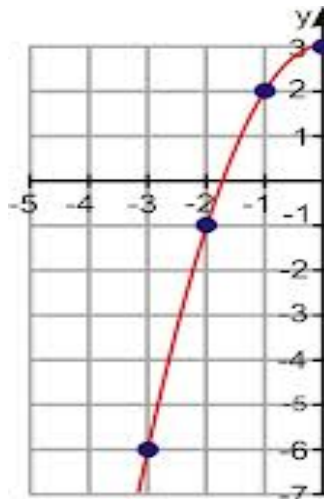


## P.S. #11.1 - Exploring the Symmetry in Graphs of Quadratic Functions

Name: \_\_\_\_\_ Class: \_\_\_\_\_

For 1 – 7: Below you see only one side of the graph of a quadratic function.

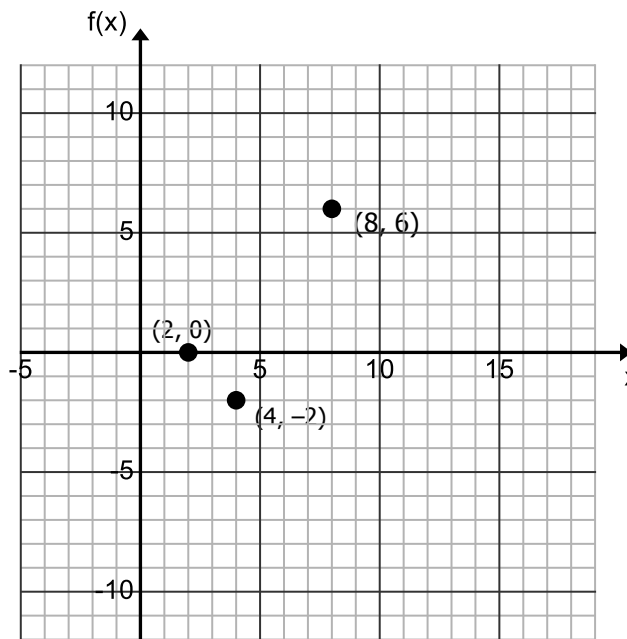


$x$	$f(x)$

- 1.) Complete the graph by plotting three additional points of the quadratic function. Fill in the table of values above. Explain how you got these points.
  
- 2.) What are the approximate coordinates of the  $x$ -intercepts? \_\_\_\_\_ , \_\_\_\_\_
- 3.) What are the coordinates of the  $y$ -intercept? \_\_\_\_\_
- 4.) What are the coordinates of the vertex? \_\_\_\_\_
- 5.) Is it a minimum or a maximum? \_\_\_\_\_
- 6.) If we knew the equation for this curve, what would the sign of the leading coefficient be?
  
- 7.) Verify that the average rate of change for interval,  $-3 \leq x \leq -2$  or  $[-3, -2]$  is 5. Show your steps.
  
- 8.) If possible find the equation for the axis of symmetry for the graph of a quadratic function with the given pair of coordinates. If not possible, explain why.
  - a.) (3,10) and (15,10)
  - b.) (-2,6) and (6,4)

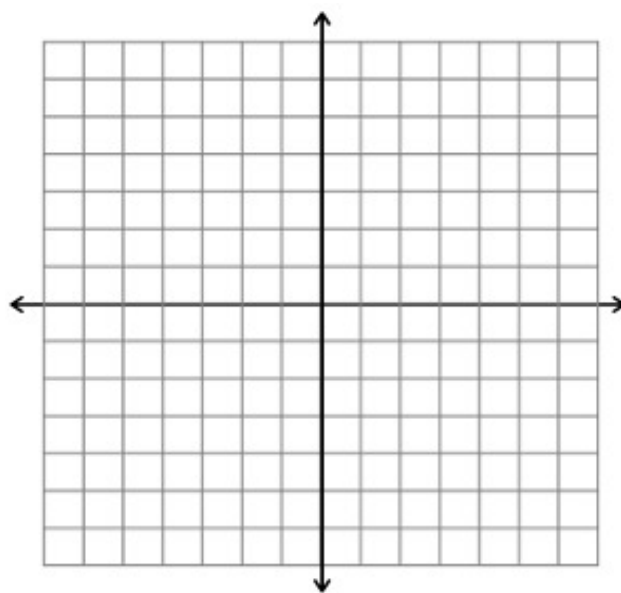
9.) The point  $(4, -2)$  is the vertex of the graph of a quadratic function. The points  $(8, 6)$  and  $(2, 0)$  also fall in the graph of the function. Complete the graph of this quadratic function by first finding two additional points on the graph. (If needed, make a table of values). Then answer the questions on the right.

