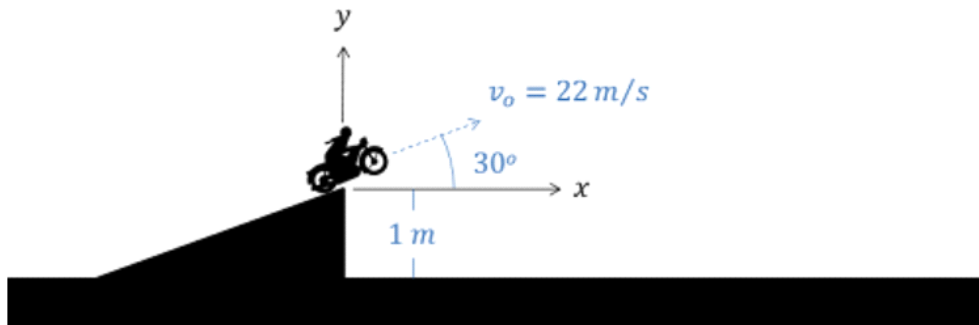# Question 1:

A motorcycle drives off a one meter tall ramp at an angle of 30 degrees as shown below. Determine the equations for the acceleration, velocity, and position over time. How far does the motorcycle in the x direction before hitting the ground?

$v_o = 22\,m/s$

30°

$1\,m$

$\text{acc} \qquad \ddot{x}(t) = 0 \qquad\qquad\qquad \ddot{y}(t) = -9.81$

$\text{Vel} \qquad \dot{x}(t) = 22\cos(30) \qquad\qquad \dot{y} = -9.81\,t + 22\sin(30)$

$\text{pos} \qquad x(t) = 22\cos(30)\,t + \dot{x} \qquad y(t) = \dfrac{-9.81}{2}\,t^2 + 22\sin(30)\,t + 1$
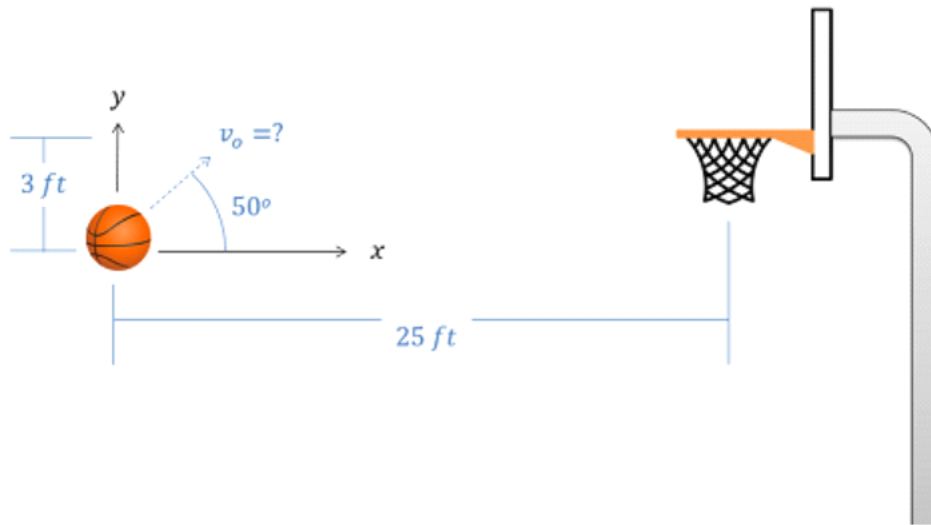
find when $y = 0$

$$0 = -\frac{9.81}{2}\,t^2 + 11\,t + 1$$

$$t = 2.33s$$

$$x(2.33) = 22\cos(30)\,(2.33) = \boxed{44.4\,m}$$

Question 2:

A basketball is thrown towards as hoop that is three feet higher in the y direction and 25 feet away in the x direction. If the ball is thrown at an initial angle of 50 degrees, what must the initial velocity be for the ball to make it into the hoop?

$$\text{acc} \qquad \ddot{X}(t) = 0 \qquad\qquad\qquad \ddot{y}(t) = -32.2$$

$$\text{vel} \qquad \dot{X}(t) = V_o \cos(50) \qquad\qquad \dot{y}(t) = -32.2t + V_o \sin(50)$$

$$\text{pos} \qquad X(t) = V_o \cos(50)t + \cancel{\dot{X}} \qquad\qquad y(t) = -\frac{32.2}{2}t^2 + V_o \sin(50)t + \cancel{\dot{X}}$$

$$\text{at } t' \qquad x = 25 \qquad y = 3$$

$$25 = V_o \cos(50)t' \qquad\qquad 3 = -\frac{32.2}{2}t'^2 + V_o \sin(50)t'$$

$$\downarrow$$

$$t' = \frac{25}{V_o \cos(50)}$$

$$3 = -\frac{32.2}{2}\left(\frac{25}{V_o \cos(50)}\right)^2 + V_o \sin(50)\left(\frac{25}{V_o \cos(50)}\right)$$

$$3 = -24354 \left(\frac{1}{V_o^2} \right) + 29.7938$$

$$V_o = \sqrt{\frac{-24354}{-26.7938}} \quad = \boxed{30.1487 \ ft/s}$$