

Maximizing the Range of a Projectile

Recall after eliminating t we have

$$y = \tan(\theta) \cdot x - \frac{g \cdot x^2}{2 \cdot v_0^2 \cdot \cos^2(\theta)}$$

$x := 0..FRAME$ $v_0 := 100$ $g := 32$

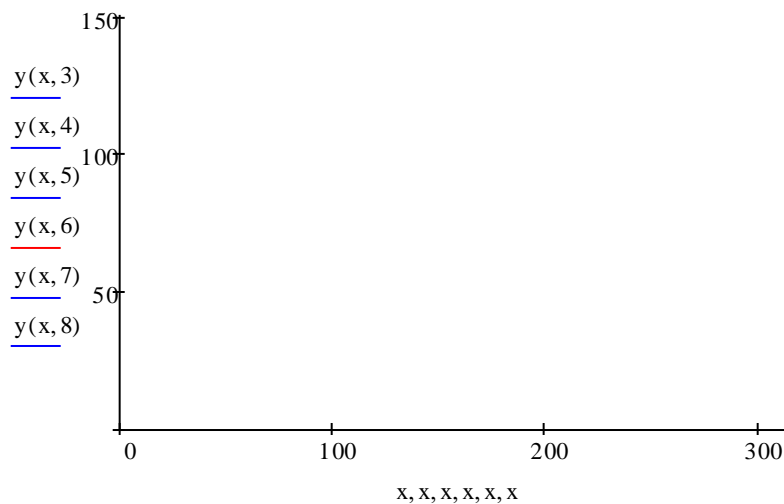
So we can plot the trajectories for several initial angles θ we define:

$$y(x, n) := \tan\left(\frac{n \cdot \pi}{24}\right) \cdot x - \frac{1}{2} \cdot \frac{g \cdot x^2}{v_0^2 \cdot \cos\left(\frac{n \cdot \pi}{24}\right)^2}$$

Since we have determined the max trajectory occurs when $\theta = \pi/4$ we plot $y(x, 6)$ in red and all others in blue

To determine the number of frames solve for the maximum range:

$$\tan\left(\frac{\pi}{4}\right) \cdot x - \frac{1}{2} \cdot \frac{g \cdot x^2}{v_0^2 \cdot \cos\left(\frac{\pi}{4}\right)^2} = 0 \quad \text{with solutions } x = \frac{v_0^2}{g} = 312.5 \quad \text{So use 313 frames}$$



When we add a ramp we add the function $y_1(t) := \frac{t}{4}$ and change Trace 7 from lines to bars
Here the maximum occurs for $y(x,7)$ so we put it in red. We cut the number of frames to 245.