- Find the y-intercept. \_\_\_\_\_
- Find the x-intercept(s). \_\_\_\_\_ , \_\_\_\_\_
- Find the interval on which the rate of change is always positive.
- What is the sign of the leading coefficient for this quadratic function? Explain how you know.



10.) Khaya stated that every  $y$ -value of the graph of a quadratic function has two different  $x$ -values. Do you agree or disagree with Khaya? Explain your answer.

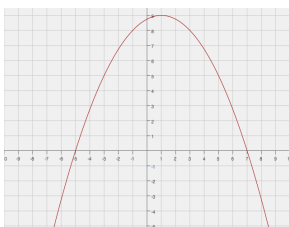
11.) Is it possible for the graphs of two **different** quadratic functions to each have  $x = -3$  as its line of symmetry and both have a maximum at  $y = 5$ ? Explain and support your answer with a sketch of the graphs.



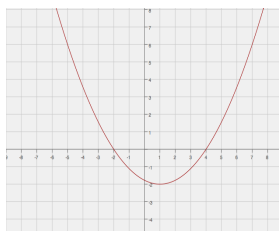
12.) Factored, the expression  $16x^2 - 25y^2$  is equivalent to:

- |                          |                          |
|--------------------------|--------------------------|
| (A) $(4x - 5y)(4x + 5y)$ | (C) $(4x - 5y)(4x - 5y)$ |
| (B) $(8x - 5y)(8x + 5y)$ | (D) $(8x - 5y)(8x - 5y)$ |

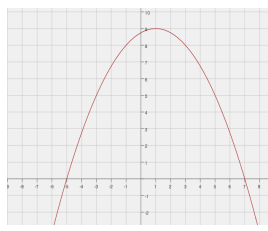
13.) Consider the following key features discussed in this lesson for the four graphs of quadratic functions below:  $x$ -intercepts,  $y$ -intercept, line of symmetry, vertex, and end behavior.



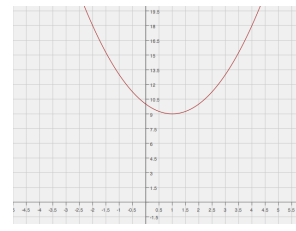
Graph A



Graph B



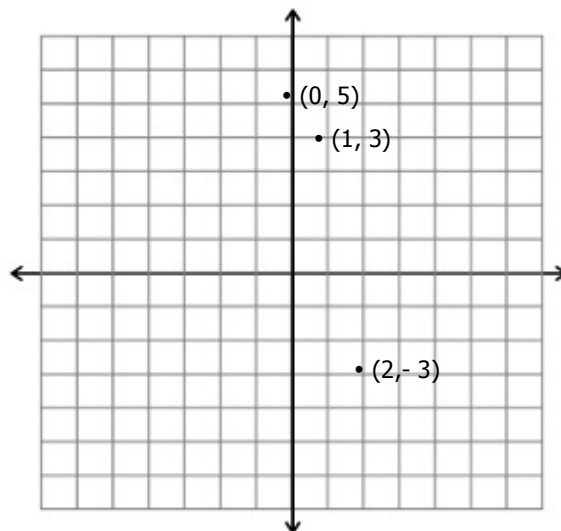
Graph C



Graph D

- a.) Which key features of a quadratic function do graphs A and B have in common?
  
