Name _____ Period _____

5.1B *Answering Real-World Questions by Graphing Quadratic Functions*

#1 – 10: Use your graphing utility to solve the following problems.

1. Phillip, Peter and Pablo each throw a ball over a fence. The height of Phillip's ball with respect to time can be modeled by the equation $y = -16t^2 + 60t$. The height of Peter's ball with respect to time can be modeled by the equation $y = -16t^2 + 50t$. The height of Pablo's ball with respect to time can be modeled by the equation $y = -16t^2 + 40t$, where y is the height in feet and t is the time in seconds for each of the three models.

a) Phillip, Peter and Pablo want to know whose ball hit the ground first. Peter thinks that they should find the x-intercept of the graphs to determine this. Phillip thinks that they should find the vertex of each graph to find which ball hit the ground first. Which one is correct? Explain your answer.

Peter is correct; the x int gives the time (t) when y = 0, which is where the ball has a height of 0 on the ground!

b) Whose ball hit the ground first? How long did it take?

Pablo; 2.5 sec

c) Whose ball hit the ground second? How long did it take?

Peter; 3.125 sec

2. A quarterback throws a football at an initial height of 5.5 feet with an initial upward velocity of 35 feet per second. The height of a tossed ball with respect to time can be modeled by the quadratic function $h(t) = -16t^2 + v_0 \cdot t + h_0$ where v_0 is the initial upward velocity, h_0 is the initial height and $h(t)$ is the height of the ball after t seconds.

a) Write the function that models the height of the ball with respect to time.

$h(t) = -16t^2 + 35t + 5.5$

b) How high will the football be after 1 second? (Consider what the 1 second represents.)

24.5 ft (the 1 sec repr the x value)

c) When will the football be 10 feet high? (Consider what the 10 feet represents.) (The 10 is the y value)

After 0.14 secs and again after 2.05 secs

d) When will the football reach its maximum height? (When graphing the function, consider what significant feature of the graph represents this concept.) (At the vertex)

After 1.09 secs.

e) What is the maximum height of the football?

24.64 ft

f) When will the football hit the ground if no one catches it? (When graphing the function, consider what significant feature of the graph represents this concept.) (the x int)

2.33 seconds

Name _____ Period _____

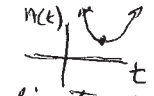
5.1B *Answering Real-World Questions by Graphing Quadratic Functions*

#1 – 10 (continued): Use your graphing utility to solve the following problems.

3. Suppose a batter hits a baseball, and the height of the baseball above the ground can be modeled by the function $h(t) = -16t^2 + 50t + 2$. Where is the vertex of the graph? Explain the meaning of the vertex in the context of this situation.

Above the ground, the maximum y-value at (1.56, 41.06) The vertex reveals how long it takes (1.56 sec) the ball to reach the maximum height (41.06 ft)

4. A pool is treated with a chemical to reduce the amount of algae. The amount of algae in the pool t days after the treatment begins can be approximated by the function $A(t) = 4t^2 - 88t + 500$. How many days after treatment begins will the pool have the least amount of algae?



t = 11 days (the x coordinate of the vertex)

5. The driver of a car traveling downhill on a road applied the brakes. The speed of the car, $s(t)$, in kilometers per hour t seconds after the brakes were applied is modeled by the function rule $s(t) = -4t^2 + 12t + 80$.

a) After how many seconds did the car reach its maximum speed?

1.5 secs

b) What was the maximum speed reached?

89 Km/h

c) How long will it take the car to stop?

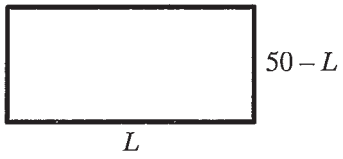
6.22 seconds

Name _____ Period _____

5.1B *Answering Real-World Questions by Graphing Quadratic Functions*

#1 – 10 (continued): Use your graphing utility to answer the following problems.

6. Andrew has 100 feet of fence to enclose a rectangular tomato patch. He wants to find the dimensions of the rectangle that encloses the most area. The width of the rectangle can be found by the expression $50 - L$ where L is the length of the rectangle.



a) In the expression representing the width of the rectangle ($50 - L$), what does the 50 represent? Explain your thinking clearly.

50 is half the perimeter, so one length + one width = 50.

b) Write a function rule to model the area of the rectangle. $A(L)$ represents the Area of the rectangular tomato patch base on the length (L) of one side.

$A(L) = L(50 - L)$
so $A(L) = -L^2 + 50L$

c) Find the coordinate representing the maximum of the graph. Explain its meaning in the context of the situation. (25, 625) When the length is 25, width is $50 - L = 25$ ($50 - 25 = 25$), so Area = $L \times W$ = 25×25 = 625

(L, A(L))

A(L) = 625

d) What size should Andrew make the tomato patch in order to enclose the most area within the fencing?

A Square shape, 25 ft × 25 ft

7. Sharon needs to create a fence for her new puppy. She purchased 40 feet of fencing to enclose the four sides of a rectangular play area.

a) Determine the dimensions the enclosure play area should be to produce the **greatest** area for her puppy to play.

According to #6d, she should make a square with her 40 ft of fencing, so $40 \div 4 = 10$ ft on each side.

b) Write a function rule to model the area of the play area.

$A(L) = L(20 - L)$
$A(L) = -L^2 + 20L$ Calc max shows vertex @ (10, 100)

c) What are the dimensions of the enclosure that will create the greatest area for her puppy to play?

Length L = 10 ft
width $20 - L$ = 10 ft
Area = 100 ft²

Name _____ Period _____

5.1B *Answering Real-World Questions by Graphing Quadratic Functions*

#1 – 10 (continued): Use your graphing utility to answer the following problems.

8. Karen is throwing an orange to her brother Jim, who is standing on the balcony of their home. The height, h (in feet), of the orange above the ground t seconds after Karen throws the orange is given by the function $h(t) = -16t^2 + 32t + 3$. If Jim's outstretched arms are 16 feet above the ground, will the orange ever be high enough so that he can catch it? Explain your answer.

Yes! The max height of the orange is 19 ft, or the y coordinate of the vertex. Jim can grab it either on the way up or the way down.

9. On wet concrete, the stopping distance, s (in feet), of a car traveling v miles per hour is given by $s(v) = 0.055v^2 + 1.1v$. At what speed could a car be traveling and still stop at a stop sign 30 feet away?

$(V, S(V))$

$(V, 30)$

use Calc intersect $V \approx 15.41$ mph, so ≈ 15 mph

10. The Buckingham Fountain in Chicago shoots water from a nozzle at the base of the fountain. The height, in feet, of the water above the ground t seconds after it leaves the nozzle is given by $h(t) = -16t^2 + 90t + 15$.

a) What is the maximum height of the water spout to the nearest tenth of a foot?

141.56 ft

b) How long does it take for the water to hit the ground?

5.79 secs

Section 5.1B