Time And Distance

01. If I walk at the rate of 4 kmph I miss the train by 10 minutes. If I walk at the rate of 5 kmph I reach 5 minutes before the arrival of the train. How far is the station from my house assuming that I start walking from my house?
02. Robi drove 100 miles to visit a friend. If he had driven 8 miles per hour faster than he did, he would have arrived in $\frac{5}{6}$ of the time he actually took. How many minutes did the trip take?
03. Zainaul covered a distance of 340 miles between Dhaka and Rajshahi taking a total of 5 hours. If part of the distance was covered at a speed of 60 miles per hour and the rest at a speed of 80 miles per hour, how many hours did she travel at 60 miles per hour?
04. One day Mr. Wahid started 30 minutes late from home and reached his office 50 minutes late, while driving 25% slower than his usual speed. How much time in minutes does Mr. Wahid usually take to reach his office from home?
05. The speed of a railway engine is 42 km per hour when no compartment is attached, and the reduction in speed is directly proportional to the square root of the number of compartments attached. If the speed of the train carried by this engine is 24 km per hour when 9 compartments are attached, what is the maximum number of compartments that can be carried by the engine?
06. A boy covers a distance of 6 kilometers partly by walking and partly by cycling. If he cycles at 18 kilometers per hour and walks at 6 kilometers per hour and takes 35 minutes in all, find the distance he covers by walking.
07. Rahim drives from Jessore to Chuadanga in 45 minutes. The road between Jessore and Chuadanga is 48 km. long and it consists of both rough and good surfaces. Where the surface is good, Rahim drives at 72 km/h; and where the surface is bad, he drives at 48 km/h. Find the number of kms of good surface.
08. During a car trip, Matin stopped to rest after he traveled ½ of the total distance to his destination. He stopped again after he traveled 1/4th of the distance remaining between his first stop and his destination, and then he drove the remaining 120 miles to his destination. What was the total distance, in miles, from Matin's starting point to his destination?
09. Mr. Nader drove from Mymenshingh to Dhaka at 60 miles/hour. Returning on the same route, there was a lot of traffic, and he was only able to drive at 40 miles/hour. If the return trip took 1 hour longer, what is the distance between Dhaka and Mymenshingh?
10. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B, 75 kms away from A at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:
11. A can lay railway track between two given stations in 16 days and B can do the same job in 12 days. With help of C, they did the job in 4 days only. Then, C alone can do the job in:
12. During a car trip, Matin stopped to rest after he traveled ½ of the total distance to his destination. He stopped again after he traveled 1/4th of the distance remaining between his first stop and his destination, and then he

drove the remaining 120 miles to his destination. What was the total distance, in miles, from Matin's starting point to his destination?

13. A train can travel 50% faster than a car. Both start from point A at the same time and reach point B, 75 kms away from A, at the same time. On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:
14. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:
15. Robert is travelling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph, he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M.?
16. A man walking non-stop along a road at 3 km/hr is overtaken by a car running at 30 km/hr. If the car breaks down 1 kilometer beyond where it passes the man, how many minutes after the breakdown does the man reach the car?
17. A car travels a distance of 840 km at a uniform speed. If the speed of the car is 10 km/hr more, it takes two hours less to cover the same distance. The original speed of the car was:
18. A train leaves Sylhet at 6 a.m. & reaches Dhaka at 10 a.m. Another train leaves Dhaka at 8 a.m. and reaches Sylhet at 11.30 a.m. At what time do the 2 trains cross one another:
19. If a train runs at 40 km/hr, it reaches its destination late by 11 min. but if it runs at 50 km/hr, it is late by 5 min. only. The correct time for the train to cover its journey is:
20. The ratio between the rates of travelling of *A* & *B* is 2:3 and therefore *A* takes 10 mins. more than the time taken by *B* to reach a destination. If *A* had walked at double the speed, he would have covered the distance in:
21. A train X starts from Dhaka at 4 P.M. & reaches Ashuganj at 5 P.M. while another train Y starts from Ashuganj at 4 P.M. and reaches Dhaka at 5.30 P.M. The two trains will cross each other at:
22. Two trains are running in opposite directions towards each other with speeds of 54 km/h and 48 km/h respectively. If the length of one train is 250 m and they cross each other in 18 seconds, the length of the other train is:
23. A train 150 m long passes a milestone in 15 seconds and another train of the same length travelling in opposite direction in 8 seconds. The speed of the second train is:
24. A train travelling at 48 km/h completely crosses another train having half its length and travelling in opposite direction at 42 km/h, in 12 seconds. It also passes a railway platform in 45 seconds. What is the length of the platform?
25. The current of a stream runs at 1 km/hr. A motor boat goes 35 km upstream and back again to the starting point in 12 hours. The speed of motorboat in still water is:
26. A man can row $9\frac{1}{3}$ km/hr in still water & he finds that it takes him thrice as much time to row up than as to row down the same distance in river. The speed of the current is:
27. A man has to go 10 km to catch a bus. He walks part of the way at 7 km/h and runs rest of the way at 12 km/h. If he takes 1 hr and 15 mins to complete his journey find the distance he covers by walking
28. A man's running speed is 3 times of his walking speed. He runs a distance and come back by walking total time taken 2 hrs. What was the distance if he runs 9 miles per hour02: A man goes to his office at a certain time. If his

waking speed is 5 kmh then he is 7 minutes late. When his speed is 6 kmh he reaches 5 minutes before. How far his office from his house

29. The average speed of Train in the onward Journey is 25% more than that is the return journey .The train halts for an hours on reaching the destination. The total time taken for the complete journey for return trip be 17 hours, covering a distance of 800 km. Find the speed of the Train is the onward journey?

Solution	Student's Discussion

01. Let, the station be x km far from my house.

$\therefore$ It will take me $\frac{x}{4}$ hours, if I walk 4 kmph

And it will take me $\frac{x}{5}$ hours, if I walk 5 kmph

According to the condition of the question $\frac{x}{4}-\frac{x}{5}=\frac{10+5}{60}$ $\Rightarrow \frac{x}{20}=\frac{1}{4}$ $\Rightarrow x=5$

$\therefore$ The station is 5 kms far from my house (Answer)

02. Let the actual speed be x miles per hour.
Total distance to visit a friend is 100 miles.

So, actual time is $\frac{100}{x}$ hours.

After increase his speed 8 miles per hour, the time is $\frac{100}{x+8}$ hour.

According to the question- $\frac{\frac{100}{x+8}}{\frac{100}{x}}=\frac{5}{6}$; $\Rightarrow \frac{100}{x+8}\times\frac{x}{100}=\frac{5}{6}$; $\Rightarrow 6x = 5x + 40$; $\therefore x = 40$

So, actual speed is 40 miles per hour.

So, actual time is $\frac{100}{x}=\frac{100}{40}$ hour $=\frac{100}{40}\times 60 = 150$ min. **Answer: The trip takes 150 minutes.**

03. Given that,

The total distance is = 340 miles.

Let, the distance covered at a speed of 60 miles be x miles.

$\therefore$ We know that $\frac{Dis\tan ce}{Speed}$ = Time

$\therefore$ We get, $\frac{x}{60}+\frac{340-x}{80}=5$

$\Rightarrow \frac{4x+3(340-x)}{240}=5$ $\Rightarrow 4x + 1020 - 3x = 5\times 240$ $\Rightarrow x = 1200 - 1020$ $\Rightarrow x = 180$

$\therefore$ Answer: The distance covered at 60 mile per hour is 180 miles.

04 Let the distance between office & home be x k.m.

and usual speed be 100 km/h.

We know, time = $\frac{disance}{speed}$.

So, $\frac{x}{75} - \frac{x}{100} = \frac{1}{3}$ [$\because$ 50-30=20 minute = $\frac{1}{3}$ hours]

$\Rightarrow \frac{4x-3x}{300} = \frac{1}{3} \quad \Rightarrow x = \frac{300}{3}$ = 100 km.

So, the usual time required = $\frac{\text{distance}}{\text{usual speed}} = \frac{100}{100}$ = 1hour = 60 minutes

Answer: Wahid usually takes 60 minutes to reach his office from home.

05. Given that, speed of the train when no compartment = 42 km / hr with 9 compartment, speed = 24 km/ hr

$\therefore$ Reduced speed = (42 – 24) km / hr = 18 km/ hr.

It is also given that, the reduction of the speed is directly proportional to square root of no. of compartment.

We know that, if A is directly proportional to B, we can write A = KB. Here, $18 = k\sqrt{9} = 18 = 3k \Rightarrow k = 6$

Train does not move when the speed is zero. It means if the speed of the train is reduced by 42 km / hr, then the train will not move. Let, after adding the 'N' number of compartments the speed of the train will be reduced by 42 km / hr.

