

Projectiles

- Projectile motion is a combination of horizontal and vertical motion
- Assume zero air resistance
- Horizontal velocity is constant
- Vertical acceleration is constant

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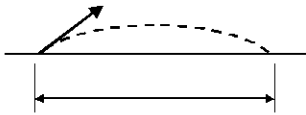
Equations

- Use same equations as for rectilinear motion
- Typically solve for time in the air, then solve for horizontal distance, maximum height, or initial velocity

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Sample Problem

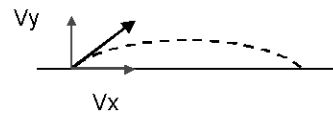
- A ball is shot from a tube at an initial velocity of 88 ft/s @ 30°. How high and how far will it go?



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Determine Velocity Components

- $V_x = 88 \text{ ft/s} \times \cos 30^\circ$
- $V_y = 88 \text{ ft/s} \times \sin 30^\circ$



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Determine Time of Flight

- Determine when $s = \text{zero}$ (hits ground) in the vertical mode.

$$s_y = v_y t + \frac{1}{2} a t^2$$

$$0 = (88 \text{ ft/s} \cdot \sin 30^\circ) t - \frac{1}{2} (32.2 \text{ ft/s}^2) t^2$$

$$0 = (44 \text{ ft/s}) t - (16.1 \text{ ft/s}^2) t^2$$

$$t = 0 \text{ and } t = 2.7 \text{ sec}$$

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Determine Horizontal Distance

- Note: horizontal travel is at a constant velocity

$$s_x = s_0 + v_x t$$

$$s_x = 0 + [(88 \text{ ft/s}) \cos 30^\circ] \times 2.7 \text{ sec}$$

$$s_x = 206 \text{ ft.}$$

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Maximum Altitude

- Maximum height occurs when vertical velocity = zero
- Need to find time to reach maximum altitude (half of total time)
- Then solve for vertical distance

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Solved Equations

$$v = v_0 + at$$

$$0 = (88 \text{ ft/s} \times \sin 30) - (32.2 \text{ ft/s}^2)t$$

$$t = 1.37 \text{ sec}$$

$$s_y = s_0 + v_y t + \frac{1}{2} at^2$$

$$s_y = 0 + (44 \text{ ft/s} \times 1.37 \text{ s}) - (16.1)(1.37)^2$$

$$s_y = 30 \text{ ft}$$

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Week 3 Homework

- Chapter 10
- Problems: 33, 37, 40, 41, & 44
- Read Chapter 11
–Sections 11-1 thru 11-5

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