More Projectiles Launched at Angles

1) A cannonball is launched from a flat field with an initial velocity of 120 m/s at 30.0° above the horizontal. Ignore air resistance.
   a) Sketch the projectile's path, labelling the initial velocity and launch angle.
   b) Determine the initial horizontal and vertical velocities.
   c) Determine the final vertical velocity immediately before the cannonball strikes the ground.
   d) Determine how long the cannonball is in the air.
   e) Determine the maximum height the cannonball reaches above the ground.
   f) Determine the horizontal distance travelled by the cannonball.

2) A soccer ball is kicked from ground level. The ball stays in the air for 4.3 s and lands 55 m from where it was kicked. Ignore air resistance.
   a) Sketch the projectile's path, labelling the initial velocity, maximum height, and horizontal distance travelled.
   b) Determine the horizontal velocity of the ball.
   c) Determine how long it takes the ball to reach its maximum height.
   d) Determine the initial vertical velocity of the ball.
   e) Determine the final vertical velocity immediately before the ball strikes the ground.
   f) Determine the maximum height the ball reaches above the ground.
   g) Determine the magnitude and direction of the ball's initial velocity.
   h) Determine the magnitude and direction of the ball's impact velocity.

3) In a circus, a human cannonball is launched from a cannon and lands in a safety net at the same height as the cannon. His initial velocity is 18.3 m/s at 40.0° above the horizontal. Ignore air resistance.
   a) Sketch the projectile's path, labelling the initial velocity, launch angle, and location of the safety net.
   b) Determine the initial horizontal and vertical velocities.
   c) Determine the final vertical velocity immediately before the stuntman reaches the safety net.
   d) Determine how long the stuntman is in the air.
   e) Determine the horizontal distance travelled by the stuntman.
   f) Determine the maximum height the stuntman reaches above the launch point.

4) The circus manager from the previous problem wants to make the stunt more dramatic by launching the stuntman through a hoop 9.0 m above the cannon before landing in a safety net at the same height as the launch point. The cannon's launch angle is changed to 45.0° and the initial velocity is increased to 21.0 m/s. The manager needs to determine where to place the hoop and safety net. Ignore air resistance.

a) Sketch the projectile's path, labelling the initial velocity, launch angle, hoop, and safety net.
b) Determine the initial horizontal and vertical velocities.
c) Determine the maximum height the stuntman reaches above the launch point.
d) Determine the vertical velocity of the stuntman when he reaches the height of the hoop.
e) Determine the time at which the stuntman passes through the height of the hoop on the way up and on the way down.
f) Determine the two possible horizontal distances from the cannon where the hoop could be placed.
g) Determine the final vertical velocity immediately before the stuntman reaches the safety net.
h) Determine the total time the stuntman is in the air.
i) Determine how far from the cannon the safety net should be placed.