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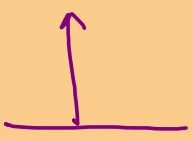
PARAMETRIC EQUATIONS

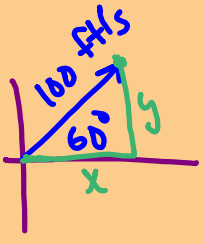
Equations that describe the horizontal & vertical motion of an object in terms of time.

$$h(t) = \frac{1}{2}at^2 + V_0t + S_0$$

- $h(t)$: height
- t: time
- a: acceleration of gravity
- V_0: initial velocity
- S_0: initial position

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





$$x = |v|t\cos\theta$$
$$y = |v|t\sin\theta$$

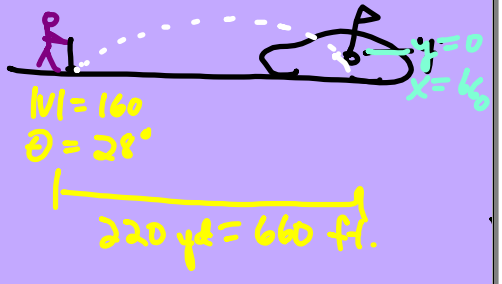
$$x_t = |v|t\cos\theta$$
$$y_t = \frac{1}{2}at^2 + |v|t\sin\theta + S_0$$

Derek 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°. Will the ball land in the hole?

$x_t = 160t\cos 28°$

$y_t = \frac{1}{2}(-32)t^2 + 160t\sin 28° + 0$

$y_t = -16t^2 + 160t\sin 28°$

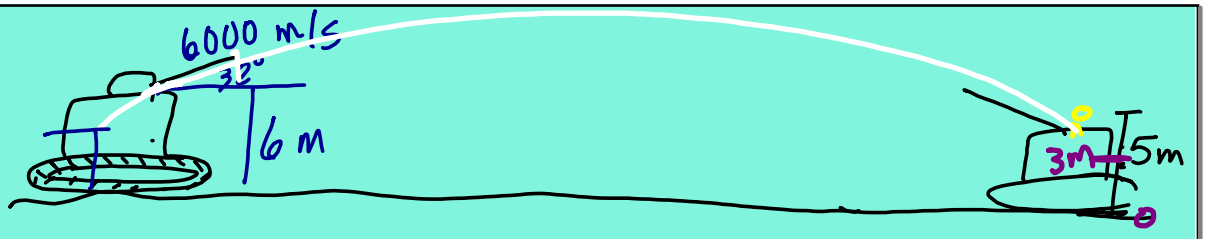


$\frac{660}{160\cos 28°} = \frac{160t\cos 28°}{160\cos 28°}$

$4.7 \text{ sec} = t$

$y = -16(4.7)^2 + 160(4.7)\sin 28°$

$y = -0.39$



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

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

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

$$3 = -4.9t^2 + 6000t\sin 32^\circ + 6$$

$$0 = -4.9t^2 + 6000t\sin 32^\circ + 3$$

$$t = \frac{-6000\sin(32) \pm \sqrt{(6000\cdot\sin(32))^2 - 4(-4.9)(3)}}{2(-4.9)}$$

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

$$X_t = 6000(648.9)\cos 32^\circ$$

$$= 3301790 \text{ m}$$

$$\approx 3302 \text{ Km}$$

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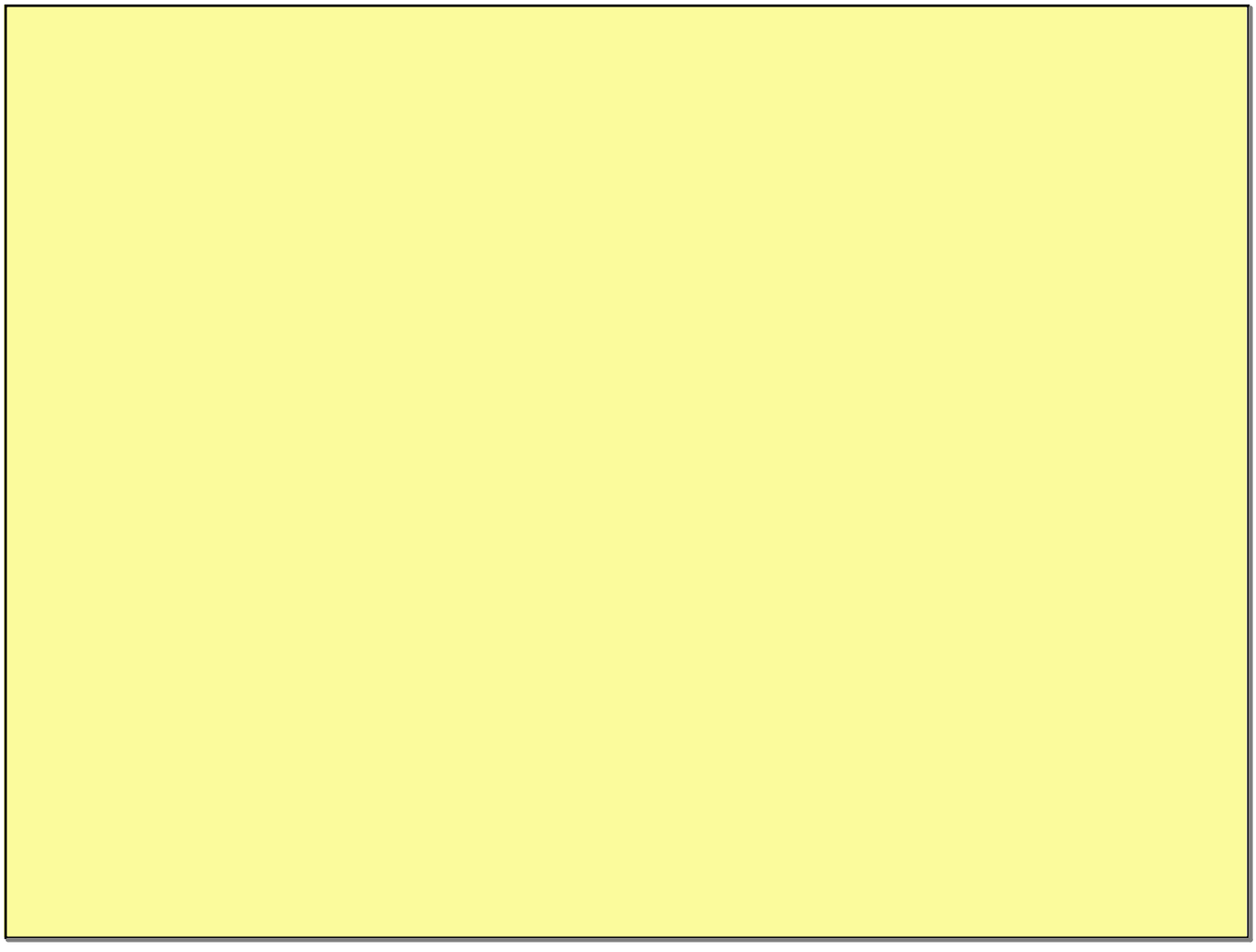

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