$\therefore$ We get, $42 = k\sqrt{n} \Rightarrow 42 = 6\sqrt{n} \Rightarrow \sqrt{n} = 7 \Rightarrow n = 49$

$\therefore$ After adding 49 compartments, the speed will be zero.

$\therefore$ The train can carry less than 49 compartments.

The maximum number of compartments, that the train can carry is 48 (which is less than 49)

$\therefore$ **Answer is 48.**

06. Let, he cycles x km So, he walks $(6 - x)$ km.

We know, Time = $\left(\frac{Distance}{speed}\right)$

So, $\frac{x}{18} + \frac{(6-x)}{6} = \frac{35}{60}$

$\Rightarrow \frac{x+3(6-x)}{18} = \frac{35}{60} \quad \Rightarrow \frac{x+18-3x}{3} = \frac{35}{60} \quad \Rightarrow \frac{18-2x}{3} = \frac{35}{60}$

$\Rightarrow 180 - 20x = 105$

$\Rightarrow -20x = -75 \quad \Rightarrow x = \frac{75}{20} = 3.75$

So, he walks (6 – 3. 75) = 2.25 km **Ans.**

Alternative Method:

Let the covers x km by walking.

So, he covers $(6 - x)$ km by cycling.

$\frac{\text{Distance}}{\text{Speed}}$ = time

So, according to the question,

$\frac{x}{6} + \frac{6-x}{18} = \frac{35}{60} = \frac{7}{12} \quad \Rightarrow \frac{3x+6-x}{18} = \frac{7}{12} \quad \Rightarrow \frac{2x+6}{3} = \frac{7}{2}$

$\Rightarrow 4x + 12 = 21 \quad \Rightarrow 4x = 21 - 12 = 9$

$\therefore x = \frac{9}{4} = 2.25$ kms. **So, he covers 2.25 kms by walking. (Answer)**

07. Let, Rahim drives x km. at 72 km/h

$\Rightarrow$ Time taken for x km = $\frac{x}{72}$ hours

$\therefore$ $(48 - x)$ km is driven at 48 km/h

$\Rightarrow$ Time taken for $(48 - x)$ km = $\frac{48-x}{48}$ hours

According to the question,

$\frac{x}{72} + \frac{48-x}{48} = 45 \times \frac{1}{60} = \frac{3}{4}$

$\Rightarrow \frac{2x+3(48-x)}{144} = \frac{3}{4} \quad \Rightarrow \frac{2x+144-3x}{144} = \frac{3}{4} \Rightarrow -x = 3 \times 36 - 144 \quad \Rightarrow x = 36$

$\therefore$ **The number of kms of good surface = 36 kms (Answer: 36 km)**

08. Let, the total distance be x.

The distance up to his first stop = $\frac{1}{2}x$

and after that he traveled until 2nd stop = $\frac{1}{2}x \times \frac{1}{4} = \frac{x}{8}$ miles.

Remaining distance = $x - (\frac{1}{2}x + \frac{1}{8}x)$

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

$= (\frac{8x-5x}{8}) = \frac{3x}{8}$

$\therefore \frac{3x}{8} = 120 \Rightarrow x = \frac{8 \times 120}{3} = 320$ miles **(Answer)**

09. Let, the distance be x miles.

We know, time = $\left(\frac{\text{Distance}}{\text{speed}}\right)$

When going to Dhaka, required time = $\frac{x}{60}$ hours

and when returning, required time = $\frac{x}{40}$ hours

According to question, we get, $\frac{x}{40}-\frac{x}{60}=1$

$\Rightarrow \frac{3x-2x}{120}=1 \Rightarrow x=120$ miles **(Answer)**

10. Let speed of the car be x kmph.

Then, speed of the train = x + 50% of x = 1.5$x$kmph

$\Rightarrow \frac{75}{x}-\frac{75}{1.5x}=\frac{12.5}{60}$ $\Rightarrow \frac{75\times1.5-75}{1.5x}=\frac{12.5}{60}$ $\Rightarrow 37.5 \times 60 = 12.5 \times 1.5x$

$\therefore$ x = 120 kmph (Answer)

11. According to the question, (A + B + C)'s 1 day's work = $\frac{1}{4}$

A's 1 day's work = $\frac{1}{16}$ and, B's 1 day's work = $\frac{1}{12}$

$\therefore$ C's 1 day's work = $\frac{1}{4}-\left(\frac{1}{16}+\frac{1}{12}\right)=\left(\frac{1}{4}-\frac{7}{48}\right)=\frac{5}{48}$.

$\therefore$ C can do the work = $\frac{48}{5}$ = 9 $\frac{3}{5}$ days. **(Answer).**

12. Let the total distance be x kms.

The distance up to his first stop = $\frac{1}{2}x$

and after that he traveled until 2nd stop = $\frac{1}{2}x \times \frac{1}{4} = \frac{x}{8}$ miles.

Remaining distance = $x-(\frac{1}{2}x+\frac{1}{8}x) = x-(\frac{4x+x}{8}) = x-\frac{5x}{8} = (\frac{8x-5x}{8}) = \frac{3x}{8}$

$\therefore \frac{3x}{8}=120$ $\Rightarrow x = \frac{8\times120}{3}=320$ miles **(Answer).**

13. Let speed of the car be x kmph.

Then, speed of the train = x + 50% of x = 1.5x kmph

$\Rightarrow \frac{75}{x}-\frac{75}{1.5x}=\frac{12.5}{60} \Rightarrow \frac{75\times1.5-75}{1.5x}=\frac{12.5}{60} \Rightarrow 37.5 \times 60 = 12.5 \times 1.5x$ $\therefore x=120$ **(Answer).**

14. Let, the duration of the flight be x hours.

Then, $\frac{600}{x} - \frac{600}{x+(1/2)} = 200 \Rightarrow \frac{600}{x} - \frac{1200}{2x+1} = 200$

$\Rightarrow \frac{1200x+600-1200x}{x(2x+1)} = 200 \quad \Rightarrow x(2x+1) = 3 \quad \Rightarrow 2x^2 + x - 3 = 0 \quad \Rightarrow (2x+3)(x-1) = 0$

$\Rightarrow x = 1$ hr. **[neglecting the -ve value of x] (Answer).**

15. Let the distance travelled be x km.

Difference of time = (2pm – 12.00pm) = 2 hours

Then, $\frac{x}{10} - \frac{x}{15} = 2 \quad \Rightarrow 3x - 2x = 60 \quad \Rightarrow x = 60$ km.

Time taken to travel 60 km at 10 km/hr = $\left(\frac{60}{10}\right) hrs = 6$ hrs.

So, Robert started 6 hours before 2 P.M. *i.e.,* at 8 A.M.

$\therefore$ Required speed = $\left(\frac{60}{5}\right) kmph = 12$ kmph. **(Answer).**

16. After overtaking the man the car takes $\frac{60}{30} = 2$ minutes to go 1 km.

For the man,

3 kms are traveled in 60 minutes

$\therefore$ 1 kms are traveled $\frac{60}{30} = 20$ minutes

So, After breakdown of car, the man takes 20 – 2 = 18 minutes to reach the car. **Answer: 18 minutes.**

17. Let, the original speed be x km/hr.

Then, $\frac{840}{x} - \frac{840}{x+10} = 2 \quad \Rightarrow 840(x+10) - 840x = 2x(x+10)$

$\therefore x^2 + 10x - 4200 = 0$ or $(x+70)(x-60) = 0$.

$\therefore x = 60$ km/hr. **(Answer).**

18. Let, distance between Sylhet and Dhaka be y km.

Average speed of train leaving Sylhet = $\left(\frac{y}{4}\right)$ km/hr.

Average speed of train leaving Dhaka = $\left(\frac{2y}{7}\right)$ km/hr.

Suppose they meet x hrs after 6 a.m.

Since, the sum of distance two train where between they cross is = y

$\therefore \frac{xy}{4} + \frac{2y(x-2)}{7} = y \quad \Rightarrow \frac{x}{4} + \frac{2x-4}{7} = 1$

$\therefore 15x = 44$ or $x = \frac{44}{15} = 2$ hrs 56 mins.

So, they meet at 8.56 a.m. **(Answer).**

19. Let, required time = x mins.

$\therefore$ distance covered in $(x + 11)$ min.

At 40 km/hr = distance covered in $(x + 5)$ min at 50 km/hr.

