

Unit 3D

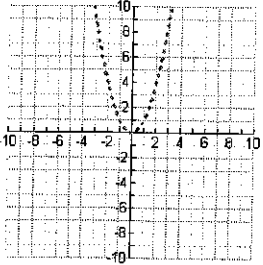
Algebra 1 Calculator Lab- Graph Transformations

Name: _____

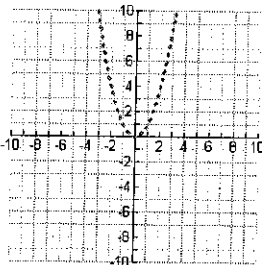
Date: _____

For each function, use the graphing calculator to sketch the graph. The parent function $f(x)$ is shown dashed on each coordinate plane; add the new sketch on the same coordinate axes.

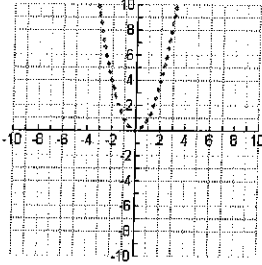
1. $g(x) = x^2 + 4$



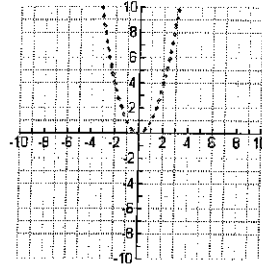
2. $h(x) = x^2 - 2$



3. $t(x) = x^2 - 1$

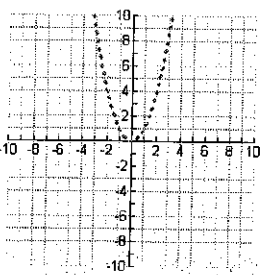


4. $n(x) = x^2 + 8$

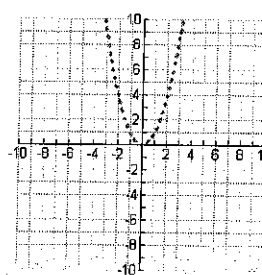


For each function, use the graphing calculator to sketch the graph. The parent function $f(x)$ is shown dashed on each coordinate plane; add the new sketch on the same coordinate axes.

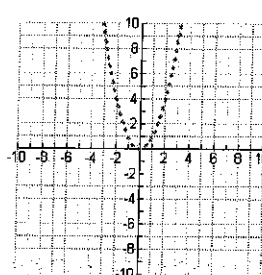
5. $g(x) = (x - 5)^2$



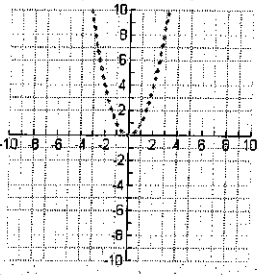
6. $h(x) = (x - 7)^2$



7. $t(x) = (x + 3)^2$



8. $n(x) = (x + 6)^2$



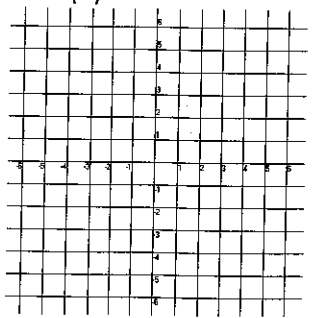
Complete the following statements:

If the number is added or subtracted **outside** the function, it will be a _____ shift.
 $f(x) = f(x) \pm k$

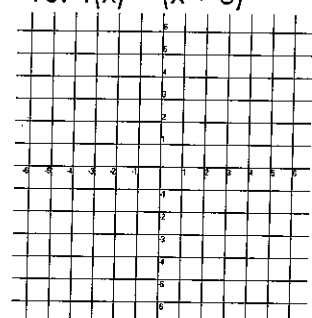
If the number is added or subtracted **inside** the function, it will be a _____ shift.
 $f(x) = f(x \pm k)$

Sketch each of the following functions below; use the calculator to check your answers.

