59. In a very popular lecture demonstration, a projectile is fired at a falling target as in Figure P3.59. The projectile leaves the gun at the same instant that the target is dropped from rest. Assuming that the gun is initially aimed at the target, show that the projectile will hit the target. (One restriction of this experiment is that the projectile must reach the target before the target strikes the floor.)
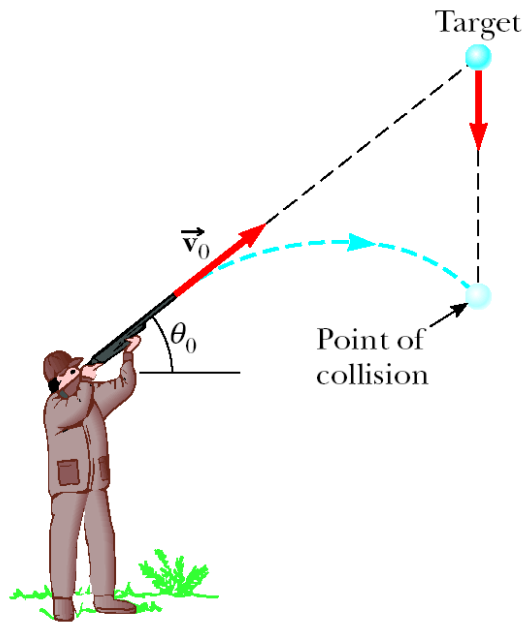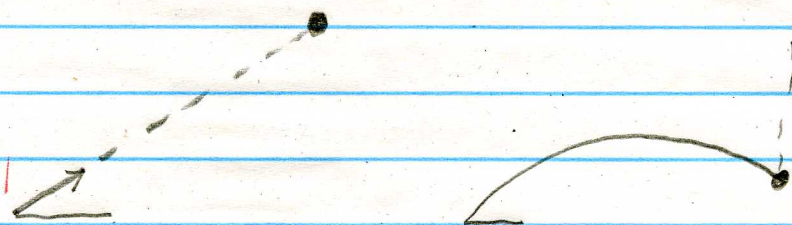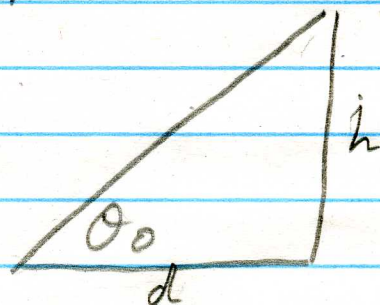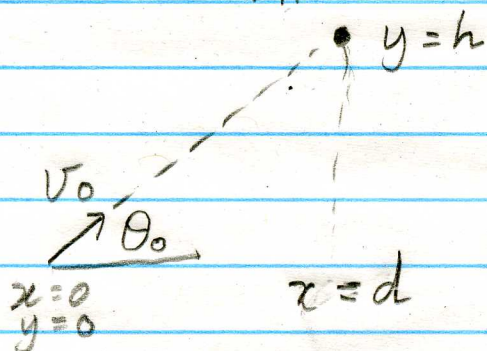

Figure P3.59

SHOOT THE MONKEY

SET UP VARIABLE NAMES:

$y = h$

V_0 θ_0

$x = 0$
$y = 0$

$x = d$

$$\tan \theta_0 = h/d$$

$P \equiv$ PROJECTILE $T \equiv$ TARGET

Let $x_P = d$ at time t_0

Need to show that at t_0,

$(x_P, y_P) = (x_T, y_T)$

IE NEED TO SHOW: $y_P = y_T$ at t_0