- b.) Compare the graphs A and C and explain the similarities between their key features.
  
- c.) Compare the graphs A and D and explain the similarities between their key features.
  
- d.) What do all four of the graphs have in common?

14.) Use the symmetric properties of quadratic functions to sketch the graph of the function below, given these points and given the vertex of the graph is the point (0,5).



## P.S. #11.2 - Graphing Quadratic Functions from Factored Form

Name: \_\_\_\_\_ Class: \_\_\_\_\_

Find the roots of the following functions.

1.)  $f(x) = 2(x - 5)(x + 1)$

2.)  $f(x) = (3x - 7)(x + 2)$

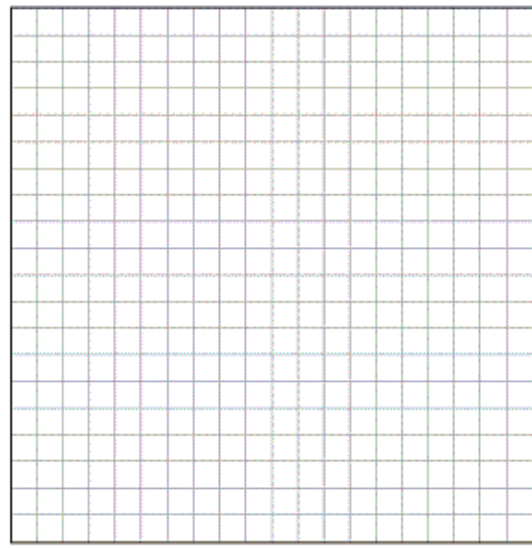
3.) Consider the function  $f(x) = (2x - 1)(5 - x) - 13 + 8x^2 - 14x$ .

a.) Write an equation that defines  $f(x)$  as a trinomial.

b.) Solve for  $x$  when  $f(x) = 0$

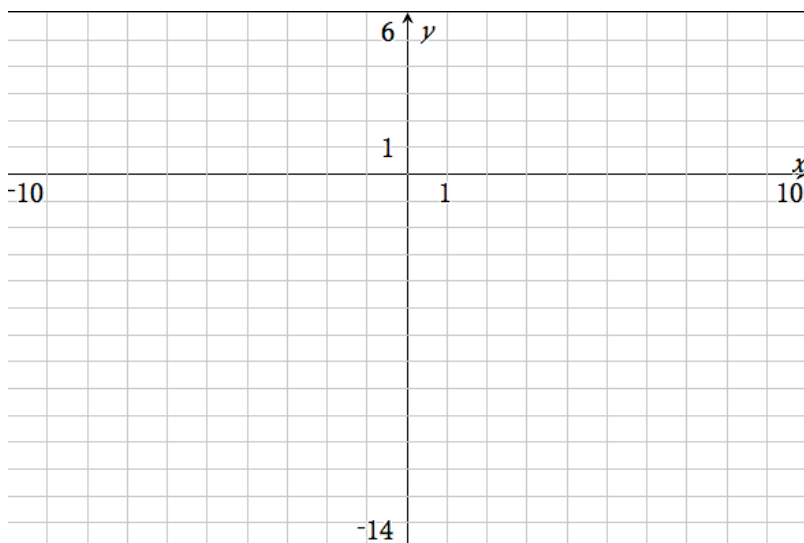
For 4 – 7, graph the following functions and identify key features of the graph.

