

Uniform Motion

1. A ball is rolling on the ground at a speed of 2.5 m/s. After 5.0 s, how far has it moved?
2. A student sprints at a constant speed of 8.10 m/s. How long will it take him to run 100. m?
3. A car travels east at 40.0 km/h for 30. min and then east at 60.0 km/h for 15 min. How far does it travel in this time?
4. A marathon runner completes a 42.0 km race in 2 h 37 min. What is his average speed in m/s?
5. A woman jogs 1500 m west to the grocery store and walks 450 m east to the bus stop. If this takes 1200 s, what is her
 - a. average speed,
 - b. average velocity?
6. A motorist travels for 3.0 h at 80.0 km/h and 2.0 h at 100.0 km/h.
 - a. How far does she travel?
 - b. What is her average speed?
7. A bike travels with an average velocity of 8.0 m/s west for 30.0 min, then 10.0 m/s east for 20.0 min.
 - a. What distance did the bike travel?
 - b. What is the displacement of the bike?
8. A car drives 8.0 km at 10.0 m/s, then 40.0 km at 25 m/s. What is the average speed?
9. A race car circles 10 times around an 8.0 km track in 20.0 min.
 - a. What is its average speed?
 - b. What is its average velocity?
10. In a 400 m relay race, the anchorman for the Griffins runs 100. m in 9.8 s; his rival for the Jokers covers 100. m in 10.1 s. What is the largest lead the Joker runner can have (at the instant the Griffin starts the final 100 m) so the Griffin does not lose?
11. Two runners on a 400 m circular track. Runner A jogs at 7.6 m/s. Runner B runs at 8.0 m/s but starts 5.0 s later from the same start line. When do they first meet, and at what distance along the track from the start line does that meeting occur (measured in the racing direction)?

12. A 200 km trip has two highway segments and one stop. Segment 1 is 120 km at 100. km/h. Segment 2 is 80.0 km, of which the first 20.0 km is through construction at 60.0 km/h; the remaining 60.0 km is at a constant speed v you may choose. You also take a 10.0 min rest break between segments. If you want your overall average speed for the full 200 km (including the rest) to be 90.0 km/h, what constant speed must you drive on the last 60.0 km?
13. A river is 500 m wide. A boat can move at 3.0 m/s relative to still water. The river current is 1.5 m/s east.
- Draw a picture that shows the boat being driven at an angle upstream to account for the current, so that the boat travels straight across the river.
 - How long does the crossing take?
14. Two runners, A and B, run on a 200 m circular track in the same direction. B starts 10.0 s before A. Speeds are constant: $v_A = 7.5$ m/s, $v_B = 6.0$ m/s.
- When and where (distance from the common start line along the track) do they first meet?
 - How many full laps has each completed by that moment?
 - If they immediately continue with the same speeds, at what time do they meet for the third time (counting the first meeting as #1)?