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| **TIME & DISTANCE** |

**FORMULAE:**

* **Speed = (Distance/Time) S = (D/T)**
* **Distance = (Speed x Time) D = ST**
* **Time = (Distance/Speed) T = (D/S)**
* **To convert a speed in km. per hour to meters per second, we multiply it by (5/18).**

**Ex. 54 km. per hour = 54(5/18) = 15 m/sec.**

* **To convert a speed in meters per second to km. per hour, we multiply it by (18/5).**

**Ex. 35 meters per second = 35(18/5) = 126 km/hr**

1. **Express a speed of 18 km per hour in meters per second:**

**18 km/hr = 18(5/18) = 5 m/sec.**

1. **Express a speed of 3 meters per second in km per hour:**

**3 m/sec = 3(18/5) = 10.8 km/hr**

1. **A and B are two towns. A man travels on cycle from A to B at a speed of 15 km/hr and returns back at the rate of 10 km/hr. Find his average speed for the whole journey?**

**RULE: If a certain distance is covered at x km/hr, and then one returns back to the starting point at y km/hr, then average speed = 2xy/(x + y) km/hr**

**= (2 x 10 x 15)/25 = (300/25) = 12 km/hr**

1. **A man travels (2/15) of his total journey by train, (9/20) by a tonga and the remaining 10 km on foot. Find his total journey.**

**Let the total distance be x km.**

**Then (2x/15) + (9x/20) + 10 = x …………….LCM = 60……… (8x) + (27x) + 600 = 60x**

**Implies (35x + 600) = 60x ……………25x = 600 …………..x = 24 km**

1. **Distance between two towns A and B is 110 km. A motor cycle rider starts from A towards B at 8 a.m. at a speed of 20 km per hour. Another motor cycle rider starts from B towards A at 9 a.m. at a speed of 25 km per hour. Find, when they will cross each other?**

**At 8 a.m. A started his journey, by 9 a.m. he completed 20 km**

**By 9 a.m. the distance to be covered = 110 - 20 = 90 km**

**Since they are moving in opposite direction, every hour they cover 20 + 25 = 45 km**

**By 10 a.m. the distance to be covered = 90 – 45 = 45 km**

**By 11 a.m. they will cross each other**

1. **A man crosses a street 600 meters long in 5 minutes. Find his speed in km per hour?**

**Distance covered in 60 minutes (or 1 hour) = 600 x 12 = 7200 meters = 7.2 km**

1. **If a man covers 10.2 km in 3 hours, find the distance covered by him in 5 hours?**

**3 hours …………..10.2 km**

**5 hours …………...? By cross-multiplication, we get**

**= (10.2 x 5)/3 = 17 km**

1. **A train travels 92.4 km/hr. How many meters will it travel in 10 minutes?**

**60 min ……………92.4 km**

**10 min …………….? By cross-multiplication, we get**

**(92.4/6) = 15.4 km (or) 15400 meters**

1. **Anil takes 4 hours to cover a distance of 9 km. The time taken by him to travel 24 km is:**

**9 km ………………4 hours**

**24 km …………….? By cross multiplication, we get**

**(24 x 4)/9 = (32/3) hours (or) 10 (2/3) hours (or) 10 hours (2/3)(60) min**

**= 10 hours 40 min**

1. **A man covers a certain distance in 2 hr 45 min., when he walks at the rate of 4 km/hr. How much time will he take to cover the same distance if he runs at a speed**

**of 16.5 km/hr ?**

**Distance covered on walking = 4 + 4 + 3 = 11 km**

**Time required to go by running = (distance/speed) = (11/16.5) = (1/1.5) = (2/3) hour**

**= (2/3)(60) min = 40 min**

1. **Excluding stoppages, the speed of a bus is 54 km/hr. and including stoppages it is**

**45 km/hr. For how many minutes does the bus stop per hour?**

1. **9 (b) 10 (c) 12 (d) 20**

**Due to stoppages, it covers 9 km less.**

**Now, time taken to cover 9 km = (9/54) x 60 = 10 min**

1. **The ratio between the rates of walking of A and B is 3 : 4. If the time taken by B to cover a certain distance is 24 minutes, time taken by A to cover that much distance is:**