4.)  $f(x) = -3(x - 2)(x + 2)$



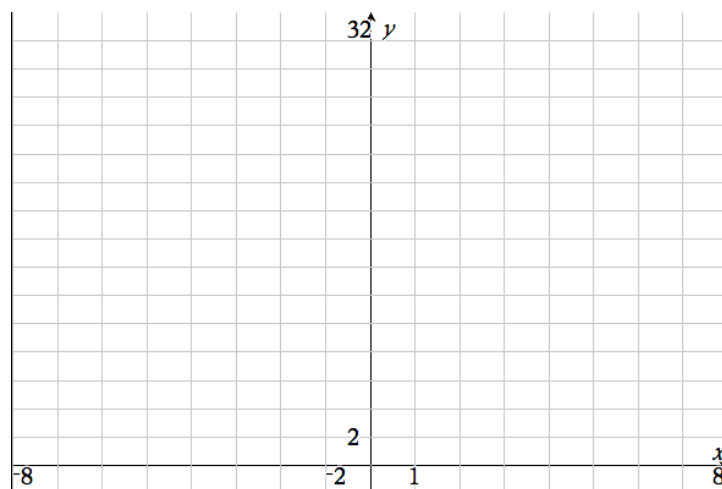
Roots/Zeros	Axis of Symmetry	Vertex	Y-Intercept

5.)  $f(x) = (x + 2)(x - 5)$



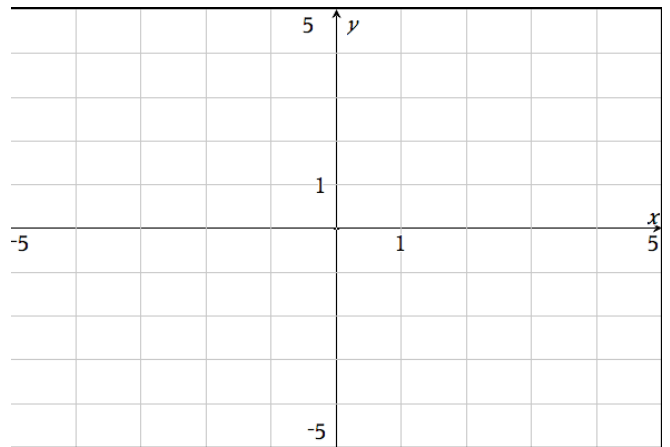
<i>Roots/Zeros</i>	<i>Axis of Symmetry</i>	<i>Vertex</i>	<i>Y-Intercept</i>

6.)  $g(x) = -x^2 + 5x + 24$



<i>Roots/Zeros</i>	<i>Axis of Symmetry</i>	<i>Vertex</i>	<i>Y-Intercept</i>

7.)  $h(x) = x^2 - 2x + 1$



<i>Roots/Zeros</i>	<i>Axis of Symmetry</i>	<i>Vertex</i>	<i>Y-Intercept</i>

8.) Jack bought 3 slices of cheese pizza and 4 slices of mushroom pizza for a total cost of \$12.50. Anna bought 3 slices of cheese pizza and 2 slices of mushroom pizza for a total cost of \$8.50. What is the cost of one slice of mushroom pizza?

- (A) \$1.50                      (B) \$2.00                      (C) \$3.00                      (D) \$3.50

9.) Given the sequence:  $a_1 = 6$  and  $a_{n+1} = a_n + 4$ .

a.) List the first 5 terms of this sequence.

b.) Write an explicit formula for this sequence.

10.) A rocket is launched from a cliff. The relationship between the height,  $h$ , in feet, of the rocket and the time,  $t$ , in seconds, since its launch can be represented by the following function:

$$h(t) = -16t^2 + 80t + 384$$

where  $x$  is the time in seconds the rocket is in the air and the range is the height in feet of the rocket.

a.) Sketch the graph of the motion of the rocket use the key features of the function.



b.) When will the projectile hit the ground?

c.) When will the rocket hit the maximum height?

d.) What is the maximum height the rocket reaches?

e.) At what height was the rocket launched?