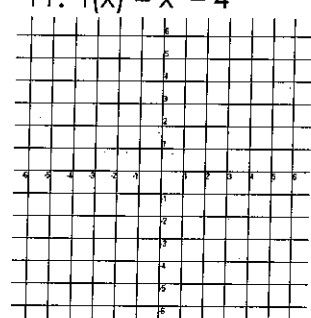
9. $f(x) = x^2 + 3$



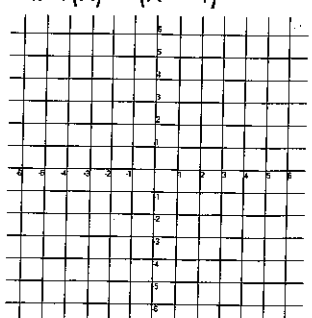
10. $f(x) = (x + 3)^2$



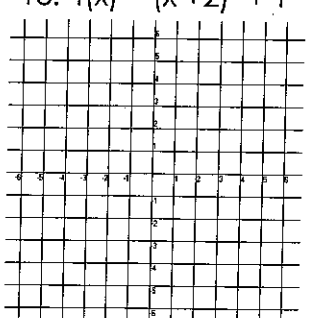
11. $f(x) = x^2 - 4$



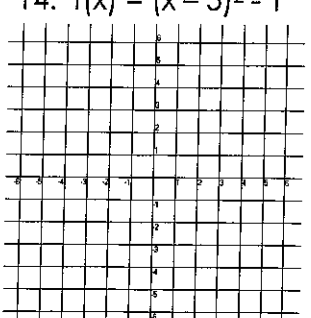
12. $f(x) = (x - 4)^2$



13. $f(x) = (x + 2)^2 + 1$

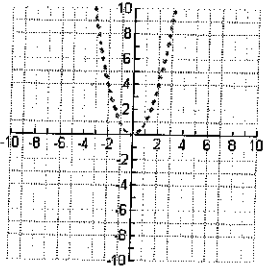


14. $f(x) = (x - 5)^2 - 1$

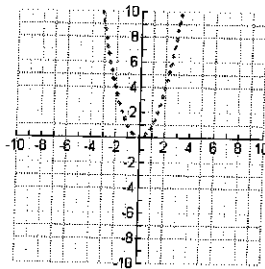


For each function, use the graphing calculator to sketch the graph. The parent function $f(x)$ is shown dashed on each coordinate plane; add the new sketch on the same coordinate axes.

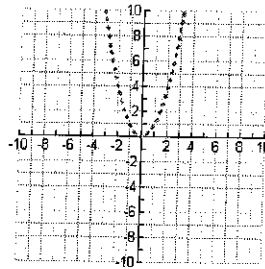
15. $g(x) = 3x^2$



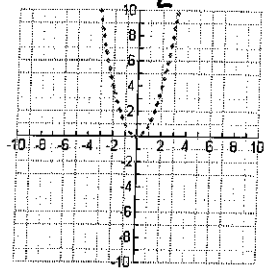
16. $h(x) = 5x^2$



17. $t(x) = 2.7x^2$



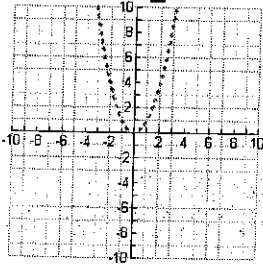
18. $n(x) = \frac{3}{2}x^2$



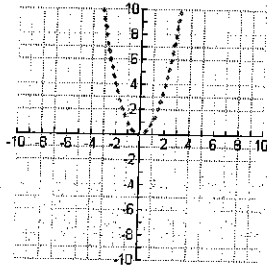
Each of these graphs changes the parent function $f(x) = x^2$ by multiplying by a number greater than one. Make a generalization about the effect that this number has on the graph.

For each function, use the graphing calculator to sketch the graph. The parent function $f(x)$ is shown dashed on each coordinate plane; add the new sketch on the same coordinate axes.

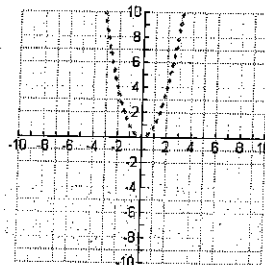
19. $g(x) = \frac{1}{2}x^2$



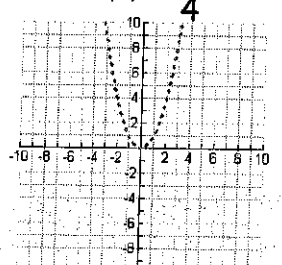
20. $h(x) = 0.4x^2$



21. $t(x) = 0.05x^2$



22. $n(x) = \frac{3}{4}x^2$



Each of these graphs changes the parent function $f(x) = x^2$ by multiplying by a number between zero and one. Make a generalization about the effect that this number has on the graph.

Complete the following statements:

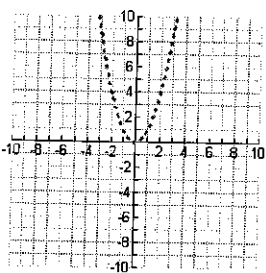
ANY number multiplied by a parent function causes a _____ in the graph. $f(x) = k f(x)$

If the value of the number is greater than one ($|a| > 1$), it will be a _____.

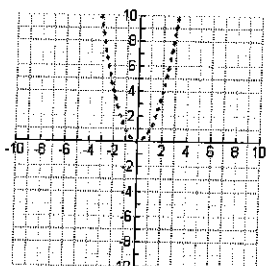
If the value of the number is between zero and one ($0 < |a| < 1$), it will be a _____.

For each function, use the graphing calculator to sketch the graph. The parent function $f(x)$ is shown dashed on each coordinate plane; add the new sketch on the same coordinate axes.

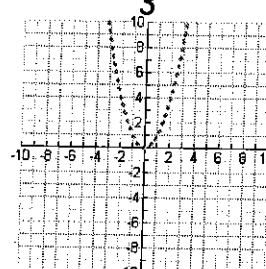
23. $g(x) = -x^2$



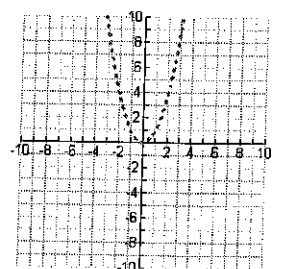
24. $h(x) = -2x^2$



25. $t(x) = -\frac{1}{3}x^2$



26. $n(x) = -0.3x^2$



Each of these graphs changes the parent function $f(x) = x^2$ by multiplying by any negative number. Make a generalization about the effect that multiplying by a negative number outside the function has on the graph.