**B speed is 4 km/hr & time taken = 24 min**

**A speed is 3 km/hr & will take more time than B. (Indirect proportion)**

**= (24 x 4) / 3 = 32 min**

1. **A is twice as fast as B and B is thrice as fast as C is. The journey covered by C in 42 min, will be covered by A in:**
2. **63 min (b) 28 min (c) 14 min (d) 7 min**

**A : B : C = 6 : 3 : 1**

**1 …………….42 min**

**6 ……………..? (more speed means less time taken – indirect proportion)**

**(1 x 42)/6 = 7 min**

1. **If a boy takes as much time in running 10 meters as a car takes in covering 25 meters; the distance covered by the boy during the time the car covers 1 km., is:**
2. **300 meters (b) 400 meters (c) 500 meters (d) 600 meters**

**25 meters by car = 10 meters by boy**

**1000 meters by car = ? meters by boy**

**= (1000 x 10)/25 = 400 meters**

1. **A man travels 35 km partly at 4 km/hr and partly at 5 km/hr. If he covers former distance at 5 km/hr and later distance at 4 km/hr., he could cover 2 km more in the same time. The time taken to cover the whole distance, at original rate is:**
2. **5 hours (b) 7 hours (c) 8 hours (d) 9 hours**

**Suppose the man covers first distance in x hours and the second distance in y hours.**

**Then 4x + 5y = 35 and 5x + 4y = 37.**

**Solving these equations, we get x = 5 and y = 3.**

**So, total time taken = 5 + 3 = 8 hours**

1. **Siddarth has to cover a distance of 6 km in 45 minutes. If he covers one half of the distance in (2/3)rd time, what should be his speed in km/hr to cover the remaining distance in the remaining time?**
2. **16 (b) 12 (c) 8 (d) 3**

**3 km is covered in (2/3) x 45 = 30 min**

**Remaining distance = 3 km & remaining time = 15 min = (1/4) hr**

**Required speed = (D/T) = 3/(1/4) = 12 km per hour**

1. **A train covers a distance in 50 min if it runs at a speed of 48 km per hour on an average. The speed at which the train must run to reduce the time of journey to 40 min, will be:**
2. **50 km/hr (b) 55 km/hr (c) 60 km/hr (d) 70 km/hr**

**50 min ………….48 km/hr**

**40 min ………….?**

**(less time means more speed – indirect proportion)**

**= (50 x 48)/40 = 60 km/hr**

**KEY POINTS:**

* **The time taken by a train x meters long, in passing a signal post (or) a pole (or) a standing man is the same as the time taken by the train to cover a distance of x meters.**
* **The time taken by a train x meters long, in passing a bridge (or) a tunnel (or) a train at rest (or) a platform of length y meters is the same as the time taken by the train to cover a distance of (x + y) meters.**
* **If two trains (or) two bodies are moving in the same direction with a speed of**

**s km/hr and t km/hr respectively such that s > t, then their**

**relative speed = (s – t) km/hr**

* **If two trains (or) two bodies are moving in opposite directions with a speed of**

**s km/hr and t km/hr respectively, then relative speed = (s + t) km/hr**

1. **A train 135 meters long is running with a speed of 54 km per hour. In what time will it pass a telegraph pole?**

**Speed = 54 km/hr = 54(5/18) = 15 m/sec**

**Length of train 135 meters can be covered in (135/15) = 9 seconds**

1. **A train 540 meters long is running with a speed of 72 km per hour. In what time will it pass a tunnel 160 meters long?**

**Speed = 72 km/hr = 72(5/18) = 20 m/sec**

**Total length to be covered = Train length + tunnel length = 540 + 160 = 700 meters**

**Required time = (700/20) = 35 sec**

1. **A train 100 meters long is running with a speed of 70 km per hour. In what time will it pass a man who is running at 10 km per hour in the same direction in which the train is going?**