$\therefore 40 \times \frac{x+11}{60} = 50 \times \frac{x+5}{60} \Rightarrow 4(x + 11) = 5(x + 5)$

$\therefore x = 19$ mins. **(Answer).**

20. Ratio of time taken by A and $B = \frac{1}{2} : \frac{1}{3}$. Suppose B takes x min.

Then, A takes $(x + 10)$ min.

$(x+10) : x = \frac{1}{2} : \frac{1}{3}$ or $\frac{x+10}{x} = \frac{3}{2} \Rightarrow$ or $2x + 20 = 3x \Rightarrow x = 20.$

Normally A takes = 20 + 10 = 30 minutes.

If A had walked at double the normal speed,

He would have covered the distance in $\frac{30}{2}$ = 15 minutes. **(Answer).**

21. Suppose, the distance between Dhaka & Ashuganj is x km.;

Time taken by X to cover x km = 1 hour.

Time taken by Y to cover x km $= \frac{3}{2}$ hours. $\therefore$ Speed of $X = x$ km/h, Speed of Y$= \left(\frac{2x}{3}\right)$ km/h

$\therefore$ Let they meet y hours after 4 a.m. Then, $xy + \frac{2xy}{3} = x; \Rightarrow y\left(1 + \frac{2}{3}\right) = 1$ or $y = \frac{3}{5}$ hours.

$\therefore y = \left(\frac{3}{5} \times 60\right)$ min = 36 min. So, the two trains meet at 4.36 p.m. **(Answer).**

22. Relative speed = (54 + 48) km/h $= \left(102 \times \frac{5}{18}\right)$ m/sec

Let the length of the other train be x meters.

So, according to the question,

$102 \times \frac{5}{18} \times 18 = 250 + x; \Rightarrow x = 510 - 250 \therefore x = 260$ meters. **(Answer).**

23. Speed of first train $= \left(\frac{150}{15}\right)$ m/sec = 10 m/sec;

Let, the speed of second train be x meters per sec.

Relative speed = $(10 + x)$ m/sec.

$\therefore \frac{300}{10+x} = 8$ or $300 = 80 + 8x \Rightarrow x = \frac{220}{8} = \frac{55}{2}$ m/sec.

$\therefore$ Speed of second train $= \left(\frac{55}{2} \times \frac{18}{5}\right)$ km/h = 99 km/h. **(Answer).**

24. Let, the length of first train be $2x$ meters.
Then, then length of second train is x meters.
Relative speed = (48 + 42) km/h

$$= \left(90 \times \frac{5}{18}\right) \text{m/sec} = 25 \text{ m/sec.} \quad \therefore \ 25 \times 12 = 3x$$

$\therefore$ x = 100 meters.

$\therefore$ Length of the first train $2x$ = 200 m. Let the length of platform be y meters.

Speed of 1st train $= \left(48 \times \frac{5}{18}\right) \text{m/sec} = \frac{40}{3}$ m/sec.

$\therefore \ \frac{40}{30} \times 45 = 200 + y \Rightarrow y = 600 - 200 \ \therefore \ y = 400$ meters **(Answer).**

25. Let, the speed in still water be x km/hr.

$$\frac{35}{x-1} + \frac{35}{x+1} = 12 \Rightarrow 35\,(2x) = 12\,(x^2 - 1) \Rightarrow 12x^2 - 70x - 12 = 0 \Rightarrow 12x^2 - 72x + 2x - 12 = 0$$

$\Rightarrow 12x\,(x - 6) + 2\,(x - 6) = 0 \Rightarrow (x - 6)\,(12x + 2) = 0 \ \therefore \ x = 6$ **(Answer).**

26. Let, speed upstream = x km/hr; Then, speed downstream = $3x$ km/hr

Speed in still water $= \frac{1}{2}(x + 3x) = 2x$ km/hr.

Speed of current $= \frac{1}{2}(3x - x) = x$ km/hr. $\quad \therefore 2x = \frac{28}{3}$ or $x\frac{14}{3} = 4\frac{2}{3}$ km/hr. **(Answer)**

Alternative Method:

Given that,

The speed in still water is $9\frac{1}{3} = \frac{28}{3}$ km/hr.

Let, the speed of the current be = x km/hr.

$\therefore$ downstream speed $= \left(\frac{28}{3} + x\right)$ km/hr

And upstream speed $= \left(\frac{28}{3} - x\right)$ km/hr

So, according to the question,

$$\frac{28}{3} + x = 3\left(\frac{28}{3} - x\right)$$

$\Rightarrow \frac{28+3x}{3} = \frac{28-3x}{3} \times 3 \Rightarrow 28 + 3x = -9x + 84$

$\Rightarrow 3x + 9x = 84 - 28$

$\therefore x = \frac{56}{12} = 4\ \frac{8}{12} = 4\ \frac{2}{3}$ km/hr **(Answer)**

27. Let, total distance be X km
ATQ, x/5 – x/6 =12/60 [Time = distance/Speed] x = 6 km (Ans.)

28. Let, he walks x km and run (10 – x) km
According to the question x/7 + (10 – x)/12 = 1hr 15mins
Or, (12x + 70 – 7x)/84 = 1+15/60; Or, 70 + 5x = 1.25 × 84 = 105 ; Or, 5x = 35; Or, x = 7 km **(Ans.)**

29. Let, the speed of return journey is x km/hr
The speed of onward journey is 125x/100 or 5x/4 km/hr
Distance covered in onward and return journey = 400 + 400 = 800 km
Actual time to cover distance = 17 – 1 = 16 hour
ATQ, 400/(5x/4) + 400/x = 16, Or, X = 45km.
So, speed at onward journey is = (5 × 45)/4 = 225/4 = 56.25 km **(Ans.)**

Permutation and Combination

01. 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?

02. In how many ways can a group of 5 men and 2 women be made out of a total of 7 men and 3 women?

03. There are 8 men and 10 women and you need to form a committee of 5 men and 6 women. In how many ways can the committee be formed?

04. A bag contains 2 white balls, 3 black balls and 4 red balls. In how many ways can 3 balls be drawn from the bag, if at least one black ball is to be included in the draw?

05. How many 3 digit numbers can be formed from the digits 2, 3, 5, 6, 7 and 9 which are divisible by 5 and none of the digits is repeated?

06. There are 6 periods in each working day of a school. In how many ways can one organize 5 subjects such that each subject is allowed at least one period?

07. How many 6 digit telephone numbers can be formed if each number starts with 35 and no digit appears more than once?

08. An event manager has ten patterns of chairs and eight patterns of tables. In how many ways can he make a pair of table and chair?

09. How many numbers, between 100 and 1000, can be formed with the digits 3,4,5,0,6,73,4,5,0,6,7 ? (repetition of digits is not allowed)

10. A company has 10 software engineers and 6 civil engineers. In how many ways can a committee of 4 engineers be formed from them such that the committee must contain exactly 1 civil engineer?

Solution — Permutation and Combination

01. In a group of 6 boys and 4 girls, four children are to be selected such that at least one boy should be there.
Hence we have 4 options as given below

We can select 4 boys ...(option 1) Number of ways to this = ${}^6C_4$

We can select 3 boys and 1 girl ...(option 2) Number of ways to this = ${}^6C_3 \times {}^4C_1$

We can select 2 boys and 2 girls ...(option 3) Number of ways to this = ${}^6C_2 \times {}^4C_2$

We can select 1 boy and 3 girls ...(option 4) Number of ways to this = ${}^6C_1 \times {}^4C_3$

Total number of ways = ${}^6C_4 + {}^6C_3 \times {}^4C_1 + {}^6C_2 \times {}^4C_2 + {}^6C_1 \times {}^4C_3 = 15+80+90+24=209$

02. We need to select 5 men from 7 men and 2 women from 3 women.

Number of ways to do this = ${}^7C_5 \times {}^3C_2 = 21\times3=63$

03. We need to select 5 men from 8 men and 6 women from 10 women
Number of ways to do this = ${}^8C_5 \times {}^{10}C_6 = 56\times210=11760$

04. From 2 white balls, 3 black balls and 4 red balls, 3 balls are to be selected such that at least one black ball should be there. Hence we have 3 choices as given below

We can select 3 black balls...(option 1)
We can select 2 black balls and 1 non-black ball ...(option 2)
We can select 1 black ball and 2 non-black balls ...(option 3)

Number of ways to select 3 black balls = 3C3
Number of ways to select 2 black balls and 1 non-black ball = 3C2 × 6C1
Number of ways to select 1 black ball and 2 non-black balls = 3C1 × 6C2

Total number of ways = 3C3 + 3C2 × 6C1 + 3C1 × 6C2=1+18+45=64

05. We need to find out how many 3 digit numbers can be formed from the 6 digits (2,3,5,6,7,9) which are divisible by 5.

Since the 3 digit number should be divisible by 5, we should take the digit 5 from the 6 digits(2,3,5,6,7,9) and fix it at the unit place. There is only 1 way of doing this.