**P.S. #11.3 - Graphing Quadratic Functions  
from Vertex Form**

Name: \_\_\_\_\_ Class: \_\_\_\_\_

1.) Without graphing, state the vertex for each of the following quadratic equations.

a.)  $f(x) = x^2 - 2.5$

d.)  $g(x) = (x - 4)^2 + 7$

b.)  $h(x) = (x + 4)^2$

e.)  $n(x) = 4x^2 + 8x + 2$

c.)  $z(x) = 2(x - 5)^2 + 3.5$

f.)  $q(x) = -(x + 1)^2 - 8$

2.) Write quadratic equations representing the function with the following vertex. Use a leading coefficient other than 1 for at least two of the examples below.

a.)  $(0, 100)$

c.)  $(100, 200)$

b.)  $\left(-2, \frac{3}{2}\right)$

d.)  $\left(-\frac{3}{4}, -6\right)$

3.) A school wants to add a coed soccer program. To determine interest in the program, a survey will be taken. In order to get an unbiased sample, which group should the school survey?

(A) every third student entering the building

(B) every member of the varsity football team

(C) every member in Ms. Zimmer's drama classes

(D) every student having a second-period French class



Complete the square for each of the quadratic functions below to write each function in function form. Then identify the axis of symmetry and the vertex. Indicate if the vertex is a minimum or a maximum.

<i>Parabola #4</i>	<i>Vertex Form</i>	<i>Symmetry</i>	<i>Vertex</i>	<i>Min/Max</i>
$a(x) = x^2 + 2x - 3$				

<i>Parabola #5</i>	<i>Vertex Form</i>	<i>Symmetry</i>	<i>Vertex</i>	<i>Min/Max</i>
$b(x) = 5x^2 + 40x - 32$				

<i>Parabola #6</i>	<i>Vertex Form</i>	<i>Symmetry</i>	<i>Vertex</i>	<i>Min/Max</i>
$c(x) = -x^2 + 2x - 3$				

<i>Parabola #7</i>	<i>Vertex Form</i>	<i>Symmetry</i>	<i>Vertex</i>	<i>Min/Max</i>
$f(x) = x^2 - 9$				

<i>Parabola #8</i>	<i>Vertex Form</i>	<i>Symmetry</i>	<i>Vertex</i>	<i>Min/Max</i>
$g(x) = -3x^2 + 3x + 6$				

<i>Parabola #9</i>	<i>Vertex Form</i>	<i>Symmetry</i>	<i>Vertex</i>	<i>Min/Max</i>
$h(x) = 2x^2 + x - 6$				

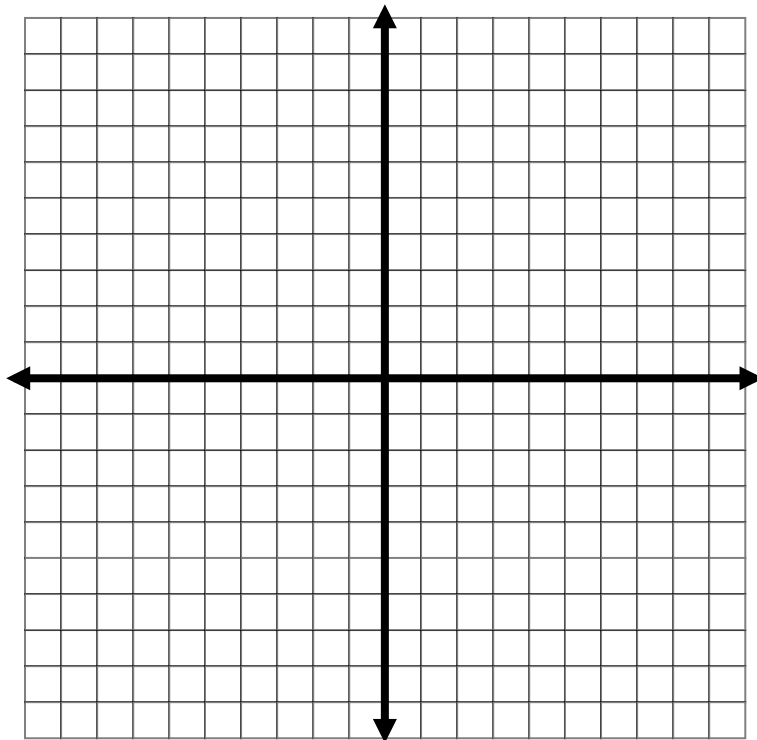
10.) Using vocabulary from this lesson, describe the relationship between the quadratic equations  $y = x^2 + 1$  and  $y = -2x^2 + 1$ .



