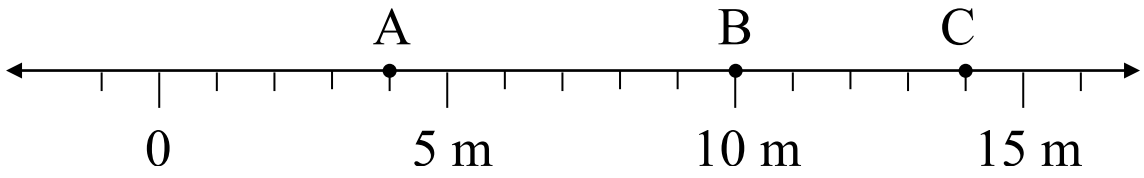
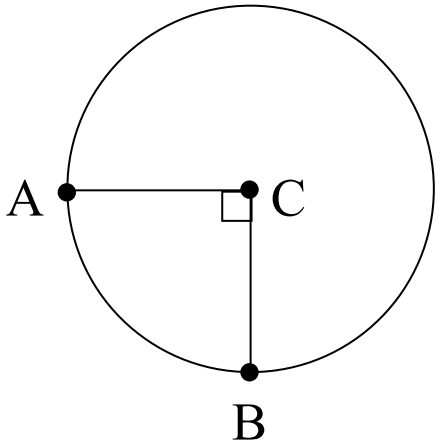
1. A person moves on the number line shown below. The person begins at point B, walks to pt. C, and then turns around and walks to pt. A. For this entire range of motion determine: (a) the person's final position, (b) the displacement, and (c) the distance.



2. An ant crawls clockwise along the perimeter of the circle from A to B. The circle has radius 5.00 cm and C is its center. Use the center of the circle as your point of reference as you determine:
(a) the ant's initial position,
(b) the ant's final position,
(c) the ant's displacement, and
(d) the ant's distance.



3. Using the given information try to determine the motion of a person along a number line where point A is at the origin. Note: there may be multiple solutions, one solution, or no solution.
   (a) $\mathbf{s_f} = 2$ m, 0° from A; $\mathbf{d} = 3$ m, 0°; d = 3 m
   (b) $\mathbf{s_i} = 0$ m from A; $\mathbf{d} = 0$ m; d = 4 m
   (c) $\mathbf{s_f} = 1$ m, 180° from A; $\mathbf{d} = 2$ m, 180°; d = 6 m
   (d) $\mathbf{s_i} = 3$ m, 0° from A; $\mathbf{d} = 2$ m, 0°; d = 0 m

4. A driver sets the cruise control to 65 mph for the first 100.0 miles of her trip, but then increases it to 75 mph for the last 50.0 miles of her trip.
   (a) Determine her average speed.
   (b) How much time did the increased speed save her?

5. At average speed 42 mph it takes 14 minutes to drive from FHS to West Town Mall via interstate. (a) What is the distance? (b) Find the time driving 8.0 miles along Kingston Pike at average speed 30 mph. (c) Find the average velocity of both trips given the displacement 7.4 miles, 24°.

6. Sound travels with constant speed of 343 m/s in typical conditions. (a) Find the distance sound travels in 1.00 minute. (b) Determine the time for sound to travel 100 m.

7. Suppose lightning occurs 1.00 mile away (about 1609 m). How much time elapses between seeing the lightning and hearing the thunder it causes? The speed of light is constant in air: 3.00×10^8 m/s.

8. A commuter drives 15.0 km on the highway at a speed of 25.0 m/s (56 mph), parks at work and walks 150 m at a speed of 1.50 m/s from his car to his office. (a) Determine the total time of the commute. (b) Determine the average speed of the entire commute. Repeat for highway speeds of 30.0 m/s (67 mph) and 35.0 m/s (78 mph).

9. Suppose you travel two parts of a trip at different speeds v_1 and v_2. (a) Show that the average speed equals the mean of the two speeds if the amount of time spent moving at each speed is the same. (b) Derive an expression for the average speed if part of the trip is a factor n longer in time.

10. The weather radar at Milliville records the following values for a thunderstorm's position:
    4:00 pm 5.50 miles, 284.5° from Milliville
    4:30 pm 1.25 miles, 225.0° from Milliville
    5:00 pm 4.78 miles, 131.5° from Milliville
    Chart the storm's course with ruler and protractor and determine the thunderstorm's speed and direction. Can it be determined if the speed and direction are constant?