**Speed of train relative to man = 70 – 10 = 60 km/hr = (60)(5/18) = (50/3) m/sec**

**Time required to cover the length of train 100 meters = (100)/(50/3) = (100)(3/50)**

**= 6 seconds**

1. **Two trains 132 meters and 108 meters in length are running towards each other on parallel lines, one at the rate of 32 km per hour and another at 40 km per hour. In what time will they be clear of each other from the moment they meet?**

**Relative speed = 32 + 40 = 72 km/hr = 72 (5/18) = 20 m/sec**

**Sum of lengths of the trains = 132 + 108 = 240 meters**

**Time taken by the trains in passing each other = (240/20) = 12 sec**

**PRACTICE EXERCISE**

1. **A scooterist covers a certain distance at 36 km/hr. How many meters does he cover in 2 minutes?**

**Speed = 36 kmph = 36(5/18) = 10 meters/sec.**

1. **If a man runs at 3 meters per second, how many kilometers does he run in 1 hour 40 minutes?**

**Speed of the man = 3(18/5) = (54/5) km per hour**

**Distance covered in (5/3) hours = (54/5)(5/3) = 18 km.**

1. **There are two towns A and B. Anil goes from A to B at 40 kmph and comes back to the starting point at 60 kmph. What is his average speed during the whole journey?**

**Average speed = (2xy/x + y) kmph = (2 x 40 x 60/40 + 60) = 48 kmph**

1. **Walking at the rate of 4 kmph a man covers a certain distance in 2 hours 45 min. Running at a speed of 16.5 kmph, the man will cover the same distance in:**
2. **36 min (b) 40 min (c) 44 min (d) 50 min**

**Distance = time x speed = (11/4)(4) = 11 km.**

**Now, distance = 11 km & new speed = 16.5 kmph**

**Time = (distance/speed) = (11/16.5) hours = (11/16.5)(60) min = (2/3)(60) = 40 min**

1. **A car can finish a certain journey in 10 hours at a speed of 48 kmph. In order to cover the same distance in 8 hours, the speed of the car must be increased by:**
2. **6 kmph (b) 7.5 kmph (c) 12 kmph (d) 15 kmph**

**Speed = (Total distance/Time taken)**

**= (48 x 10)/8 = 60 kmph**

**Therefore the speed of the car must be increased by 60 - 48 = 12 kmph**

1. **A train covers a certain distance in 50 min. If it runs at a speed of 48 kmph on an average. The speed at which the train must run to reduce the time of journey to 40 minutes, will be:**
2. **50 kmph (b) 55 kmph (c) 60 kmph (d) 70 kmph**

**50 min ……………….48 kmph**

**40 min ………………..? (indirect proportion)**

**(50 x 48)/40 = 60 kmph**

1. **A car takes 6 hours to cover a journey at a speed of 45 kmph. At what speed must it travel in order to complete the journey in 5 hours?**
2. **50 kmph (b) 52 kmph (c) 54 kmph (d) 60 kmph**

**Indirect proportion (6 x 45)/5 = 54 kmph**

1. **If a man running at 15 kmph crosses a bridge in 5 minutes, then the length of the bridge is:**

**Speed = 15(5/18) = (25/6) m/sec.**

**Distance covered in 5 min = (25/6)(5 x 60) = 1250 meters**

1. **Ravi runs at 15.6 kmph. How many meters does he run in 2 minutes?**

**Speed = 15.6(5/18) = (13/3) m/sec.**

**Distance = speed x time = (13/3)(2 x 60) = 520 meters**

1. **If the speed of a train be 92.4 kmph, how many meters would it cover in 20 min? (in meters)**

**20 min = (1/3) hour. Therefore ( 92400/3) = 30800 meters**

1. **Deepak can cover a distance of 5 km in 20 minutes. Find the distance covered by him in 50 minutes?**

**50 min = 20 min + 20 min + 10 min = 5 + 5 + 2.5 = 12.5 km**

1. **A man travels for 14 hours 40 minutes. He covers half of the journey by train at the rate of 60 kmph and the rest half by road at the rate of 50 km per hour. The distance travelled by him is:**
2. **720 km (b) 800 km (c) 960 km (d) 1000 km**

