1. Five forces act on an object.

(1) 60 N at 90°
(2) 40 N at 0°
(3) 83 N at 270°
(4) 40 N at 180°
(5) 50 N at 60°

What are the magnitude and direction of the force that would produce equilibrium?
(**32.20-N 39.08° SoW**)

2. You pull a 18.00-kg suitcase at constant speed on a horizontal floor by exerting a 39.00-N force on the handle, which makes an angle θ with the horizontal. The force of friction on the suitcase is 30.00-N.

(a) What angle does the handle make with the horizontal? (**39.72°**)
(b) What is the normal force on the suitcase? (**151.48-N**)
(c) What is the coefficient of friction? (**.20**)

3. You push a 350.00-N trunk up a 20.00° inclined plane at a constant velocity by exerting a 214.00-N force parallel to the plane's surface.

(a) What is the component of the trunk's weight parallel to the surface? (**119.71-N**)
(b) What is the sum of all forces parallel to the plane's surface? (**0-N**)
(c) What is the magnitude and direction of the friction force? (**94.29-N down the ramp**)
(d) What is the coefficient of friction? (**.29**)

4. An arrow is shot at 28.00° above the horizontal. Its initial speed is 53.00-m/s and it hits the target.

(a) What is the maximum height the arrow will attain? (**31.59-m**)
(b) The target is at the height from which the arrow was shot. How far away is it? (**237.63-m**)

5. An airplane traveling 1016.00-m above the ocean at 150.00-km/h is to drop a box of supplies to shipwrecked victims below.

(a) How many seconds before being directly overhead should the box be dropped? (**14.40-s**)
(b) What is the horizontal distance between the plane and the victims when the box is dropped? (**599.98-m**)

6. Divers in Acapulco dive from a cliff that is 62.0-m high. If the rocks below the cliff extend outward for 24.00-m, what is the minimum horizontal velocity a diver must have to clear the rocks? (**6.75-m/s**)

7. A 605.00-kg racing car completes one lap in 14.30-s around a circular track with a radius of 55.00-m. The car moves at constant speed.

(a) What is the acceleration of the car? (**10.62-m/s^2**)
(b) What force must the track exert on the tires to produce this acceleration? (**6425.10-N**)

8. An athlete whirls in a 6.65-kg hammer tied to the end of a 1.30-m chain in a horizontal circle. The hammer makes one revolution in 1.00-s.

(a) What is the centripetal acceleration of the hammer? (**51.3-m/s^2**)
(b) What is the tension in the chain? (**341-N**)

9. A coin is placed on a vinyl stereo record making 33 1/3 revolutions per minute.

(a) In what direction is the acceleration of the coin? (**Toward the center**)
(b) Find the magnitude of the acceleration when the coin is placed 5.0, 10, and 16 cm from the center of the record. (**6.09 x 10^{-1}-m/s^2, 1.22-m/s^2, 1.95-m/s^2**)

10. According to the Guinness Book of World Records (1990) the highest rotary speed ever attained was 2010.00-m/s (4500 mph). The rotating rod was 6.00-in. long. Assume that the speed quoted is that of the end of the rod.

(a) What is the centripetal acceleration of the end of the rod? (**2.64×10^{7}-m/s^{2}**)

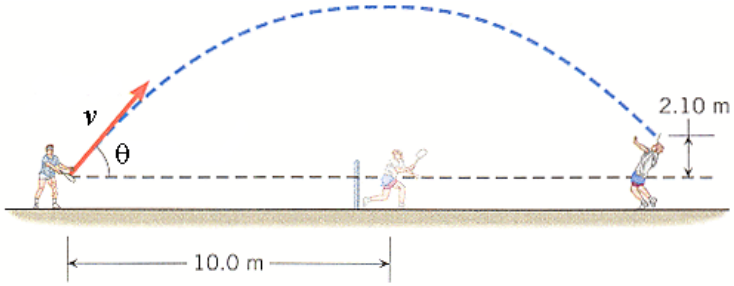
(b) If you were to attach a 9.00-g object to the end of the rod, what force would be needed to hold it on the rod? (**2.38×10^{5}-N**)

E1. While standing on a bridge 40.0 m above ground, you drop a stone from rest. When the stone has fallen 3.50 m, you throw a second stone straight down. What initial velocity must you give the second stone if they are both to reach the ground at the same instant? Take the downward direction to be the negative. (**-10-m/s**)

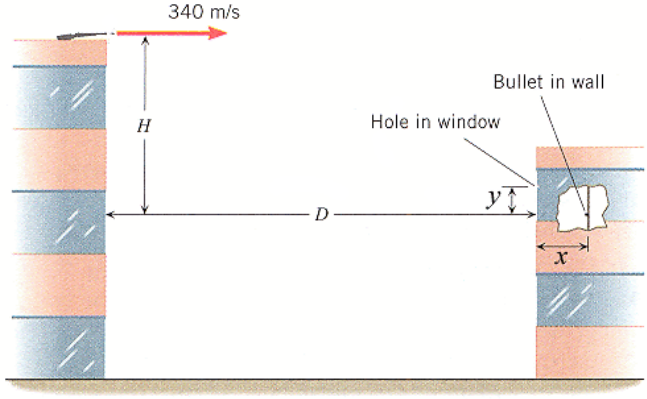
E2. In the javelin throw at a track-and-field event, the javelin is launched at a speed of 35 m/s at an angle of 36° above the horizontal. As the javelin travels upward, its velocity points above the horizontal at an angle that decreases as time passes. How much time is required for the angle to be reduced from 36° at launch to 17°? (**1.22-s**)

E3. A pitched ball is hit by a batter at a 40° angle and just clears the outfield fence, 100 m away. Assume that the fence is at the same height as the pitch and find the velocity of the ball when it left the bat. Neglect air resistance. (**31.6-m/s @ 40°**)

E4. The lob in tennis is an effective tactic when your opponent is near the net. It consists of lofting the ball over his head, forcing him to move quickly away from the net (see the drawing). Suppose that you loft the ball with an initial speed of v = 19.0 m/s, at an angle of θ = 53.5° above the horizontal. At this instant your opponent is 10.0 m away from the ball. He begins moving away from you 0.30 s later, hoping to reach the ball and hit it back at the moment that it is 2.10 m above its launch point. With what minimum average speed must he move? (**8.83-m/s**)



E5. From the top of a tall building, a gun is fired. The bullet leaves the gun at a speed of 340 m/s, parallel to the ground. As the drawing shows, the bullet puts a hole in a window of another building and hits the wall that faces the window. (y = 0.54 m, and x = 6.3 m.) Using the data in the drawing, determine the distances D and H, which locate the point where the gun was fired. Assume that the bullet does not slow down as it passes through the window. (**H = 43.6-m, D = 1010-m**)



E6. A satellite has a mass of 5950 kg and is in a circular orbit 4.70 x 10^5 m above the surface of a planet. The period of the orbit is two hours. The radius of the planet is 4.15 x 10^6 m. What is the true weight of the satellite when it is at rest on the planet's surface? (**2.59 x 10^4-N**)