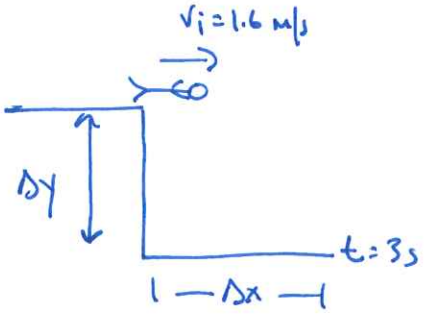
Name: Solutions Date: Pd:

Accelerated Physics

Mr. Roberts

Projectile Motion – Case 1 (object launched horizontally) Practice Problems

A diver running 1.6 m/s dives out horizontally from the edge of a vertical cliff and reaches the water below 3 seconds later. How high was the cliff and how far from its base did the diver hit the water?



$v_{ix} = \frac{\Delta x}{t}$

$1.6 = \frac{\Delta x}{3}$

$\Delta x = (3)(1.6)$

$\boxed{\Delta x = 4.8 \text{ m}}$

$\Delta y = v_{iy}^{0} t + \frac{1}{2} a_y t^2$

$\Delta y = \frac{1}{2}(-9.8)(3)^2$

$\boxed{\Delta y = 44.1 \text{ m}}$

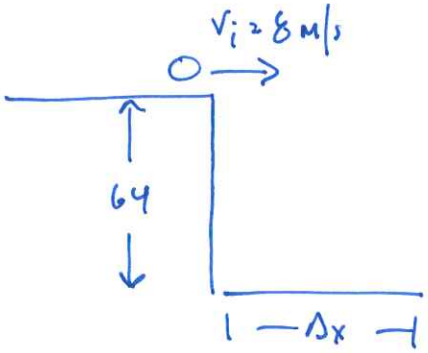
$v_{ix} = 1.6$ m/s $\quad v_{iy} = 0$

$a_x = 0 \quad a_y = -9.8$ m/s^2

$\Delta x = ? \quad \Delta y = ?$

$t = 3$

1. You accidentally throw your car keys horizontally at 8.0 m/s from a cliff 64 meters high. How far from the base of the cliff should you look for the keys?



Find Time

1) $\Delta y = v_{iy}^{0} t + \frac{1}{2} a_y t^2$

$-64 = \frac{1}{2}(-9.8) t^2$

$\frac{-128}{-9.8} = t^2$

$\boxed{t = 3.61 \text{s}}$

2) Find Δx

$v_{ix} = \frac{\Delta x}{t}$

$8 = \frac{\Delta x}{3.61}$

$\boxed{\Delta x = 28.91 \text{ m}}$

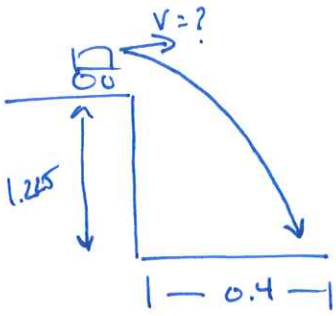
$v_{ix} = 8$ m/s $\quad v_{iy} = 0$

$\Delta x = ? \quad \Delta y = -64$

$a_x = 0 \quad a_y = -9.8$

$t = ?$

2. A toy car runs off the edge of a table that is 1.225 meters high. The car lands 0.400 meters from the base of the table.
   a. How long did it take the car to fall?
   b. How fast was the car going on the table before it went off the edge?



$\Delta y = -1.225$ $\Delta x = 0.4$

$v_{iy} = 0$ $v_{ix} = ?$

$a_y = -9.8$ $a_x = 0$

$t = ?$

A) $\Delta y = v_{iy}^{\,0} t + \frac{1}{2} a_y t^2$

$-1.225 = \frac{1}{2}(-9.8)\, t^2$

$\frac{-2.45}{-9.8} = t^2$

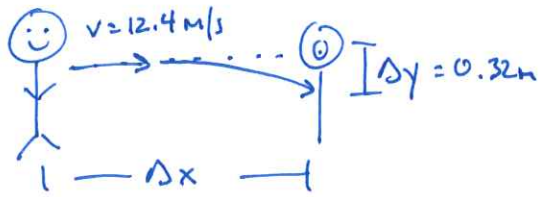
$t = 0.5\ s$

B) $v_{ix} = \frac{\Delta x}{t}$

$v_{ix} = \frac{0.4}{0.5}$

$v_{ix} = 0.8\ m/s$

3. A dart player throws a dart horizontally at 12.4 m/s. The dart hits the board 0.32 m/s below the height from which it was thrown.
   a. How long is the dart in the air?
   b. How far away is the player from the board?



