

# Projectile Motion

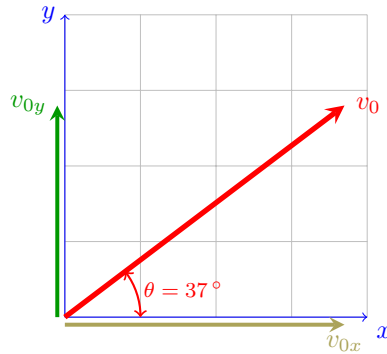
Motion of object with  $x$ -component and  $y$ -component which are independent of each other. Can be described with parametric equations ( $x = f(t)$  and  $y = f(t)$ ). Initial velocity is:

$$\vec{v}_0 = v_{0x}\hat{i} + v_{0y}\hat{j}$$

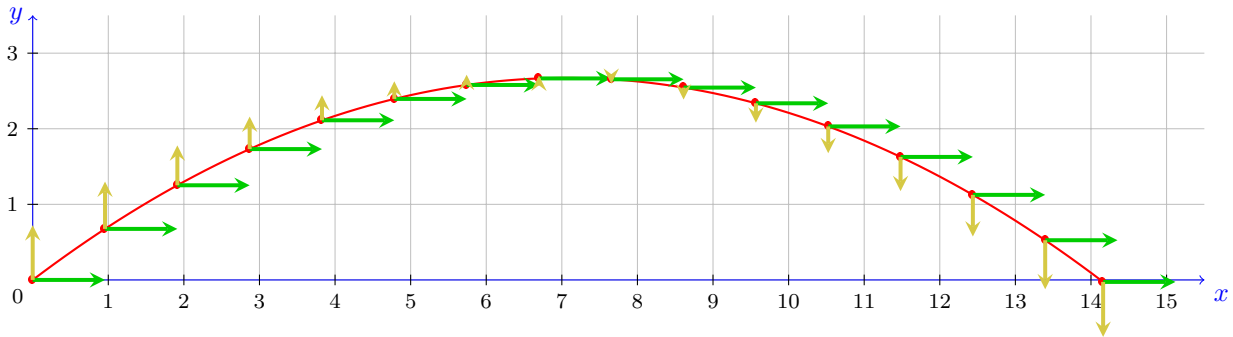
and  $x$ - and  $y$ -components are

$$v_{x0} = v_0 \cos \theta_0 \text{ and } v_{y0} = v_0 \sin \theta_0$$

where  $\theta_0$  is the angle between  $v_0$  and the positive  $x$  direction.



Motion is split into  $x$ -component and  $y$ -component. Typically,  $x$  is horizontal (no acceleration) and  $y$  is vertical (acceleration due to gravity,  $a = -9.81 \text{ m/s}^2$ ). If  $v_0 = 12 \text{ m/s}$  and  $\theta = 37^\circ$ , the motion is:



where the arrows represent the **velocity** in the  $x$ - and  $y$ -directions. The parametric equations for **position vs. time** are:

$$\vec{x} = (12 \cos \theta_0)t$$

and

$$\vec{y} = (12 \sin \theta_0)t - \frac{1}{2} \cdot 9.81t^2$$

where  $\theta_0 = 37^\circ$

This is the same image but with different code. This code requires the pgfplots package while the first only requires tikz.

