

Quadratic Functions Day II

1. A **quadratic function** is a function that can be written in the **standard form**:

$y = ax^2 + bx + c$, where $a \neq 0$

D.P.O.

parent function: $y = x^2$

2. Every quadratic function has a U-shaped graph called a parabola.

3. If the leading coefficient **a is positive**, the parabola opens up.

ex $y = 3x^2 + 2$

4. If the leading coefficient **a is negative**, the parabola opens down.

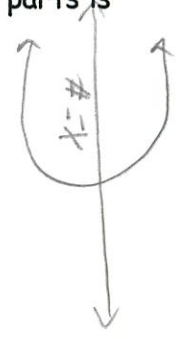
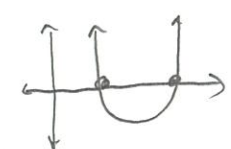
ex $y = -x^2 + 3x + 6$

5. The Turning point (vertex) is the lowest point (**minimum**) of a parabola that opens up and the highest point (**maximum**) of a parabola that opens down.

6. The **vertical line** passing through the **vertex** that divides the parabola into two symmetric parts is called the axis of symmetry. Its' equation is always $x = \#$.

7. Solutions of quadratic functions can also be called the Roots, x-intercepts, or zeros.

\rightarrow b/c $y = 0$



To find the Vertex and Axis of Symmetry Algebraically

algebraically

1. Put the quadratic function in standard form: $y = ax^2 + bx + c$
2. Identify the numeric values of a, b, and c.
3. The vertex has an x-coordinate of $x = \frac{-b}{2a}$. Plug in the values for a and b.
4. Substitute whatever you get for x in step 3 into the quadratic function to find the y-coordinate of the vertex.
5. The axis of symmetry is the vertical line $x = \frac{-b}{2a}$.

$x = \#$ same
(x)

T.P. \approx Algebraically \approx

Examples 1-3: Find the vertex and Axis of Symmetry for these quadratic functions.

1) $y = -2x^2 + 4x - 9$

A.O.S:
 $x = \frac{-b}{2a}$
 $x = \frac{-(4)}{2(-2)}$
 $x = \frac{-4}{-4}$
 $x = 1$

T.P. Vertex: (1, -7)

$a = \frac{-2}{ax^2}$ $b = \frac{4}{bx}$ $c = \frac{-9}{c}$

T.P. $y = -2x^2 + 4x - 9$
 $y = -2(1)^2 + 4(1) - 9$
 $y = -2(1) + 4(1) - 9$
 $y = -2 + 4 - 9$
 $y = -7$

Axis of Symmetry: $x = 1$

2) $y = x^2 - 10x$

A.O.S:
 $x = \frac{-b}{2a}$
 $x = \frac{-(-10)}{2(1)}$
 $x = \frac{10}{2}$
 $x = 5$

T.P. Vertex: (5, -25)

$a = \frac{1}{ax^2}$ $b = \frac{-10}{bx}$ $c = \frac{0}{c}$

T.P. $y = x^2 - 10x$
 $y = (5)^2 - 10(5)$
 $y = 25 - 10(5)$
 $y = 25 - 50$
 $y = -25$

Axis of Symmetry: $x = 5$

3) $y = -1 + x^2 + 4x$

A.O.S:
 $y = x^2 + 4x - 1$
 $x = \frac{-b}{2a}$
 $x = \frac{-(4)}{2(1)}$
 $x = \frac{-4}{2}$
 $x = -2$

T.P. Vertex: (-2, -5)

$a = \frac{1}{ax^2}$ $b = \frac{4}{bx}$ $c = \frac{-1}{c}$

T.P. $y = -1 + x^2 + 4x$ $\xrightarrow{\text{use original equation}}$
 $y = -1 + (-2)^2 + 4(-2)$
 $y = -1 + 4 + 4(-2)$
 $y = -1 + 4 - 8$
 $y = -5$

Axis of Symmetry: $x = -2$

$|x+2| = \text{left}$
 $|x-2| = \text{right}$

$-|x| = \text{Reflection in the } x\text{-axis}$
 $5|x| = \text{narrower}$
 $.5|x| = \text{wider}$

Name: _____

Date: _____

$|x|+2 = \text{up}$
 $|x|-2 = \text{down}$

8A Pd _____

Quadratic Functions Classwork Extra Practice

T.P. / vertex

1) Which one of the following equations represents a **quadratic function**?

