132

Moderate

1. (d); $0^2 + 1 = 1$
$1^2 + 1 = 2$
$2^2 + 1 = 5$
$3^2 + 1 = 10$
$4^2 + 1 = 17$
$5^2 + 1 = 26$
2. (b); Squares of Prime numbers.
$2^2, 3^2, 5^2, 7^2, 11^2$; Next is $13^2 \rightarrow 169$
3. (c); $34 + 2 = 36, 36 + 2^2 = 40, 40 + 2^3 = 48,$
$48 + 2^4 = 64, 64 + 2^5 = 96$
4. (b); $9 \times 2 + 1 = 19$
$19 \times 2 + 2 = 40$
$40 \times 2 + 3 = 83$
$83 \times 2 + 4 = + 170$
$170 \times 2 + 5 = 345$
$345 \times 2 + 6 = 696$

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5. (e); 980 ÷ 2 – 6 = 484, 484 ÷ 2 – 6 = 236
236 ÷ 2 – 6 = 112, 112 ÷ 2 – 6 = 50
50 ÷ 2 – 6 = 19

6. (c); 8 × 1 + 1 = 9, 9 × 2 + 2 = 20, 20 × 3 + 3 = 63
63 × 4 + 4 = 256, 256 × 5 + 5 = 1285
1285 × 6 + 6 = 7716

7. (c); 4832 + 1008 = 5840
5840 + 1008 = 6848
6848 + 1008 = 7856

8. (d); 10 + 90 = 100, 100 + 100 = 200, 200 + 110 = 310
310 + 120 = 430

9. (c); 6 + 11 = 17, 17 + 22 = 39, 39 + 33 = 72,
72 + 44 = 116

10 (a); 325 – 66 = 259, 259 – 55 = 204,
204 – 44 = 160, 160 – 33 = 127,
127 – 22 = 105, 105 – 11 = 94

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11. (c); 1 + 3 = 4, 4 + 6 = 10, 10 + 12 = 22,
22 + 24 = 46, 46 + 48 = 94

12. (c); 0.5 + 0.05 = 0.55, 0.55 + 0.10 = 0.65,
0.65 + 0.15 = 0.80, 0.80 + 0.20 = 1.0

13. (b); 5 6 9 15 25 40
+1 +3 +6 +10 +15
+2 +3 +4 +5

14. (c); $1^2, 3^2, 5^2, 7^2, 9^2$; Next is $11^2 = 121$

15. (b); Two series are mixed. First series: 1, 4, 9, 16
Second series : 1, 8, 27, ?
So, the next term is : $4^3 = 64$

16. (d); 4 × 3 = 12, 12 × 3 = 36, 36 × 3 = 108, 108 × 3 = 324

17. (d); $1 \times 1 = 1$, $1 \times 2 = 2$, $2 \times 3 = 6$, $6 \times 4 = 24$, $24 \times 5 = 120$, $120 \times 6 = 720$
18. (b); $120 \div 1 = 120$, $120 \div 2 = 60$, $60 \div 3 = 20$, $20 \div 4 = 5$, $5 \div 5 = 1$
19. (a); $4 + 2 = 6$, $6 + 3 = 9$, $9 + 4 = 13$
20. (c); $5760 \div 6 = 960$, $960 \div 5 = 192$, $192 \div 4 = 48$,
    $48 \div 3 = 16$, $16 \div 2 = 8$
21. (c); $1 + 1 = 2$, $2 \times 3 = 6$, $6 + 1 = 7$, $7 \times 3 = 21$, $21 + 1 = 22$, $22 \times 3 = 66$,
    $66 + 1 = 67$, $67 \times 3 = 201$
22. (c); $48 \div 2 = 24$, $24 \times 4 = 96$, $96 \div 2 = 48$, $48 \times 4 = 192$, $192 \div 2 = 96$
23. (b); Two series mixed
    First series : 1, 3, 9, ?
    Second series : 2, 6, 18, 54
    So, the missing term is $\rightarrow 3^3 = 27$.
24. (a); $165 + 30 = 195$, $195 + 60 = 255$, $255 + 30 = 285$,
    $285 + 60 = 345$
    Next $\rightarrow 345 + 30 = 375$
25. (b); $9 \times 3 = 27$, $27 \times 4 = 31$, $31 \times 5 = 155$, $155 + 6 = 161$, $161 \times 7 = 1127$,
    $1127 + 8 = 1135$
26. (c); $2 + 1 = 3$, $3 \times 1 = 3$, $3 + 2 = 5$, $5 \times 2 = 10$, $10 + 3 = 13$, $13 \times 3 = 39$,
    $39 + 4 = 43$, $43 \times 4 = 172$, $172 + 5 = 177$
27. (b); $2^2 - 1$, $4^2 - 1$, $6^2 - 1$, $8^2 - 1$, $10^2 - 1$, $12^2 - 1$,
    Missing term $= 6^2 - 1 = 35$
28. (d); $2^3 - 1$, $3^3 - 1$, $4^3 - 1$, $5^3 - 1$, $6^3 - 1$, $7^3 - 1$
    Next $\rightarrow 8^3 - 1 = 511$
29. (b); $3 \times 2 + 1 = 7$, $7 \times 2 + 1 = 15$, $15 \times 2 + 1 = 31$,
    $31 \times 2 + 1 = 63$, $63 \times 2 + 1 = 127$
    Missing term = 31
30. (b); $4 \times 3 - 2 = 10$, $10 \times 3 - 2 = 28$, $28 \times 3 - 2 = 82$,
    $82 \times 3 - 2 = 244$, $244 \times 3 - 2 = 730$
    Missing term = 28

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31. (a); 3 12 27 48 75 108 147

+9 +15 +21 +27 +33 +39

+6 +6 +6 +6 +6

So, the next term is 147

32. (d); 563 + 84 = 647

647 – 84 × 2 = 479

479 + 84 × 2^2 = 815

815 – 84 × 2^3 = 143

So, next term is 143

33. (a); Sum of previous two terms starting from 7

5 + 2 = 7

7 + 2 = 9, 9 + 7 = 16, 16 + 9 = 25

Next is 25 + 16 = 41

34. (d); (10 + 14) + 2 = 26

(14 + 26) + 2 = 42

(26 + 42) + 2 = 70

(42 + 70) + 2 = 114

35. (c); Each term is product of previous two terms starting from 16.

So, next term is 16 × 128 = 2048

36. (c); 3^2 + 1 = 10, 10^2 + 1 = 101

Next is $(101)^2$ + 1 = 10202

37. (d); One digit is removed from left and right atlernatively.

38. (b); Next term = (Previous term – first 3 digits of previous term).

5824 – 582 = 5242

5242 – 524 = 4718

4718 – 471 = 4247

4247 – 424 = 3823

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39. (c); Each term is sum of three previous terms starting from 8
So, 1 + 3 + 4 = 8
3 + 4 + 8 = 15
4 + 8 + 15 = 27
8 + 15 + 27 = 50
So, next term = 50

40. (c); $66 \rightarrow 6 \times 6 = 36$
$36 \rightarrow 3 \times 6 = 18$
$18 \rightarrow 1 \times 8 = 8$

Difficult

1. (b); It is a combination of 3 series.
1st series : 0, 3, 6,...
2nd series : 4, 7, ?
3rd series : 6, 9, 12,....
In the 2nd series, each term is increased by 3 to obtain the next term. So, the missing term is 7 + 3 = 10

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2. (a); It is a combination of 3 series.
1st series : 8, 7, 6, ?
2nd series : 9, 10, 11, 12
3rd series : 8, 9, 10, ...
So, the missing term is 6 – 1 = 5

3. (c); $7 \times \frac{1}{2} + \frac{1}{2} = 4$, $4 \times 1 + 1 = 5$

$5 \times \frac{3}{2} + \frac{3}{2} = 9$, $9 \times 2 + 2 = 20$

So, the missing term is 20.

