Chapter 6 Review

d_x = v_x t 

d_y = 4.9t^2

v_y = gt

c = 2\pi r

v = \frac{2\pi r}{t}

\[ g = 9.8\text{m/s}^2 \]

\[ G = 6.67 \times 10^{-11} \]

\[ F = \frac{m_1 m_2}{d^2} \]

\text{angular speed} = \frac{\text{rotations or degrees}}{\text{time}}

1. Magnitude and Direction

2. Horizontal velocity is constant (ignoring air resistance). Vertical velocity is not constant, it accelerates due to gravity.

3. 45°

4. 70° The two numbers should add up to 90.

5. Two ants are sitting on a spinning record. One sits near the center and the other near the edge.

   a. How do their angular speeds compare?

      Same

   b. How do their linear speeds compare?

      Different, one near the edge is faster.
      It travels a larger circle in the same amount of time.

6. A ball tied to a string is twirled around in a circle as shown. Draw a vector showing the direction of the ball’s velocity and the direction of the centripetal force on the ball at each of the three points.
7. Is there a gravitational force between you and your pencil? Do you notice this force? Explain.

Yes, but it's too small to notice.

8. Why is a tall SUV more likely than a car to roll over in an accident?

It is easier for an SUV's center of gravity to get outside of its support area.

9. A monkey throws a banana horizontally from the top of a tree. The banana hits the ground 3 seconds later and lands 30 meters from the base of the tree.

   a. How fast did the monkey throw the banana?

   \[ d_x = v_x t \]
   \[ 30m/3s = 10 \text{ m/s} \]

   b. How high is the tree?

   \[ d_y = 4.9t^2 = 4.9(3)^2 = 44.1 \text{ m} \]

   c. How fast was the banana moving horizontally as it hit the ground?

   Horizontal velocity is constant, so it is the same 10 m/s.

   d. How fast was the banana moving vertically as it hit the ground?

   \[ v_y = gt = 9.8m/s^2(3s) = 29.4 \text{ m/s} \]

   e. What was the resultant velocity of the banana as it hit the ground?

   Pythagorean Theorem

   \[ A^2 + B^2 = C^2 \]
   where A is the horizontal speed and B is the vertical speed

   \[ (29.4m/s)^2 + (10m/s)^2 = C^2 \]
   \[ 964.4 = C^2, C = 31.05 \text{ m/s} \]
10. You are sitting on a merry-go-round at a distance of 2 meters from its center. It spins 15 times in 3 minutes.

a. What distance do you move as you make one revolution?
\[ c = 2\pi r = 2\pi(2m) = 12.56\text{m} \]

b. What is your angular speed in RPM?
\[ 15 \text{ Rev / 3 min} = 5 \text{ RPM} \]

c. What is your angular speed in degrees per minute?
\[ 5 \text{ RPM} \times 360^\circ = 1800^\circ / \text{min} \]

d. What is your linear speed in meters per minute?
\[ 5 \text{ RPM} \times 12.56\text{m} = 62.8 \text{ m/min} \]

e. What is your linear speed in meters per second?
\[ (62.8 \text{ m/min}) / (60 \text{ sec/min}) = 1.047 \text{ m/s} \]