For 4 – 5, graph the following quadratic functions by creating a table of values. Identify the key features.

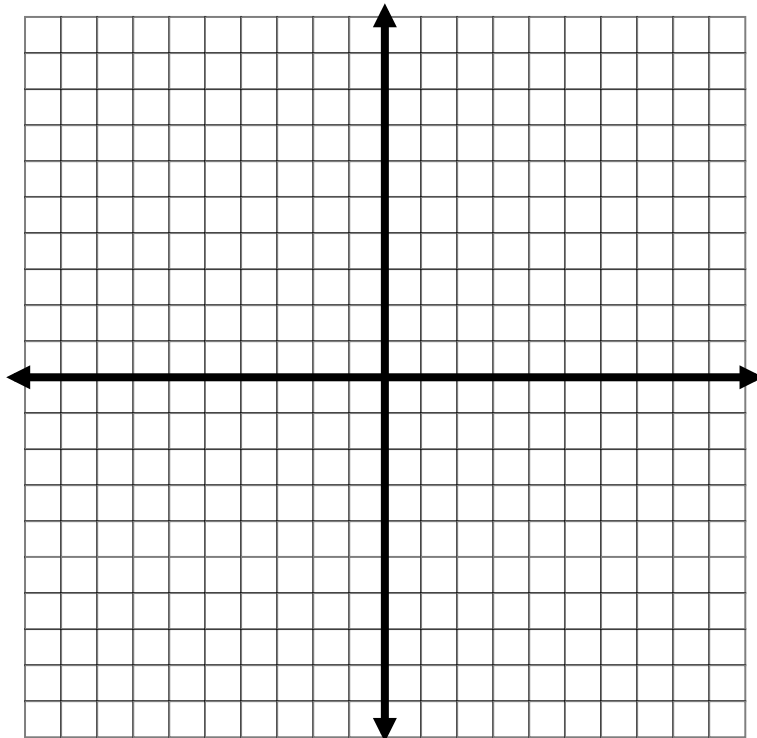
4.)  $p(x) = -x^2 + 6x$

$x$	$y$



5.)  $r(x) = x^2 + 4x - 2$

$x$	$y$

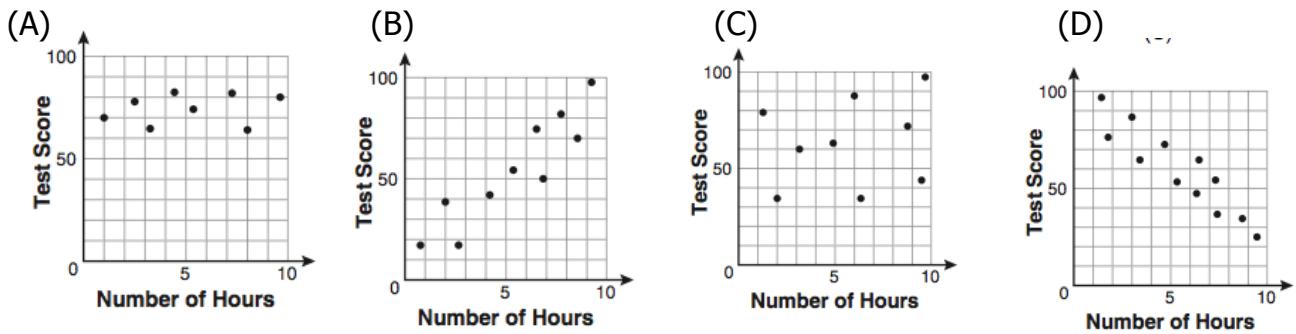


6.) At 1821 feet tall, the CN Tower in Toronto, Ontario, is one of the world’s largest self-supporting structures. Suppose you are standing in the observation deck on top of the tower and you drop a penny from there and watch it fall to the ground. The table shows the penny’s distance from the ground after various periods of time (in seconds) have passed.

