Parametric Equations

(projectile motion)

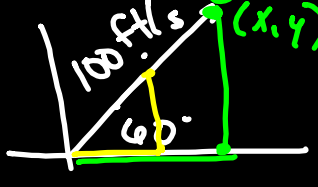
equations that describe the horizontal & vertical motion of an object in terms of time

$$h(t) = \frac{1}{2}at^2 + V_0 t + S_0$$

- $\frac{1}{2}at^2$: accel. of gravity
- $V_0 t$: initial velocity
- S_0: initial position

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

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



$$x = r\cos\theta$$

$$x = 100t\cos\theta$$

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

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

Garrett 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?

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

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

$x_t = 160 t \cos 28°$

$y_2 = \frac{1}{2}(-32) t^2 + 160 t \sin 28° + 0$

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

$4.7 \text{ sec} = t$

$y = -16(4.7)^2 + 160(9.7)\sin 28°$

$= -0.39 \text{ ft}$

No, not in the hole

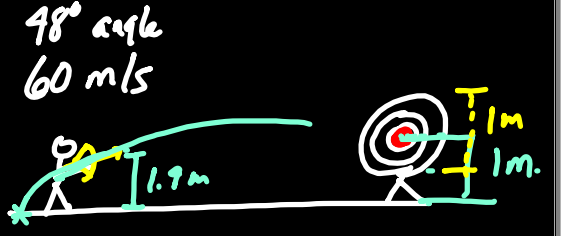
$x_t = 60t\cos 48^\circ$

$y_t = \frac{1}{2}(-9.8)t^2 + 60t\sin 48^\circ + 1.4$

Ian

$1 = -4.9t^2 + 60t\sin 48^\circ + 1.4$

$0 = -4.9t^2 + 60t\sin 48^\circ + 0.4$



Where should he set the target in order to hit the bullseye?

$$t = \frac{-60\sin 48^\circ \pm \sqrt{(60\sin 48^\circ)^2 - 4(-4.9)(0.4)}}{2(-4.9)}$$

$t = -0.009 \qquad t = 9.1$ sec

$x = 60(9.1)\cos 48^\circ = \boxed{365\text{ m}}$