Quadratics 6 - Quadratic Application

Standards A-REI.4b, F-IF.9
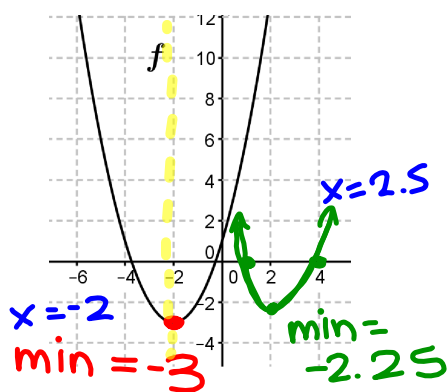
GLO: #3 Complex Thinker   **HW#1:** Quads 6 #1-5

Math Practice: Model with Mathematics

Learning Targets:
What are key words you should look for when solving Real-World quadratic problems and what do they mean?

Given the graph of the quadratic function f below and
$g(x) = 1(x-1)(x-4)$, select whether each statement is
True or False

f

$\min_f = -3$

$\min_g = -2.25$

$x_f = -2$

$x_g = 2.5$

x-int:
(1,0) & (4,0)

$x = 2.5$

$x = -2$
$\min = -3$

$\min = -2.25$

Statement	True	False
The minimum value for $f(x)$ is greater than the minimum value for $g(x)$. **vertex**		✓
The value of x when $f(x)$ is at its minimum is greater than the value of x when $g(x)$ is at its minimum.		✓
Both x-intercepts of $g(x)$ occur when x is less than zero.		✓
The line of symmetry of $f(x)$ is $x = -2$.	✓	

$g(x) = (x-1)(x-4)$

x-int: (1,0) (4,0)

vertex: (2.5, -2.25)

• $\dfrac{1+4}{2} = \dfrac{5}{2} = 2.5$

• $g(2.5) = (2.5-1)(2.5-4)$
  $= (1.5)(-1.5)$
  $= -2.25$

Key terms:
• line of symmetry
• minimum/maximum
  (vertex)
• x-intercept

Oct 16-12:01 PM

2

2. A ball is hit by a baseball player, and the height of the ball is given by the function $h(t) = -16t^2 + 58t + 3$ where $h(t)$ is the height of the ball (in feet), t seconds after the ball is hit.

a. What is the value of $h(0)$. What does this value represent in the context of the given situation?

y-int (c-value)

$h(0) = -16(0)^2 + 58(0) + 3$ (Calculate Value, x=0)

$\boxed{h(0) = 3}$ • At 0 seconds, the ball was 3 feet high.
  • The initial height of the ball was 3 feet.

b. What is the value of $h(1)$. What does this value represent in the context of the given situation?

$h(1) = -16(1)^2 + 58(1) + 3$ (Calculate Value, x=1)

$\qquad = -16 + 58 + 3$ At 1 second, the

$\qquad = 42 + 3$ ball will be

$h(1) = 45$ 45 feet high.

Oct 21-11:29 PM

3

2. A ball is hit by a baseball player, and the height of the ball is given by the function $h(t) = -16t^2 + 58t + 3$ where $h(t)$ is the height of the ball (in feet), t seconds after the ball is hit.

c. Determine the coordinates of the vertex (max) of $h(t)$ and interpret what these values mean in the context of the given situation. (Calculate Maximum)

vertex

$x : \dfrac{-b}{2a}$

$y :$

$(1.8, 55.6)$

At about 1.8 seconds the ball will reach its max height at about 55.6 feet.

d. Recall that an equation is actually asking you a question. Translate the equation $h(t) = 0$ into a question, and then explain what the answer to this question represents in the context of the given situation.

height = 0 feet   t = ?

• When will the ball hit the ground?

• At what time will the ball be 0 feet high?

Where is the x-int of the graph (when will ball hit ground)?
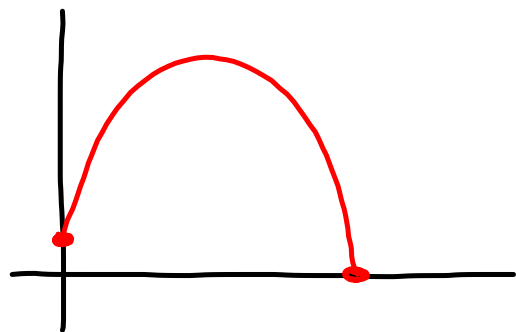
2. A ball is hit by a baseball player, and the height of the ball is given by the function $h(t) = -16t^2 + 58t + 3$ where $h(t)$ is the height of the ball (in feet), t seconds after the ball is hit.

e. Set up an equation and solve it using the quadratic formula, to determine the time, t, when the ball will hit the ground. Round your answer to the thousandths place.