Time (seconds)	Distance (feet)
0	1821
2	1757
4	1565
6	1245
8	797
10	221

- a.) Draw a scatterplot of the data in your calculator.
- b.) Determine the type of regression you should use to model the function (linear, exponential, or quadratic).
- c.) Write the equation of the linear regression.
- d.) Use your equation to predict the penny’s location after falling 10.5 seconds.

7.) There is a negative correlation between the number of hours a student watches television and his or her social studies test score. Which scatter plot below displays this correlation?



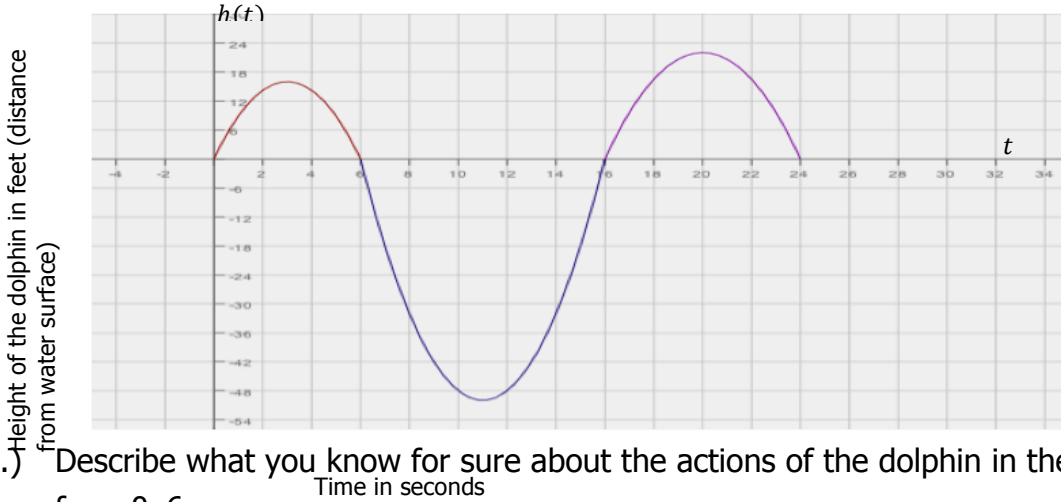
8.) Consider the function  $f(x) = \frac{1}{3}x^2 + 4x + 7$ .

- a.) Find the vertex by using the equation for the axis of symmetry.
- b.) Find the vertex by completing the square to put the function in vertex form.

## P.S. #11.5 - Applications of Quadratic Functions

Name: \_\_\_\_\_ Class: \_\_\_\_\_

- 1.) In a study of the activities of dolphins, a marine biologist made a 24-second video of a dolphin swimming and jumping in the ocean with a specially equipped camera that recorded one dolphin’s position with respect to time. This graph represents a piecewise function,  $f(t)$ , that is defined by quadratic functions on each interval. It relates the dolphin’s vertical distance (in feet) from the surface of the water to the time (in seconds) from the start of the video. Use the graph to answer the questions below.



- a.) Describe what you know for sure about the actions of the dolphin in the time interval from 0–6 sec.
- b.) Can you determine the horizontal distance the dolphin traveled in that time interval? Explain why or why not.
- c.) Where will you find the values for which  $f(t) = 0$  and explain what they mean in the context of this problem.
- d.) How long was the dolphin swimming under water in the recorded time period?
- e.) Estimate the maximum height, in feet, the dolphin jumped in the recorded 24-second time period?
- f.) Locate the point on the graph where  $f(t) = -50$  and explain what information the coordinates of that point give you in the context of this problem.