EXPLORATION 1 Identifying Graphs of Quadratic Functions

7. Match each quadratic function with its graph. Explain your reasoning. Then use a graphing calculator to verify that your answer is correct.

a. $g(x) = -(x - 2)^2$

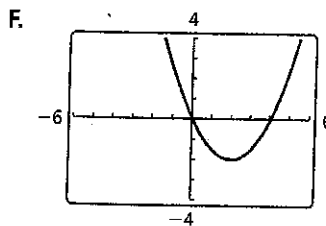
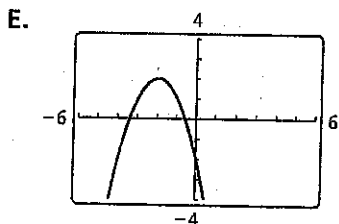
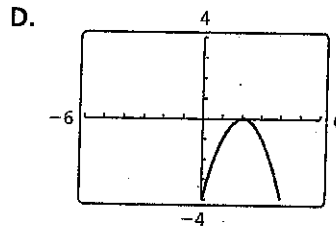
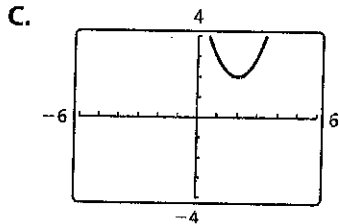
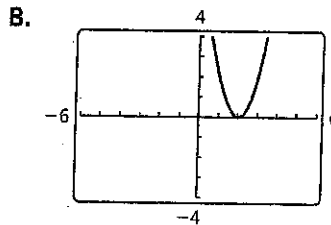
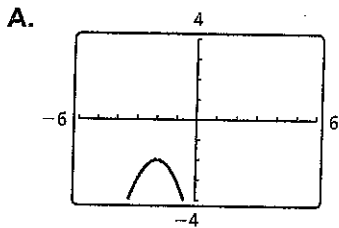
b. $g(x) = (x - 2)^2 + 2$

c. $g(x) = -(x + 2)^2 - 2$

d. $g(x) = 0.5(x - 2)^2 - 2$

e. $g(x) = 2(x - 2)^2$

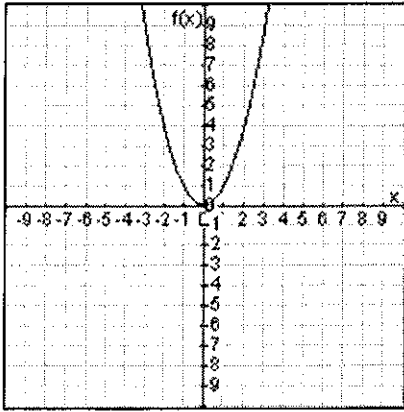
f. $g(x) = -(x + 2)^2 + 2$



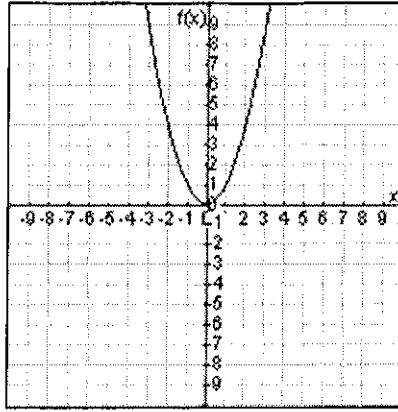
Lesson 5.6

Describe the transformation applied to the parent function $f(x) = x^2$. Then do a quick sketch of each one.