4. (c); $5 + 343 = 5 + 7^3 = 348$
$348 + 216 = 348 + 6^3 = 564$
$564 + 125 = 564 + 5^3 = 689$
$689 + 64 = 689 + 4^3 = 753$

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5. (b); 4.5 + 11.5 = 16

16 + 9.5 = 25.5

25.5 + 7.5 = 33

33 + 5.5 = 38.5

38.5 + 3.5 = 42

42 + 1.5 = 43.5

So, the missing term is 25.5

6. (a);

14		18		82		118		630		730
	+4		+64		+36		+512		+100	
	2^2		4^3		6^2		8^3		10^2	

7. (c); $5 \times 2^2 + 15 = 35$

$10 \times 3^2 - 14 = 76$

$15 \times 4^2 + 13 = 253$

$20 \times 5^2 - 12 = 488$

$25 \times 6^2 + 11 = 911$

$30 \times 7^2 - 10 = 1460$

So, next term is 1460

8. (b); 19 + 13 × 6 = 97

97 + 13 × 5 = 162

162 + 13 × 4 = 214

214 + 13 × 3 = 253

253 + 13 × 2 = 279

9. (c); + 6, + 11, + 16, + 21, + 26

63 + 26 = 89

10. (c); $+ 2^2, + 3^3, + 4^2, + 5^3, + 6^2$

178 + 36 = 214

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11. (c); The given series is based on the pattern :

$30 = 12 \times 6 - 7 \times 6$

$120 = 30 \times 5 - 6 \times 5$

$460 = 120 \times 4 - 5 \times 4$

$1368 = 460 \times 3 - 4 \times 3$

$2730 = 1368 \times 2 - 3 \times 2$

Similarly,

(a) $= 16 \times 6 - 7 \times 6 = 96 - 42 = 54$

(b) $= 54 \times 5 - 6 \times 5 = 240$

(c) $= 240 \times 4 - 5 \times 4 = 940$

(d) $= 940 \times 3 - 4 \times 3 = 2808$

Hence 2808 will be there in place of (d).

12. (b);

$$7 \xrightarrow{\times 13} 91 \xrightarrow{\times 11} 1001 \xrightarrow{\times 7} 7007 \xrightarrow{\times 5} 35035 \xrightarrow{\times 3} 105105$$

Similarly,

$$14.5 \xrightarrow{\times 13} 188.5 \xrightarrow{\times 11} 2073.5 \xrightarrow{\times 7} 14514.5$$

Hence, 14514.5 will come in place of (c).

13. (a); The given series is based on the following pattern:

$$582 \xrightarrow{-2^3} 574 \xrightarrow{+3^3} 601 \xrightarrow{-4^3} 537 \xrightarrow{+5^3} 662 \xrightarrow{-6^3} 446$$

Similarly,

$$204 \xrightarrow{-2^3} \underset{(a)}{196} \xrightarrow{+3^3} \underset{(b)}{223} \xrightarrow{-4^3} \underset{(c)}{159} \xrightarrow{+5^3} \underset{(d)}{284}$$

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14. (d); 85 → 43 → 44 → 67.5 → 137 → 345

×0.5+0.5 ×1+1 ×1.5+1.5 ×2+2 ×2.5+2.5

Similarly,

125 → 63 (a) → 64 (b) → 97.5 (c)

×0.5+0.5 ×1+1 ×1.5+1.5

Hence, 97.5 will come in place of (c).

15. (a); $1 \times 2 + 2 \times 2 = 6$

$6 \times 4 + 4 \times 3 = 36$

$36 \times 6 + 6 \times 4 = 240$

$240 \times 8 + 8 \times 5 = 1960$

$1960 \times 10 + 10 \times 6 = 19660$

16. (d); 949 → 189.8 → 56.94 → 22.776 → 11.388 → 6.8328

×0.2 ×0.3 ×0.4 ×0.5 ×0.6

Hence, missing term $\Rightarrow$ 56.94

17. (e); $14 \times 3 + 1.5 = 43.5$

$43.5 \times 6 + 1.5 \times 2 = 264$

$264 \times 12 + 1.5 \times 4 = 3174$

$3174 \times 24 + 1.5 \times 8 = 76188$

Hence, missing term is 3174.

18. (c); $41 \times 2^2 = 164$

$164 \times 4^2 = 2624$

$2624 \times 6^2 = 94464$

$94464 \times 8^2 = 6045696$

19. (a); $12 \times 1 = 12$

$12 \times 1.5 = 18$

$18 \times (1 + 1.5) = 18 \times 2.5 = 45$

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45 × (1.5 + 2.5) = 45 × 4 = 180

180 × (4 + 2.5) = 180 × 6.5 = 1170

So, next term is:

1170 × (4 + 6.5) = 12285

20. (a); 40280625 ÷ 55 = 732375

732375 ÷ 45 = 16275

16275 ÷ 35 = 465

465 ÷ 25 = 18.6

18.6 ÷ 15 = 1.24

So, next term = 1.24 ÷ 5 = 0.248

So, next term is 0.248

21. (c); 14 × 1 – 2 = 14 –2 = 12

12 × 2 – 3 = 24 –3 = 21

21 × 3 – 4 = 63 –4 = 59

59 × 4 – 5 = 236 –5 = 231

231 × 5 – 6 = 1155 –6 = 1149

So, next term is:

1149 × 6 – 7 = 6894 – 7 = 6887

22. (b); 12 × 12 × 12 = 1728

14 × 14 × 14 = 2744

16 × 16 × 16 = 4096

18 × 18 × 18 = 5832

20 × 20 × 20 = 8000

22 × 22 × 22 = 10648

So, next term → 24 × 24 × 22 = 13824

23. (c); 120 ÷ 8 = 15

15 ÷ 7 = 105

105 ÷ 6 = 17.5

17.5 × 5 = 87.5

Next term → 87.5 ÷ 4 = 21.875

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24. (e); 3 6 21 28 55 66 ? 120

+3 +7 +11 +15

So, missing term is 105

25. (e); 529 = 23 × 23

841 = 29 × 29

961 = 31 × 31

1369 = 37 × 37

1681 = 41 × 41

1849 = 43 × 43

Next term → 47 × 47 = 2209

[The numbers are formed by squaring the prime numbers greater than or equal to 23]

26. (c); 3 × 7 + 2 × 7 = 21 + 14 = 35

35 × 6 + 3 × 6 = 210 + 18 = 228 ≠ 226

228 × 5 + 4 × 5 = 1140 + 20 = 1160

1160 × 4 + 5 × 4 = 4640 + 20 = 4660

4660 × 3 + 6 × 3 = 13980 + 18 = 13998

Hence, wrong number is 226

27. (b); 18 × 7 – 7 = 126 – 7 = 119

119 × 6 – 6 = 714 – 6 = 708

708 × 5 – 5 = 3540 – 5 = 3535 ≠ 3534

3535 × 4 – 4 = 14140 – 4 = 14136

Hecnce , 3534 is the wrong number

28. (c); 4 × 1 + 2 = 4 + 2 = 6

6 × 2 + 3 = 12 + 3 = 15 ≠ 18

15 × 3 + 4 = 45 + 4 = 49

49 × 4 + 5 = 196 + 5 = 201

201 × 5 + 6 = 1005 + 6 = 1011

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29. (a); $2 \times 6 + 7 \times 6 = 12 + 42 = 54$