- A) $y = x + 2$ linear
- B) $y = |x + 2|$ abs. value
- C) $y = x^2$
- D) $y = 2x$

2) Find **algebraically** the equation of the **axis of symmetry** and the coordinates of the **vertex** of the parabola whose equation is

$y = -2x^2 - 8x + 3$. [Show all work.]

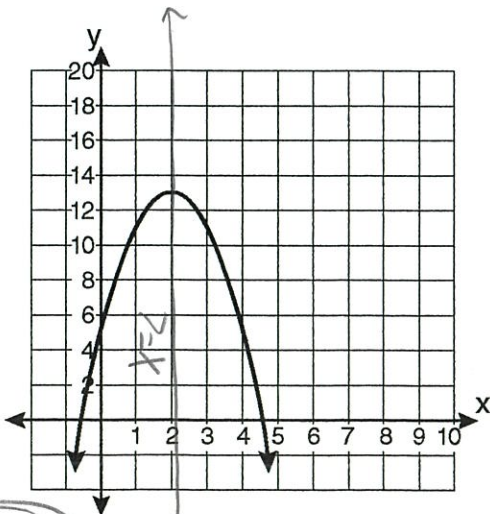
$a = -2$
 $b = -8$
 $c = 3$

$x = \frac{-b}{2a}$
 $x = \frac{-(-8)}{2(-2)}$
 $x = \frac{8}{-4}$
 $x = -2$

$y = -2x^2 - 8x + 3$
 $y = -2(-2)^2 - 8(-2) + 3$
 $y = -2(4) - 8(-2) + 3$
 $y = -8 + 16 + 3$
 $y = 11$

A.O.S: $x = -2$ vertex/T.P. = $(-2, 11)$

3) What is the equation of the **axis of symmetry** of the parabola shown in the diagram below?



- A) $x = 2$
- B) $x = 4.5$
- C) $x = 13$
- D) $x = -0.5$

4) What are the coordinates of the **minimum point** of a parabola whose equation is

$y = x^2 + 3$ $a = 1$

- A) $(-1, 2)$
- B) $(3, 12)$
- C) $(0, 3)$
- D) $(3, 0)$

$x = \frac{-b}{2a}$
 $x = \frac{-(0)}{2(1)}$
 $x = \frac{0}{2}$ $x = 0$

$y = x^2 + 3$
 $y = (0)^2 + 3$
 $y = 0 + 3$
 $y = 3$

5) The height, y , of a ball tossed into the air can be represented by the equation

$y = -x^2 + 10x + 3$, where x is the elapsed time.

What is the **equation of the axis of symmetry** of this parabola?

- A) $x = 5$
- B) $x = -5$
- C) $y = -5$
- D) $y = 5$

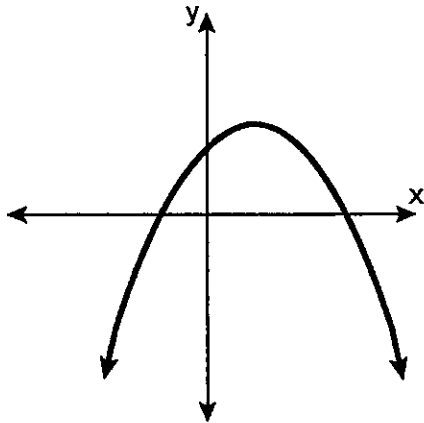
$x = \frac{-b}{2a}$
 $x = \frac{-(10)}{2(-1)}$ $x = \frac{-10}{-2}$ $x = 5$

6) Consider the graph of the equation $y = ax^2 + bx + c$, when $a \neq 0$. If a is multiplied by 3, what is true of the graph of the resulting parabola?

- A) The new parabola is narrower than the original parabola.
- B) The vertex is 3 units above the vertex of the original parabola.
- C) The new parabola is 3 units to the right of the original parabola.
- D) The new parabola is wider than the original parabola.

