Section 1.1 Questions

Understanding Concepts

1. State whether each of the following is a scalar or a vector:
   (a) the magnitude of a vector quantity
   (b) a component of a vector quantity in some particular coordinate system
   (c) the mass you gained in the past 15 years
   (d) the product of a scalar and a vector
   (e) the area under the line and above the time axis on a velocity-time graph
2. Give a specific example for each of the following descriptions of a possible motion:
   (a) The velocity is constant.
   (b) The speed is constant, but the velocity is constantly changing.
   (c) The motion is in one dimension, and the total distance travelled exceeds the magnitude of the displacement.
   (d) The motion is in one dimension, the average speed is greater than zero, and the average velocity is zero.
   (e) The motion is in two dimensions, the average speed is greater than zero, and the average velocity is zero.
3. If two measurements have different dimensions, can they be added? multiplied? In each case, give an explanation if "no," an example if "yes."
4. Light travels in a vacuum at 3.00×10^8 m/s. Determine the time in seconds for each of the following:
   (a) Light travels from the Sun to Earth. The average radius of Earth's orbit around the Sun is 1.49×10^{11} m.
   (b) Laser light is sent from Earth, reflects off a mirror on the Moon, and returns to Earth. The average Earth-Moon distance is 3.84×10^5 km.
5. **Figure 19** shows the idealized motion of a car.
   (a) Determine the average speed between 4.0 s and 8.0 s; and between 0.0 s and 8.0 s.
   (b) Calculate the average velocity between 8.0 s and 9.0 s; between 12 s and 16 s; and between 0.0 s and 16 s.
   (c) Find the instantaneous speed at 6.0 s and 9.0 s.
   (d) Calculate the instantaneous velocity at 14 s.

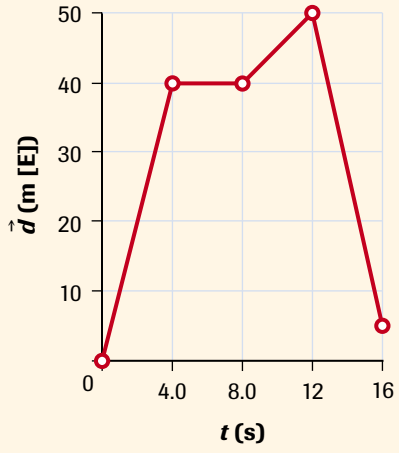

Figure 19
Position-time graph

6. What quantity can be calculated from a position-time graph to indicate the velocity of an object? How can that quantity be found if the line on the graph is curved?
7. Use the information in **Figure 20** to generate the corresponding position-time graph, assuming the position at time $t = 0$ is 8.0 m [E].

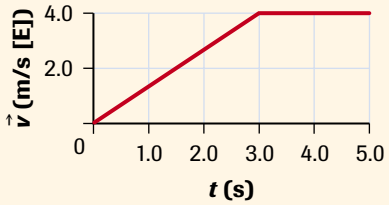

Figure 20
Velocity-time graph

8. In a total time of 2.0 min, a duck on a pond paddles 22 m [36° N of E] and then paddles another 65 m [25° E of S]. Determine the duck's
   (a) total distance travelled
   (b) average speed
   (c) total displacement
   (d) average velocity

Applying Inquiry Skills

9. (a) Review your work in Practice question 17, and use a plane mirror to determine how accurately you drew the tangents used to find the instantaneous velocities.
   (b) Describe how to draw tangents to curved lines as accurately as possible.

Making Connections

10. Research has shown that the average alcohol-free driver requires about 0.8 s to apply the brakes after seeing an emergency. **Figure 21** shows the approximate reaction times for drivers who have been drinking beer. Copy **Table 3** into your notebook, and use the data from the graph to determine the reaction distance (i.e., the distance travelled after seeing the emergency and before applying the brakes).

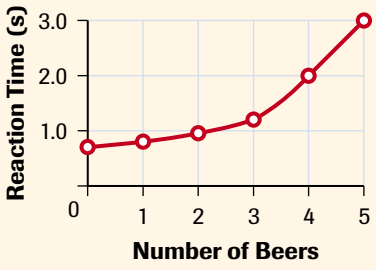

Figure 21
Effect of beer on reaction times for drivers

Table 3 Data for Question 10

Speed	Reaction Distance		
	no alcohol	*4 bottles*	*5 bottles*
17 m/s (60 km/h)	?	?	?
25 m/s (90 km/h)	?	?	?
33 m/s (120 km/h)	?	?	?