Since the number 5 is placed at unit place, we have now five digits(2,3,6,7,9) remaining. Any of these 5 digits can be placed at tens place

Since the digit 5 is placed at unit place and another one digit is placed at tens place, we have now four digits remaining. Any of these 4 digits can be placed at hundreds place.

Required Number of three digit numbers =4×5×1=20

06. 5 subjects can be arranged in 6 periods in ${}^{6}P_{5}$ ways.
Any of the 5 subjects can be organized in the remaining period (${}^{5}C_{1}$ ways).
Two subjects are alike in each of the arrangement. So we need to divide by 2! to avoid over counting.
Total number of arrangements = $({}^{6}P_{5} \times {}^{5}C_{1})/2! = 1800$

07. The first two places can only be filled by 3 and 5 respectively and there is only 1 way for doing this.
Given that no digit appears more than once. Hence we have 8 digits remaining (0,1,2,4,6,7,8,9)
So, the next 4 places can be filled with the remaining 8 digits in ${}^{8}P_{4}$ ways.
Total number of ways = ${}^{8}P_{4} = 8\times7\times6\times5 = 1680$

08. He has 10 patterns of chairs and 8 patterns of tables
A chair can be selected in 10 ways.
A table can be selected in 8 ways.
Hence one chair and one table can be selected in 10×8 = 80 ways

09. Here we can take only 3 digit numbers, between 100 and 1000.

We have 6 digits (3,4,5,0,6,7) But in these 6 digits, 0 cannot be used at the hundreds place. Hence any of the 5 digits (3,4,5,6,7) can be placed at hundreds place.0

Since one digit is placed at hundreds place, we have 5 digits remaining. Any of these 5 digits can be placed at units place.

Since one digit is placed hundreds place and another digit is placed at units place, we have 4 digits remaining. Any of these 4 digits can be placed at tens place.

Hence, required number of 3 digit numbers =5×4×5=100

10. The committee should have 4 engineers. But the committee must contain exactly 1 civil engineer.
Hence, select 3 software engineers from 10 software engineers and select 1 civil engineer from 6 civil engineers.
Number of ways this can be done = ${}^{10}C_{3} \times {}^{6}C_{1} = 10\times9\times8 = 720$

বিগত বছরের প্রশ্নাবলী ও বিশদ সমাধান	২০১৯ সালে ৩০ জুন পর্যন্ত অনুষ্ঠিত সকল সরকারী ও বেসরকারী ব্যাংকের প্রশ্নাবলী ও সমাধান

01. Two trains running at the rate of 75 km and 60 km an hour respectively on parallel rails in opposite directions are observed to pass each other in 8 seconds and when they are running in the same direction

at the same rates as before, a person sitting in the faster train observes that he passes the other in $31\frac{1}{2}$ seconds. Find the lengths of the trains. *[6 Govt. Banks & 2 Financial Institutions SO (General) 19, Written]*

Solution:

Relative speed of two trains while running in opposite direction = (75 + 60) km/h = 135 km/h

$$= \frac{135 \times 1000}{3600} \text{ m/s} = \frac{75}{2} \text{ m/s}$$

$\therefore$ Relative speed of two trains while running in same direction = (75–60) km/h = 15 km/h

$$= \frac{35 \times 1000}{3600} \text{ m/s} = \frac{25}{6} \text{ m/s}$$

Now,

We know, Distance = Time × Speed

$\therefore$ Length of the two trains = $\left(\frac{75}{2} \times 9\right)$ m = 300 m

Now, length of the slower train = $\left(\frac{25}{6} \times 31\frac{1}{2}\right)$ m = $\left(\frac{25}{6} \times \frac{63}{2}\right)$ m = 131.25 m

$\therefore$ length of the faster train = (300–131.25)m = 168.75 m

Ans: 131.25 m and 168.75 m

02. A cow was standing on a bridge, 5m away from the middle of the bridge. A train was coming towards the bridge from the ends nearest to the cow. Seeing this, Cow ran towards the train and managed to escape when the train was 2m away from bridge. If it had run in the opposite direction, it would hit by the train 2m before the end of the bridge. What is the length of the bridge in meters assuming the speed of the train is 4 times that of cow? *[4 Govt. Banks Officer (General) 19, Written]*

Solution:

Let,

The distance of cow from the shortest end–x meters.

$\therefore$ Half of the bridge = (x + 5) meters.

$\therefore$ Length of the total bridge = 2(x + 5) Or, (2x + 10) meters

$\therefore$ The distance of the cow from the longest end = (2x + 10–x) meters. = (x+10) meters.

Let,

The x meters covered by cow in t seconds.

$\therefore$ In t seconds the distance covered by the train = 4x meters.

When t = 0,

The distance between train and bridge = (4x + 2) meters

In second case,

The distance covered by the cow = (x + 10 –2) meters = (x + 8) meters

$\therefore$ " " " " Train = (4x + 2 + 2x + 10 –2) meters = (6x + 10) meters

According to question,

$4(x+8) = 6x + 10 \Rightarrow 4x + 32 = 6x + 10 \Rightarrow 2x = 22 \therefore x = 11$

$\therefore$ Length of the bridge, $2x + 10 = \{(2 \times 11) + 10\}$ meters = 32 meters.

Ans: 32 meters

03. A man went downstream for 28 km in a motor boat and immediately returned. It took the man twice as long to make the return trip. If the speed of the river flow were twice as high, the trip downstream and back would take 672 minutes. Find the speed of the boat in still water and the speed of the river flow.

[4 Govt. Banks Officer (General) 19, Written]

Solution:
Let,

The speed of boat = x km/h

and, The speed of river flow = y km/h

$\therefore 2\left(\frac{28}{x+y}\right) = \frac{28}{x-y} \Rightarrow 2(x-y) = x + y \Rightarrow 2x - 2y = x + y \Rightarrow 2x - x = 2y + y$

$\therefore x = 3y$ ..... (i)

Now, If the speed of the river flow = 2y then,

$$\frac{28}{x+2y} + \frac{28}{x-2y} = \frac{672}{60} \Rightarrow \frac{28}{3y+2y} + \frac{28}{3y-2y} = \frac{56}{5}$$

$$\Rightarrow 28\left(\frac{1}{5y} + \frac{1}{y}\right) = \frac{56}{5} \Rightarrow \frac{1+5}{5y} = \frac{2}{5} \Rightarrow 10y = 30 \therefore y = 3$$

From(i), $x = 3 \times 3 = 9$

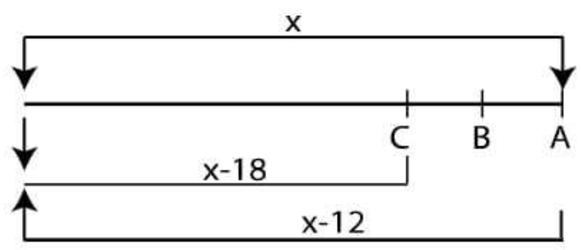
$\therefore$ The speed of the boat in still water is 9km/h and the speed of the river flow is 3 km/h

Ans: The speed of the boat in still water = 9km/h and the speed of the river flow = 3 km/h

04. Three runners A, B and C run a race, with runner A finishing 12 m ahead of runner B and 18 m ahead of runner C, in another race of same type runner B finished 8 m ahead of runner C. Each runner travels the entire distance at a constant speed. Find the length of the race.

[5 Govt. Banks Officer (Cash) 19, Written]

Solution:



Let, the total distance = x m

When B covers x-12 m then C covers x-18 m

$\therefore$ When B covers 1 m then C covers $\frac{x-18}{x-12}$ m

$\therefore$ When B covers x m then C covers $\frac{x(x-18)}{x-12}$ m

According to question,

$$x - \frac{x(x-18)}{x-12} = 8 \quad \Rightarrow \frac{x(x-12)-x(x-18)}{x-12} = 8$$

$$\Rightarrow x^2 - 12x - x^2 + 18x = 8x - 96 \Rightarrow 6x = 8x - 96 \Rightarrow 2x = 96 \Rightarrow x = \frac{96}{2} \quad \therefore x = 48$$

Ans: 48 m

05. A man rowing in favour of the current can go 96 km in 12 hours and he can go the same distance in 48 hours against the current. What is the speed of the current per hour? *[Sadharab Bima Corporation Asst. Manager19, Written]*

Solution:

Speed of boat + Speed of current = $\frac{96}{12}$ km/h ..... (i)

Speed of boat – Speed of current = $\frac{96}{48}$ km/h ..... (ii)

Performing (i) – (ii) , 2 (speed of current) = $\left(\frac{96}{12} - \frac{96}{48}\right)$ km/h$\Rightarrow$ 2(Speed of current) = (8–2) km/h

$\therefore$ Speed of current $= \frac{6}{2}$ km/h $= 3$km/h

Ans: 3km/h

06. 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 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?

