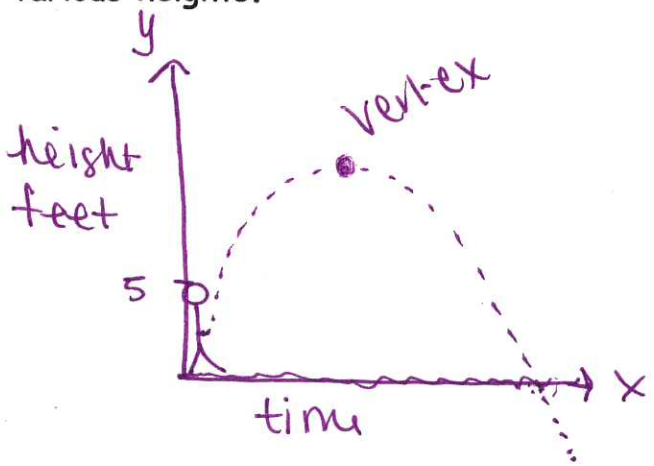
	Name:	Date: 1/2
	Topic/Objective: Projectile Motion	Class/Period:

Questions/Main Ideas:	Notes:
Projectile Motion	Defined as: A form of motion in which an object is thrown or dropped.
The Equation:	$h(t) = -16t^2 + vt + s$ t = time in seconds v = initial speed (velocity) s = initial height (feet)
Uses for the model	If we are given the initial velocity (or speed) of the object and the height (or position) at which the object is launched or dropped, we can use this model to determine how long it takes for the object to reach various heights.

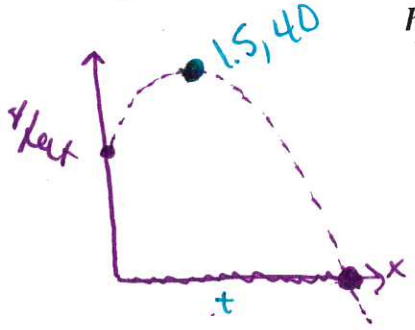


Solving projectile motion problems:

Hint: Draw a picture AND use previously learned knowledge!

A person is launched from 4 feet high off the cliff at a speed of 48 feet per second. Their projectile motion is represented by the following function

$$h = -16t^2 + 48t + 4$$



(2) What is the maximum height that the person reaches?

$h = -16(1.5)^2 + 48(1.5) + 4$

$h = -16(2.25) + 72 + 4$

$h = -36 + 76$

$h = 40$ feet

(1) How long will it take for the person to reach his maximum height?

$h = -16t^2 + 48t + 4$

$x = \frac{-b}{2a} = \frac{-48}{2(-16)} = \frac{-48}{-32} = 1.5$

$t = 1.5$ seconds

(3) The person landed in the water after how many seconds?

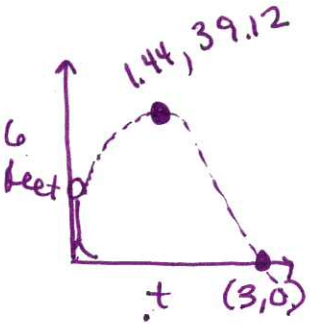
$x = \frac{-48 \pm \sqrt{(48)^2 - 4(-16)(4)}}{2(-16)}$

$x = \frac{-48 \pm \sqrt{2304 + 256}}{-32}$

$x = \frac{-48 \pm \sqrt{2560}}{-32} = \frac{-48 \pm 51}{-32} \rightarrow \frac{-48+51}{-32} = \frac{3}{-32} = -.09$

$\frac{-48-51}{-32} = \frac{-99}{-32} = 3.09$ sec.

Answer: 3.09 sec



An athlete throws a ball from an initial height of 6 feet and with an initial vertical velocity of 46 feet per second.

a. Write an equation that satisfies the scenario.

$h(t) = -16t^2 + 46t + 6$

b. How long did it take for the ball to reach its maximum height?

$x = \frac{-b}{2a} = \frac{-46}{2(-16)} = \frac{-46}{-32} = 1.44$ seconds

$t = 1.44$

c. What was the maximum height of the ball?

$h = -16(1.44)^2 + 46(1.44) + 6$

$h = -16(2.07) + 66.24 + 6$

$h = -33.12 + 72.24$

$h = 39.12$ feet

d. The ball landed on the ground after how many seconds?

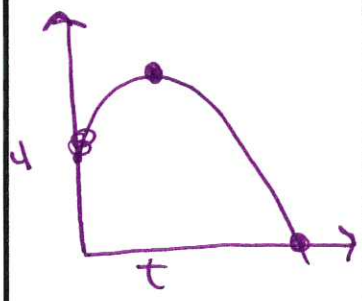
$x = \frac{-46 \pm \sqrt{2116 - 4(-16)(6)}}{-32}$

$x = \frac{-46 \pm \sqrt{2116 + 384}}{-32} = \frac{-46 \pm \sqrt{2500}}{-32}$

$x = \frac{-46 \pm 50}{-32} \Rightarrow \frac{-46+50}{-32} = \frac{4}{-32} = -.125$

$\Downarrow$

$\frac{-46-50}{-32} = \frac{-96}{-32} =$ 3 seconds



A toy rocket is launched up in the air with an initial velocity of 30 feet per seconds at 4 feet above ground.

a. Write an equation that represents the scenario.

$h(t) = -16t^2 + 30t + 4$

b. How long did it take for the rocket to reach its maximum height?

$t = x = \frac{-b}{2a} = \frac{-30}{-32} = .9375$ seconds

c. What was the highest point that the rocket reached?

$h = -16(.9375)^2 + 30(.9375) + 4$

$h = -14 + 28 + 4$

$h = 18$ feet

d. The rocket landed in the water after how many seconds?

$x = \frac{-30 \pm \sqrt{900 - 4(-16)(4)}}{-32}$

$x = \frac{-30 \pm \sqrt{1156}}{-32} = \frac{-30 \pm 34}{-32} \Rightarrow \frac{-30+34}{-32} = -.125$

$\frac{-30-34}{-32} = 2$

2 seconds