$$t = ? \quad h(t) = 0 \text{ feet} \quad \text{(Calculate Zero)}$$

$$a = -16$$
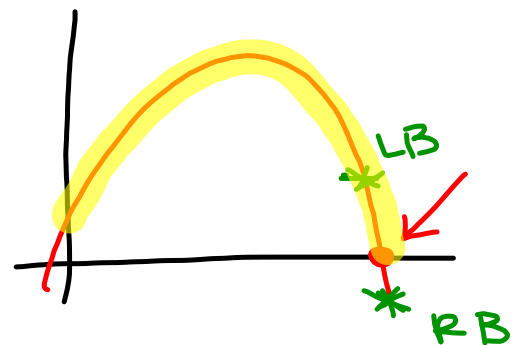$$0 = -16t^2 + 58t + 3 \quad b = 58$$
$$c = 3$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{-(58) \pm \sqrt{(58)^2 - 4(-16)(3)}}{2(-16)}$$

$$\vdots$$

$$t = 3.676 \text{ seconds}$$

The ball will hit the ground after about 3.676 seconds.

$$x = 3.7 \sim \quad y = 0$$

LB

RB

2. A ball is hit by a baseball player, and the height of the ball is given by the function $h(t) = -16t^2 + 58t + 3$ where $h(t)$ is the height of the ball (in feet), t seconds after the ball is hit.

f. After how many seconds was the baseball 40 ft above the ground? (Compare $y_2 = 40$, Calculate Intersect)

$h(t) = 40 \text{ ft}$

$40 = -16t^2 + 58t + 3$

$-40 \qquad\qquad\qquad -40$

$0 = -16t^2 + 58t - 37$

$y_2 = 40$

$(1.8, 55.6)$

$(0, 3)$

0.8 sec   2.8 sec

$(3.676, 0)$

The ball was 40 feet above the ground after 0.8 seconds & 2.8 seconds.

2. A ball is hit by a baseball player, and the height of the ball is given by the function $h(t) = -16t^2 + 58t + 3$ where $h(t)$ is the height of the ball (in feet), t seconds after the ball is hit.
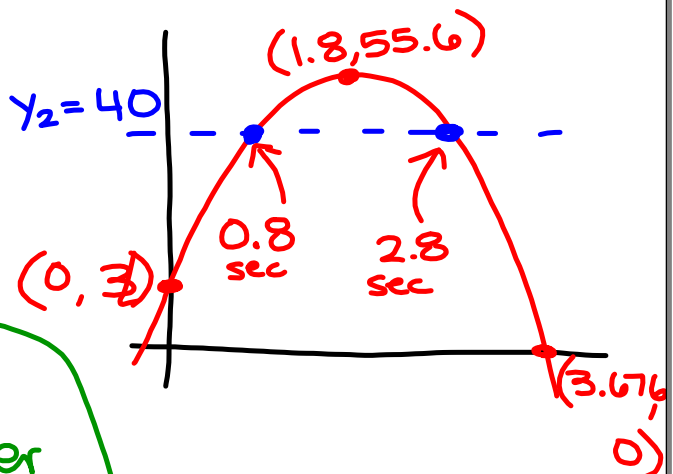
t seconds $h(t)$ feet

g. State the domain and range of h in the context of the problem.

Domain: All real numbers between & including
   0 & 3.676 seconds.

Range: All real numbers between & including
   0 & 55.6 ft.

3. A cell phone company predicts monthly profit using the equation $P(x) = -0.6x^2 + 30x + 150$ where $P(x)$ is the monthly profit in thousands of dollars, and x is the amount spent on advertising in thousands of dollars.

a. What amount should the company spend on advertising to maximize the monthly profit? Show or explain your work. (Calculate Maximum)

Vertex (maximum)   (look @ x-coordinate)

(25, 525)
  x   P(x)

The company should spend $25,000 on advertising to maximize monthly profit.

b. Predict the maximum monthly profit. Show or explain your work. (Calculate maximum, look @ y-coordinate)

Maximum monthly profit is $525,000.

3. A cell phone company predicts monthly profit using the equation $P(x) = -0.6x^2 + 30x + 150$ where $P(x)$ Is the monthly profit in thousands of dollars, and x is the amount spent on advertising in thousands of dollars.

c. To the nearest dollar, what is the maximum amount the company can spend on advertising and still have a positive profit?
Show or explain your work.

Find x–int	Profit of $\$1$ $(P(x)=1)$
(Calculate Zero)	compare $y_2 = 1$
$x = 54.5803$	(Calculate Intersect)
Spending $\$54,570$ on advertising will still give us a positive profit.	$x = 54.552214$ $y = 1$
	Spending $\$54,552$ on advertising will still give us a positive profit.

Oct 16-12:17 PM