Sonali Bank, Officer (Cash-19) [Written]

Solution:

Given, velocity of man = 20 kmph & velocity of current = 5kmph.

$\therefore$ Man's downstream velocity = 20 + 5 = 25 kmph.

& the upstream velocity = 20 — 5 = 15 kmph.

$\therefore$ Total time taken by the man $= \left(\frac{30}{25} + \frac{30}{15}\right) = 1.2 + 2 = 3.2$ hours

$= 3.2 \times 60 = 192$ minutes = 3 hours 12 minutes.

07. The distance between two stations 'X and Y' is 450 km. A train L starts at 6:00 pm from X and moves towards Y at an average speed of 60 km/h. Another train M starts from Y at 5:20 pm and moves towards X at an average speed of 80 km/h. How far from X will the two trains meet and at what time?

Sonali Bank, Officer (Cash-19) [Written]

Solution:

M goes in advance of = 6.00 — 5.20 = 40 minutes.

Now let, two trains will meet d km away from x station.

$\therefore$ L needs to cover = d km

& M needs to cover = (450 – d) km

Distance As we know, time $= \frac{\text{Distance}}{\text{Velocity}}$

$\frac{450-d}{809} - \frac{d}{60} = \frac{40}{60} \Rightarrow \frac{3(450-d) - 4d}{240} = \frac{2}{3} \Rightarrow 1{,}350 - 3d - 4d = \frac{2 \times 240}{3} = 160$

$\Rightarrow 7d = 1{,}350 — 160 = 1{,}190$. $\therefore d = \frac{1190}{7} = 170$

$\therefore$ Two trains will meet at 170km away from x station.

They will meet after $= \frac{170}{60} = 2\frac{2}{5}$ hours = 2 hours 50 minutes.

They will meet at = 6.00 pm + 2 hours 50 minutes = 8:50 pm.

} Ans.

08. A Train 400 meter long overtook a man walking along the line in the same direction at a speed of 5 km/hr and passed him in 40 seconds. The train reached the station in 20 minutes after it had passed the man. In what time did the man reach the station?

Sonali Bank Ltd. (SO-19)

Solution:

আমরা জানি, $t = \frac{d_1 + d_2}{v_1 - v_2}$ [ট্রেন ও লোকটি একই দিকে গতিশীল বলে]

$\Rightarrow 40 = \frac{400 + 0}{\frac{(v_1 - 5)5}{18}}$

[এখানে, t = 40; ট্রেনের দৈর্ঘ্য $d_1 = 400$ মিটার; লোকটির দৈর্ঘ্য ট্রেনের সাপেক্ষে,

$\Rightarrow (v_1 - 5) = \frac{400 \times 18}{40 \times 5}$

$\Rightarrow v_1 - 5 = 36$

$\therefore v_1 = 36 + 5 = 41$

অর্থাৎ ট্রেনটির গতিবেগ 41 kmph.

অতএব, 20 মিনিটে ট্রেনটি অতিক্রম করে $\frac{41}{3}$ km [$\geq$ 20 মিনিট $= \frac{1}{3}$ ঘণ্টা]

এখন, এই $\frac{41}{3}$ km পথ লোকটি ৫ kmph বেগ কত সময়ে অতিক্রম করবে সেটাই বের করতে হবে।

আমরা জানি, প্রয়োজনীয় সময় $= \frac{\text{দূরত্ব}}{\text{বেগ}} = \frac{41}{\frac{3}{5}} = \frac{41}{3} \times \frac{1}{5} = \frac{41}{15}$ = 2 ঘণ্টা 44 মিনিট (Ans.)

উল্লেখ্য, $\frac{41}{15}$ ঘণ্টাকে কিভাবে ২ ঘণ্টা 44 মিনিটে আনা হলো তা লক্ষ্য করুন: 15) 41 (2

$\frac{30}{11}$

এতএব, $\frac{41}{15} = 2\frac{11}{15}$ ঘণ্টা

এখানে, 1 ঘণ্টা = 60 মিনিট

$\therefore \frac{11}{15}$ ঘণ্টা $= \frac{60 \times 11}{15}$ = 44 মিনিট।

09. The speed of the boat in still water is 24 kmph and the speed of the stream is 4 km/hr. The time taken by the boat to travel from A to B downstream is 36 minutes less than the time taken by the same boat to travel from B to C upstream. If the distance between A and B is 4km more than the distance between B and C, what is the distance between A and B? Sonali Bank Ltd. (SO-19)

Solution:

ধরি, A হতে B এর দূরত্ব x km

এবং B হতে C এর দূরত্ব (x – 4) km

দেয়া আছে, স্রোতের অনুকূলে নৌকার বেগ = 24 + 4 = 28 kmph

$\therefore$ স্রোতের প্রতিকূলে নৌকার বেগ = 24 – 4 = 20 kmph

প্রশ্নমতে, $\frac{x \times 4}{20} - \frac{x}{28} = \frac{36}{60}$ [মিনিট ঘণ্টায় পরিণত করতে 60 দ্বারা ভাগ করতে হয়]

$\Rightarrow \frac{7(x - 4) - 5x}{140} = \frac{3}{5}$

$\Rightarrow 7x - 28 - 5x = \frac{3 \times 140}{5}$

$\Rightarrow 2x - 28 = 84$

$\Rightarrow 2x = 84 + 28 = 112$

$\therefore x = \frac{112}{2}$ = 56 km (Answer)

10. A man covers a certain distance on a toy train. Had the train moved 4 km/hr faster, it would have taken 30 minutes less. If it moved 2 km/hr slower, it would taken 20 minutes more. Find the distance.

Sonali Bank Ltd. Officer (Cash-19)

Solution:

Let,The distance be x km
and initial speed by y km/hr.

Original time taken $= \frac{\text{Distance}}{\text{Speed}} = \frac{x}{y}$

According to the first condition,

$\frac{x}{y} - \frac{x}{y+4} = \frac{30}{60}$ [30 minutes $= \frac{30}{60}$ hours]

$\Rightarrow \frac{xy + 4x - xy}{y(y+4)} = \frac{1}{2}$

$\Rightarrow \frac{4x}{y(y+4)} = \frac{1}{2}$

$\Rightarrow 8x = y^2 + 4y$

$\therefore x = \frac{y^2 + 4y}{8}$ ..... (i)

Again, $\frac{x}{y-2} - \frac{x}{y} = \frac{20}{60}$

$\Rightarrow \frac{xy - xy + 2x}{y(y-2)} = \frac{1}{3}$

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

$\Rightarrow 6x = y^2 - 2y$

$\therefore x = \frac{y^2 - 2y}{6}$ ..... (ii)

From equation (i) & (ii) we get have

$\frac{y^2 + 4y}{8} = \frac{y^2 - 2y}{6}$

$\Rightarrow 6y^2 + 24y = 8y^2 - 16y$

$\Rightarrow 8y^2 - 6y^2 = 24y + 16y$

$\Rightarrow 2y^2 = 40y$

$\therefore y = \frac{40}{2} = 20$

Putting the value of y = 20 in equation (i)

$x = \frac{y^2 + 4y}{8} = \frac{(20)^2 + (4 \times 20)}{8} = \frac{480}{8}$ 60 km (Answer).

11. Two trains running at the rate of 75km an 60 km an how respectively on parallel rails in opposites directions, are observed to pass each other in 8 seconds and when they are running in the same direction at the same rates as before, a person sitting in the faster train observes that he passes the other in $33\frac{1}{2}$ seconds. Find the lengths of the trains.

Sonali Bank Ltd. Officer (Cash-19)

Solution:

-Relative speed white running in opporite direction = (75 + 60) kmph = $\left(135 \times \frac{5}{18}\right)$ $ms^{-1} = \frac{75}{2} ms^{-1}$

Again, relative speed while running in same direction = (75 – 60) kmph

$= 15 \text{ kmph} = \left(135 \times \frac{5}{18}\right) ms^{-1} = \frac{25}{6} ms^{-1}$

As we know, velocity $= \frac{\text{Distance}}{\text{Time}}$

$\therefore$ Distance = velocity × Time

$\therefore$ Lengths of the both trains $= \left(\frac{75}{2} \times 8\right) = 300$ meter

Now, as the faster train exceeds the slower train in the same direction in $33\frac{1}{2}$ seconds.

