Let's look at the concept of relative speed today. A good understanding of relative speed can be very useful in some questions. If you don't use relative speed in these GMAT questions, you can still solve them but they would be rather painful to work through (they might need multiple variables and you know my policy on variables – use one, if you must)
So the first question is – what is relative speed? To understand this, let's first consider 'speed'. When your car's speedometer shows 60 mph, what does it mean? It means that you are traveling at a speed of 60 mph relative to Earth. For an observer in space, your speed could be different. It would be the resultant of your speed and Earth's speed. If this is hard to imagine, think of a plane flying in the sky. Say, it is flying at a speed of 500 mph. What happens if a strong wind starts blowing in the same direction as the plane? The wind's speed gets added to the plane's speed and the plane travels even faster. So anyway, the speed we usually talk about is relative to Earth.
It is sometimes useful to consider the speed of an object relative to another object. Say, two people are sitting next to each other in the same train which is moving at a speed of 100 mph. Are they moving relative to each other? No. Their speed relative to each other is 0. Ofcourse, relative to the Earth, they are moving at the same speed as the train i.e. 100 mph. When working on relative speed questions, just focus on the two objects we are talking about and how fast they are moving relative to each other. Their actual speed may not be of much relevance to us.
Let's consider a few cases related to relative speed. Say, there are two people, A and B.
Case 1: A is standing still and B is moving at a speed of 5 mph.
What is B's speed relative to A? B is moving away from A at a rate of 5 miles every hour. So B's speed relative to A is 5 mph. What is A's speed relative to B? Is it 0? No! A's speed relative to Earth is 0. A's speed relative to B is 5 mph since distance between A and B is increasing at a rate of 5 mph. Confused? When we say 'relative to B', we assume that B is stationary. Since distance between the two is increasing at a rate of 5 mph, we say A's speed relative to B is 5 mph.
Case 2: A is walking due east at a speed of 5 mph and B is walking due east at a speed of 2 mph.
What is A's speed relative to B? Distance between A and B is increasing by 3 miles every hour. So A's speed relative to B is only 3 mph, not 5 mph. Think of it this way – A is moving fast but not as fast when compared with B since B is also moving. Similarly, B's speed relative to A is also 3 mph. Notice that when they move in the same direction, their relative speed is the difference of their speeds.
Case 3: A is walking due east at a speed of 5 mph and B is walking due west, away from A, at a speed of 2 mph.
What is A's speed relative to B? Distance between A and B is increasing by 7 miles every hour. So A's speed relative to B is 7 mph, not 5 mph. Think of it this way – A is moving fast and even faster as compared with B since B is moving in the opposite direction. Similarly, B's speed relative to A is also 7 mph. Notice that when they move in the opposite directions, their relative speed is the sum of their speeds. It doesn't matter whether they are moving toward each other or away from each other.
Let's look at some easy questions on relative speed to cement the concepts. We will look at some tough nuts next week.
Question 1: Train A starts from station A traveling at 30 miles per hour toward station B. At the same time, on a parallel track, train B leaves station B at 40 miles per hour toward station A. When the two trains meet, how far is train A from station B if the distance between stations A and B is 700 miles?
(A) 140
(B) 240
(C) 300
(D) 340
(E) 400
Solution: Both the trains start at the same time from stations that are 700 miles away from each other. This means that in the beginning, distance between them is 700 miles. When they meet, they have together covered the entire 700 miles.
Relative to each other, their speed is 30 + 40 = 70 mph.
Time for which they travel till they meet = 700/70 = 10 hrs
Train A covered 30*10 = 300 miles. This means, it is 400 miles away from station B. Answer (E)
Meanwhile, train B covered 40*10 = 400 miles.
Let's look at a variation of this question now.
Question 2: Train A leaves the station and travels at 30 miles per hour. Three hours later, train B leaves the same station traveling in the same direction at 40 miles per hour on a parallel track. How far from the station was train A overtaken by train B?
(A) 90

(B) 180
(C) 200
(D) 300
(E) 360
Solution: Train A travels at 30 mph for 3 hrs and covers 30*3 = 90 miles in this time. This is when train B leaves the station. Now both the trains are running in the same direction and their relative speed is 40 – 30 = 10 mph. This means that train B covers an extra 10 miles every hour. Since the initial distance between the two trains is 90 miles, it takes train B (90/10 =) 9 hrs to catch up with train A. In 9 hrs, train B must have traveled 40*9 = 360 miles. Hence, train A must also be 360 miles away from the station.
Answer (E)