Investigation – Graphing Quadratic Functions

Objective:
Students will investigate transformations with a quadratic function.

Connections to Previous Learning:
Students should understand transformations with linear functions and be able to graph functions using a graphing calculator.

Connections to AP*:
AP Calculus Topic: Analysis of Functions

Materials:
Student Activity pages, graphing calculators

Teacher Notes:
Students work with a partner to investigate transformations with the quadratic functions using a graphing calculator.

Investigation – Graphing Quadratic Functions

1. Complete a table of values and graph $y = x^2$.

2. Using a graphing calculator, graph each function. State which graph is the steepest.

   a) $y = x^2$ b) $y = 2x^2$ c) $y = 3x^2$ d) $y = 4x^2$

3. Using a graphing calculator, graph each function. State which graph is the steepest.

   a) $y = x^2$ b) $y = \frac{1}{2}x^2$ c) $y = \frac{1}{3}x^2$ d) $y = \frac{1}{4}x^2$

4. Determine which graph is the steepest without using a graphing calculator and without graphing.

   $y = 10x^2$ $y = 6x^2$ Explain your answer. Use a graphing calculator to check your predictions.

5. Using a graphing calculator, graph each function.

   a) $y = -x^2$ b) $y = -2x^2$ c) $y = -3x^2$ d) $y = -4x^2$

6. Using the graphing calculator, graph each function.

   a) $y = -x^2$ b) $-\frac{1}{2}x^2$ c) $y = -\frac{1}{3}x^2$ d) $y = -\frac{1}{4}x^2$

7. a) Sketch a graph for $y = ax^2$ if a > 0. b) Sketch a graph for $y = ax^2$ if a < 0.

8. Using a graphing calculator, graph each function. Give the minimum value for y for each function.

   a) $y = x^2$ b) $y = x^2 + 1$ c) $y = x^2 - 1$ d) $y = x^2 + 3$

9. Using the graphing calculator, graph each function. Give the maximum value for y for each function.

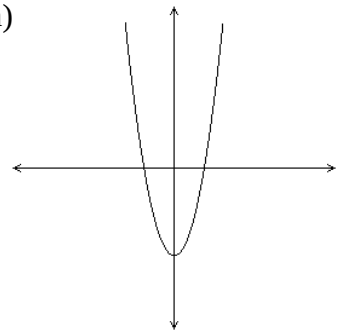
   a) $y = -x^2$ b) $y = -x^2 + 1$ c) $y = -x^2 - 2$ d) $y = -x^2 + 4$

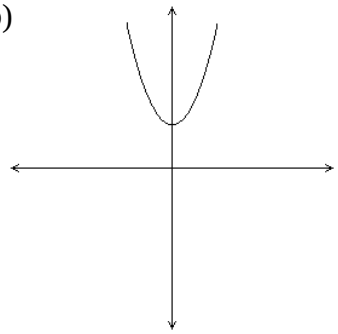
10. Without a calculator, determine the vertex for each graph and state if it gives a maximum or a minimum value for *y*. Use a graphing calculator to check your answers.

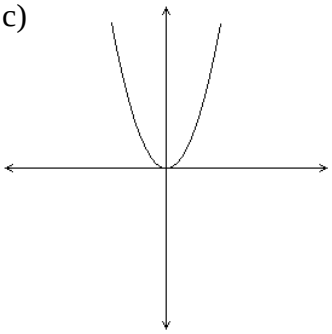
    a) $y = 4x^2$ b) $y = -x^2 + 3$ c) $y = x^2 - 5$ d) $y = -6x^2 + 8$

Match each function with its graph.

i. $y = 8x^2$ ii. $y = 8x^2 + 3$ iii. $y = 8x^2 - 3$

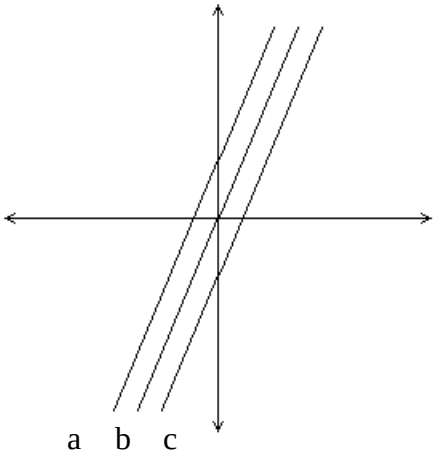
a) 

b) 

c) 

11. Match each function with its graph.

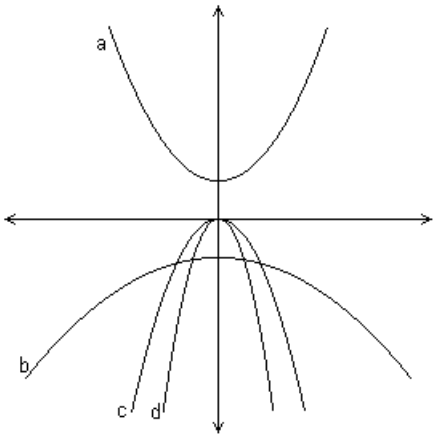
i. $8x$ ii. $y = 8x + 3$ iii. $y = 8x - 3$