$\therefore$ The length of the slower train $= \left(\frac{25}{6} \times 33.5\right) = 300\ 131.25$ meter.

$\therefore$ The length of the faster train = 300 – 131.25 = 168.75 meter

(Ans.) Faster train 168.75 meter & slower train 131.25 meter.

বিগত বছরের প্রশ্নাবলী ও বিশদ সমাধান	২০১৮ সালে অনুষ্ঠিত সকল সরকারী ও বেসরকারী ব্যাংকের প্রশ্নাবলী ও সমাধান

12. After traveling 108km, a cyclist observed that he would have required 3 hours less if he could have traveled at a speed 3 km/hr more At what speed did he travel? *[Bangladesh Development Bank Ltd. (S) written-18]*

Solution: Let, the speed be x km/hr.

Since distance is 108 km, $\therefore$ time $= \frac{108}{x}$ hrs

So, when speed is increased by 3 km/hr, speed is = (x + 3) km/hr $\therefore$ The required time $= \frac{108}{x+3}$ hrs

According to the question,

$\frac{108}{x} - \frac{108}{x+3} = 3 \Rightarrow \frac{108(x+3) - 108x}{x(x+3)} = 3 \Rightarrow 324 = 3x^2 + 9x \Rightarrow 324 - 3x^2 - 9x = 0 \Rightarrow -3x^2 - 9x + 324 = 0$

$\Rightarrow -3(x^2 + 3x - 108) = 0 \Rightarrow x^2 + 3x - 108 = 0 \Rightarrow x^2 + 12x - 9x - 108 = 0 \Rightarrow x(x+12) - 9(x + 12) = 0$

$\Rightarrow (x-9)(x+12) = 0$

Either, x – 9 = 0 Or, x + 12 = 0

$\therefore$ x = 9, or, x = – 12 [Velocity can't be negative]

$\therefore$ He traveled at a speed of 9 km/hr.

Ans: 9 km/hr.

13. A committee is to consist of three members. If there are seven men and five women available to serve on the committee, how many different committees can be formed? *[Bangladesh Krishi Bank Ltd. (OC)-18]*

Solution:

Here, 3 members is to be included in

Available men = 7 & Available women = 5

So, the combinations can be

i) $7c_3 \times 5c_0 = \frac{7!}{3! \times 4!} \times \frac{5!}{5! \times 0!} = 35 \times 1 = 35$	ii) $7c_2 \times 5c_1 = \frac{7!}{2! \times 5!} \times \frac{5!}{1! \times 4!} = 21 \times 5 = 105$
iii) $7c_1 \times 5c_2 = \frac{7!}{1! \times 6!} \times \frac{5!}{2! \times 3!} = 7 \times 10 = 70$	iv) $7c_0 \times 5c_2 = \frac{7!}{7! \times 0!} \times \frac{5!}{3! \times 2!} = 1 \times 10 = 10$

So, total combinations = 35 + 105 + 70 + 10 = 220 ways.

Ans. 220 ways

14. A train passes a man in 3 second, and another train from opposite direction pass the man is 4 second, both train same length. How long time need to pass the train each other? *[Basic Bank Ltd. (Cashier)-18]*

Solution:

Let, length of each train be x meter

Now, we know that time taken by the train to pass a standing man is the same time to pass the length of its own.

$\therefore$ Speed of the 1st train, $v_1 = \frac{x}{3} ms^{-1}$

And speed of the 2nd train, $v_2 = \frac{x}{4} ms^{-1}$

As the two trains are running in opposite direction, so we add their speed and distance.

$\therefore$ This two train pass a distance of (x + x) meter = 2x meter with speed of $\left(\frac{x}{3} + \frac{x}{4}\right) ms^{-1}$

Now, we know required time = $\frac{\text{Distance}}{\text{Speed}}$

$\Rightarrow$ Time = $\frac{2x}{\frac{x}{3} + \frac{x}{4}} = \frac{2x}{\frac{4x + 3x}{12}} = \frac{2x}{\frac{7x}{12}} = \frac{2x}{1} \times \frac{12}{7x} = 3.42$ seconds

Ans. Time taken by the two train to cross each other is 3.42 seconds.

15. A committee of 5 is to be formed form 6 male students and 5 female students. In how many ways can this be done so that the committee contains at least one male and one female student?

[Rupali Bank Ltd. (Officer-Cash) Cancelled-18]

Solution:

Ways	Male(6)	Female (5)	Committee	Total result
i)	4	1	${}^6C_4 \times {}^5c_1 = 15 \times 5$	75
ii)	3	2	${}^6C_3 \times {}^5c_2 = 20 \times 10$	200
iii)	2	3	${}^6C_1 \times {}^5c_4 = 6 \times 5$	30
			Total number of ways	455

Ans: 455 ways

16. A place of stone fell form a ballon when it was flying in the upward direction with a velocity 20 m/sec. What will be the height of the balloon when the stone hit the ground in 10 seconds?

[Bangladesh Bank (Officer)-18]

Solution:

Velocity of ballon, $u = 20ms^{-1}$; Time, t = 10 Second

Now, let when the stone fell the balloon, the ballon was at h, height and the stone took 10 second to touch the ground.

Now, according to the Newton's law,

$$h = -ut + \frac{1}{2}gt^2 = -(10 \times 20) + \frac{1}{2} \times 9.8 \times (10)^2 = -200 + 490 = 290 \text{ meters}$$

Now, at the moment of falling stone from ballon, the ballon didn't stop rather it will fly more upward during this 10 second.

As, we know $u = \frac{h_2}{t}$

$\therefore h_2 = u \times t = (20 \times 10)\ m = 200$ meter.

So, after 10 seconds, when the stone hit the ground,

The balloon will be in $h = (h_1 + h_2) = 290 + 200 = 490$ meter high.

Ans : 490 meter

17. A committee of 5 persons is to be formed form 6 male and 5 female members. In how many this committee can be formed so that there is at least 1 male and 1 female member in the committee?

[Sonali Bank Ltd. (SO)-18]

Solution:

6 male members	5 female members
1	4

2	3
3	2
4	1

So, there are following ways to make the committee.

$6c_1 \times 5c_4 = 6 \times 5 = 30$

$6c_2 \times 5c_3 = 15 \times 10 = 150$

$6c_3 \times 5c_2 = 20 \times 10\ 10 = 200$

$\underline{6c_4 \times 5c_1 = 15 \times 5 = 75}$

$\therefore$ Total number of ways to form the committee is = 30 + 150 + 200 + 75 = 455.

18. After traveling 108 km, a cyclist observed that he would have required 3 hr less if he could have travelled at a speed 3 km/hr more. At what speed did he travel? *[Bangladesh Bank (AD)-18]*

Solution:

Let, the speed be x km/hr.

Since distance is 108 km, $\therefore$ time = $\frac{108}{x}$ hrs

So, when speed is increased by 3 km/hr, speed is = (x + 3) km/hr $\therefore$ The required time = $\frac{108}{x+3}$ hrs

According to the question,

$$\frac{108}{x} - \frac{108}{x+3} = 3 \Rightarrow \frac{108(x+3) - 108x}{x(x+3)} = 3 \Rightarrow 324 = 3x^2 + 9x \Rightarrow 324 - 3x^2 - 9x = 0 \Rightarrow -3x^2 - 9x + 324 = 0$$

$$\Rightarrow -3(x^2 + 3x - 108) = 0 \Rightarrow x^2 + 3x - 108 = 0 \Rightarrow x^2 + 12x - 9x - 108 = 0 \Rightarrow x(x+12) - 9(x + 12) = 0$$

$\Rightarrow (x-9)(x+12) = 0$

Either, x – 9 = 0 Or, x + 12 = 0

$\therefore$ x = 9, $\therefore$ x = – 12 [Velocity can't be negative]

$\therefore$ He traveled at a speed of 9 km/hr.

Ans: 9 km/hr.

