# Unit 01 Review

1. Define the following terms
   (a) distance

   **Solution:** total amount traveled by an object (a scalar)

   (b) displacement

   **Solution:** how far an object is from its starting point (a vector)

   (c) speed

   **Solution:** how fast an object travels (a scalar)

   (d) velocity

   **Solution:** speed and direction (a vector)

   (e) acceleration

   **Solution:** the rate that velocity changes (a vector)

2. What is the acceleration of a ping-pong ball that is initially traveling at 15 m/s, and then is returned to the other player with a velocity of −15 m/s in 0.2 s?

   **Solution:**

   $$v_i = 15 \text{ m/s} \qquad a = \frac{v_f - v_i}{t}$$
   $$v_f = 15 \text{ m/s} \qquad = \frac{-15 - 15}{0.2}$$
   $$t = 0.2 \text{ s} \qquad = -150 \text{ m/s}^2$$
   $$a = ?$$

3. What is the final velocity of an ice cream truck that has an initial velocity of 5 m/s, and accelerates at 2.1 m/s$^2$ for 7.3 s?

   **Solution:**

   $$v_i = 5 \text{ m/s} \qquad a = \frac{v_f - v_i}{t}$$
   $$a = 2.1 \text{ m/s}^2 \qquad 2.1 = \frac{v_f - 5}{7.3}$$
   $$t = 7.3 \text{ s} \qquad 15.33 = v_f - 5$$
   $$v_f = ? \qquad 20.33 \text{ m/s} = v_f$$

4. How much time will it take an octopus that swims at 23 m/s to travel 82 m?

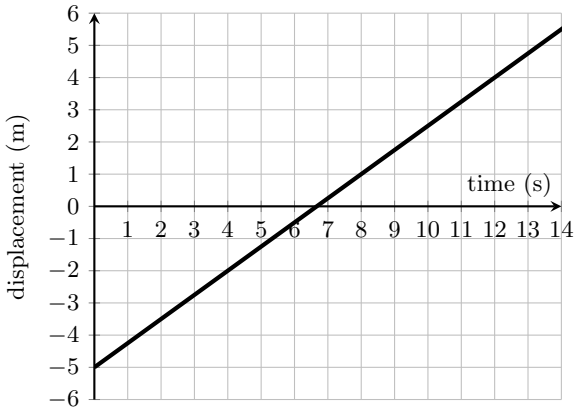
   **Solution:**

   $$v = 23 \text{ m/s} \qquad v = \frac{d}{t}$$
   $$d = 82 \text{ m}^2 \qquad 23 = \frac{82}{t}$$
   $$t = ? \qquad 23t = 82$$
   $$t = 3.57 \text{ s}$$

5. What does it mean to say that an object is accelerating at $10\,\text{m/s}^2$ ?

**Solution:** The object's velocity is changing by 10 m/s every second.

6. Consider this graph of a motor boat's displacement over time.




(a) The object is moving

√ **forward** ◯ backward

(b) The object is

◯ speeding up

◯ slowing down

√ **moving at a constant speed**

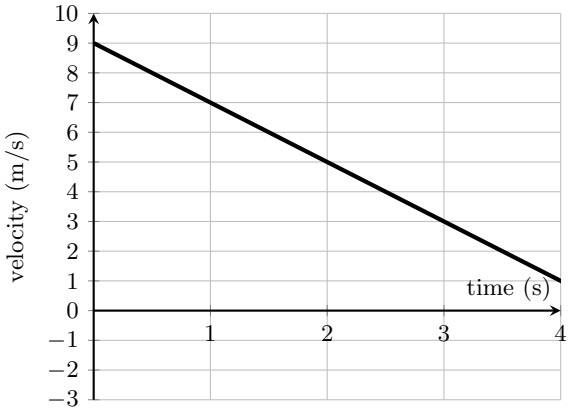
(c) Calculate the velocity.

**Solution:** $0.75\,\text{m/s}$

(d) Calculate the acceleration.

**Solution:** $0\,\text{m/s}^2$

7. Consider this graph of this train's velocity over time.




(a) The object is moving

√ **forward** ◯ backward

(b) The object is

◯ speeding up

√ **slowing down**

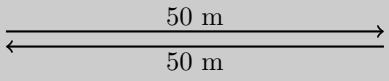
◯ moving at a constant speed

(c) Calculate the acceleration.

**Solution:** $-2\,\text{m/s}^2$

8. A bear walks 50 m east in 60 s. Then, he turns around and walks 50 m west back to his starting point in 120 s. What is his (a) average speed and (b) average velocity for the entire trip?

**Solution:**




$$\text{distance} = 50\text{ m} + 50\text{ m} = 100\text{ m}$$
$$\text{displacement} = 50\text{ m} - 50\text{ m} = 0$$
$$\text{total time} = 60\text{ s} - 120\text{ s} = 180\text{ s}$$

$$\text{speed} = \frac{\text{distance}}{\text{time}} = \frac{100}{180} = 0.56\text{ m/s}$$
$$\text{velocity} = \frac{\text{displacement}}{\text{time}} = \frac{0}{180} = 0\text{ m/s}$$