

Practice Problems

1. A runner jogs 7 miles north in 55 minutes and then sprints 2 miles west in 13 minutes. Find the runner's average speed and the magnitude of the runner's average velocity. Express both answers in miles per hour.
2. An object with an initial velocity of 5 m/s has a constant acceleration of 2 m/s². When its speed is 15 m/s, how far has it traveled?
3. A particle starting from a position x_0 and with a velocity v_0 is subjected to a constant acceleration of 3 m/s². At $t = 4$ s, it is at $x = 100$ m; at $t = 6$ s, it has a velocity of 15 m/s. Find its position at $t = 6$ s.
4. A car accelerates from rest for 20 s until it reaches 40 m/s. The speed is then held constant for 20 s, after which there is an acceleration of -4 m/s² until the car stops.
 - a. Graph the car's acceleration vs. time.
 - b. Graph the car's velocity vs. time.
 - c. Graph the car's position vs. time. Label the maximum value reached on the y-axis.
 - d. What is the average speed of the car?
5. Two trains face each other on adjacent tracks. They are initially at rest 40 m apart. The train on the left accelerates rightward at 1.4 m/s². The train on the right accelerates leftward at 2.2 m/s². How far does the train on the left travel before the two trains pass?
6. A speeder passes a stationary police officer going at a constant speed of 34 m/s. The officer begins pursuit after 4 seconds and accelerates at a constant rate until he pulls up alongside the speeder. If the police officer travels 646 m from his starting position, at what rate did he accelerate?
7. The position of a particle is given by $x(t) = 4t^3 - 48t$, where x is in meters and t is in seconds.
 - a. What is the average velocity of the object from $t = 0$ s to $t = 4$ s?
 - b. What is the velocity at $t = 4$ s?
 - c. What is the acceleration at $t = 4$ s?
 - d. Where is the object located when it stops for the first time?
8. The acceleration of an object is given by $a(t) = 5t$. At $t = 0$, the object has a velocity of 18 m/s and is located 14 m from the origin. What is the object's position at $t = 3$ s?

1. 7.9 mph, 6.4 mph
2. 50 m
3. 124 m
4. See graphs, 28 m/s
5. 15.6 m
6. 5.7 m/s²
7. 16 m/s, 144 m/s, 96 m/s², -64 m
8. 90.5 m