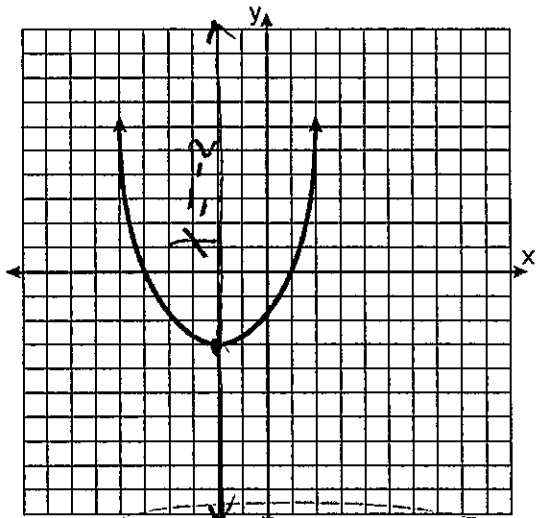
$y = 3(x+2)^2$

7) What type of graph is shown in the diagram below?



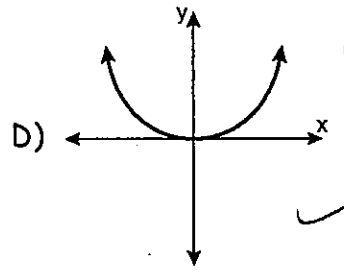
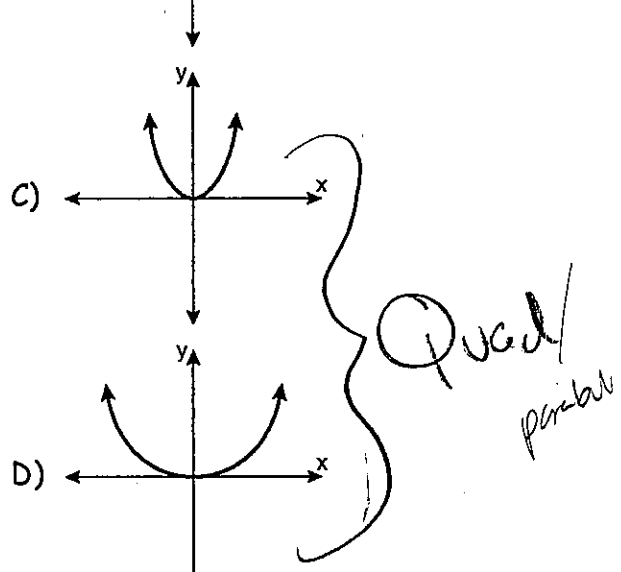
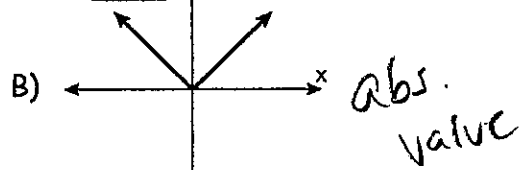
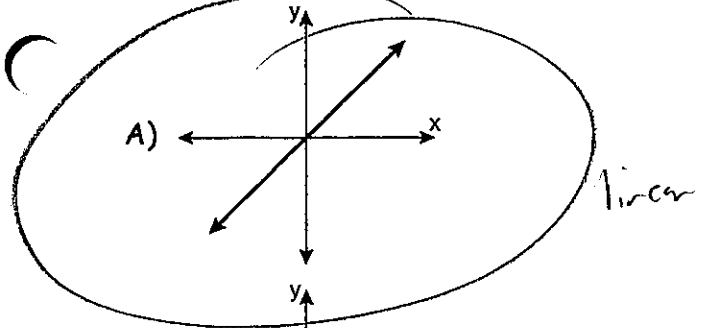
- A) exponential
- B) quadratic** *parabola*
- C) linear
- D) absolute value \checkmark

8) What are the vertex and the axis of symmetry of the parabola shown in the diagram below?

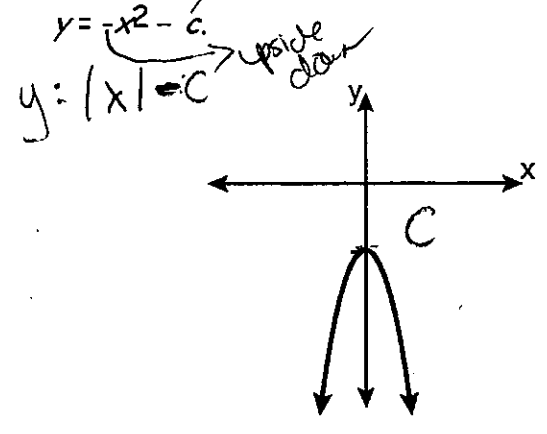


- A) The vertex is $(-2, -3)$, and the axis of symmetry is $x = -2$.**
- B) The vertex is $(-3, -2)$, and the axis of symmetry is $x = -2$.
- C) The vertex is $(-3, -2)$, and the axis of symmetry is $y = -2$.
- D) The vertex is $(-2, -3)$, and the axis of symmetry is $y = -2$.