**Total distance = 2x.**

**(x/60) + (x/50) = 14(2/3) = (44/3) hours LCM = 300**

**5x + 6x = (44/3)(300) = 4400 implies x = 400.**

**Total distance = 2 x 400 = 800 meters.**

1. **Walking at (3/4) of his usual speed, a man is late by 2½ hours. The usual time would have been:**

**4 kmph ………………..x hours**

**3 kmph ……………….(x + 2.5) hours Indirect proportion**

**4x – 3x = 3 x 2.5 = 7.5 hours**

1. **Walking at (6/7) of his usual speed, a man is 25 min too late. His usual time is:**

**7 kmph …………….x min**

**6 kmph ……………(x + 25) min**

**7x = 6(x + 25) implies x = 150 min = 2 ½ hours**

1. **If a student walks from his house to school at 5 kmph, he is late by 30 min. However, if he walks at 6 kmph, he is late by 5 min only. The distance of his school from his house is:**

**Let the distance be x km.**

**Difference in timings = 25 min = (25/60) = (5/12) hour**

**(x/5) – (x/6) = (5/12) or 12x – 10x = 25 or x = 12.5 km**

1. **Two trains starting at the same time from two stations 200 km apart and going in opposite directions cross each other at a distance of 110 km from one of the stations. What is the ratio of their speeds?**

**In the same time, they cover 110 km & 90 km respectively.**

**Ratio of their speeds = 110 : 90 = 11 : 9**

1. **Two trains start from stations A and B and travel towards each other at speeds of 50 kmph and 60 kmph respectively. At the time of their meeting the second train has travelled 120 km more than the first. The distance between A and B is:**
2. **990 km (b) 1200 km (c) 1320 km (d) 1440 km**

**At the time of meeting, let the distance travelled by the first be x km. Then, distance covered by the second train is (x + 120) km. We know that speed = (distance/time)**

**(x/50) = (x +120/60) or 60x – 50x = 6000 or x = 600.**

**Distance between A and B = x + x + 120 = 1320 km.**

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| **SELF-PRACTICE EXERCISE** |

1. **Find the distance covered by a man walking for 10 minutes at a speed of 6 km/hr?**

**Distance = 6 km/hr x (10/60) hr = 1 km**

1. **Find the time taken to cover a distance of 125 km by a train moving at a speed of 50 km/hr?**

**Time = (125/50) hours = 2.5 hours**

1. **A train covers a distance of 1250 km in 25 hours. Find the speed of the train?**

**Speed = (1250/25) = 50 kmph**

1. **A car takes 50 seconds to travel 500 meters. What is its speed in km per hour?**

**Speed of the car = (500/50) = 10 m/sec.**

**10m/sec = (10 x 18/5) = 36 km/hr**

1. **Compare the rates of two trains, one travelling at 45 km an hour and the other at 10 meters a second?**
2. **4 : 5 (b) 3 : 5 (c) 5 : 4 (d) 5 : 3**

**Speed of the first train = 45 kmph**

**Speed of the second train = 10 m/sec = 10(18/5) = 36 kmph**

**Ratio of the speeds of the trains = 45 : 36 = 5 : 4**

1. **What is the length of the bridge which a man riding 15 km an hour can cross in 5 minutes?**

**Distance = speed x time = (15)(5/60) = (5/4) km = 1¼ km**

1. **A man covers a certain distance by car driving at 30 kmph and he returns back to the starting point riding on a scooter 20 kmph. Find his average speed for the whole journey?**

**Average speed = 24 kmph**

1. **On a tour a man travels at the rate of 64 km an hour for the first 160 km, then travels the next 160 km at the rate of 80 km an hour. The average speed in km per hour for the first 320 km of the tour is:**
2. **35.55 (b) 71.11 (c) 36 (d) 72**

**Average speed = (2xy/x + y) = (2 x 64 x 80/64 + 80) = 71.11 kmph**

1. **A man is walking at a speed of 12 km per hour. After every km he takes rest for 12 minutes. How much time will he take to cover a distance of 36 km?**

