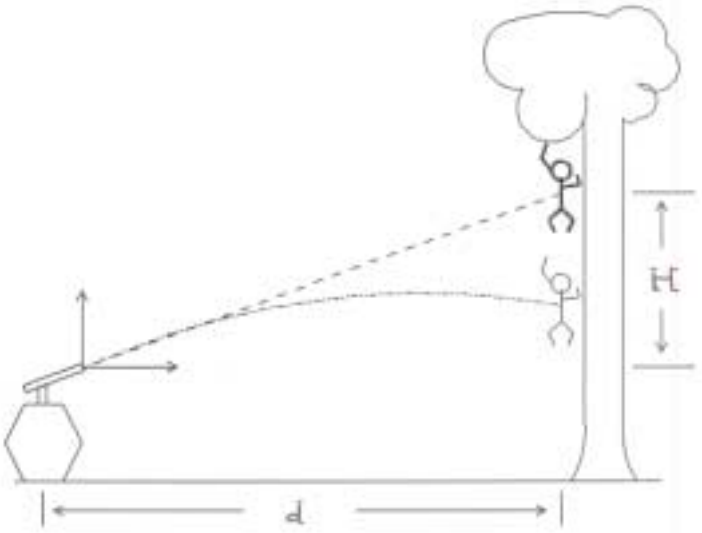
The Monkey Gun



It takes a certain amount of time, t, for the bullet to travel the horizontal distance, d, between the gun and the monkey. The question is: since the monkey drops right when the gun is fired, will the monkey fall to a vertical position that is the same as that of the bullet after the bullet has traveled the horizontal distance d?

$$Y_{monkey} = H - gt^2/2 \qquad Y_{bullet} = 0 + V_y t - gt^2/2$$

and

$$X_{bullet} = 0 + V_x t \text{ where } V_x = V\cos\theta \text{ and } V_y = V\sin\theta .$$

At time T the bullet will have gone a distance d so that

$$X_{bullet} = d = V\cos\theta\, T \text{ or } T = d/V\cos\theta .$$

Substituting into the Y_{bullet} equation

$$Y_{bullet} = V\sin\theta\,[d/V\cos\theta] - gT^2/2 = d\tan\theta - gT^2/2$$

And

$$Y_{monkey} = H - gT^2/2.$$

Finally, $\theta = \tan^{-1}(H/d)$ so that

$$Y_{bullet} = H - gT^2/2 = Y_{monkey}.$$