Name: ______________________________ **Date:** ________________

Lesson 8 Practice Problems

Section 8.1: Characteristics of Quadratic Functions

1. For each of the following quadratic functions:
   - Identify the coefficients *a, b, c*
   - Determine if the parabola opens up or down and state why.
   - Graph the function on your calculator. Draw the graph neatly below.
   - Identify the vertical-intercept.
   - Mark and label the vertical intercept on the graph.

   a) $f(x) = 2x^2 - 4x - 4$

   $a =$ _________ $b =$ _________ $c =$ _________

   Vertical Intercept: __________

   Which direction does this parabola open? Why?

   b) $f(x) = -x^2 + 6x - 4$

   $a =$ _________ $b =$ _________ $c =$ _________

   Vertical Intercept: __________

   Which direction does this parabola open? Why?

   c) $f(x) = 2x^2 - 6x + 4$

   $a =$ _________ $b =$ _________ $c =$ _________

   Vertical Intercept: __________

   Which direction does this parabola open? Why?

d) $f(x) = x^2 - 3x$

a = __________ b = __________ c = __________

Vertical Intercept: ___________

Which direction does this parabola open? Why?

e) $f(x) = \frac{x^2}{2} - 3$

a = __________ b = __________ c = __________

Vertical Intercept: ___________

Which direction does this parabola open? Why?

2. For each of the following quadratic functions (Show your work):
   - Calculate the vertex *by hand* and write it as an ordered pair.
   - Determine the axis of symmetry and write it as a linear equation (x = #).

	Function	$-\frac{b}{2a}$	$f\left(-\frac{b}{2a}\right)$	Vertex	Axis of Symmetry
a)	$f(x) = -2x^2 + 2x - 3$				
b)	$g(x) = \frac{x^2}{2} - 3x + 2$				
c)	$f(x) = -x^2 + 3$				
d)	$p(t) = 4t^2 + 2t$				
e)	$h(x) = 3x^2$				

3. Complete the table. Show your work.

	Function	Domain	Range	Horizontal Intercept(s) (if any)
a)	$f(x) = -2x^2 + 2x - 3$			
b)	$g(x) = \frac{x^2}{2} - 3x + 2$			
c)	$f(x) = -x^2 + 3$			
d)	$p(t) = 4t^2 + 2t$			
e)	$h(x) = 3x^2$			

4. For each quadratic function:
   - Graph the function on your calculator using an appropriate viewing window. Draw the graph neatly below.
   - Label the vertical intercept.
   - Determine the vertex. Mark and label the vertex on the graph.
   - Determine the horizontal intercepts (if they exist) and label them on the graph

a) $f(x) = -2x^2 + 6x + 3$

Vertical Intercept: ___________

Horizontal Intercept(s): ____________________________

Vertex: ____________

b) $f(x) = \frac{3}{4}x^2 - 2x$

Vertical Intercept: ___________

Horizontal Intercept(s): ____________________________

Vertex: ____________

c) $f(x) = 5x^2 + 4$

Vertical Intercept: ___________

Horizontal Intercept(s): ____________________________

Vertex: ____________

Section 8.2: Solving Quadratic Equations Graphically

5. Solve each equation using your calculator. Draw the graph and plot/label the point(s) of intersection. Clearly identify the final solution(s).

a) $x^2 - x - 6 = 0$

b) $x^2 - 9x + 10 = -4$

c) $x^2 - 8 = 1$

6. Solve each equation using your calculator. Draw the graph and plot/label the point(s) of intersection. Clearly identify the final solution(s).

a) $-x^2 + 6x - 4 = -10$

b) $\frac{3}{2}x^2 - 6x + 6 = 10$

c) $5x^2 + \frac{x}{2} - 5 = 8$

Section 8.3: Applications of Quadratic Functions

7. The function $h(t) = -0.2t^2 + 1.3t + 15$, where *h(t)* is height in feet, models the height of an "angry bird" shot into the sky as a function of time (seconds).

    a) Draw a complete diagram of this situation. Find and label each of the following: vertex, horizontal intercept (positive side), and vertical intercept.

    b) How high above the ground was the bird when it was launched?

    c) After how many seconds does the bird reach its highest point?

    d) How high is the angry bird at its highest point?

    e) After how many seconds does the angry bird hit the ground?

    f) If the bird is traveling at 15 feet per second, how far does the angry bird travel before it hit the ground?

    g) Determine the practical domain of this function.

    h) Determine the practical domain and practical range of this function.

8. A company's revenue earned from selling x items is given by the function $R(x) = 680x$, and cost is given by $C(x) = 10000 + 2x^2$.

   a) Write a function, $P(x)$, that represents the company's *profit* from selling x items.

   b) Identify the vertical intercept of $P(x)$. Write it as an ordered pair and interpret its meaning in a complete sentence.

   c) How many items must be sold in order to maximize the profit?

   d) What is the maximum profit?

   e) How many items does this company need to sell in order to break even?

   f) Determine the practical domain and practical range of this function.