$54 \times 5 + 6 \times 5 = 270 + 30 = 300$

$300 \times 4 + 5 \times 4 = 1200 + 20 = 1220$

$1220 \times 3 + 4 \times 3 = 3660 + 12 = 3672 \neq 3674$

$3672 \times 2 + 3 \times 2 = 7344 + 6 = 7350$

30. (e); $0 + 5 = 5$

$5 + 13 = 18$

$18 + 25 = 43$

$43 + 41 = 84$

$84 + 61 = 145$

Next term = $145 + 85 = 230$

31. (d); $10 \times 1 + 1 \times 7 = 10 + 7 = 17$

$17 \times 2 + 2 \times 7 = 34 + 14 = 48$

$48 \times 3 + 3 \times 7 = 144 + 21 = 165$

$165 \times 4 + 4 \times 7 = 660 + 28 = 688$

$688 \times 5 + 5 \times 7 = 3440 + 35 = 3475$

Next term $\rightarrow 3475 \times 6 + 6 \times 7 = 20850 + 42 = 20892$

32. (c); $1 \times 3 = 3$

$3 \times 8 = 24$

$24 \times 15 = 360$

$360 \times 24 = 8640$

$8640 \times 35 = 302400$

Next term $\rightarrow 302400 \times 48 = 14515200$

33. (b); $12 \times 1 + 2 \times 1 = 12 + 2 = 14$

$14 \times 2 + 2 \times 2 = 28 + 4 = 32$

$32 \times 3 + 2 \times 3 = 96 + 6 = 102$

$102 \times 4 + 2 \times 4 = 408 + 8 = 416$

$416 \times 5 + 2 \times 5 = 2080 + 10 = 2090$

Next term $\rightarrow 2090 \times 6 + 2 \times 6 = 12540 + 12 = 12552$

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34. (a); $10 \times \frac{3}{2} = 15 \quad \Rightarrow \quad 15 \times \frac{4}{4} = 15 \quad \Rightarrow \quad 15 \times \frac{5}{6} = 12.5$

$12.5 \times \frac{6}{8} = 9.375 \quad \Rightarrow \quad 9.375 \times \frac{7}{10} = 6.5625$

Next term = $6.5625 \times \frac{8}{12} = 4.375$

35. (d); 3 × 7 + 1 = 21 + 1 = 22
22 × 6 + 2 = 132 + 2 = 134
134 × 5 + 3 = 670 + 3 = 673
673 × 4 + 4 = 2692 + 4 = 2696
So, the missing term is 134

36. (a); 6 × 1 + 1 × 7 = 6 + 7 = 13
13 × 2 + 2 × 6 = 26 + 12 = 38
38 × 3 + 3 × 5 = 114 + 15 = 129
129 × 4 + 4 × 4 = 516 + 16 = 532

37. (c); 17 × 0.5 + 0.5 = 9
9 × 1 + 1 = 10
10 × 1.5 + 1.5 = 16.5
16.5 × 2 + 2 = 35
So, the missing term is 10

38. (a); $3 \times 1 + 1^2 = 3 + 1 = 4$
$4 \times 2 + 2^2 = 8 + 4 = 12$
$12 \times 3 + 3^2 = 36 + 9 = 45$
$45 \times 4 + 4^2 = 180 + 16 = 196$
So, missing term is 45

39. (b); 16 × 0.5 = 8, 8 × 1.5 = 12
12 × 2.5 = 30, 30 × 3.5 = 105

40. (a); 7 × 1 + 1 × 5 = 12
12 × 2 + 2 × 4 = 32
32 × 3 + 3 × 3 = 105
105 × 4 + 4 × 2 = 428
So, the next term is 428.

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Previous Year (Memory Based)

1. (a); The given terms are squares of consecutive prime numbers.
$2^2, 3^2, 5^2, ?, 11^2, 13^2, 17^2, 19^2$
So, the missing term is: $7^2 = 49$

2. (a); The pattern is:
n^{th} term + $(n + 1)^{th}$ term + (n + 1) = $(n + 2)^{th}$ term
3rd term = 1st term + 2nd term + 2.
4th term = 2nd term + 3rd term + 3.
Missing term = 6th term = 4th term + 5th term + 5
= 24 + 41 + 5 = 70.

3. (c); It is a combination of two series :
First series : 45, 47, 49, 51, 53.
Second series : 54, ?, 56, 57
Second series consists of consecutive natural numbers.
So, missing term = 55.

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4. (a); Terms on even places are product of their adjacent terms.
6 × 3 = 18
3 × 7 = 21
7 × ? = 56
So, next term = 8.

5. (b); It is a combination of two series :
$1^{st} \rightarrow$ 2, 4, 6, ? $\rightarrow$ even nos.
$2^{nd} \rightarrow$ 15, 12, 7, ?
in the 2nd series, the pattern is :-
– 3, – 5, – 7, ...
So, the missing terms are $\rightarrow$ 8, (7 – 7), i.e., 8, 0

6. (a); It is a combination of two series.

20, 19, 17, 14, ?

First –1 –2 –3

So, ? = 14 – 4 = 10

20, 16, 13, 11, ?

–4 –3 –2

So, ? = 11 – 1 = 10

7. (d); It is a combination of two series:

(i) 0, 3, 8, 15, 24, ?

+3 +5 +7 +9

? = 24 + 11 = 35

(ii) 2, 5, 10, 17, 26

8. (c); Tens and units digits form two differnet series of consecutive odd numbers.

13, 35, 57, 79, 911

So, next term = 1113.

9. (c); Combination of the two series:

(i) 625, 125, 25, 5,

÷5 ÷5 ÷5

(ii) 5, 25, ?

×5 ×5

So, the missing term is 125

10. (b); Combination of two series:

(i) 3, 7, 13, 21, 31,

+4 +6 +8 +10

So, ? = 31 + 12 = 43

(ii) 4, 7, 13, 22, 34

+3 +6 +9 +12

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11. (a); The pattern is:

$-1, \times 10 + 1, -1, \times 10 + 1, -1, \times 10 - 1$

So, missing term = $10 \times 10 + 1 = 101$

12. (c); 13, 32, 24, 43, 35, ?, 46, 65, 57, 76

Combination of two series:

(i) 13, 24, 35, 46, 57

+11 +11 +11 +11

(ii) 32, 43, ?, 65, 76

+11 +11 +11 +11

So, missing term = 43 + 11 = 54

13. (b); It is a combination of 3 series :

(i) 2, 4, 6, 8, ?

(ii) 1, 4, 7, 10

(iii) 2, 5, 8, 11

(i) Consists of consecutive even numbers.

So, next term is 10

14. (c); Increment in numerater is increasing by 1, every time.

