Maximizing the Range of a Projectile

Recall after eliminating t we have

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

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

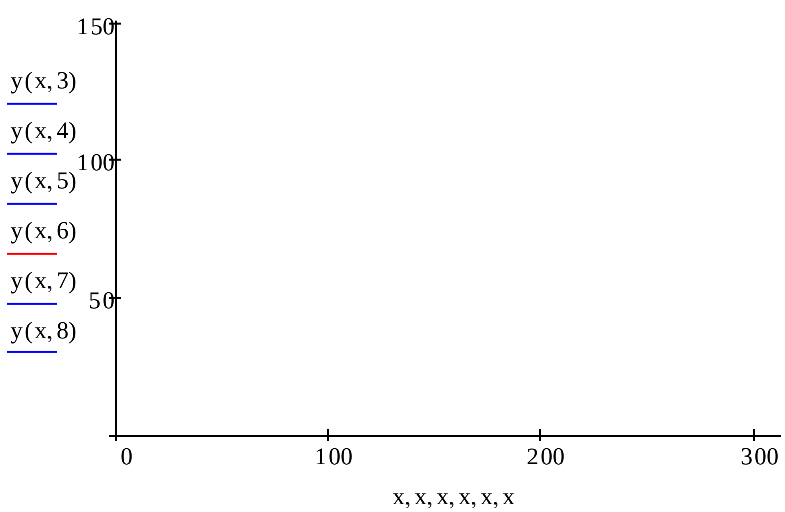
So we can plot the trajectories for several initial angles θ we define:

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

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

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

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



When we add a ramp we add the function $y1(t) := \frac{t}{4}$ 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.