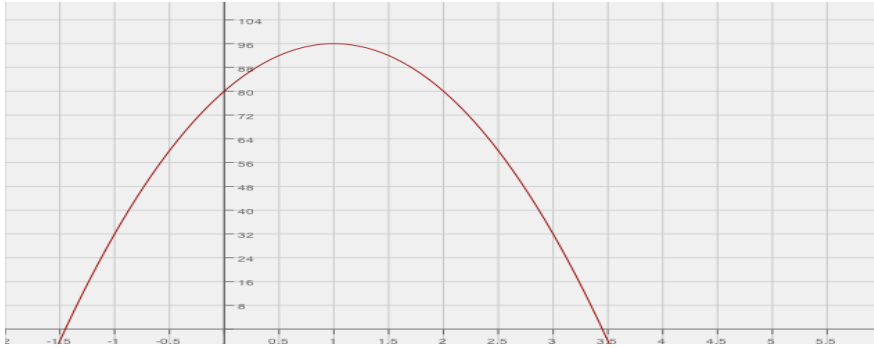
- 2.) A toy company is manufacturing a new toy and trying to decide on a price that will result in a maximum profit. The graph below represents profit ( $P$ ) generated by each price of a toy ( $x$ ). Answer the questions based on the graph of the quadratic function model.



- a.) If the company wants to make a maximum profit, what should the price of a new toy be?
- b.) What is the minimum price of a toy that will produce profit for the company? Explain your answer.
- c.) Estimate the value of  $P(0)$  and explain what the value means in the problem and how this may be possible.
- d.) If the company wants to make a profit of \$137 for how much should the toy be sold?
- e.) Find the domain that will only result in a profit for the company and find its corresponding range of profit.
- f.) Choose the interval where the profit is increasing the fastest:  
 $[2, 3]$ ,  $[4, 5]$ ,  $[5.5, 6.5]$ ,  $[6, 7]$
- g.) The company owner believes that selling the toy at a higher price will result a greater profit. Explain to the owner how selling the toy at a higher price will affect the profit.

3.) Adelyn and Ryan each threw a baseball into the air.

The vertical height of Adelyn’s baseball is represented by the graph  $P(t)$  below.  $P$  represents the vertical distance of the baseball from the ground in feet and  $t$  represents time in seconds.



$t$	$R(t)$
0	86
0.5	98
1	102
1.5	98
2	86
2.5	66
3	38
3.52	0

The vertical height of Ryan’s baseball is represented by the table values.  $R(t)$  represents the vertical distance of the baseball from the ground in feet and  $t$  represents time in seconds.

Use the above functions to answer the following questions.

- a.) Whose baseball reached the highest? Explain your answer.
- b.) Whose ball reached the ground fastest? Explain your answer.
- c.) Adelyn claims that her ball reached its maximum faster than Ryan’s? Is her claim correct or incorrect? Explain your answer.
- d.) Find  $P(0)$  and  $R(0)$  values and explain what it means in the problem. What conclusion can you make based on these values? Did they throw the ball from the same place? Explain your answer.
- e.) Ryan claims that he can throw the ball higher than Adelyn. Is his claim correct or incorrect? Explain your answer.



- 4.) Find the equation of a quadratic function that passes through the points  $(0,4)$ ,  $(-2,0)$ , and  $(1,3)$ . Show your work.
- 5.) A garden measuring 12 m by 16 m is to have a pedestrian pathway that is  $w$  meters wide installed all the way around it, increasing the total area to 285 sq m. What is the width,  $w$ , of the pathway?
- 6.) Kassy wants to plant a garden and surround it with decorative stones. She has enough stones to enclose a rectangular garden with a perimeter of 68 ft, and she wants the garden to cover 240 sq ft. What will the length and width of her garden be?