Increment in denominater is increasing by 2 every time

Fraction	Numerater	Denominater
↓	↓	↓
$\frac{4}{7}$	2 + 2 = 4	3 + 4 = 7
$\frac{7}{13}$	4 + 3 = 7	7 + 6 = 13
$\frac{11}{21}$	7 + 4 = 11	13 + 8 = 21

So, missing term is $\frac{7}{13}$

15. (c); The pattern is:
$-(36 \times 1), -(36 \times 2), -(36 \times 3)$
So, $420 - 36 \times 6 = 204$

16. (c); The next number is :
Previous number × 0.3
So, Missing number = $48.6 \times 0.3 = 14.58$

17. (c); $+ 2^2, + 4^2, + 6^2, ...$
Next term $\rightarrow 300 + 36 = 336$

18. (c); $\times 1 + 1^2, \times 2 + 2^2, \times 3 + 3^2, \times 4 + 4^2$
Missing term = $51 \times 4 + 4^2 = 204 + 16 = 220$

19. (a); $\times 6 - 1, \times 5 - 1, \times 4 - 1, \times 3 - 1$
Missing term = $935 \times 3 - 1 = 2805 - 1 = 2804$

20. (c); + 3, + 6, + 12, + 24, + 48 ; Next is: 51 + 48 = 99

21. (d); $\times 1 + 1, \times 2 + 2, \times 3 + 3, \times 4 + 4, ...$
Missing term is $\rightarrow 18 \times 3 + 3 = 54 + 3 = 57$

22. (e); Add prime numbers starting from 7 to each term to obtain the next term.
11 + 7 = 18, 18 + 11 = 29, 29 + 13 = 42, 42 + 17 = 59, 59 + 19 = 78 not 80
So, the wrong term is 80

23. (b); $(2 + 7) \times 1 = 9$
$(9 + 6) \times 2 = 30 \neq 32$
$(30 + 5) \times 3 = 105$
So, the wrong number is 32.

24. (e); $\times 11, \times 9, \times 7, \times 5, \times 3, \times 1, ...$
$17325 \times 3 = 51975 \neq 34650$

25. (a); Each term should be multiplied by 3 to obtain the next term.
So, wrong number is 10.

26. (c); + 4, + 12, + 20, + 28, + 36, + 44, ...
So, wrong number is 46.
it should be 44.

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27. (d); 16 22 40 78 144 246

6 18 38 66 102

12 20 28 36

So, the next term is 246.

28. (c); 2 + 4 = 6, 6 + 8 = 14, 14 + 16 = 30, 30 + 32 = 62,

62 + 64 = 126

So, missing number = 62.

29. (c); 10 14 25 55 140 388

4 11 30 85 248

×3–1 ×3–3 ×3–5 ×3–7

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30. (d); 11 = 2 × 3 + 5

38 = 11 × 4 – 6

197 = 38 × 5 + 7

1172 $\neq$ 197 × 6 – 8

So, 1172 is wrong.

31. (a); 107 – 71 = 36 = 6^2

71 – 46 = 25 = 5^2

46 – 30 = 16 = 4^2

30 – 21 = 9 = 3^2

21 – 19 = 2 $\neq$ 2^2

So, 19 should be replaced by 17, so that

21 – 17 = 4 = 2^2

32. (d); 16 = 9 + 7
25 = 16 + 9
41 = 25 + 16
68 $\neq$ 41 + 25

33. (c); 4 → 2 → $\boxed{3.5}$ → 7.5 → 26.25 → 118.125

×0.5 ×1.5 ×2.5 ×3.5 ×4.5

So, 3.5 is the wrong number it should be replaced by 3

34. (b); 16 → 4 → 2 → 1.5 → 1.75 → 1.875

×0.25 ×0.5 ×0.75 ×1 ×1.25

So, 1.75 is the wrong number.

35. (c); 3 → 10 → 32 → 100 → 308

×3+1 ×3+2 ×3+4 ×3+8

Hence, Next term = 308

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36. (e); 5 → 3 → 4 → 10 → 38

×1–2 ×2–2 ×3–2 ×4–2

So, missing term = 10

37. (b); $5 \times 1 + 1^2 = 6$
$6 \times 2 + 2^2 = 16$
$16 \times 3 + 3^2 = 57$
$57 \times 4 + 4^2 = 244$, Hence, missing number = 16

38. (a); 3 → 10 → 21 → 34 → 51

+7 +11 +13 +17

+4 +2 +4

So, 34 is the missing number

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39. (d); $5 \times 2 + 1 = 11$

$11 \times 2 + 3 = 25$

$25 \times 2 + 5 = 55$

$55 \times 2 + 7 = 117$

40. (a); Series is: + 2, + 3, – 4, – 5, + 6, + 7, – 8, – 9, + 10

So, next number = 4 + 10 = 14

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Chapter 15

Quadratic Equation

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Chapter 15

Quadratic Equation

As we know, if we use the short method, in these types of questions it takes very little time to solve in the examination.

So let us understand the concept.

Quadratic equation: It is a second order polynomial equation with a single variable.

Example: $ax^2 + bx + c = 0$

There will be two values of x which satisfy the given equation.

Sign Method: Now from the exam's point of view, we can conclude the signs of the roots from the signs of the coefficients.

Case I: If b = +ve, c = +ve

Example: $ax^2 + bx + c = 0$, x_1 = –ve, x_2 = –ve

Case II: If b = –ve, c = –ve,

then one root will be positive(+) (bigger number) and other root will be negative(–) (smaller number)

Example: $ax^2 – bx – c = 0$, x_1 = +ve, x_2 = –ve

Case III: If b = +ve, c = –ve

then one root will be –ve (bigger number)

and other root will be +ve (smaller number)

Example: $ax^2 + bx – c = 0$, x_1 = –ve, x_2 = +ve

Case IV: If b = –ve, c = +ve

$ax^2 – bx + c = 0$

x_1 = +ve, x_2 = +ve

x's co-efficient (b)	Constant (c)	x_1	x_2
+	+	–	–
+	–	–	+
–	+	+	+
–	–	+	–

When we see the equation then we can conclude the signs of the roots, so we can find the relation between x and y.

Now we have the signs of the roots of equation and if we remember the table then we can conclude it within 5 seconds.

Now come to the second part:

Suppose we have the equation:

$$x^2 - 5x + 6 = 0$$

From the table we can conclude that both the roots of the equation will be +ve.

Now we have to break the constant (6) such that their sum will be 5.

$$6 = 3 \times 2 \quad \text{also, } (3 + 2 = 5)$$

$$\therefore\ x_1 = +3,\ x_2 = +2$$

Now if there is a value attached to the x's co-efficient, then we have to divide the value to get the roots.

Sol. $2x^2 - 11x + 15 = 0$

$2 \qquad 3 \times 5$

$6 + 5 = 11$

$$\therefore\quad x_1 = +\frac{6}{2} = +3, \qquad x_2 = +\frac{5}{2} = +2.5$$

Types of Questions

Direction (1 – 14): Two equations (I) and (II) are given in each question. On the basis of these equations you have to decide the relation between x and y and give answer.

(a) if $x > y$ (b) if $x < y$

(c) if $x \geq y$ (d) if $x \leq y$

(e) if $x = y$ or no relation can be established between 'x' and 'y'.

1. I. $x^2 - 3x + 6 = 0$ II. $3y^2 + 13y + 12 = 0$

Sol. (a); We even don't have to calculate the values.

Here signs of roots of first quadratic equation $(x_1, x_2) = +ve$
and signs of roots of second quadratic equation $(y_1, y_2) = -ve$
$\therefore$ $x > y$ (Always)

2. I. $5x^2 + 3x - 14 = 0$ II. $10y^2 - 3y - 27 = 0$

Sol. (e); Here $x_1 = -ve$ $x_2 = +ve$
$y_1 = +ve$, $y_2 = -ve$
Now we can't establish the relation between x and y.
Note: Above two types of questions can be solved without calculation. So if in the exam we have any of these cases then we can simply conclude the relation by the sign method.

