Projectile Motion and Range

A projectile is fired with initial speed $v_0$ from the edge of a cliff, at an angle $\theta$ with respect to the horizontal ($x$) direction. The cliff is a height $y = h$ above the ground. The equations describing the motion of the projectile are therefore, with $(x, y) = (0, h)$ being the edge of the cliff,

\[
x = v_0 t \cos \theta \quad \text{and} \quad y = h + v_0 t \sin \theta - \frac{1}{2} gt^2
\]

Using $g = 9.8 \text{ m/sec}^2$ and choosing some appropriate value for $v_0$, make a parametric plot of the trajectory, that is $y$ versus $x$. Make it so that you can easily reproduce the plot for different values of $h$ and $\theta$. Try different values of $h$ and $\theta$ and convince yourself that the trajectories look reasonable.

Then, solve the equation $y(t) = 0$ for the time when the projectile hits the ground. Use this time to find the range $x(t)$, and make a plot of the range versus either $\theta$ for a fixed $h$, or versus $h$ for a fixed $\theta$. In fact, it would be most slick if you used **Manipulate** to allow the fixed value to be easily changed.

Send the grader an email with your notebook as an attachment.