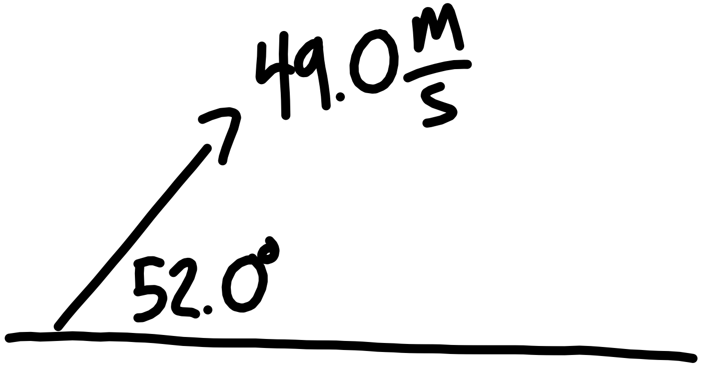
①



$$v_f = v_i + at$$

$$d = v_i t + \frac{1}{2}at^2$$

$$v_f^2 = v_i^2 + 2ad$$

$$V_{iy} = V_i \sin\theta$$

$$V_{ix} = V_i \cos\theta$$

$$V_{iy} = \boxed{38.6\ \frac{m}{s}}$$ 1

$$V_{ix} = 30.2\ \frac{m}{s}$$

a) Y

at top (→ 0)

$V_{fy} = V_{iy} + at$

$0 = V_{iy} + at$

$-V_{iy} = at$

$\frac{-V_{iy}}{a} = t$ → $\frac{-38.6}{-9.81} = t$ (2)

$3.94\,s = t$

↳ time to top

$\times 2 = 7.88\,s = t_{total}$ (3)

X

$$d_x = v_{ix} t + \frac{1}{2} a t^2 \quad (a \to 0)$$

$$d_x = v_{ix} t$$

$$d_x = (30.2)(7.88) = \boxed{238\text{ m}}$$

4

b) $\underline{y}$

at top → 0

$$v_{fy}^2 = v_{iy}^2 + 2ad_y$$

$$0 = v_{iy}^2 + 2ad_y$$

$$-v_{iy}^2 = 2ad_y$$

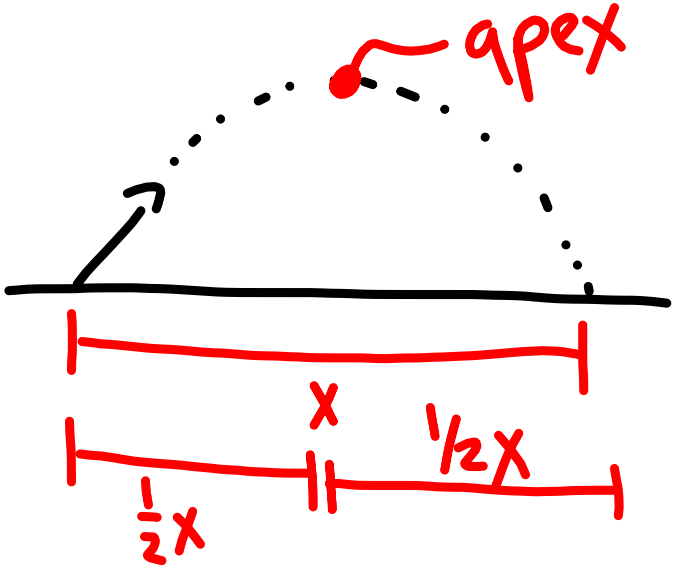
$$\frac{-v_{iy}}{2a} = d_y$$

$$\frac{-38.6}{2(-9.81)} = d_y$$

$$\boxed{76.0\,m = d_y}$$

c) $-49.0 \frac{m}{s}$

45° Max Range Proof



y

at

apt $\cancel{V_f} \to 0$ $= V_{i_y} + at$

$\hookrightarrow$

$0 = V_i \sin\theta + at$

$\hookrightarrow -g$

$0 = v_i \sin\theta - gt$

$-V_i \sin\theta = -gt$

X

$$d_x = V_{ix}t + \frac{1}{2}at^2$$

0 accel

$$d_x = V_i \cos\phi \, t$$

$$\frac{d_x}{V_i \cos\phi} = t$$

$$V_i \sin\phi = g \frac{d_x}{V_i \cos\phi}$$

$$V_i \sin\phi \, V_i \cos\phi = g d_x$$

we found t at apex

$$\frac{2 V_i^2 \sin\phi \cos\phi}{g} = d_x$$

$$\frac{V_i^2 \, 2\sin\phi\cos\phi}{g} = d_x \quad \rightarrow \quad \sin 2\phi$$

$2(45°)$

$$d_x = \frac{V_i^2 \sin 2\phi}{g} \quad \rightarrow$$