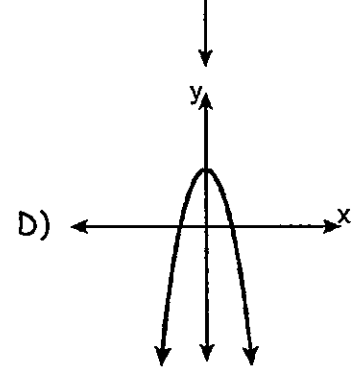
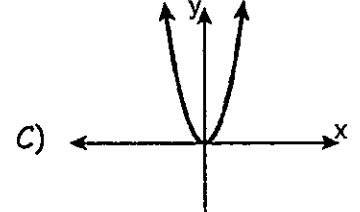
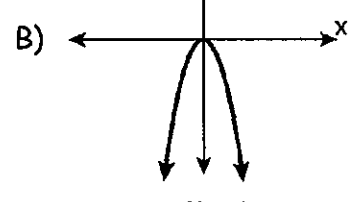
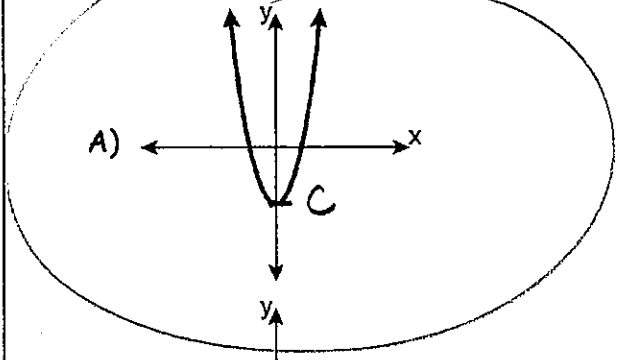
9) Which graph represents a linear function?



10) The diagram below shows the graph of



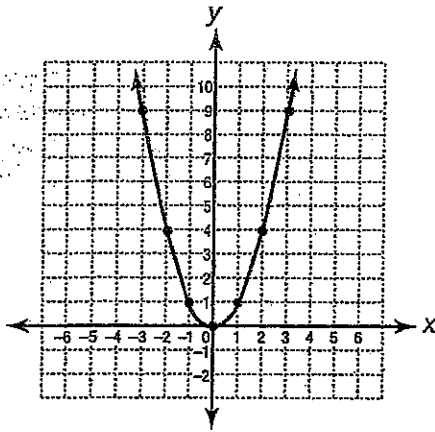
Which diagram shows the graph of $y = x^2 - c$?



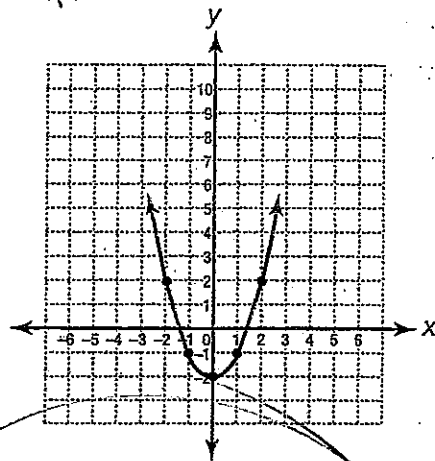
parent: $y = x^2$

11) Which of the following is the graph of $y = x^2 + 2$? Up 2 from (0,0)