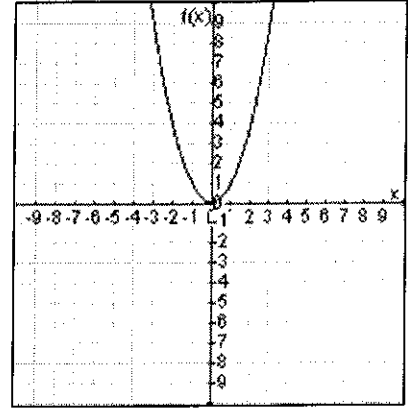
1. $f(-x) + 2$



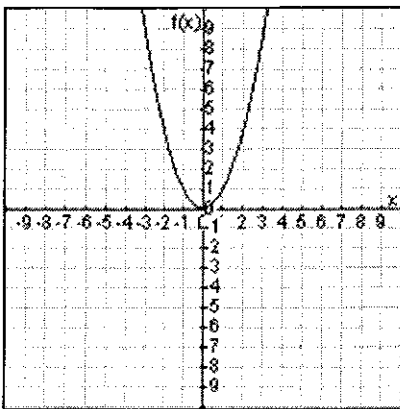
2. $f(x - 2)$



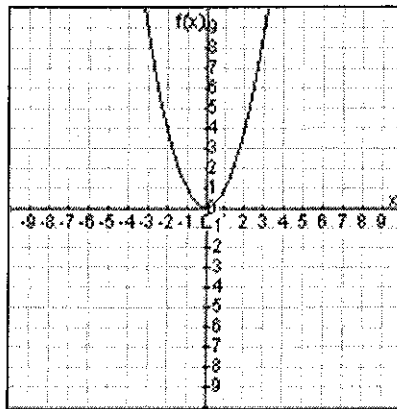
3. $-f(x + 5)$



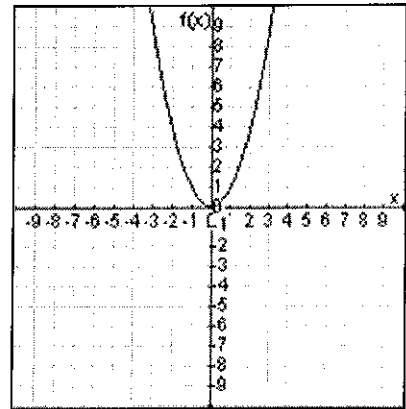
4. $g(x) = (x - 1)^2$



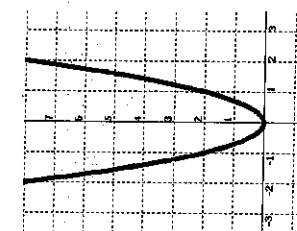
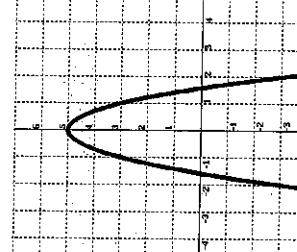
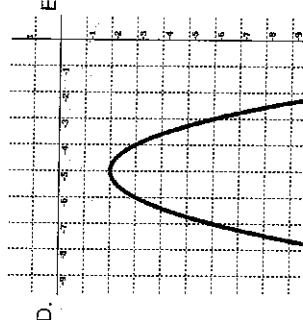
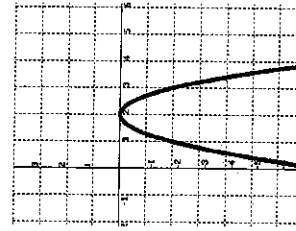
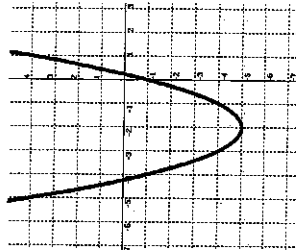
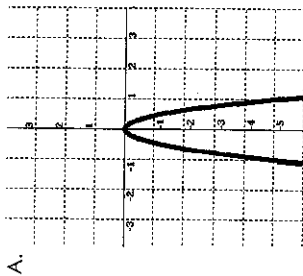
5. $g(x) = x^2 - 8$



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



PART 1: Match the graph to its function.



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

_____ 3. $f(x) = -5x^2$

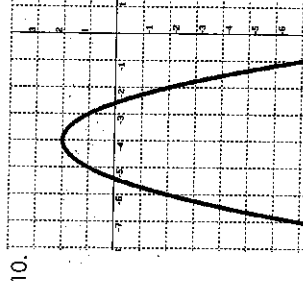
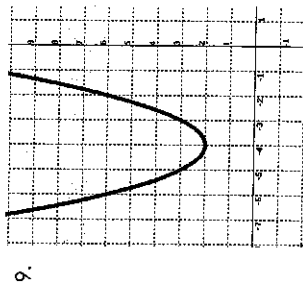
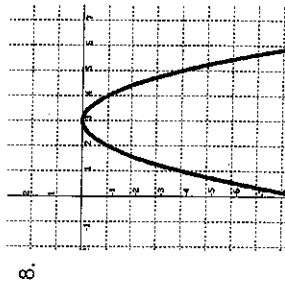
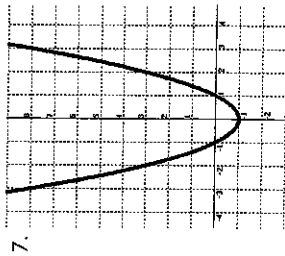
_____ 5. $f(x) = -2(x - 2)^2$

_____ 2. $f(x) = 2x^2$

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

_____ 6. $f(x) = -(x + 5)^2 - 2$

PART 2: Write a function that would result in the graph shown. Assume there is no vertical stretch or shrink



[Characteristics of Functions]

Example 1

$$f(x) = (x - 1)^2 + 3$$

Name/Shape:

Horizontal Shift:

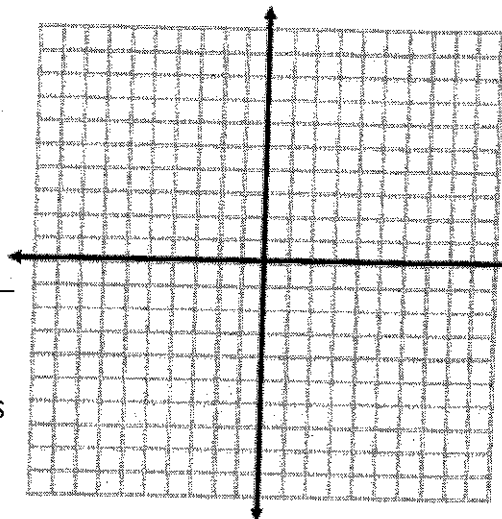
Reflection(s):

None x-axis y-axis

Vertical Shift:

Dilation:

None Vertical Stretch Vertical Shrink



| | |
|---------------------|--|
| Vertex | |
| Domain | |
| Range | |
| Increasing Interval | |
| Decreasing Interval | |
| Zeros | |
| Y-intercept | |
| Maximum | |
| Minimum | |
| Axis of Symmetry | |
| Left End Behavior | |
| Right End Behavior | |
| Even/Odd/Neither | |

Example 2

$$g(x) = \frac{1}{2}x^2 - 2$$

Name/Shape:

Horizontal Shift:

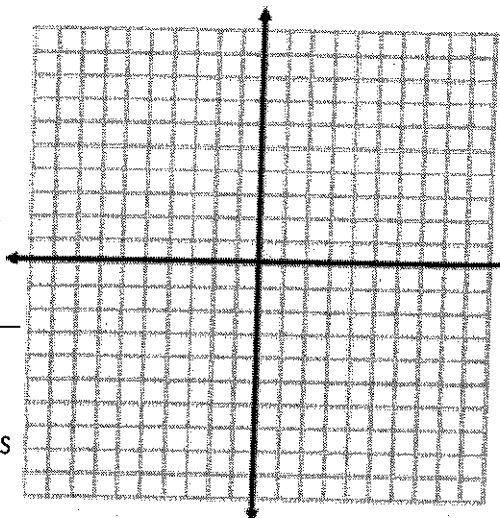
Reflection(s):

None x-axis y-axis

Vertical Shift:

Dilation:

None Vertical Stretch Vertical Shrink



| | |
|---------------------|--|
| Vertex | |
| Domain | |
| Range | |
| Increasing Interval | |
| Decreasing Interval | |
| Zeros | |
| Y-intercept | |
| Maximum | |
| Minimum | |
| Axis of Symmetry | |
| Left End Behavior | |
| Right End Behavior | |
| Even/Odd/Neither | |

Example 3 You Try!