3. I. $x^2 + 5x + 6 = 0$ II. $y^2 + 3y + 2 = 0$

Sol. (d); $x^2 + 5x + 6 = 0$
$\rightarrow 3 \times 2$ and, $3 + 2 = 5$
$\therefore x_1 = -3$, $x_2 = -2$
$y^2 + 3y + 2$
$\rightarrow 2 \times 1$ and, $2 + 1 = 3$
$\therefore y_1 = -2$, $y_2 = -1$
$\therefore x \le y$

4. I. $2x^2 + 3x + 1 = 0$ II. $12y^2 + 7y + 1 = 0$

Sol. (b); $2x^2 + 3x + 1 = 0$
$\rightarrow 2 \times 1$ and, $2 + 1 = 3$

$$\therefore \quad x_1 = -\frac{2}{2} = -1,\ x_2 = -\frac{1}{2} = -0.5$$

Now, $12y^2 + 7y + 1 = 0$
$\rightarrow 12 = 4 \times 3$ and, $4 + 3 = 7$

$$\therefore\ y_1 = -\frac{4}{12} = -\frac{1}{3} = -0.33,\ y_2 = -\frac{3}{12} = -\frac{1}{4} = -0.25$$

$\therefore y > x$

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5. I. $2x^2 + 23x + 63 = 0$ II. $4y^2 + 19y + 21 = 0$

Sol. (b); I. $2x^2 + 23x + 63 = 0$

2 63

2×1 9×7

also, $14 + 9 = 23$

$\therefore \quad x_1 = -\frac{14}{2} = -7, \; x_2 = -\frac{9}{2} = -4.5$

II. $4y^2 + 19y + 21 = 0$

4 21

2×2 7×3

also, $12 + 7 = 19$

$\therefore \quad y_1 = -\frac{12}{4} = -3, \; y_2 = -\frac{7}{4} = -1.75$

$\therefore \quad x < y$

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6. I. $4x^2 - 29x + 45 = 0$ II. $3y^2 - 19y + 28 = 0$

Sol. (e); I. $4x^2 - 29x + 45 = 0$

4 45

2×2 9×5

also, $20 + 9 = 29$

$\therefore \quad x_1 = +\frac{20}{4} = +5, \; x_2 = +\frac{9}{4} = +2.25$

II. $3y^2 - 19y + 28 = 0$

3 28

3×1 7×4

also, $12 + 7 = 19$

$\therefore \quad y_1 = +\frac{12}{3} = 4, \; y_2 = +\frac{7}{3} = 2.33$

$\therefore$ No relationship can be estabilished

7. I. $2x^2 - 13x + 21 = 0$ II. $5y^2 - 22y + 21 = 0$

Sol. (c); I. $2x^2 - 13x + 21 = 0$

2 21

2 × 1 7 × 3

also, 6 + 7 = 13

$x_1 = +\frac{6}{2} = 3, \quad x_2 = +\frac{7}{2} = 3.5$

II. $5y^2 - 22y + 21 = 0$

5 21

5 × 1 7 × 3

also, 15 + 7 = 22

$\therefore \quad y_1 = +\frac{15}{5} = 3, \; y_2 = +\frac{7}{5} = 1.4 \;\; x \geq y$

8. I. $12x^2 + 11x - 56 = 0$ II. $4y^2 - 15y + 14 = 0$

Sol. (d); I. $12x^2 + 11x - 56 = 0$

12 56

4 × 3 8 × 7

also, 32 - 21 = 11

$\therefore \quad x_1 = -\frac{32}{12} = -2.67, \; x_2 = +\frac{21}{12} = 1.75$

II. $4y^2 - 15y + 14 = 0$

4 14

2 × 2 7 × 2

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also, 8 + 7 = 15

$\therefore \quad y_1 = +\frac{8}{4} = 2,\ y_2 = +\frac{7}{4} = 1.75;\quad x \le y$

9. I. $7x - 3y = 13$ II. $5x + 4y = 40$

Sol. (b); equation (I) × 4 + equation (II) × 3

$$\begin{array}{r} 28x - 12y = 52 \\ 15x + 12y = 120 \\ \hline 43x = 172 \end{array} \Rightarrow x = 4$$

$\therefore$ put it in equation (I)

$4 \times 7 - 3y = 13 \Rightarrow 3y = 15 \Rightarrow y = 5$

$\therefore \quad x < y$

10. I. $\sqrt{1225}x + \sqrt{4900} = 0$ II. $(81)^{1/4} y + (343)^{1/3} = 0$

Sol. (a); I. $35x + 70 = 0 \Rightarrow x = -\frac{70}{35} = -2$

II. $3y + 7 = 0 \Rightarrow y = -\frac{7}{3} = -2.33$

$\therefore \quad x > y$

11. I. $\frac{18}{x^2} + \frac{6}{x} - \frac{12}{x^2} = \frac{8}{x^2}$ II. $y^3 + 9.68 + 5.64 = 16.95$

Sol. (b); I. $18 + 6x - 12 = 8 \quad 6x = 2 \Rightarrow x = \frac{1}{3} \Rightarrow x = 0.33$

II. $y^3 = 1.63 \Rightarrow y > 1$

$\therefore \quad y > x$

12. I. $x = \sqrt[3]{2197}$ II. $y^2 = 169$

Sol. (c); I. $x = 13$ II. $y^2 = 169 \Rightarrow y = \pm 13$

$\therefore \quad x \ge y$

13. I. $x = \sqrt{2304}$ II. $y^2 = 2304$

Sol. (c); I. $x = \sqrt{2304}$

$\therefore$ x = 48 (don't consider – 48 as value of x)

II. $y^2 = 2304 \Rightarrow y = \pm 48$

$\therefore x \geq y$

14. I. $\frac{15}{\sqrt{x}} - \frac{9}{\sqrt{x}} = (x)^{1/2}$ II. $y^{10} - (36)^5 = 0$

Sol. (e); I. $\frac{6}{\sqrt{x}} = \sqrt{x} \Rightarrow x = 6$

II. $y^{10} = (36)^5 \Rightarrow y^{10} = (6^2)^5 \Rightarrow y^{10} = 6^{10}$

$\therefore$ y = 6

$\therefore$ x = y

15. I. $7x^2 + 16x - 15 = 0$ II. $y^2 - 6y - 7 = 0$

Sol. (e); I. x_1 = –ve x_2 = +ve II. y_1 = +ve y_2 = –ve

$\therefore$ Relation can't be estabilished

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Foundation

Direction (1-30): In each of these questions, two equations (I) and (II) are given. You have to solve both the equations and give answer

(a) if x > y (b) if x < y

(c) if $x \geq y$ (d) if $x \leq y$

(e) if x = y or relationship between x and y cannot be established.

1. I. $x^2 + 5x + 6 = 0$ II. $y^2 + 7y + 12 = 0$
2. I. $x^2 + 20 = 9x$ II. $y^2 + 42 = 13y$
3. I. $12x + 3y = 14$ II. $4x + 2y = 16$
4. I. $x = \sqrt{625}$ II. $y = \sqrt{676}$
5. I. $x^2 + 4x + 4 = 0$ II. $y^2 - 8y + 16 = 0$
6. I. $x^2 - 19x + 84 = 0$ II. $y^2 - 25y + 156 = 0$
7. I. $x^3 - 468 = 1729$ II. $y^2 - 1733 + 1564 = 0$
8. I. $\frac{9}{\sqrt{x}} + \frac{19}{\sqrt{x}} = \sqrt{x}$ II. $y^5 - \frac{(2 \times 14)^{11/2}}{\sqrt{y}} = 0$

9. I. $\sqrt{784}\,x + 1234 = 1486$ II. $\sqrt{1089}\,y + 2081 = 2345$

10. I. $\frac{12}{\sqrt{x}} - \frac{23}{\sqrt{x}} = 5\sqrt{x}$ II. $\frac{\sqrt{y}}{12} - \frac{5\sqrt{y}}{12} = \frac{1}{\sqrt{y}}$