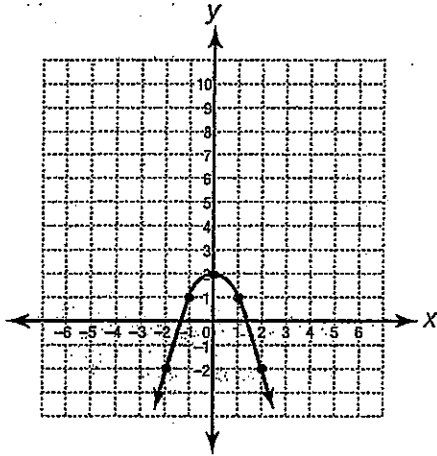
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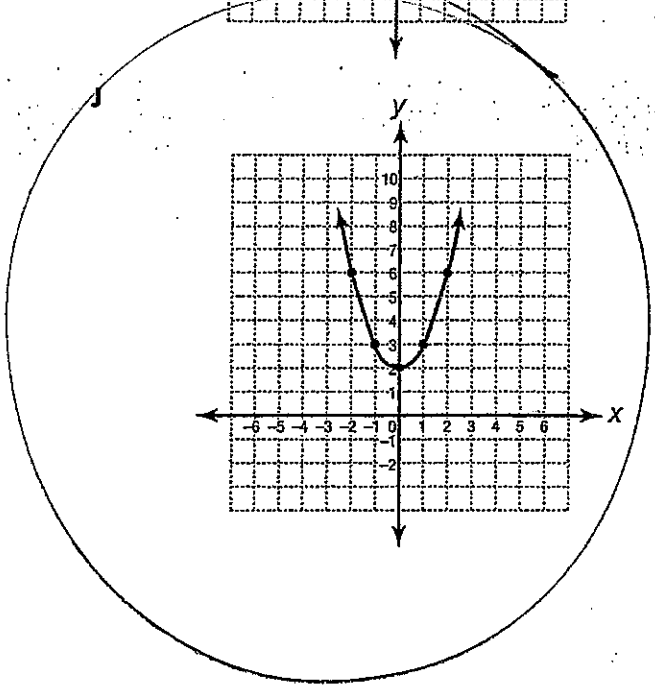
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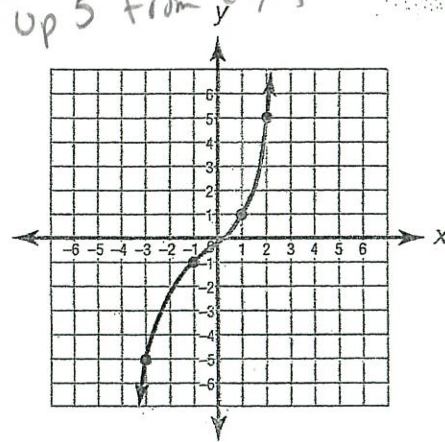
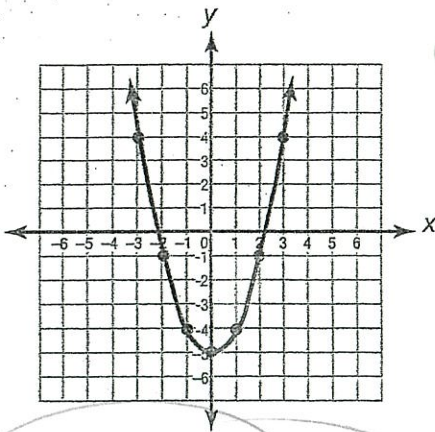


parent: $y = x^2$

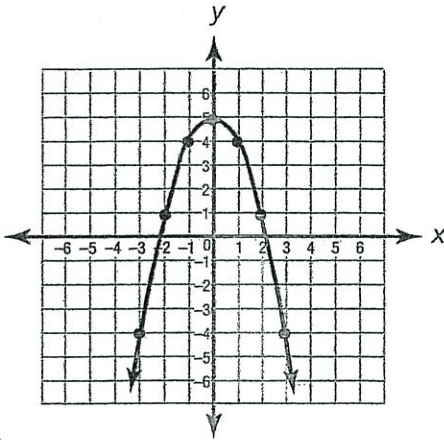
12) Which of the following is the graph of $y = -1x^2 + 5$?

↑ c
Upside down
↑ up 5 from (0,0)

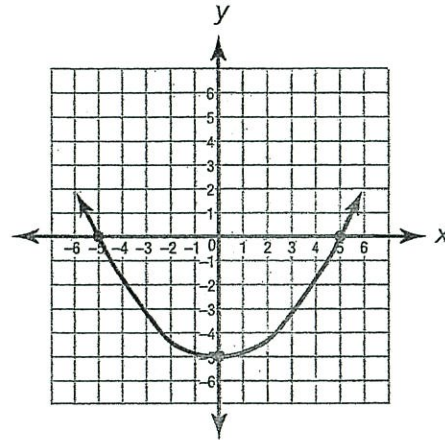
A



B



D



10