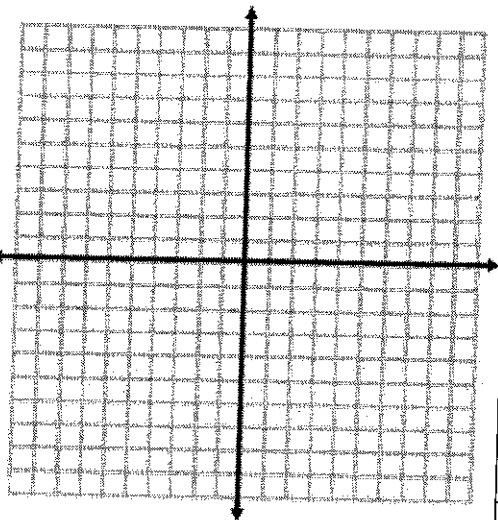
$n(x) = -3(x + 1)^2$

Name/Shape:

Horizontal Shift:

Reflection(s):
None x-axis y-axis

Vertical Shift:



Dilation:
None Vertical Stretch Vertical Shrink

| | |
|---------------------|--|
| Vertex | |
| Domain | |
| Range | |
| Increasing Interval | |
| Decreasing Interval | |
| Zeros | |
| Y-intercept | |
| Maximum | |
| Minimum | |
| Axis of Symmetry | |
| Left End Behavior | |
| Right End Behavior | |
| Even/Odd/Neither | |

Example 4

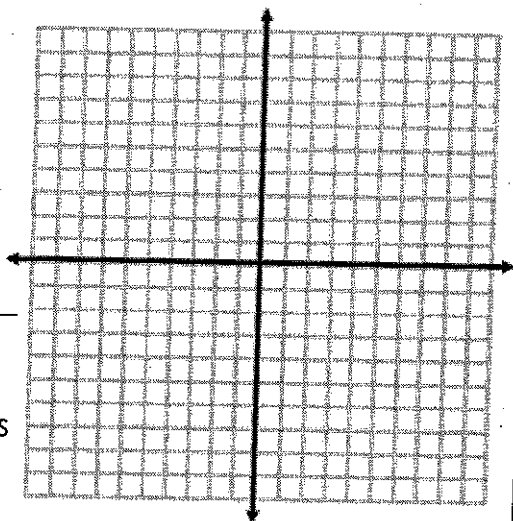
$t(x) = (x - 2)^2 + 3$

Name/Shape:

Horizontal Shift:

Reflection(s):
None x-axis y-axis

Vertical Shift:



Dilation:
None Vertical Stretch Vertical Shrink

| | |
|---------------------|--|
| Vertex | |
| Domain | |
| Range | |
| Increasing Interval | |
| Decreasing Interval | |
| Zeros | |
| Y-intercept | |
| Maximum | |
| Minimum | |
| Axis of Symmetry | |
| Left End Behavior | |
| Right End Behavior | |
| Even/Odd/Neither | |

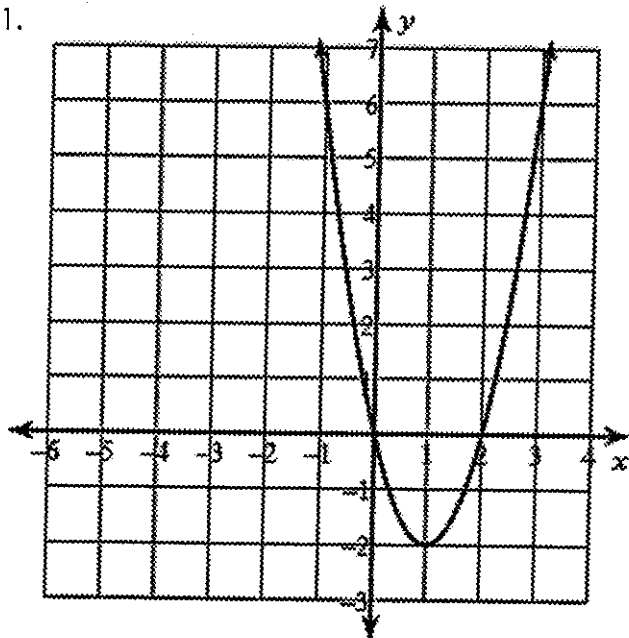
Algebra 1
Homework – Quadratic Characteristics

