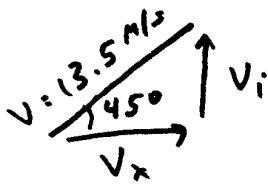


120921 Traditional HW Quiz - Class Practice problems

Key

1. Emily can kick a soccer ball at 30 mph (13.5 m/s). How far can she kick it assuming it's a projectile?



$$\Delta x = ?$$

$$V_x = 13.5 \cos 45 = 9.55 \text{ m/s}$$

$$t = ?$$

$$\Delta y = 0$$

$$V_i = +9.55 \text{ m/s}$$

$$V_f = -9.55$$

$$a = -9.8$$

$$t = ?$$

$$a = \frac{\Delta v}{\Delta t}$$

$$-9.8 = \frac{-19.10}{\Delta t}$$

$$\Delta t = 1.95$$

$$\Delta x = V_x t = 9.55 (1.95) = \underline{18.6 \text{ m}}$$

2. Emily launches a soccer ball off of platform 20 m in the air, kicking it from the base of the platform. She kicks it as hard as she can to get it to go as far as she can.

- a. How far will the ball land from the base of the platform? (Some v 's before)

$$\Delta y = -20$$

$$V_i = +9.55$$

$$V_f = \text{frown}$$

$$a = -9.8$$

$$t = ?$$

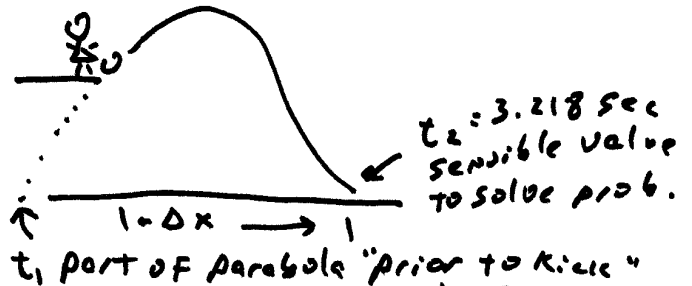
$$\Delta y = V_i t + \frac{1}{2} a t^2$$

$$-20 = 9.55t - 4.9t^2$$

$$4.9t^2 - 9.55t - 20 = 0$$

Quad. EQN: $a = 4.9$
 $b = -9.55$
 $c = -20$

$$t_1 = -1.269, t_2 = 3.218$$



- b. What is its landing velocity?

$$\Delta x = V_x \cdot t = 9.55 \text{ m/s} (3.218 \text{ s}) = \underline{30.7 \text{ m}}$$

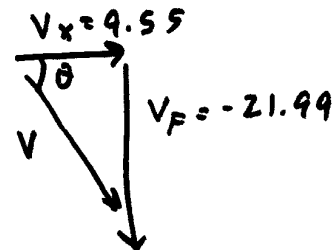
$$V_f = V_i + a \Delta t$$

$$V_f = +9.55 + (-9.8)(3.218) = -21.99 \text{ m/s}$$

$$V = \sqrt{9.55^2 + 21.99^2} = 23.97 \text{ m/s}$$

$$\theta = \tan^{-1} \left(\frac{21.99}{9.55} \right) = 66.5^\circ$$

$\vec{V} = 23.97 \text{ m/s } 66.5^\circ \text{ below the horizon}$



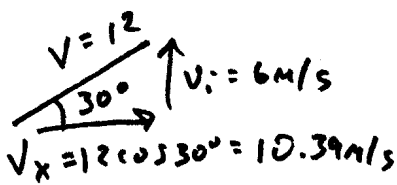
- c. How fast will it be going when it lands?

23.97 m/s

120921TraditionalHWQuiz - Projectile Problems

1. Sam throws a ball 30° above horizontal at a speed of 12 m/s and from an initial height of 1.5 m above the ground.

a. How far will the ball go horizontally before reaching the ground?



$$\Delta y = -1.5 \quad \text{Quad Eqn: } 4.9t^2 - 6t - 1.5 = 0$$

$$v_i = 6 \quad a = 4.9 \quad b = -6 \quad c = -1.5$$

$$v_f = ? \quad t = -.213 \text{ sec}, 1.437 \text{ sec}$$

$$a = -9.8 \quad \Delta x = v_x t = 10.39(1.437) = \underline{14.9 \text{ m}}$$

$$t = ?$$

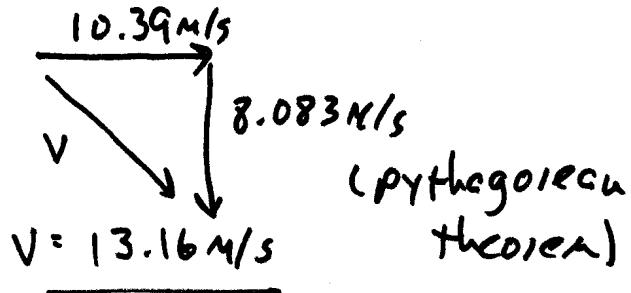
$$-1.5 = 6t - 4.9t^2$$

b. How fast will the ball be going when it reaches the ground?

$$v_f = v_i + at$$

$$v_f = 6 + (-9.8)(1.437)$$

$$v_f = -8.083 \text{ m/s}$$



2. A projectile is aimed directly upward and reaches a height of 30 m. What's the maximum range for this projectile?

$$v_i = 0 \quad \Delta y = -30$$

$$v_f = ? \quad v_i = 0$$

$$a = -9.8 \quad v_f = ?$$

$$t = ?$$

$$v_f^2 = v_i^2 + 2a\Delta y$$

$$v_f^2 = 2(-9.8)(-30)$$

$$v_f = 24.25 \text{ m/s}$$

Launcher shoots at 24.25 m/s, for max range direct it at 45° angle:

$$\Delta y = 0 \quad v_i = +17.15$$

$$v_f = -17.15$$

$$a = -9.8$$

$$t = ?$$

$$a = \frac{\Delta v}{\Delta t} \quad -9.8 = \frac{v_f - v_i}{\Delta t} = \frac{-34.30}{\Delta t}$$

$$\Delta t = 34.30 / 9.8 = 3.50 \text{ sec}$$

$$\Delta x = v_x t = 17.15(3.5) = \underline{60.0 \text{ m}}$$