11. I. $6x^2 - 49x + 99 = 0$ II. $5y^2 + 17y + 14 = 0$

12. I. $x = (1331)^{1/3}$ II. $2y^2 - 17y + 36 = 0$

13. I. $2x^2 + 3x + 1 = 0$ II. $12y^2 + 7y + 1 = 0$

14. I. $7x - 3y = 13$ II. $5x + 4y = 40$

15. I. $2x + 5y = 6$ II. $5x + 11y = 9$

16. I. $6x^2 + 29x + 35 = 0$ II. $3y^2 + 19y + 30 = 0$

17. I. $\sqrt{1225}\,x + \sqrt{4900} = 0$ II. $(81)^{1/4}\,y + (343)^{1/3} = 0$

18. I. $x^2 - 5x + 6 = 0$ II. $2y^2 - 15y + 27 = 0$

19. I. $2x^2 + x - 1 = 0$ II. $2y^2 - 3y + 1 = 0$

20. I. $8x + 7y = 135$ II. $5x + 6y = 99$

21. I. $x^2 = 64$ II. $2y^2 + 25y + 72 = 0$

22. I. $7x + 3y = 26$ II. $2x + 17y = -41$

23. I. $x = \sqrt[3]{2197}$ II. $y^2 = 169$

24. I. $x = \sqrt{1764}$ II. $y^2 = 1764$

25. I. $3x^2 + 5x - 2 = 0$ II. $2y^2 - 7y + 5 = 0$

26. I. $5x^2 + 2x - 3 = 0$ II. $2y^2 + 7y + 6 = 0$

27. I. $7x + 4y = 3$ II. $5x + 3y = 3$

28. I. $x^2 + 5x - 6 = 0$ II. $2y^2 - 11y + 15 = 0$

29. I. $7x = 4y + 85$ II. $y = \sqrt[3]{17576}$

30. I. $x^2 - 25 = 0$ II. $4y^2 = 24y - 35$

Moderate

Direction (1-30): In each of these questions, two equations (I) and (II) are given. You have to solve both the equations and give answer

(a) if $x > y$ (b) if $x \geq y$

(c) if $x < y$ (d) if $x \leq y$

(e) if $x = y$ or relationship between x and y cannot be established.

1. I. $4x^2 - 43x + 105 = 0$ II. $7y^2 - 29y + 30 = 0$

2. I. $x^2 + 13x + 40 = 0$ II. $y^2 + 7y + 10 = 0$

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3. I. $x = \sqrt[3]{2197}$ II. $2y^2 - 54y + 364 = 0$
4. I. $13x - 8y + 81 = 0$ II. $15x - 5y + 65 = 0$
5. I. $x = \sqrt{172}$ II. $y^2 - 29y + 210 = 0$
6. I. $676x^2 - 1 = 0$ II. $y = \frac{1}{\sqrt[3]{13824}}$
7. I. $2x^2 + 5x - 33 = 0$ II. $y^2 - y - 6 = 0$
8. I. $x^2 + 12x + 36 = 0$ II. $y^2 + 15y + 56 = 0$
9. I. $2x^2 - 3x - 35 = 0$ II. $y^2 - 7y + 6 = 0$
10. I. $12x^2 - 47x + 40 = 0$ II. $4y^2 + 3y - 10 = 0$
11. I. $x = \frac{\sqrt{256}}{\sqrt{576}}$ II. $3y^2 + y - 2 = 0$
12. I. $8x^2 - 49x + 45 = 0$ II. $8y^2 - y - 9 = 0$
13. I. $42x - 17y = -67$ II. $7x - 12y = -26$
14. I. $2.3x - 20.01 = 0$ II. $2.9y - x = 0$
15. I. $x^2 - 26x + 168 = 0$ II. $y^2 - 25y + 156 = 0$
16. I. $2x^2 + 13x - 7 = 0$ II. $2y^2 - 5y + 3 = 0$
17. I. $x^2 + 12x + 32 = 0$ II. $2y^2 + 15y + 27 = 0$
18. I. $x^2 - 82x + 781 = 0$ II. $y^2 = 5041$
19. I. $3x^2 - 7x - 20 = 0$ II. $y^2 - 8y + 16 = 0$
20. I. $9x^2 - 114x + 361 = 0$ II. $y^2 = 36$
21. I. $9x^2 - 29x + 22 = 0$ II. $y^2 - 7y + 12 = 0$
22. I. $3x^2 - 4x - 32 = 0$ II. $2y^2 - 17y + 36 = 0$
23. I. $x^2 + 14x + 49 = 0$ II. $y^2 + 9y = 0$
24. I. $35x^2 - 53x + 20 = 0$ II. $56y^2 - 97y + 42 = 0$
25. I. $x = \sqrt[3]{4913}$ II. $13y + 3x = 246$
26. I. $x^2 - 3481 = 0$ II. $3y^2 = \sqrt[3]{216000}$
27. I. $20x^2 - 67x + 56 = 0$ II. $56y^2 - 67y + 20 = 0$
28. I. $x^2 = 14641$ II. $y = \sqrt{14641}$
29. I. $x^2 + 42 = 13x$ II. $y = \sqrt[4]{1296}$
30. I. $15x^2 - 46x + 35 = 0$ II. $4y^2 - 15y + 14 = 0$

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Difficult

Direction (1-6): Three equations (I), (II) and (III) are given in each question. On the basis of these equations you have to decide the relation between 'x', 'y' and 'z' and give answer

(a) if $x < y = z$ (b) if $x \le y < z$
(c) if $x < y > z$ (d) if $x = y > z$
(e) if $x = y = z$ or if none of the above relationships is established.

1. I. $7x + 6y + 4z = 122$ II. $4x + 5y + 3z = 88$
   III. $9x + 2y + z = 78$
2. I. $7x + 6y = 110$ II. $4x + 3y = 59$
   III. $x + z = 15$
3. I. $x = \sqrt{(36)^{1/2} \times (1296)^{1/4}}$ II. $2y + 3z = 33$
   III. $6y + 5z = 71$
4. I. $8x + 7y = 135$ II. $5x + 6y = 99$
   III. $9y + 8z = 121$
5. I. $(x + y)^3 = 1331$ II. $x - y + z = 0$
   III. $xy = 28$
6. I. $x + 3y + 4z = 96$ II. $2x + 8z = 80$
   III. $2x + 6y = 120$

Direction (7-9): Two equations (I) and (II) are given in each question. On the basis of these equations you have to decide the relation between 'x' and 'y' and give answer

(a) if $x > y$ (b) if $x \ge y$
(c) if $x < y$ (d) if $x \le y$
(e) if $x = y$ or Relation cannot be established.

7. I. $\frac{3x}{3x+7} - \frac{3x+7}{3x} = 14$ II. $\frac{y}{(18y-5)} - \frac{18y-5}{y} = 2$
8. I. $\frac{x}{x+7} + \frac{x+7}{x} = 12$ II. $\frac{y}{y+8} + \frac{y+8}{y} = 16$
9. I. $\frac{x}{x-11} + \frac{x-11}{x} = 7$ II. $\frac{4y}{4y-13} + \frac{4y-13}{4y} = 9$

Direction (10-15): Two equations (I) and (II) are given in each question. On the basis of these equations you have to decide the relation between 'x' and 'y' and give answer

(a) if $x > y$ (b) if $x \geq y$
(c) if $x < y$ (d) if $x \leq y$
(e) if $x = y$ or Relation cannot be established.