Name: _____

Date: _____

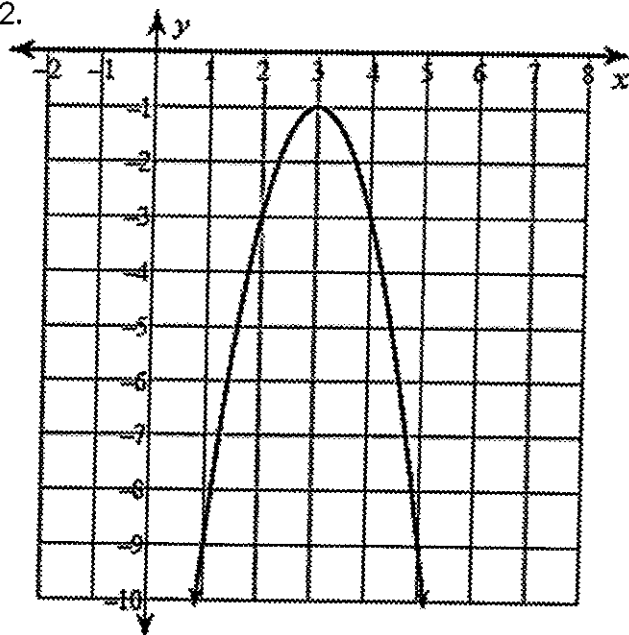
Fill in the characteristics of the given quadratic equation.

1.



| CHARACTERISTICS | |
|---------------------|--|
| Vertex | |
| Domain | |
| Range | |
| Increasing Interval | |
| Decreasing Interval | |
| Zeros | |
| Y-intercept | |
| Maximum | |
| Minimum | |
| Axis of Symmetry | |
| Left End Behavior | As $x \rightarrow -\infty$, $y \rightarrow$ |
| Right End Behavior | As $x \rightarrow \infty$, $y \rightarrow$ |

2.



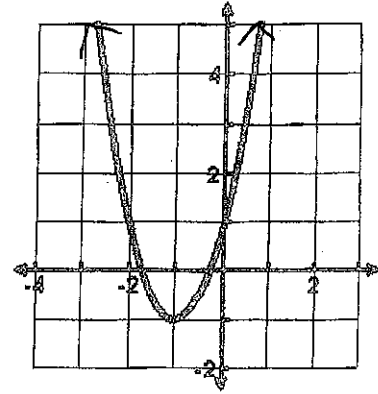
| CHARACTERISTICS | |
|---------------------|--|
| Vertex | |
| Domain | |
| Range | |
| Increasing Interval | |
| Decreasing Interval | |
| Zeros | |
| Y-intercept | |
| Maximum | |
| Minimum | |
| Axis of Symmetry | |
| Left End Behavior | As $x \rightarrow -\infty$, $y \rightarrow$ |
| Right End Behavior | As $x \rightarrow \infty$, $y \rightarrow$ |

Name: _____ Date: _____

Characteristics of Functions

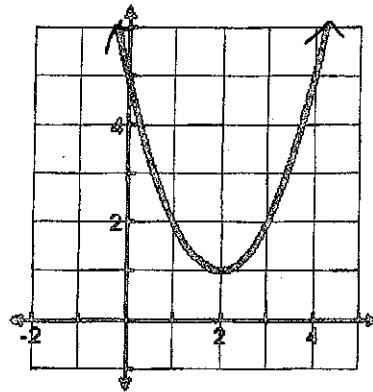
1. $f(x) = 2x^2 + 4x + 1$

- a. Domain: _____ b. Range: _____
- c. Extrema: _____ d. Axis of Sym: _____
- e. Increasing: _____ f. Decreasing: _____
- g. End Behavior: $x \rightarrow \infty, y \rightarrow$ _____ & $x \rightarrow -\infty, y \rightarrow$ _____
- h. Average rate of change $0 \leq x \leq 2$



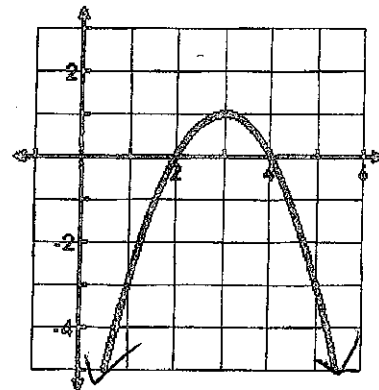
2. $f(x) = (x - 2)^2 + 1$

- a. Domain: _____ b. Range: _____
- c. Extrema: _____ d. Axis of Sym: _____
- e. Increasing: _____ f. Decreasing: _____
- g. End Behavior: $x \rightarrow \infty, y \rightarrow$ _____ & $x \rightarrow -\infty, y \rightarrow$ _____
- h. Average rate of change $0 \leq x \leq 2$

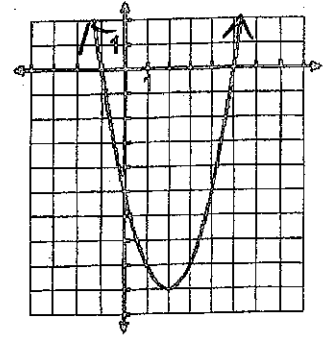


3. $f(x) = -(x - 2)(x - 4)$

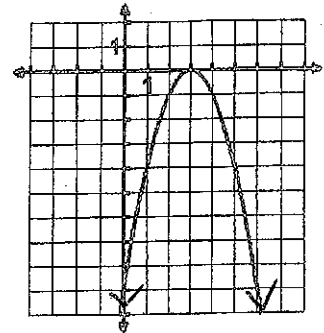
- a. Domain: _____ b. Range: _____
- c. Extrema: _____ d. Axis of Sym: _____
- e. Increasing: _____ f. Decreasing: _____
- g. End Behavior: $x \rightarrow \infty, y \rightarrow$ _____ & $x \rightarrow -\infty, y \rightarrow$ _____
- h. Average rate of change $0 \leq x \leq 2$



