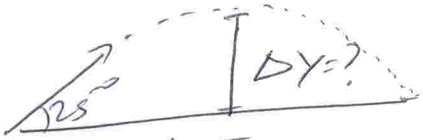
# Projectiles at an angle - Section



#2 Use your Projectile Motion Notes w/s to guide you through these problems.

- Find $V_i$ of projectile to solve for $V_{i,y}$.
- Use Range (R) or $\Delta x$ formula to solve for $V_{initial}$

$$\Delta x = \frac{V_i^2 \cdot \sin \cdot 2(\theta)}{|g|}$$ ← absolute




301.5 m

**given data**

$\Delta x = 301.5$

$\theta = 25°$

$g = -9.81 m/s^2$

$V_{f,y} = 0 m/s$

$\Delta y\ max = ?$

$[V_i = 62.14 m/s]$

$$\Delta x = \frac{V_i^2 \cdot \sin 2 \cdot \theta}{|g|}$$

TIP: students forget to multiply by 2.

$$301.5m = \frac{V_i^2 \cdot \sin \cdot 2 \cdot (25°)}{9.8 m/s^2}$$

$$301.5m = \frac{V_i^2 \cdot \sin(50)}{9.8 m/s^2}$$

$$\frac{(9.8 m/s^2)(301.5m)}{\sin(50°)} = V_i^2$$

Tip: Check to see if calc. is in degrees.

$$\sqrt{3861.02} = \sqrt{V_i^2}$$ ← square root.

$[V_i = 62.14 m/s]$ → problem continued

#2 cont. <u>Projectiles at an angle</u>

use $V_i$ to solve for $V_{i,y}$

<u>How?</u>

Use trig to break into components

$V_{i,y} = R \cdot \sin\theta$
(hyp)

$V_{i,y} = 62.14 \cdot \sin 25^\circ$

$V_{i,y} = 26.26\ m/s$ ← This will allow you to calculate for $\Delta y$

• Look at <u>notes #3</u> on <u>projectile section</u> to solve for <u>Max Height</u>.

assume $V_{f,y} = 0\ m/s$

* use formula $V_{f,y}^2 = V_{i,y}^2 + 2g(\Delta y)$

$0 = (26.25\ m/s)^2 + 2(-9.81\ m/s^2)\Delta y$

$-689.06\ m^2/s^2 = -19.62\ m/s^2(\Delta y)$

$[\Delta y = 35.12\ m]$ whew!....

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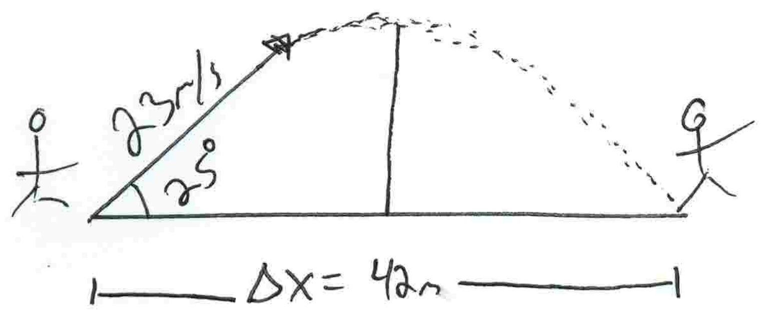



$V_i = 23m/s$

$\theta = 25°$

$\Delta x = 42m$

$\Delta y = ?$

$\Delta t = ?$

Step 1 decompose $V_i$ into components ($V_{i,y}$)

$V_{i,y} = R \cdot \sin\theta$

$V_{i,y} = 23m/s \cdot \sin(25)°$

$V_{i,y} = 9.72 m/s$

Step 2 - use $V_{i,y}$ to solve for $\Delta t$ + $\Delta y$ (look at formula chart)

• ~~$V_{f,y} = V_{i,y} + g\Delta t$~~ or $\Delta t = -2V_{i,y}/g$

#3 continued on next page.

# Projectiles Launched at an Angle



$V_{i,y} = 9.72\,m/s$

$\Delta t = \frac{-2\,v_{i,y}}{g}$ ← Solve for $\Delta t$

$\Delta t = \frac{-2(9.72\,m/s)}{-9.81\,m/s^2}$

$[\Delta t = 1.98\,s]$

## Max height ($\Delta y$)

$V_{f,y} = 0$ $\quad V_{f,y}^2 = V_{i,y}^2 + 2g(\Delta y)$

$0 = (9.72\,m/s)^2 + 2(-9.8\,m/s^2)\Delta y$

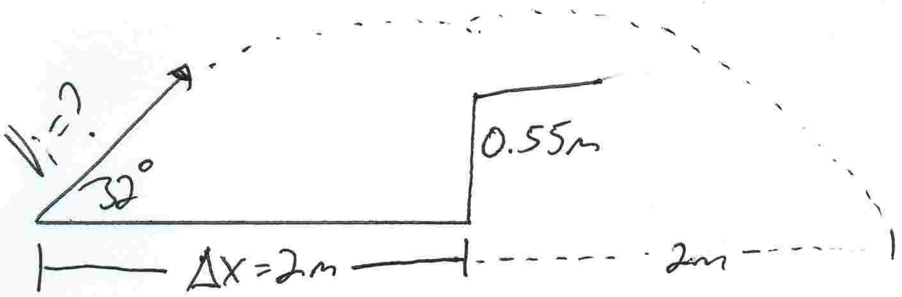
$0 = 94.48\,m^2/s^2 + (-19.62\,m/s^2)\Delta y$

÷ divide

$-94.48\,m^2/s^2 = -19.62\,m/s^2(\Delta y)$

$[\Delta y = 4.82\,m]$

# #4. Projectile motion at an angle




$$\Delta x = \frac{V_i^2 \cdot \sin 2(\theta)}{|g|}$$

*The reason we use 4m for $\Delta x$ is because 2m is only half of the Range. Look at diagram.

$$4m = \frac{(V_i^2) \cdot \sin \cdot 2 \cdot (32^\circ)}{9.8 m/s^2}$$

$$4m = \frac{(V_i^2) \cdot \sin(64^\circ)}{9.8 m/s^2}$$

$$(4m)(9.8 m/s^2) = V_i^2 \cdot \sin(64^\circ)$$

$$39.24 m^2/s^2 = (V_i^2) \cdot \sin(64^\circ)$$

$$\frac{39.24 m^2/s^2}{\sin(64^\circ)} = V_i^2$$

$$\sqrt{43.66} = \sqrt{V_i^2}$$ *square root

$$[V_i = 6.6 m/s]$$