Chapter 3 Motion in Two or Three Dimensions

Example 1:
A projectile is fired at 37° above the horizontal with an initial speed of 65.0 m/s from the top of a 50.0 m tall cliff. Find its range.

Example 2:
While flying horizontally at 275 mph a bomber releases its bomb load. If the plane is flying at an altitude of 6000 ft how far from target horizontally must the release be made?

Example 3:
A daredevil is shot out of canon at 40° above the horizontal with a speed of 25.0 m/s. If the net is located 2.00 m higher than the launch point, what is the horizontal distance to the net if it is to safely catch the daredevil?

Example 4:
The maximum distance Jill can throw a ball is 250 ft when she is standing on level ground. At what initial speed did Jill throw the ball? (Assume the ball is thrown at 45° above the horizontal and that it leaves her hand when it is 6.25 ft above the ground.)

Example 5:
A football is kicked from a position on the ground that is 40.0 m from the base of the goal. If the ball strikes the top cross bar which is 3.00 m above the ground, at what two angles could the ball have been kicked? (Assume the ground is horizontal.)

Example 7:
A person standing on the Earth's equator is moving in a circle at a constant speed. This motion is caused by the Earth's rotation. Calculate the radial acceleration of this person.

Example 8:
A space station is designed so that people can walk on the inside of the outer wall and feel their normal weight. The station is to be 750 m in diameter. What is the period of the station's rotation?

Example 9:
A child is swinging a stone in a horizontal circle. The circle has a radius of 4.50 ft and the stone has a radial acceleration of 52.6 ft/s^2. If the child releases the stone when it is 6.15 ft above the ground, how far from the child's feet does the stone land? (Assume the child is standing at the center of the circle.)

Example 10:
John can row a boat at 3.34 ft/s with respect to the water. If the river flows South at 1.86 ft/s, in what direction must John row if he is to reach a point directly across from his starting point? (Assume that John starts on the East bank.)

Example 11:
The pilot of a plane notices that the compass indicates the plane has a heading of due East. The plane's speed relative to the air is 105 mph. If the wind is blowing 60.0 mph, 75.0° S of E with respect to the ground, what is the velocity of the plane with respect to the ground?

Example 12:

A ship is sailing at 2.5 m/s, 60° N of E with respect to the Earth. A waiter on the ship is walking from port to starboard at 1.15 m/s. He is carrying a bowl of soup in which a fly is doing the backstroke at 0.25 m/s 45° to the right of the direction the waiter is walking. What is the velocity of the fly with respect to the Earth?

Example 13:

A car is traveling horizontally at 15.0 mph; raindrops have a speed of 20.0 mph with respect to the car. A passenger in the car notices the rain is slanted at 30° from vertical toward the back of the car. Find the velocity of the rain with respect to the ground.