19. A train 300m long overtook a man walking along the line in the same direction of the rate of 4km an hour and passed him in 30 second. The train reached the station in 15 minutes after it has passed the man. In what time did the man reach the station? *[Joint Recruitment Test for 5 Banks (Officer)-18]*

Solution:

Let,The spped of the train be x km/h

since the direction is same,The relative speed = (x – 4) km/h $= \frac{(x-4) \times 1000}{3600}$ m/s = $(x-4) \times \frac{5}{18}$ m/s

We know,

time = $\frac{\text{distance}}{\text{speed}} = \frac{300}{(x-4)\frac{5}{18}} \Rightarrow 300 = \frac{30 \times 5}{18}(x-4) \Rightarrow 300 = \frac{25}{3}(x-4) \Rightarrow x - 4 = \frac{900}{25} \quad \therefore x = 40$

After passing the man the train travel $= \left(40 \times \frac{15}{60}\right)$ km = 10 km.

So,The time needed for man = $\frac{10\text{km}}{4\text{km/h}}$ = 2.5 hours

Ans: 2.5 hours

Alternative solution:

Here, the length of the train 300m & time to pass the man is 30 seconds.

$\therefore$ Relative Speed of train & Man $= \frac{300}{30}\text{ms}^{-1} = 10\text{ms}^{-1} = 10 \times \frac{18}{5}$ = 36 kmph.

$\therefore$ speed of the train = 36 + 4 = 40 kmph.

$\therefore$ Distance covered by train after passing the man to reach the station $= \left(40 \times \frac{15}{60}\right)$ = 10 km

So, the man will cover 10km distance in $\frac{10}{4}$ hours = 2.5 hours

Ans: The man reached the station after 2.5 hours.

20. Two boats on opposite banks of a river start moving towards each other. They first pass each other 1,400 meters from one bank. They each continue to the opposite bank, immediately turn around and start back to the other bank. When they pass each other a second time, they are 600 meters from the other bank. We assume that each boat travels at a constant speed all along the journey. Find the width of the river? *[Joint Recruitment Test for 5 Banks (Officer)-18]*

Solution:

Let, the width of the river is w meters

When they met for the first time, one boat travelled 1,400 m & another boat travelled (w–1,400)m.

And for the second meeting, one boat travelled (w+600)m & another boat travelled (2w – 600)m

Now, according to question,

$\frac{1400}{w-1400} = \frac{w+600}{2w-600}$ [As. Speed is constant in both cases so the ratio of their respective distance travelled will be same]

$\Rightarrow 1{,}400(2w-600) = (w+600)(w-1{,}400) \Rightarrow 2{,}800w - 8{,}40{,}000 = w^2 - 1{,}400w + 600w - 8{,}40{,}000$

$\Rightarrow w^2 - 800w - 8{,}40{,}000 + 8{,}40{,}000 - 2{,}800w = 0 \Rightarrow w^2 - 3{,}600w = 0 \Rightarrow w^2 = 3{,}600w$

$\therefore$ w=3,600 [Dividing both sides by w]

Ans: The width of the river is 3,600 meters.

21. Two rabbits start running towards each other, one from A to B and another from B to A. They cross each other after one hour and the first rabbit reaches B, $\frac{5}{6}$ hour before the second rabbit reaches A. If the distance between A and B is 50km. What is the speed of the slower rabbit?

[Joint Recruitment Test for 8 Banks (SO)-18]

Solution:

Let, time taken by the slower rabbit = x hrs $\quad\therefore$ time taken by the faster rabbit= $\left(x - \frac{5}{6}\right)$ hrs

$\therefore$ The speed of faster rabbit = $\frac{50}{x - \frac{5}{6}}$ kmph and the speed of slower rabbit = $\frac{50}{x}$ kmph.

Since, they run from opposite direction,their relative speed =. $\frac{50}{x - \frac{5}{6}} + \frac{50}{x}$

Now, according to Problem,

$$\frac{\mathbf{50}}{\left(\frac{\mathbf{50}}{\mathbf{x-\frac{5}{6}}}\right) + \left(\frac{\mathbf{50}}{\mathbf{x}}\right)} = 1 \Rightarrow \frac{1}{x - \frac{5}{6}} + \frac{1}{x} = 1 \Rightarrow \frac{1}{\frac{6x-5}{6}} + \frac{1}{x} = 1 \Rightarrow \frac{6x + 6x - 5}{(6x-5)\,x} = 1$$

$$\Rightarrow \frac{12x-5}{6x^2 - 5x} = 1 \Rightarrow 6x^2 - 5x = 12x - 5 \Rightarrow 6x^2 - 5x - 12x + 5 = 0 \Rightarrow 6x^2 - 17x + 5 = 0$$

$$\Rightarrow 6x^2 - 15x - 2x + 5 = 0 \Rightarrow 3x(2x-5) - 1(2x-5) = 0 \Rightarrow (2x-5)(3x-1) = 0$$

Either, $(2x-5)=0 \ \therefore x=\frac{5}{2}$ or, $(3x-1)=0 \ \therefore x=\frac{1}{3}$

Since, $x=\frac{1}{3}$ is not acceptable because it is less than $\frac{5}{6}$

So, time taken by slower rabbit $x=\frac{5}{2}$ hrs

$\therefore$ Speed of the slower rabbit $=\frac{50}{\frac{5}{2}}=\frac{50}{1}\times\frac{2}{5}=20$ kmph.

Ans: The speed of the slower rabbit is 20 kmph.

22. A man rows to a place 40 km distant and back in a total of 18 hours. He finds that he can row 5 km with the stream in the same time as 4 km against the stream. What is the speed of boat in still water?

[Joint Recruitment Test for 8 Banks (SO)-18]

Solution:

Let, time taken to go 5 km downstream and 4km upstream be "t" hours

So, his downstream speed, $D_s=\frac{5}{t}$ kmph [As velocity $=\frac{\text{Distance}}{\text{Time}}$]

And his upstream speed, $U_s=\frac{4}{t}$ kmph

Now, according to Problem,

$\frac{40}{\frac{5}{t}}+\frac{40}{\frac{4}{t}}=18 \Rightarrow 8t+10t=18 \Rightarrow 18t=18 \ \therefore t=1$

So, his downstream speed, $D_s=\frac{5}{t}=\frac{5}{1}=5$ kmph & his upstream speed, $U_s=\frac{4}{t}=\frac{4}{1}=4$ kmph.

$\therefore$ The speed of boat in still water $=\frac{\text{Downstream speed + Upstream speed}}{2}=\frac{5+4}{2}=\frac{9}{2}=4.5$ kmph.

Ans: The speed of boat in still water 4.5 kmph.

23. A motorist and a cyclist start from A to B at the same time. A to B is 18km. The speed of motorist is 15 m/hr, more than the cyclist. After covering half the distance, the motorist rest for 30 minutes and thereafter his speed is reduced by 20%. If the motorist reaches the destination B, 15 min earlier than that of the cyclist, then find the speed of the cyclist. *[Joint Recruitment Test for 3 Banks (Officer-Cash)-18*

Solution:

Here we let the speed of the cyclist is x kmph.

$\therefore$ The speed of the motorist is (x + 15) kmph.

Here,Cyclist goes through all the path in x kmph and motorist goes half the way in (x + 15) kmph and other half the way in 80 of (x + 15) kmph,

According to problem,

$$\frac{18}{x} - \left[\frac{9}{x+15} + \frac{9}{80\% \text{ of } (x+15)}\right] = \frac{15+30}{60} \Rightarrow \frac{18}{x} - \left[\frac{9}{x+15} + \frac{9}{\frac{4(x+15)}{5}}\right] = \frac{45}{60}$$

$$\Rightarrow \frac{18}{x} - \left[\frac{9}{x+15} + \frac{45}{4(x+15)}\right] = \frac{45}{60} \Rightarrow \frac{18}{x} - \left[\frac{9}{x+15} + \frac{45}{4(x+15)}\right] = \frac{3}{4}$$

$$\Rightarrow \frac{2}{x} - \frac{1}{x+15} - \frac{5}{4(x+15)} = \frac{1}{12} \quad \text{[Dividing by 9]} \Rightarrow \frac{2\times 4(x+15) - 4x - 5x}{4x(x+15)} = \frac{1}{12}$$

$\Rightarrow (8x + 120 - 9x) \times 12 = 4x^2 + 60x \Rightarrow (120 - x) \times 12 = 4x^2 + 60x \Rightarrow 1{,}440 - 12x = 4x^2 + 60x$

$\Rightarrow 4x^2 + 60x + 12x - 1440 = 0 \Rightarrow 4x^2 + 72x - 1{,}440 = 0 \Rightarrow x^2 + 18x - 360 = 0$

$\Rightarrow x^2 + 30x - 12x - 360 = 0 \Rightarrow x(x+30) - 12(x + 30) = 0$

$\Rightarrow (x+30)(x-12) = 0$

As, speed can't be negative, so $x = -30$ is not acceptable.

