


# PARAMETRIC EQUATIONS

Equations that describe the horizontal & vertical motion of an object in terms of time.

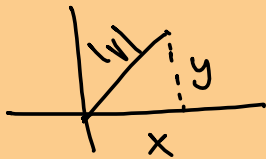
$100 \text{ ft/s}$   
 $|v|$   
 $\theta$



$$h(t) = \frac{1}{2}at^2 + v_0t + S_0$$

$a = 9.8 \text{ m/s}^2$   
 $a = -32 \text{ ft/s}^2$

velocity



$$x = |v| \cos \theta$$

$$y = |v| \sin \theta$$

$$x_t = |v|t \cos \theta$$

$$y_t = \frac{1}{2}at^2 + |v|t \sin \theta + S_0$$

Tiger estimates the distance to the pin to be 220 yds. His swing will produce an initial velocity of 160 ft/s at an angle of  $28^\circ$ . Will the ball land in the hole?

$$x_t = v t \cos \theta$$

$$y_t = \frac{1}{2} a t^2 + v t \sin \theta + s_0$$

$$x_t = 160 t \cos 28^\circ$$

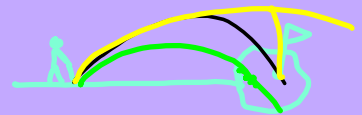
$$y_t = -16 t^2 + 160 t \sin 28^\circ + 0$$

$$\frac{660}{160 \cos 28^\circ} = \frac{160 t \cos 28^\circ}{160 \cos 28^\circ}$$

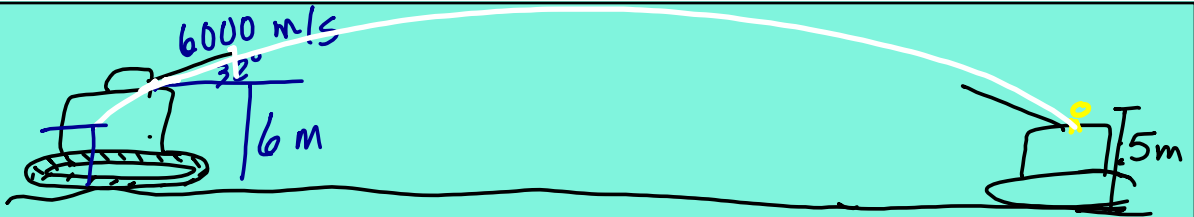
$$4.7 \text{ sec} = t$$

$$y_t = -16(4.7)^2 + 160(4.7) \sin 28^\circ$$

$$y = -0.39 \text{ ft}$$



$$220 \text{ yd} = 660 \text{ ft}$$



How far from the enemy tank must he launch to hit the ninja?

$$x_t = 6000t \cos 32^\circ$$

$$y_t = \frac{1}{2}(-9.8)t^2 + 6000t \sin 32^\circ + 6$$

$$= -4.9t^2 + 6000t \sin 32^\circ + 6$$

$$5 = -4.9t^2 + 6000t \sin 32^\circ + \frac{6}{5}$$

$$0 = -4.9t^2 + 6000t \sin 32^\circ + 1$$

$$t = \frac{-6000 \sin 32^\circ \pm \sqrt{(6000 \sin 32^\circ)^2 - 4(-4.9)(1)}}{2(-4.9)}$$

$$t = 648.9 \text{ sec}$$

$$x_t = 6000(648.9) \cos 32^\circ = 3,301,790 \text{ m}$$

