PHYS 121: Practice Problem of the Day:
Sept 27, 2011

P19. Projectile Motion Max Height: Difficulty: Medium, Exam class question: Probably not

Note: This is problem 3-4 from RWB In-Class Notes for Physics 121

Problem 3-4

Find a formula for the peak height $H$ of the above projectile trajectory in terms of $R$ and $\theta$. (As a check: When $R$ is a maximum, you should find $H = R/4$)

Solution by RWB on Next Page...
Solution to Problem P19: (by RWB)

3-4) The projectile reaches its peak when the time is half the total time.

\[ t = \frac{1}{2} T = \frac{V_0 \sin \Theta}{g} \]

\[ y = V_0 \sin \Theta - \frac{1}{2} gt^2 = \frac{V_0^2 \sin^2 \Theta}{g} - \frac{V_0^2 \sin^2 \Theta}{2g} \]

\[ H = \frac{V_0^2 \sin^2 \Theta}{2g} \]

\[ R = \frac{V_0^2 \sin 2\theta}{g} = \frac{V_0^2 \cdot 2 \sin \Theta \cos \Theta}{g} \]

\[ \frac{V_0^2}{g} = \frac{R}{2 \sin \Theta \cos \Theta} \]

\[ H = \frac{R}{2 \sin \Theta \cos \Theta} \cdot \frac{\sin^2 \Theta}{2} = \frac{\sqrt{R^2 (1 + \tan \Theta)}}{4} \]

Check:

at \[ \theta = \frac{\pi}{4} \]

\[ R = \frac{\pi}{4} \]

\[ H = \frac{R}{4} \]