CHAPTER 3 PRACTICE QUESTIONS

Directions: Complete the following problems as specified by each question, and then check your work using the solutions that follow. For extended, step-by-step solutions, access your Student Tools online.

1. If you begin at position $\vec{r}_1 = (3\text{ m})\hat{i} - (2\text{ m})\hat{j}$ and move to position $\vec{r}_2 = (4\text{ m})\hat{i} + (1\text{ m})\hat{j}$, what is your displacement? If you walked in a straight line from your first position to your second, what distance did you travel?

2. If in the previous question it took you 5 s to move from your initial position to your final position, what was your average velocity? What was your average speed?

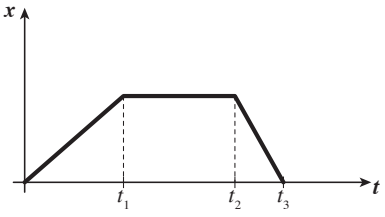
3. Consider a jogger running on a circular track. Each lap he makes is 400 m long and takes him about 2 minutes. During one lap, what is his average velocity? What is his average speed? Express both results in units of m/s.

4. At an initial point in time, an object moves along the *x*-axis with a speed of 5 m/s. At a later point in time, it is moving along the *y*-axis with a speed of 5 m/s. Did this object accelerate? Why or why not?

5. An object has an initial velocity of $\vec{v}_1 = (4\text{ m/s})\hat{i}$ and a final velocity of $\vec{v}_2 = (3\text{ m/s})\hat{j}$. What was the object's change in velocity? If it took 5 s, what was its average acceleration?

6. A sprinter begins his 100 m dash at rest and finishes in 10 s. Assuming his acceleration was constant, what was his speed at the end of the sprint? What was his acceleration?

7. Using the following position vs. time graph of some object, plot the velocity vs. time and acceleration vs. time for the object.



8. An object has an initial velocity of 0 and accelerates in a straight line at a constant rate of 10 m/s² for 10 s. What is its displacement?

9. If a car moves at 6 m/s and undergoes an acceleration of 4 m/s² for 8 m, what velocity does the car end with?

10. A car, starting from rest, accelerates at a rate of 5 m/s^2 for 4 s. The driver then sees a dog crossing the street, and he slams on his brakes. He decelerates at a rate of 10 m/s^2 until he reaches a stop. How far does the driver travel from when he applies the brakes until he stops fully?

11. If a ball is dropped from the roof of a 20 m building, how long does it take to hit the ground?

12. Let's say an object is not accelerating at a constant rate, but is actually accelerating at the following rate:

$a(t) = a_0 + Jt$

where a_0 is the initial acceleration, and J is the rate at which the acceleration is changing. In this case, the acceleration is increasing linearly (if J is positive) or decreasing linearly (if J is negative). For this particular acceleration, you need a new set of kinematic equations. The kinematic equations for a linearly changing acceleration are

$$x(t) = x_0 + v_0 t + \frac{1}{2}at^2 + \frac{1}{6}Jt^3$$

$$v(t) = v_0 + a_0 t + \frac{1}{2}Jt^2$$

If this object had an initial acceleration of 0, and J = 3 m/s^3, what would the position of the object be after 10 s if it started from rest? What about its final speed?