12. Match each function with its graph.

i. $y = -2x^2$ ii. $y = -5x^2$

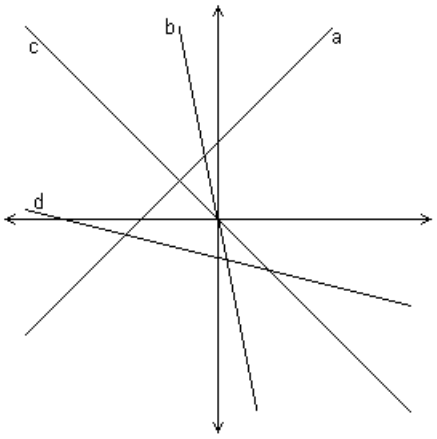
iii. $-\frac{1}{4}x^2 - 2$ iv. $y = x^2 + 2$



14. Match each function with its graph.

i. $y = -x$ ii. $y = -5x$

iii. $y = -\frac{1}{4}x - 2$ iv. $y = x + 4$

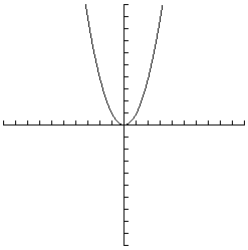


Investigation – Graphing Quadratic Functions

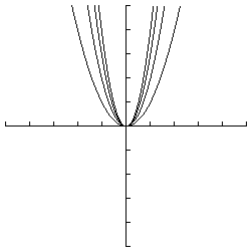
Answers:

1.

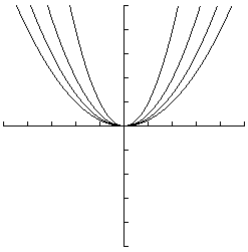
x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



2. $y = 4x^2$ is the steepest.

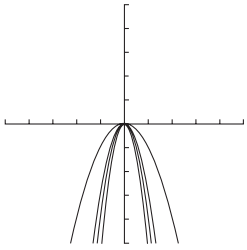


3. $y = x^2$ is the steepest.



4. $y = 10x^2$ is the steepest.

5.



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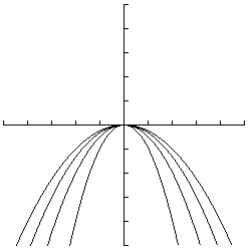
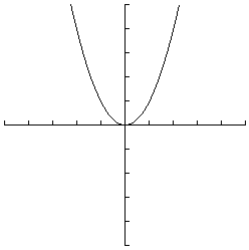
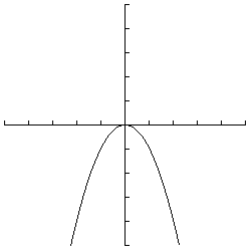


7. a) b)





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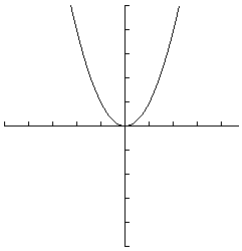
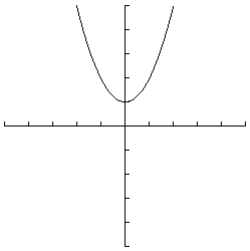
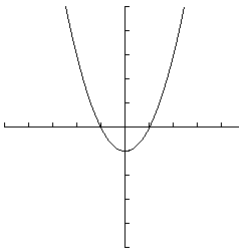


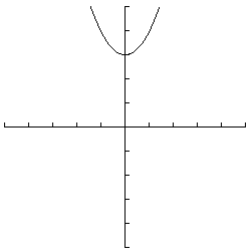
a) 0



b) 1

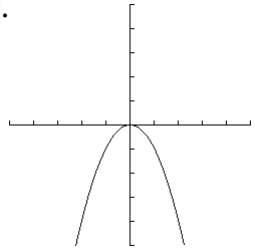


c) -1

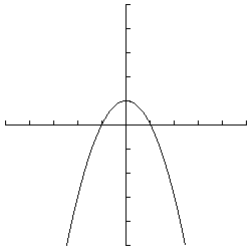


d) 3

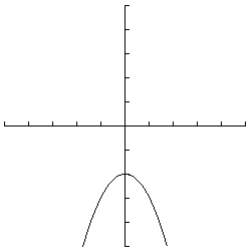
9.



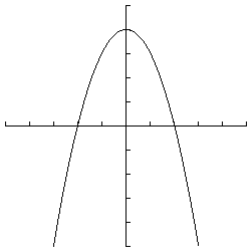
a) 0



b) 1



c) -2



d) 4

10. a) (0,0) minimum value of *y* is 0
    b) (0,3) maximum value of *y* is 3
    c) (0,-5) minimum value of *y* is -5
    d) (0,8) maximum value of *y* is 8

11. i. c ii. b iii. a
12. i. b ii. a iii. c
13. i. c ii. d iii. b iv. a
14. i. c ii. b iii. d iv. a