**To cover 36 km, the man has to take rest 35 times, as he takes rest every hour.**

**Rest time = Number of rest x Time for each rest = 35(12/60) = 7 hours**

**Total time to cover 36 km = (36/12) + 7 = 10 hours**

1. **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?**

**Difference between the time taken = 15 min = (1/4) hour**

**(x/30) – (x/40) = (1/4) implies 4x – 3x = 30 or x = 30 km**

1. **A boy goes to school at a speed of 3 kmph and returns to the village at a speed of 2 kmph. If he takes 5 hours in all, what is the distance between the village and the school?**

**Let the distance be x km. We know that Time = (Distance/speed)**

**(x/3) + (x/2) = 5 or 5x = 30 or x = 6 km**

1. **A car completes a certain journey in 8 hours. It covers half the distance at 40 km ph and the rest at 60 km ph. The length of the journey in kilometers is:**

**Let the total journey is 2x km.**

**(x/40) + (x/60) = 8 (or) 3x + 2x = 960 (or) x = 192 km**

**Total distance = 2x = 2 x 192 = 384 km**

1. **A car does a journey in 10 hours, the first half at 21 km/hr and the second half at 24 km/hr. Find the distance?**

**224 km is the answer.**

1. **Walking (3/4) of his usual speed, a person is 10 min late to his office. Find his usual time to cover the distance?**

**If he walks @ 4 kmph takes x minutes.**

**If he walks @ 3 kmph takes (x + 10) minutes. (Indirect proportion)**

**4x = 3(x + 10) or x = 30 minutes.**

1. **Walking (3/5) of his usual speed, a person is 18 min late to his office. Find his usual time to cover the distance?**

**27 minutes is the answer.**

1. **Two men A and B walk from P to Q, a distance of 21 km, at 3 km and 4 km an hour respectively. B reaches Q, returns immediately and meets A at R. Find the distance from P to R.**

**When B meets A at R, B has walked the distance PQ + QR and A the distance PR. That is, both of them have together walked twice the distance from P to Q i.e. 42 km.**

**Now the rates of A and B are 3 : 4 and they have walked 42 km.**

**Hence the distance PR travelled by A = (3/7)42 = 18 km**

1. **Two runners cover the same distance at the rate of 15 km and 16 km per hour respectively. Find the distance travelled when one takes 16 minutes longer than the other?**

**Let the distance be x km. (x/15) – (x/16) = (16/60) hours**

**LCM = 240. Then 16x – 15x = (16/60)(240). Therefore x = 64 km.**

1. **Two cyclists do the same journey by travelling respectively at the rates of 9 and 10 km an hour. Find the length of the journey when one takes 32 minutes longer than the other?**

**48 km is the answer.**

1. **Without any stoppages a person travels a certain distance at an average speed of 80 kmph, and with stoppages he covers the same distance at an average speed of 60 kmph. How many minutes per hour does he stop?**

**15 minutes is the answer**

1. **A person has to cover a distance of 80 km in 10 hours. If he covers half of the journey in (3/5)th time, what should be his speed to cover the remaining distance in time left?**

**He covers 40 km in 6 hours time. Remaining distance and time are 40 km and 4 hours only.**

**Required speed = (40/4) = 10 kmph**

1. **A man rode out a certain distance by train at the rate of 30 km an hour and walked back at the rate of 5 km per hour. The whole journey took 7 hrs. What distance did he ride?**

**30 km is the answer.**

1. **If A takes 8 hours to cover a distance and B is four times faster than A, then what time will B take to cover the same distance?**

**We know that speed and time are inverse proportional to each other i.e. more speed less is the time taken and vice versa.**

**B is four times faster than A means he takes (8/4) = 2 hours to complete the journey.**

1. **If A takes 8 hours to cover a distance and he is 4 times faster than B, then what time will B take to cover the same distance?**

**B takes 8 x 4 = 32 hours to complete the journey.**

1. **If B is 20% faster than A, then what time will he take to travel the distance which A travels in 20 minutes?**

**(100)(20) = (120)(x) implies x = (100/6) min = (50/3) min = 16 (2/3) min = 16 min 40 seconds.**

1. **If B takes 30% less time than A, to cover the same distance, what should be the speed of B if A walks at a rate of 7 km/hr?**

