Chapter 3 XtraWrk – 2D motion

3.5) A model airplane moves 200 ft horizontally and then rises, traveling 135 ft at an angle of 30º above the horizontal. Then, it travels another 135 feet at an angle of 40º below the horizontal. Find the total displacement of the airplane graphically.

3.9) A hummingbird flies 8 m westward, then 13 m northward. After one more straight-line displacement, the hummingbird is back where it started. Use the graphical method to find the magnitude and displacement of the hummingbird's third motion.

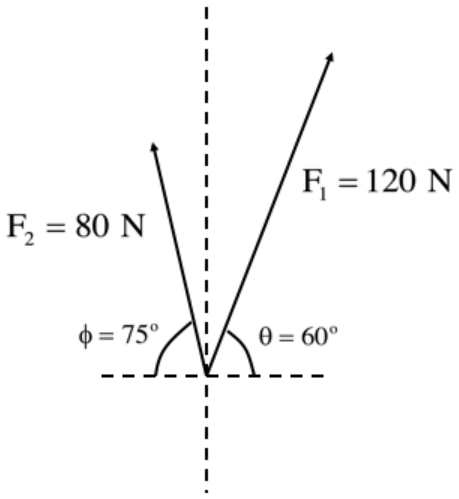
3.11) A vector that is 35.0 km long points 325 degrees counterclockwise from the positive x axis. Find the x- and y- components of this vector (show your work).

3.15) The x-component of vector A is -25.0 units, and the accompanying y-component is 40.0 units. What is the magnitude and direction of vector A?

3.17) The center of a tropical storm passes over Oahu, traveling 60º north of west at a speed of 41 km/h for three hours before suddenly shifting northward and slowing to 25 km/h. 4.5 hours after passing over Oahu, how far from Oahu is the center of the storm?

3.20) The bird's-eye view to the right shows the direction two people pull on a crate sitting on the ground. Both forces are parallel to the ground. If the axis toward the top of the page is identified as the *y-axis* and the other identified as the *x-axis*, and if the forces are in Newtons, find:

a) The single "resultant" force that is equivalent to the two forces shown, and;
b) The force a third person would have to exert on the crate to make the net force zero.



3.22) One of the fastest clocked pitches in baseball was thrown at 101 mph. By how much did the pitch drop on its 60.5 ft path to home plate? Note that the acceleration of gravity in the English system of units is 32.2 ft/s/s.

3.23) A student throws a baseball off the top of a 50.0 m tall building with an initial speed of 18.0 m/s at an angle of 30º below the horizontal.

a) What are the baseball's initial coordinates?
b) Find the x- and y-components of the initial velocity.
c) Write the velocity equations as a function of time for both the x and y directions.
d) Write the position equations as a function of time for both the x and y directions.
e) How long does it take for the ball to hit the ground?

f) What's the final velocity of the ball just before impact? (Remember, velocity is a vector…)

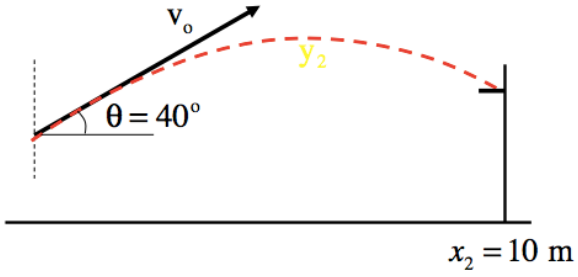
3.27) A person finds a soccer ball in a field and needs to kick it back over the fence, which is 36 m away. The fence is 3.05 m high. The person kicks the ball from ground level with a speed of 20.0 m/s at an angle of 53º above the horizontal.

a) By how much does the ball clear or fall short of the top of the fence?
b) Does the ball approach the ball while rising or falling?

3.29) A stone is thrown upward from the top of a building at 15 m/s at an angle of 25º above the horizontal. The stone hits the ground below after 3.0 s. How tall is the cliff?

3.32) Water leaves a hose at 50 m/s at an angle of 30º above the horizontal. How high up on a wall 50.0 m away will the water strike?

3.58) A basketball is shot 2.0 m above floor level at an angle of 40º. It goes through the basket 10.0 m away where the basket is 3.05 m above the court. How fast must the ball initially be moving?



Additional problems:

1. Falcon problem

A falcon moving 200 mph in the horizontal pulls in its wings and freefall for 100 meters. How far will the falcon have fallen after that 100 meters of "free fall"?

2. Tennis player problem

A tennis player standing 12.6 meters from the net and hits a ball at 3 degrees above the horizontal. The ball must rise 0.33 meters if it is to clear the net at the top of its arc. What must its initial velocity be?