$v_{ix} = 12.4\ m/s$ $v_{iy} = 0$

$a_x = 0$ $a_y = -9.8\ m/s^2$

$\Delta x = ?$ $\Delta y = -0.32$

$t = ?$

A) $\Delta y = v_{iy}^{\,0} t + \frac{1}{2} a_y t^2$

$-0.32 = \frac{1}{2}(-9.8)\, t^2$

$\frac{-0.64}{-9.8} = t^2$

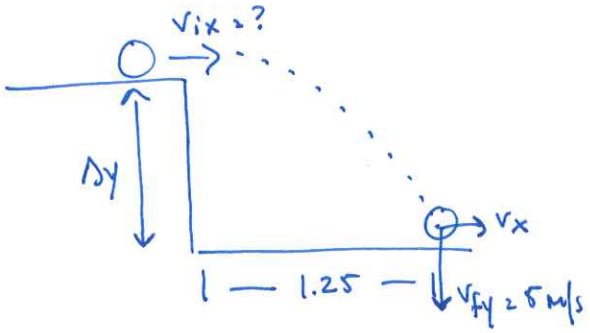
$t = 0.26\ s$

B) $v_{ix} = \frac{\Delta x}{t}$

$12.4 = \frac{\Delta x}{0.26}$

$\Delta x = 3.17\ m$

4. A ball is rolling towards the edge of a table and falls off. You witness this and observe the ball having a **vertical velocity** of 5 m/s when it hits the floor below 1.25 meters from the base of the table.
   a. How long did it take the ball to land?
   b. How tall is the table?
   c. How fast was the ball rolling before it fell off the edge?



$v_{iy} = 0$ $\quad v_{ix} = ?$

$v_{fy} = -5$ m/s $\quad \Delta x = 1.25$

$\Delta y = ?$ $\quad a_x = 0$

$a_y = -9.8$

$t = ?$

B) $v_{fy}^2 = v_{iy}^2 + 2 a_y \Delta y$

$(-5)^2 = 0^2 + 2(-9.8)\Delta y$

$25 = -19.6\,\Delta y$

$\Delta y = -1.26$ m

or

1.26 m tall

c) $v_{fy} = v_{iy} + a_y t$

$-5 = 0 + (-9.8)t$

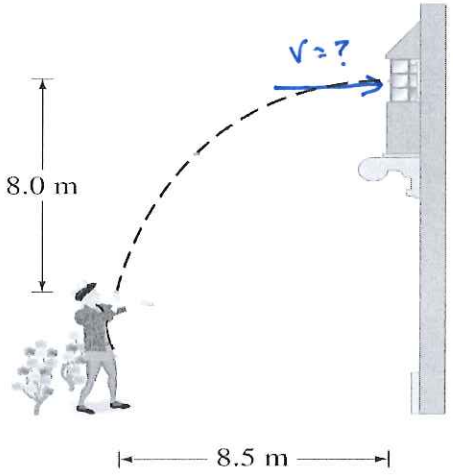
$\boxed{t = 0.51\text{ s}}$

A) $v_{ix} = \dfrac{\Delta x}{t}$

$v_{ix} = \dfrac{1.25}{0.51}$

$\boxed{v_{ix} = 2.45\text{ m}}$

5. Romeo is chucking pebbles gently up to Juliet's window, and he wants the pebbles to hit the window with only a horizontal component of velocity. He is standing at the edge of a rose garden 8.0 meters below her window and 8.5 meters from the base of the wall. How fast are the pebbles going when they hit her window?



$\Delta y = 8$ m $\quad \Delta x = 8.5$ m

$v_x = ?$

1) Find time

$\Delta y = \cancel{v_i^{\,0}} t + \frac{1}{2} a_y t^2$

$-8 = \frac{1}{2}(-9.8)\,t^2$

$t = 1.28$ s

$v_x = \dfrac{\Delta x}{t}$

$v_x = \dfrac{8.5}{1.28}$

$\boxed{v_x = 6.65\text{ m/s}}$

Typically down is the negative direction, here we can say up is negative and calculate normally.