$\therefore x = 12$

$\therefore$ The speed of the motor cyclist is 12 kmph.

Ans: 12 kmph

24. A man can row 30 km upstream and 44 km downstream in 10 hrs. It is also known that he can row 40 km upstream and 55 km downstream in 13 hrs. Find the speed of the man in still water.

[Joint Recruitment Test for 3 Banks (Officer-Cash)-18

Solution:

Let, the man's upstream speed is x kmph And the man's downstream speed is y kmph

So, $\frac{30}{x} + \frac{44}{y} = 10$ ..... (i) And, $\frac{40}{x} + \frac{55}{y} = 13$ ..... (ii)

Performing (i) $\times 4$ – (ii) $\times 3$, $\frac{176}{y} - \frac{165}{y} = 40 - 39 \Rightarrow \frac{176-165}{y} = 1 \therefore y = 11$

From (i), $\frac{30}{x} + \frac{44}{11} = 10 \Rightarrow \frac{30}{x} + 4 = 10 \Rightarrow 6x = 30 \therefore x = 5$

So, downstream speed is 11 kmph & upstream speed is 5 kmph

$\therefore$ Man's speed in still water $= \frac{1}{2}(5 + 11) = \frac{16}{2} = 8$kmph.

Ans: 8kmph.

25. A man went downstream for 28km in a motor boat and immediately returned. It took the man twice as long to make the return trip. If the speed of the river flow were twice as high, the trip downstream and back would take 672 minutes. Find the speed of the boat in still water and the speed of the river flow. *[Joint Recruitment Test for 2 Banks (Officer)-18]*

Solution:

Let, the speed of boat in still water be x kmph and the speed of stream in still water be y kmph.

$\therefore$ The boat's downstream speed will be $(x + y)$

and the boat's upstream speed will be $(x - y)$

According to 1st condition,

$2\left(\frac{28}{x+y}\right) = \frac{28}{x-y} \Rightarrow \frac{2}{x+y} = \frac{1}{x-y}$ [Dividing both sides by 28]

$\Rightarrow 2x - 2y = x + y \Rightarrow 2x - x = y + 2y = 3y \quad \therefore x = 3y$

So, according 2nd condition,

$\frac{28}{x+2y} + \frac{28}{x-2y} = \frac{672}{60} \Rightarrow \frac{28}{3y+2y} + \frac{28}{3y-2y} = \frac{56}{5} \Rightarrow 28\left(\frac{1}{5y} + \frac{1}{y}\right) = \frac{56}{5} \Rightarrow \frac{1}{5y} + \frac{1}{y} = \frac{2}{5} \Rightarrow \frac{1+5}{5y} = \frac{2}{5}$

$\Rightarrow \frac{6}{5y} = \frac{2}{5} \Rightarrow 10y = 30 \Rightarrow y = \frac{30}{10} \quad \therefore y = 3$ kmph

Now, by putting the value of y in equation (i), we get

$x = 3y \Rightarrow x = 3 \times 3 = 9$ kmph.

$\therefore$ Speed of the boat in still water is 9 kmph and speed of the stream in still water is 3 kmph.

Ans: 9 kmph and 3 kmph.

26. A train traveling at 20 m/s completely crosses another train having 192 meters length traveling in same direction at 15 m/s in 1.5 minutes. In what time will they cross each other traveling in opposite direction and length of the faster train is? *[Joint Recruitment Test for 2 Banks (Officer)-18]*

Solution:

Given information,

Speed of faster train, $v_1 = 20\ ms^{-1}$

$\therefore$ Speed of slower train, $v_2 = 15\ ms^{-1}$

Length of the faster train, d_1 = ?

$\therefore$ Length of the slower train, $d_2 = 192$

We know, crossing time, $t = \frac{d_1+d_2}{v_1-v_2} \Rightarrow 1.5 \times 60 = \frac{d_1+192}{20-15} \Rightarrow 90 = \frac{d_1+192}{5} \Rightarrow d_1 + 192 = 450$

$\Rightarrow d_1 = 450 - 192 = 258 \quad \therefore d_1 = 258$

Now, if they would run in opposite direction, they took, $t = \frac{d_1+d_2}{v_1+v_2} \Rightarrow t = \frac{258 + 192}{20 + 15} = \frac{450}{35} = 12.857$

$\therefore$ t = 12.857 seconds

Ans: Length of the faster train is 258 meter and they took 12.857 seconds to cross one another.

27. In a flight of 600 km, an aircraft was slowed down due to bad weather. Its average speed for the trip was reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight.

[Probashi Kallyan Bank Ltd. (SEO)-18]

Solution:

Here, Distance, D = 600 km

Let, Time = t & Speed = s

According to the question,

$D = st \Rightarrow 600 = st \Rightarrow s = \frac{600}{t}$ ---------- (i)

From 2nd condition, $(s - 200)\left(t + \frac{1}{2}\right) = 600$

$\Rightarrow \left(\frac{600}{t} - 200\right)\left(t + \frac{1}{2}\right) = 600$ [From equation (i)]

$\Rightarrow \left(\frac{600 - 200t}{t}\right)\left(\frac{2t + 1}{2}\right) = 600$

$\Rightarrow (600 - 200t)(2t + 1) = 1200t \Rightarrow 1200t + 600 - 400t^2 - 200t = 1200t$

$\Rightarrow 1000t - 400t^2 + 600 = 1200t \Rightarrow 400t^2 + 1200t - 1000t - 600 = 0$

$\Rightarrow 400t^2 + 200t - 600 = 0 \Rightarrow 100(4t^2 + 2t - 6) = 0 \Rightarrow 4t^2 + 2t - 6 = 0$

$\Rightarrow 4t^2 + 6t - 4t - 6 = 0$ [Dividing both sides by 100]

$2t(2t + 3) - 2(2t + 3) = 0 \Rightarrow (2t + 3)(2t - 2) = 0 \Rightarrow t = -\frac{3}{2}$ and $t = 1$

As, t cannot be negative, So, t = 1 hour

$\therefore$ Duration of the journey = Normal time + Extra/Delay

= 1h + 0.5h = 1.5 hour

Ans: 1.5 hour.

28. A train passes a man in 3 second, and another train from opposite direction pass the man is 4 second, both train same length. How long time need to pass the train each other? *[Basic Bank Ltd. (AM)-18]*

Solution:

Let, length of each train be x meter

$\therefore$ Speed of the 1st train, $v_1 = \frac{x}{3}\,ms^{-1}$ And speed of the 2nd train, $v_2 = \frac{x}{4}\,ms^{-1}$

As the two trains are running in opposite direction, so we add their speed and distance.

$\therefore$ This two train pass a distance of (x + x) meter = 2x meter with speed of $\left(\frac{x}{3} + \frac{x}{4}\right)\,ms^{-1}$

Now, we know required time = $\frac{\text{Distance}}{\text{Speed}}$

$$\Rightarrow \text{Time} = \frac{2x}{\frac{x}{3} + \frac{x}{4}} = \frac{2x}{\frac{4x + 3x}{12}} = \frac{2x}{\frac{7x}{12}} = \frac{2x}{1} \times \frac{12}{7x} = 3.42 \text{ seconds}$$

Ans. Time taken by the two train to cross each other is 3.42 seconds.

29. Two trains running at the rate of 75km and 60km an hour respectively on parallel rails in opposites directions, are observed to pass each other in 8 seconds and when they are running in the same direction at the same rates as before, a person sitting in the faster train observes that he passes the other in $33\frac{1}{2}$ seconds. Find the lengths of the trains. *[Sonali Bank Ltd. (Officer-Cash) 18]*

Solution:

Relative speed while running in opposite direction = (75 + 60) kmph

$$= \left(135 \times \frac{5}{18}\right)\,ms^{-1}\,\frac{75}{2}\,ms^{-1}$$

Again, relative speed while running in same direction = (75 – 60) kmph

$$= 15 \text{ kmph} = \left(15 \times \frac{5}{18}\right) \text{ms}^{-1} = \frac{25}{6} \text{ms}^{-1}$$

As we know, velocity $= \frac{\text{Distance}}{\text{Time}}$

$\therefore$ Distance = Velocity × Time

Lengths of the both trains $= \left(\frac{75}{2} \times 8\right) = 300$ meter

Now, as the faster train exceeds the slower train in the same direction in $33\frac{1}{2}$ seconds.

$\therefore$ The length of the slower train $= \left(\frac{25}{6} \times 33.5\right) = 131.25$ meter.

$\therefore$ The length of the faster train = 300 – 131.25 = 168.75 meter

Ans: Faster train 168.75 meter & slower train 131.25 meter.