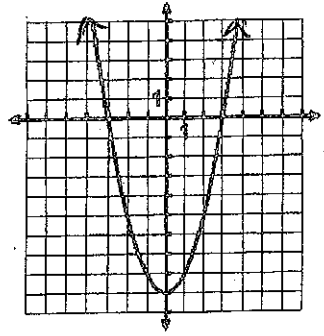
1. Domain: _____ Range: _____
 Vertex: _____ Extrema: _____
 X intercept(s): _____ Y Intercept: _____
 Increasing: _____ Decreasing: _____
 Axis of Symmetry: _____



2. Domain: _____ Range: _____
 Vertex: _____ Extrema: _____
 X intercept(s): _____ Y Intercept: _____
 Increasing: _____ Decreasing: _____
 Axis of Symmetry: _____



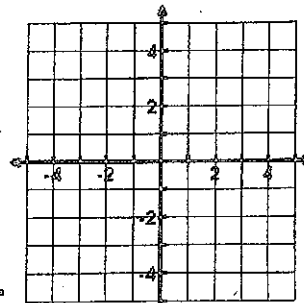
3. Domain: _____ Range: _____
 Vertex: _____ Extrema: _____
 X intercept(s): _____ Y Intercept: _____
 Increasing: _____ Decreasing: _____
 Axis of Symmetry: _____



Use the information to sketch a quadratic.

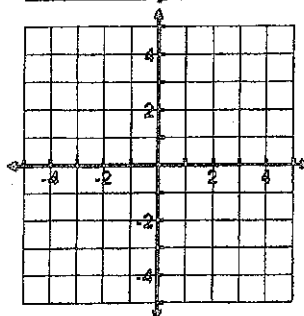
4. Domain: all real numbers
 Range: $y \geq 1$

Increasing: $-2 < x < \infty$
 Decreasing: $-\infty < x < -2$
 There is no stretch or shrink ($a = 1$)



5. Domain: all real numbers
 Vertex: (1, 2)

Increasing: $-\infty < x < 1$
 Decreasing: $1 < x < \infty$
 There is no stretch or shrink ($a = 1$)



Name: _____ Date: _____

"Modeling" Characteristics of Quadratic Equations

Wil E. Coyote is catapulting a boulder off a cliff to hit the road runner. Let t represent the number of seconds that the boulder catapults off the cliff and $h(t)$ denote the height of the boulder, in feet, above the base of the cliff. Ignoring air resistance, we can use the following formula to express the path of the boulder: $h(t) = -16t^2 + 24t + 160$

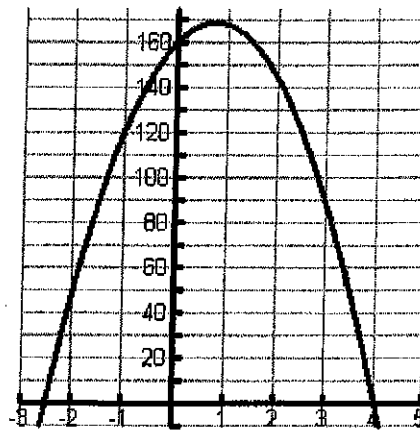
1. What does the x axis represent? _____ The y axis? _____

2. What part of the graph is insignificant? Why?

3. What was the height of the boulder before it was launched? _____

What special point on the graph is associated with this information? _____

4. If Wil E. Coyote simply pushed a boulder off the cliff, how would the graph look different?



5. How long will it take before the boulder reaches the bottom of the cliff? _____

What special point on the graph is associated with this information? _____

6. After how many seconds does the boulder change direction? _____

How high is the boulder when it changes direction? _____

What is this significant point called on the graph? _____

7. How high above the starting point does the boulder begin to change direction?

8. If Wil E. Coyote changes his mind, how many seconds does he have to stop the boulder from going over the cliff? _____

3. A baker has modeled the monthly operating costs for making wedding cakes by the function $y = 0.5x^2 - 12x + 150$ where y is the total cost in dollars and x is the number of cakes prepared.

A. Find the **vertex** and **axis of symmetry**. *The vertex would represent (Cakes Prepared, \$Cost).*

B. What is the **minimum** monthly operating cost?

C. How many **cakes** should be prepared each month to yield the minimum operating cost?

D. What are the baker's costs if he/she makes **no cakes (zero)**?

4. The path of a soccer ball is modeled by the function $h(x) = -0.005x^2 + 0.25x$, where h is the height in meters and x is the horizontal distance that the ball travels in meters. What is the **maximum height** that the ball reaches? *Hint: start by finding the vertex.*

5. The function $A(x) = x(10 - x)$ describes the area A of a rectangular flower garden, where x is its width in yards. What is the maximum area of the garden? *Hint: get your equation in standard form 1st and then start finding the vertex.*

6. A record label uses the following function to model the sales of a new release.

$$a(t) = -90t^2 + 8100t$$

The number of albums sold is a function of time, t , in days. On which **day** were the **most** albums sold? What is the **maximum** number of **albums** sold on that day?