**(100)(7) = (70)(x) implies x = 10 km/hr**

1. **A train travels 225 km in 3.5 hours and 370 km in 5 hours. Find the average speed of train?**

**Average speed = (Total distance travelled /Total time taken)**

**= (225 + 370)/(3.5 + 5) = 70 km/hr**

1. **A thief goes away with a Maruti car at a speed of 40 km/hr. The theft has been discovered after half an hour and the owner sets off in another car at 50 km/hr. When will the owner overtake the thief from the start?**

**Thief will cover 20 km in half an hour, this is the initial distance between thief and owner.**

**Relative speed of owner = (50 – 40) = 10 km/hr**

**Time to catch thief = (20/10) = 2 hours**

1. **A railway passenger counts the telegraph posts on the line as he passes them. If they are 50 meters apart and the train is going at the speed of 48 kmph, how many will he pass per minute?**
2. **15 (b) 16 (c) 18 (d) 20**

**Speed of train = 48 km/hr = (48)(5/18) = (40/3) m/sec.**

**Distance covered by train in one minute = (40/3)(60) = 800 meters**

**No. of poles crossed = (800/50) = 16 per minute**

1. **A monkey tries to ascend a greased pole 14 meters high. He ascends 2 meters in first minute and slips down 1 metre in the alternate minute. If he continues to ascend in this fashion, how long does he take to reach the top?**

**In every 2 minutes he is able to ascend 2 – 1 = 1 metre. This way he ascends upto 12 meters because when he reaches at the top, he does not slip down. Thus, upto 12 meters he takes**

**12 x 2 = 24 minutes and for the last 2 meters he takes one minute. Therefore, he takes**

**24 + 1 = 25 minutes to reach the top.**

1. **A monkey tries to ascend a greased pole 92 meters high. He ascends 10 meters in first minute and slips down 1 metre in the alternate minute. If he continues to ascend in this fashion, how long does he take to reach the top?**

**In every 2 minutes he is able to ascend 10 – 1 = 9 meters. This way he ascends up to 9 x 10 = 90 meters. Thus upto 90 meters he takes 10 x 2 = 20 minutes and for the remaining distance 92 – 90 = 2 meters, he takes (2/10) min = (1/5) min = 12 seconds.**

**Total time = 20 minutes 12 seconds.**

1. **Suresh travelled 1200 km by air which formed (2/5) of his trip. The part of his trip which was one-third of the whole trip, he travelled by car. The rest of the journey was performed by train. Find the distance travelled by train?**

**Let the total distance be x km. Then (2/5)x = 1200 or x = 3000 km.**

**Distance covered by car = (1/3)(3000) = 1000 km**

**Distance travelled by train = 3000 – 1000 – 1200 = 800 km**

1. **Two trains start at the same time from Aligarh and Delhi and proceed towards each other at the rate of 16 km and 21 km per hour respectively. When they meet, it is found that one train has travelled 60 km more than the other. The distance between two stations is:**

**Suppose they meet after x hours. Then, 21 x – 16x = 60 or x = 12 hours**

**Now, distance between the stations = (16 x 12 + 21 x 12) = 444 km.**

1. **How many seconds will a train 100 meters long running at the rate of 36 km an hour take to pass a certain telegraph post?**

**In passing the post the train must travel its own length. Now 36 km/hr = 36(5/18) = 10 m/sec**

**Required time = (100 m/10 m/sec) = 10 seconds**

1. **A train 160 meters long passes a standing man in 18 seconds. What is the speed of the train?**

**Speed of the train = (160/18)(18/5) = 32 km/hr**

1. **How long does a train 110 meters long running at the rate of 36 km/hr take to cross a bridge 132 meters in length?**

**In crossing the bridge the train must travel its own length + the length of the bridge.**

**Now 36 km/hr = 36(5/18) = 10 m/sec**

**Required time = (242/10) = 24.2 seconds**

1. **Find the length of a bridge, which a train 130 m long, travelling at 45 km/hr, can cross in 30 seconds?**

**45 km/hr = 45(5/18) = (25/2) m/sec**

**Distance covered in 30 sec = (25/2)(30) = 375 m**

**Length of the bridge = 375 – 130 = 245 meters**