

Let's start with the applications of ratios today. Before you go on to an actual question, there is a relation between variables that you need to understand:

$$\text{Distance} = \text{Speed} \times \text{Time}$$

Now let's say my driving speed is a cool 100 mph. If I have to travel 100 miles, how much time will it take me? An hour, simple! Alright. If I have to travel 200 miles, how long will it take me? 2 hrs, you say? That is correct. What if I have to travel 500 miles? How long will it take me? 5 hrs, of course.. (now I am wasting your time, I know, but bear with me) When I hold my speed at a steady 100 mph, do you see a relation between Distance and Time? Can I say that if my distance doubles, my time taken doubles too? Can I say that if the distance that I have to travel on two different days is in the ratio 1: 5 (100 miles and 500 miles respectively), then the time I take on these two days will also be in the ratio 1:5 (1 hr and 5 hrs respectively)?

Yes, I can. Same is the relation of Distance with Speed keeping time constant. If this makes sense, you are half way there. We say Distance varies directly with Time (when Speed is kept constant) and Distance varies directly with Speed (when Time is kept constant). Anyway, we will take variation some other day.

Now, let me take another scenario.

Say, I have to travel 200 miles. If I keep a speed of 100 mph, I reach in 2 hrs. But what if the maximum speed allowed on the entire stretch is just 50 mph (and I am afraid of the law)? How long will it take me? Since my speed has reduced to half, it takes me double the time i.e. 4 hrs to cover 200 mph. So can I say that if there are two routes, both of 200 miles, and if my **speed on the routes is in the ratio 2:1** (100 mph and 50 mph respectively), then my **time taken will be in the ratio 1:2** (2 hrs and 4 hrs respectively)? We say that Speed varies inversely with Time (when Distance is kept constant). So if speed in two cases is in the ratio 3:7, time taken in the two cases will be in the ratio 7:3 (keeping the Distance same in both the cases)

Now let's look at the question I posted in [the previous post](#):

Two trains, A and B, traveling toward each other on parallel tracks, started simultaneously from opposite ends of a 250 mile route. A takes a total of 3 hours to reach the opposite end while B takes a total of 2 hours to reach the opposite end. When train A meets train B during the journey, how far is train A from its starting point?



Both A and B travel a 250 mile route i.e. they travel the same distance. So the ratio of their speeds must be inverse of the ratio of time taken. (Say if train A's speed is 250 mph, it will take 1 hr and if train B's speed is 125 mph, it will take 2 hrs – ratio of speeds is 2:1, ratio of time taken is 1:2). Now we know that A takes 3 hrs to cover 250 miles and B takes 2 hrs to cover the same distance so ratio of time taken by A:B is 3:2. Then, ratio of their speeds must be 2:3. So for every 2 miles that A covers, B covers 3 miles in the same time.



As shown in the [previous ratios post](#), the total distance in ratio terms will be 5 which is equal to 250 miles (this is the

distance the trains have covered together when they meet). The multiplier is 50. So A covers a distance of  $2 \times 50 = 100$  miles and B covers a distance of  $3 \times 50 = 150$  miles. So train A is 100 miles away from its starting point! No equations needed.

Now, let's take another example.

The speed of bus A is 20% more than the speed of bus B. Bus B takes 2 hours longer than bus A to travel 600 miles. What is the speed of bus A?

Ordinarily, people would make equations and solve them to get to the answer. But we can do it quickly and orally.

Speed of bus A is 20% more than speed of bus B. This means that speed of bus A : speed of bus B is 120:100 i.e. 6:5. To travel the same distance, time taken by bus A: time taken by bus B will be 5:6. This difference of 1 in the ratio of time taken is actually given to be 2 hours. Hence, the multiplier is 2. Time taken by bus A to travel the 600 miles must be  $5 \times 2 = 10$  hrs and time taken by bus B to travel the 600 miles must be  $6 \times 2 = 12$  hrs.

Speed of bus A =  $600/10 = 60$  mph

Try this logic on the next Time-Speed-Distance question you come across. Next week, we will look at the application of Ratios in Work problems.