11. Mr. M's car goes from 0 to 60 mph in 15 s, traveling east. Find its acceleration.

12. Still traveling east, Mr. M steps on the brakes – decreasing his speed from 60 mph to 20 mph in a time of 2.5 s. Find his acceleration.

13. Convert the previous two problems into SI units.

14. Starting from rest, a sprinter attains a velocity of 11 m/s, 180° in 3.9 s. Find the sprinter's acceleration.

15. A falling acorn gains speed from 5.00 m/s to 19.7 m/s in 1.50 seconds time. Find its acceleration.

16. A police car with velocity 35 m/s, south has acceleration 8.0 m/s^2, north as the driver applies the brakes for 2.5 s. Determine the resulting speed of the car.

17. A bungee jumper has velocity 21 m/s, 270° just as the bungee cord begins to stretch. The bungee cord slows the person to a stop and shoots them back upward. The person's velocity is 14 m/s, 90° at a time 2.5 seconds after the bungee cord first began to stretch. Determine the acceleration caused by the bungee cord.

18. A rock is thrown straight upward with initial speed 16.0 m/s. Given that the rock has constant acceleration 9.8 m/s^2 in a downward direction, determine the time(s) at which it has speed 1.0 m/s.

19. Starting from rest a powerful car accelerates 4.00 m/s^2, 0.0° for 6.00 s. (a) Find the car's final velocity. (b) Find the car's displacement during this same interval.

20. The same powerful car passes Mr. M. in his VW bus, going from 24.0 m/s to 29.0 m/s in 2.00s during the process. (a) Find the acceleration rate of the car. (b) Find the distance the car travels as it passes the bus.

21. The maximum deceleration rate for most cars is about 9.0 m/s^2. For a car traveling 25 m/s, calculate the minimum stopping distance and time. Repeat for a car traveling 50 m/s initially.

22. A certain sport's car (Dodge Viper) is claimed to go from 0 to 100 mph (45 m/s) and back to 0 in 14.7 s. If 4.7 s of this time is spent in braking the car, what is the total distance covered?

23. A steam driven catapult accelerates a 20 ton aircraft from 0 to 66 m/s in 3.0 s to launch the plane from the deck of an aircraft carrier. (a) Find the rate of acceleration. (b) Determine the length needed for the runway on the deck of the carrier.

24. An eleven pound projectile leaves the barrel of an experimental "super gun" with speed 9000 mph. The barrel is 155 feet long. Determine the acceleration rate, assuming it to be uniform.

25. You are designing an interstate exit ramp. The ramp must give adequate space for cars to slow to a stop. Maximum "comfortable" deceleration is 4.0 m/s^2. The speed limit is 29 m/s. How long should the ramp be at minimum?

26. You enter the interstate on a ramp that is 0.10 km long. If you wish to attain the speed limit of 29 m/s *before* merging, what must be your acceleration rate? Is this a well designed ramp?

27. A reckless driver begins a 110 m exit ramp doing 45.0 m/s. If his acceleration due to braking is 8.00 m/s^2, find: (a) time to get to the end of the ramp, and (b) speed at the end of the ramp.

28. A bungee jumper has velocity of 20.0 m/s, 270.0° just as the cord begins to stretch. The bungee causes an acceleration of 15.0 m/s^2, 90.0°. (a) Find the time the jumper is pulled by the cord. (b) Find the amount the cord is stretched beyond its original length.

29. Cats have been known to survive long falls out of apartment windows in NY city. Assuming 12 floors is 40 m high, estimate a cat's impact speed after falling this distance.

30. A baseball is “popped up” with initial velocity 20.0 m/s, 90.0°. Find the maximum height to which the ball will rise. Find the total time the ball takes to return to its initial position.

31. A bungee jumper uses a bungee cord with an unstretched length of 25 m. The jumper freefalls this amount and then the cord stretches to a length of 55 m. (a) Estimate the maximum speed attained by the person. (b) Find the average acceleration which results from the stretching cord.

32. A ball thrown with what initial upward speed would rise to a height of 10.0 m?

33. A football player spikes the ball by throwing it downward at 10.0 m/s from a height of 1.00 m. Determine the impact speed of the ball.