Quadratic Inequalities

Determine whether the given ordered pair is a solution of each inequality.

a. $y \geq x^2$
(0, 4)

b. $y < -x^2 + 6x$
(6, -5)

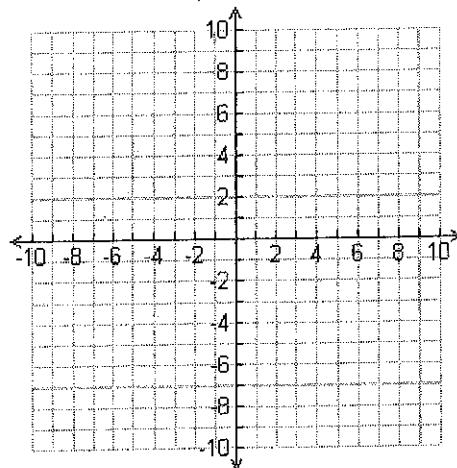
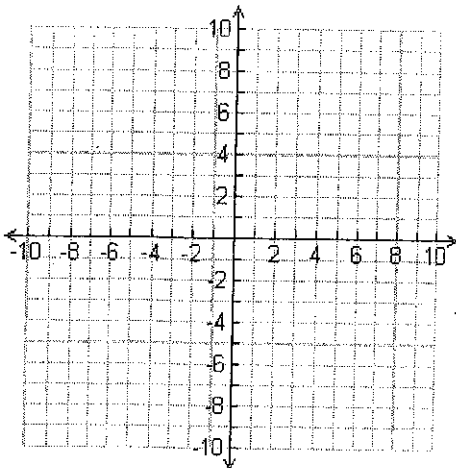
c. $y \geq 2x^2 + 3x + 2$
(-3, 4)

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Graph each inequality.

a. $y \geq x^2 + 2x - 2$

b. $y > -x^2 + 2x + 2$

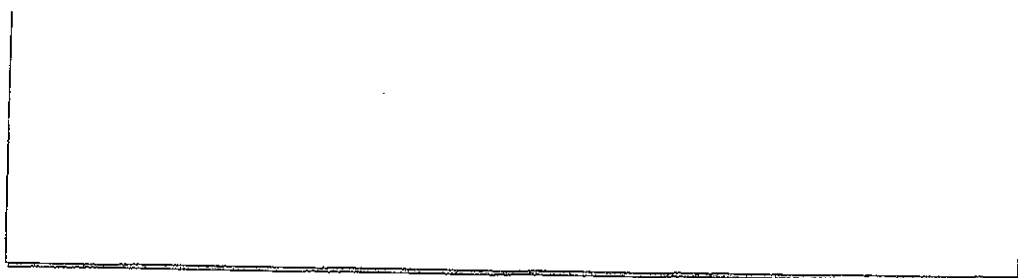


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Solve each inequality algebraically.

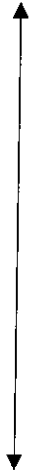
a. $x^2 + 2x \leq 3$

b. $2x^2 + 3x > 5$



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$$9x^2 - 2 \leq -3x$$



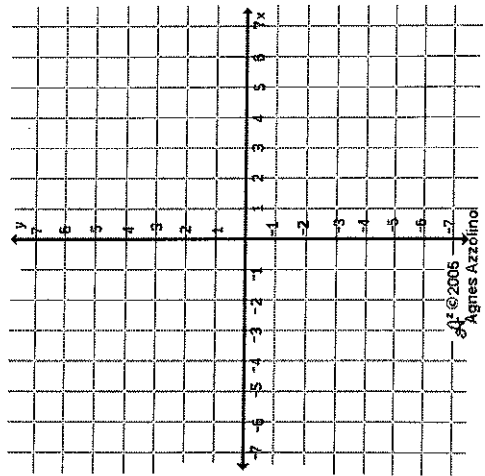
Interval notation:

$$2x^2 - 8x \geq -6$$

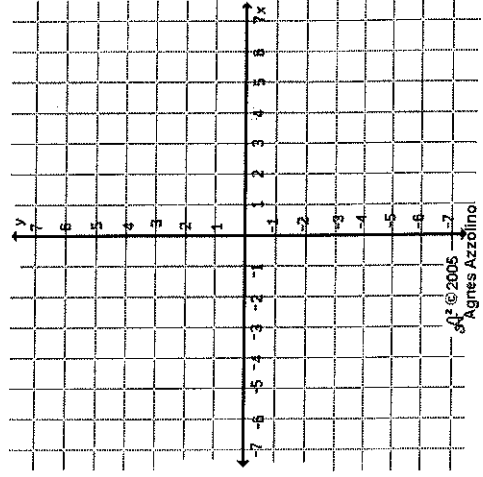


Interval notation:

$$y \geq -x^2 + 2x + 2$$



$$y < 2(x+1)(x-1)$$

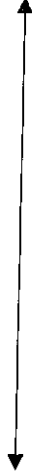


$$2x^2 + 5x \leq 12$$



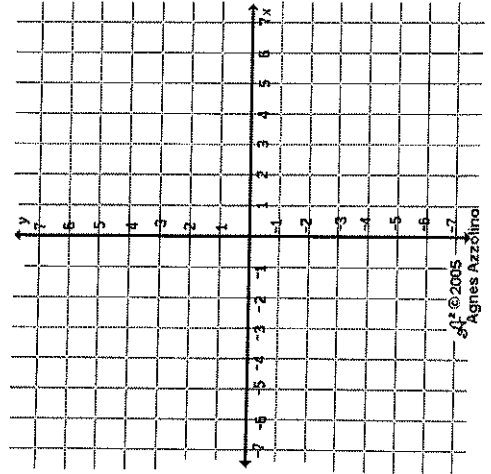
Interval notation:

$$x^2 < 3x + 10$$



Interval notation:

$$y \geq x^2 + 2x - 3$$



$$y < 2(x-1)(x-3)$$