9. An arrow is shot straight up into the air. The function $H(t) = -16t^2 + 90t + 6$ gives the height (in feet) of an arrow after t seconds. Round answers to two decimal places as needed. All answers must include appropriate units of measure.

   a) How long does it take for the arrow to reach its maximum height? Write your answer in a complete sentence.

   b) Determine the maximum height of the arrow. Write your answer in a complete sentence.

   c) How long does it take for the arrow to hit the ground? Write your answer in a complete sentence.

   d) Identify the vertical intercept. Write it as an ordered pair and interpret its meaning in a complete sentence.

   e) Determine the practical domain of $H(t)$. Use proper notation.

   f) Determine the practical range of $H(t)$. Use proper notation.

g) Use your graphing calculator to create a good graph of H(t). Use the practical domain and range to determine an appropriate viewing window. In the space below, sketch what you see on your calculator screen, and indicate the window you used.

Xmin:_________

Xmax:_________

Ymin:_________

Ymax:_________

h) Determine $H(3)$. Write a sentence explaining the meaning of your answer in the context of the arrow.

i) Use your graphing calculator to solve the equation $H(t) = 80$. Write a sentence explaining the meaning of your answer in the context of the arrow.

Section 8.4: Quadratic Regression

10. Fireworks were shot from a launching tower at an initial velocity of 70 feet per second. The data below show the height of the fireworks for varying amounts of time (in seconds).

t	1	2	3	4
$F(t)$	93	118	103	65

a) Use the Quadratic Regression feature of your calculator to generate a mathematical model for this situation. Round to three decimals.

b) Based on your model what is the height of the launching tower? Explain

c) Use your model to predict the height of the golf ball at 3 seconds. How does this compare to the value in the data table?

d) Using your model, for what values of t is the fireworks 75 feet high?

e) Use your model to determine how long it will take for the fireworks to hit the ground.

f) Use your model to determine the practical domain and practical range for this scenario.

g) Use your graphing calculator to create a good graph of *F(t)*. Use the practical domain and range to determine an appropriate viewing window. In the space below, sketch what you see on your calculator screen, and indicate the window you used.

Xmin:_________

Xmax:_________

Ymin:_________

Ymax:_________

11. Jupiter is the most massive planet in our solar system. Its gravity is 76 feet per second squared compared to Earth's 32 feet per second squared. The data below represent the height of a rocket launched from a hill on Jupiter.

t	1	2	3	4	5
$J(t)$	290	470	590	620	575

a) Use the Quadratic Regression feature of your calculator to generate a mathematical model for this situation. Round to three decimals.

b) Based on your model how high is the hill from which the rocket was launched ? Explain.

c) Use your model to predict the height of the rocket at 3 seconds. How does this compare to the value in the data table?

d) Using your model, for what values of t is the rocket 450 feet high?

e) Use your model to determine how long it will take for the rocket to hit the surface of Jupiter.

f) Use your model to determine the practical domain and practical range for this scenario.

g) Use your graphing calculator to create a good graph of *J(t)*. Use the practical domain and range to determine an appropriate viewing window. In the space below, sketch what you see on your calculator screen, and indicate the window you used.

Xmin:_________

Xmax:_________

Ymin:_________

Ymax:_________

12. A train tunnel is modeled by the quadratic function $h(x) = -0.45x^2 + 28.8$, where x is the distance, in feet, from the center of the tracks and $h(x)$ is the height of the tunnel, also in feet. Assume that the high point of the tunnel is directly in line with the center of the train tracks.

a) Draw a complete diagram of this situation. Find and label each of the following: vertex, horizontal intercept(s) and vertical intercept. Round answers to the nearest tenth as needed.

b) How high is the top of the tunnel?

c) How wide is the base of the tunnel?

d) A train with a flatbed car 6 feet off the ground is carrying a large object that is 12 feet high. How much room will there be between the top of the object and the top of the tunnel?

13. A company's profit, P, earned from selling x items is given by the table below.

x	10	80	150	225	300	340
P(x)	-3408	31622	47027	41751	13986	-9781

a) Use the Quadratic Regression feature of your calculator to write a function, $P(x)$, that represents the company's profit from selling x items. Use function notation and the appropriate variables. Round to two decimal places.

b) Use your graphing calculator to generate a scatterplot of the data *and* regression line on the same screen. You must use an appropriate viewing window. In the space below, draw what you see on your calculator screen, and write down the viewing window you used.

Xmin=____________

Xmax=____________

Ymin=____________

Ymax=___________

c) Using your function from part a), identify the vertical intercept of $P(x)$. Write it as an ordered pair and interpret its meaning in a complete sentence. Round to the nearest item and the nearest cent.

d) Identify the vertex of the function found in part a) and interpret its meaning in a complete sentence. Round to the nearest item and the nearest cent.

e) How many items does this company need to sell in order to break even? Write your answer in a complete sentence. Round UP to the nearest item.