10. I. $99x^2 + 149x + 56 = 0$ II. $156y^2 + 287y + 132 = 0$
11. I. $77x^2 + 58x + 8 = 0$ II. $42y^2 + 59y + 20 = 0$
12. I. $63x^2 + 172x + 117 = 0$ II. $30y^2 + 162y + 216 = 0$
13. I. $36x^4 + 369x^2 + 900 = 0$
    II. $144y^4 + 337y^2 + 144 = 0$
14. I. $18x^2 - 13\sqrt{7}x + 14 = 0$ II. $32y^2 - 19\sqrt{6}y + 9 = 0$
15. I. $x^2 - 82x + 781 = 0$ II. $y^2 - 5041 = 0$

Direction (16-20): Two equations (I) and (II) are given in each question. On the basis of these equations you have to decide the relation between 'x' and 'y' and give answer

(a) if $x > y$ (b) if $x \geq y$
(c) if $x < y$ (d) if $x \leq y$
(e) if $x = y$ or relation cannot be established.

16. I. $36x^2 + 47\sqrt{7}x + 105 = 0$ II. $35y^2 + 20\sqrt{3}y + 63\sqrt{2}y + 36\sqrt{6} = 0$
17. I. $91x^2 + 298x + 187 = 0$ II. $247y^2 + 216y - 391 = 0$
18. I. $81x^2 - 9x - 2 = 0$ II. $56y^2 - 13y - 3 = 0$
19. I. $391x^2 + 1344x + 1073 = 0$ II. $437y^2 + 1074y + 589 = 0$
20. I. $3216x^2 + 3859x + 481 = 0$ II. $8132y^2 - 4839y + 978 = 0$

Previous Year (Memory Based)

Direction (1-30): In each of these questions, two equations (I) and (II) are given. You have to solve both the equations and give answer

(a) if $x > y$ (b) if $x \geq y$
(c) if $x < y$ (d) if $x \leq y$
(e) if $x = y$ or relationship between x and y cannot be established.

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1. I. $x = \sqrt[3]{357911}$ II. $y = \sqrt{5041}$
2. I. $3x^2 + 15x + 18 = 0$ II. $2y^2 + 15y + 27 = 0$
3. I. $2x^2 - \left(4 + \sqrt{13}\right)x + 2\sqrt{13} = 0$ II. $10y^2 - \left(18 + 5\sqrt{13}\right)y + 9\sqrt{13} = 0$
4. I. $821x^2 - 757x^2 = 256$ II. $\sqrt{196}\,y^3 - 12y^3 = 16$
5. I. $13x - 21 = 200 - 4x$ II. $y = \sqrt[3]{2197}$
6. I. $(x + y)^2 = 3136$ II. $y + 2513 = 2569$
7. I. $x^2 = 49$ II. $y^2 + 15y + 56 = 0$
8. I. $7x^2 + 16x - 15 = 0$ II. $y^2 - 6y - 7 = 0$
9. I. $\frac{15}{\sqrt{x}} - \frac{9}{\sqrt{x}} = (x)^{\frac{1}{2}}$ II. $y^{10} - (36)^5 = 0$
10. I. $(441)^{\frac{1}{2}}x^2 - 111 = (15)^2$ II. $\sqrt{121}\,y^2 + (6)^3 = 260$
11. I. $x = \sqrt[3]{2744}$ II. $y = \sqrt{487}$
12. I. $15x^2 - 41x + 14 = 0$ II. $2y^2 - 13y + 20 = 0$
13. I. $x^2 - 8\sqrt{3}x + 45 = 0$ II. $y^2 - \sqrt{2}y - 24 = 0$
14. I. $x - 7\sqrt{2x} + 24 = 0$ II. $y - 5\sqrt{2y} + 12 = 0$
15. I. $63x - 94\sqrt{x} + 35 = 0$ II. $32y - 52\sqrt{y} + 21 = 0$
16. I. $x^2 - 7\sqrt{3}x + 35\sqrt{15} = 5\sqrt{5}x$ II. $y^2 - 5\sqrt{5}y + 30 = 0$
17. I. $\sqrt{25}x + \sqrt{16}y = 41$ II. $\sqrt{16}x + \sqrt{25}y = 40$
18. I. $\sqrt{x} - \frac{(18)^{\frac{15}{2}}}{x^2} = 0$ II. $\sqrt{y} = \frac{(19)^{\frac{9}{2}}}{y}$
19. I. $63x - 194\sqrt{x} + 143 = 0$ II. $99y - 255\sqrt{y} + 150 = 0$
20. I. $x - 7\sqrt{3x} + 36 = 0$ II. $y - 12\sqrt{2y} + 70 = 0$
21. I. $x^2 - 7\sqrt{7}x + 84 = 0$ II. $y^2 - 5\sqrt{5}y + 30 = 0$

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22. I. $x^2 - 2x - 15 = 0$ II. $y^2 + 5y + 6 = 0$

23. I. $x - \sqrt{169} = 0$ II. $y^2 - 169 = 0$

24. I. $x^2 - 25 = 0$ II. $y^2 - 9y + 20 = 0$

25. I. $7x + 3y = 77$ II. $2x + 5y = (2601)^{\frac{1}{2}}$

26. I. $(289)^{\frac{1}{2}}\, x - \sqrt{324} = 203$ II. $(484)^{\frac{1}{2}}\, y - \sqrt{225} = 183$

27. I. $679x^2 - 168x^2 = 3066$ II. $\sqrt{144}y^3 - 9y^3 = 1536$

28. I. $3x + 4y = (1681)^{\frac{1}{2}}$ II. $3x + 2y = (961)^{\frac{1}{2}}$

29. I. $3x^2 - (6 + \sqrt{17})x + 2\sqrt{17} = 0$ II. $5y^2 - (15 - \sqrt{17})y - 3\sqrt{17} = 0$

30. I. $x^2 - 16x + 63 = 0$ II. $y^2 - 2y - 35 = 0$

Inequality Questions Based on Latest Pattern 2016 – 2017

1. Quantity I: Overall profit percentage if the cost prices of two shirts are equal. One shirt is sold for 20% profit and the other is sold for 10% loss.
   Quantity II: Profit % made in selling each meter if the profit made in selling 20 m of a cloth equals the cost price of 5 m of that cloth.
   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation
2. The largest possible right circular cylinder is cut out from a wooden cube of edge 7 cm.
   Quantity I: volume of the cube left over after cutting out the cylinder
   Quantity II: Surface area of cube remained after cutting out the cylinder.
   Note: compare the magnitudes of both quantities.
   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation

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3. Quantity 1:Value of y. A vessel contains 2.5 liters of water and 10 liters of milk. 20% of the contents of the vessel are removed. To the remaining contents, x liters of water are added to reverse the ratio of water and milk. Then y liters of milk are added again to reverse the ratio of water and milk.
   Quantity 2: 120 ltr.
   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation
4. P can complete a piece of work in 16 days which Q can complete in 32 days. P and Q work on alternate days.
   Quantity 1: Time taken by them to complete the work if P starts on day 1.
   Quantity 2: time taken by them to complete the work if Q starts on day 1.
   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation
5. PBA and PDC are two secants. AD is the diameter of the circle with centre at O. ∠A= 40°, ∠P = 20°

   Quantity 1: ∠DBC
   Quantity 2: ∠ADB
   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation

6. Quantity 1: Height of the tank if the volume of cylindrical tank is 12320 cubic cm. Its radius and height are in the ratio of 7 : 10 respectively.

   Quantity 2: Level kerosene in the jar. A conical vessel of base radius 2 cm and height 3 cm is filled with kerosene. This liquid leaks through a hole in the bottom and collects in a cylindrical jar of radius 2 cm.

   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation

7. I. $p^2 - 18p + 77 = 0$
   II. $3q^2 - 25q + 28 = 0$

   Quantity 1: Value of P

   Quantity 2 : Value of q

   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation

8. A man who swim 48m / minute in still water, swims 200m against the current and 200m with the current. The difference between the time taken by him against the stream and with the stream is 10 minutes.

   Quantity 1: speed of current.

   Quantity 2: Speed of a man who completes 3 rounds of a circular path of radius 49 m in 14 minutes.

   (a) Quantity I > Quantity II (b) Quantity I < Quantity II
   (c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
   (e) Quantity I = Quantity II or No relation

9. If 10 men and 15 women complete a piece of work in 8 days while 12 men and 8 women can complete the same piece of work in 10 days. If A boy who is 50% less efficient than the man, can do the same work in 50 days.

   Quantity I : Time taken by 2 men, 4 women and 18 boys to complete the work.

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Quantity II : Time taken by 9 men, 3 women and 6 boys to complete the same work.

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

10. Babu starts from his house at certain time with a certain speed to pick up his girlfriend from office at 5 : 00 PM. One day his girlfriend left the office at 3 : 00 PM and starts walking to home with a speed of 40 km / hr and meet Babu in the way who left his home at his usual time. They reached home 40 min. Earlier than their usual time.

Quantity I : Speed of boy.

Quantity II : $492\frac{1}{2}\%$ of speed of girl.

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

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11. If the cost price of the article is $79\frac{2}{7}\%$ of the mark price and there is a discount of Rs. 68 on the marked price. There is a profit of 20% on selling the item.

Quantity I : CP of the article

Quantity II : 1111 Rs.

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

12. Quantity 1: Time taken by Manoj and Shubham to complete the work together. When Manoj works alone, he takes 4.8 hrs more than the time taken by Manoj and Shubham to complete the work together. When Shubham works alone, he takes 10.8 hrs more than the time taken by both of them to complete the work together.

Quantity 2: 7.4 hrs.

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

13. Quantity 1: Profit percent for a shopkeeper. The shopkeeper uses a faulty scale while buying cloth from wholesaler. His scale measures 10% extra than the actual measurement. While selling, the shopkeeper gives 10% less and offers a discount of 10% to the customer.

Quantity 2: Profitpercent for a man who calculates his profit on selling price. He marks up the cost of his item by 25% and then sells the item at a discount of 10%.

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

14. Quantity 1: Original duration of flight. In a flight of 3000 km an aircraft was slowed down by bad weather. Its average speed for the trip was reduced by 100 km/hr. and the time increased by one hour.

Quantity 2: Usual time of a man who, when walks at $\frac{3}{4}$th of his usual pace, reaches his office 20 minutes late.

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

15. Wheels of diameters 7 cm and 14 cm start rolling simultaneously from X and Y, which are 1990.50 cm apart, towards each other in opposite directions. Both of them make same no. of revolutions per second. Both of them meet after 10s.

Quantity 1: speed of smaller wheel.

Quantity 2: 21π cm/s

(a) Quantity I > Quantity II (b) Quantity I < Quantity II
(c) Quantity I ≥ Quantity II (d) Quantity I ≤ Quantity II
(e) Quantity I = Quantity II or No relation

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Foundation

Solutions

1. (c); $x^2 + 5x + 6 = 0$

$6 \rightarrow 3 \times 2 \rightarrow 3 + 2 = 5 \quad \therefore x_1 = -3, \; x_2 = -2$

$y^2 + 7y + 12 = 0$

$12 \rightarrow 4 \times 3 \rightarrow 4 + 3 = 7$

$\therefore \quad y = -4, y_2 = -3; \; \therefore \; x \geq y$

2. (b); $x^2 - 9x + 20 = 0$

5×4 and, $5 + 4 = 9$

$\therefore \quad x_1 = +5 \quad x_2 = +4;$

$y^2 + 42 = 13y$

$y^2 - 13y + 42 = 0$

$42 \rightarrow 7 \times 6$ and, $7 + 6 = 13;$

$\therefore y_1 = +7, \quad y_2 = +6; \; \therefore \; y > x$

3. (b); $eq^n(1) - (eq^n(2) \times 3)$

$$\begin{array}{r} 12x + 3y = 14 \\ 12x + 6y = 48 \\ - \quad - \quad - \\ \hline -3y = -34 \end{array}$$

$y = \frac{34}{3} = 11.33$

Put it in equation 1,

$12x + 34 = 14 \Rightarrow 12x = -20 \Rightarrow x = -\frac{5}{3}; \qquad \therefore x < y$

4. (b); $x = \sqrt{625} = 25$

$y = \sqrt{676} = 26; \quad \therefore \quad x < y$

5. (b); $x^2 + 4x + 4 = 0$

2×2 and, $2 + 2 = 4$

$x_1 = -2, \quad x_2 = -2$

$y^2 - 8y + 16 = 0 \Rightarrow \quad y_1, y_2 = +ve; \quad \therefore \; y > x$

6. (d); $x^2 - 19x + 84 = 0$

12×7 and, $12 + 7 = 19$

$\therefore \quad x_1 = +12, x_2 = +7$

$y^2 - 25y + 156 = 0$

13×12 and, $13 + 12 = 25$

$\therefore \quad y_1 = 13, y_2 = 12 \; \therefore \; y \geq x$

7. (c); $x^3 = 1729 + 468$

$x^3 = 2197 \Rightarrow x = 13$

$y^2 = 169 \Rightarrow y = \pm 13 \; \therefore \; x \geq y$

8. (e); $9 + 19 = x \quad \Rightarrow \quad x = 28$

$(y)^{5+\frac{1}{2}} = (2 \times 14)^{11/2} \Rightarrow (y)^{\frac{11}{2}} = (2 \times 14)^{11/2}$

$\therefore \quad y = 28 \quad \therefore \; x = y$

9. (a); $\sqrt{784}\,x + 1234 = 1486$

$28x = 252 \Rightarrow x = 9$

$33y = 264 \Rightarrow y = 8 \quad \therefore \; x > y$

10. (a); $5x = -11$

$x = \dfrac{-11}{5} = -2.2$

$y - 5y = 12 \Rightarrow y = -3 \quad \therefore \; x > y$

11. (a); $6x^2 - 49x + 99 = 0$

$2 \times 3 \qquad 11 \times 9$

and, 22 + 27 = 49

$\therefore \quad x_1 = \frac{22}{6} = \frac{11}{3} = 3.67$, $x_2 = \frac{27}{6} = \frac{9}{2} = 4.5$

$5y^2 + 17y + 14 = 0$

/ \

5 7×2

and, 10 + 7 = 17

$\therefore \quad y_1 = \frac{-10}{5} = -2$, $y_2 = \frac{-7}{5} = -1.4 \quad \therefore \; x > y$

12. (a); $x = (1331)^{1/3} = 11$

$2y^2 - 17y + 36 = 0$

/ \

2×1 9×4

and, 9 + 8 = 17

$\therefore \quad y_1 = \frac{9}{2} = 4.5$, $y_2 = \frac{8}{2} = 4 \quad \therefore \; x > y$

13. (b); I. $x_1 = \frac{-2}{2} = -1$, $x_2 = \frac{-1}{2} = -0.5$

II. $y_1 = \frac{-4}{12} = -0.33$, $y_2 = \frac{-1}{4} = -0.25 \quad \therefore \; y > x$

14. (b); eq(i) × 4 + eq(ii) × 3.

$$\begin{array}{l} 28x - 12y = 52 \\ \underline{15x + 12y = 120} \\ 43x = \quad 172 \end{array}$$

x = 4 , Put it in equation (i)

$3y = 28 - 13 \Rightarrow y = 5 \quad x < y$