

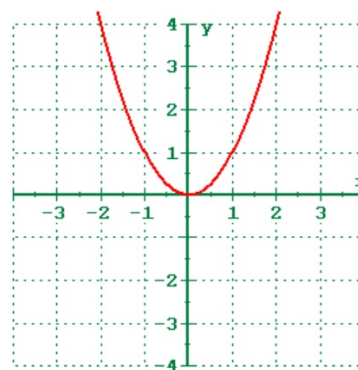
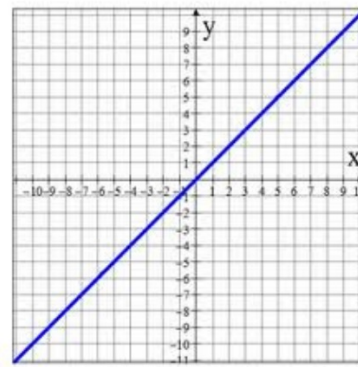
## ***Understanding Quadratics***

### ***Objectives:***

- *Identify graphs and equations of quadratic parent functions.*
- *Learn and use quadratic terminology.*
- *Investigate, describe, and predict the effects of changes in **a** on the graph of  $y = ax^2 + c$*
- *Investigate, describe, and predict the effects of changes in **c** on the graph of  $y = ax^2 + c$*

# Parent Functions

- **The parent function is the simplest function of a certain type.**
- **It is called a "Parent Function" because all of the functions in that group look like that and only change location and shape.**
- **The linear parent function is  $y = x$ .**
  - **All graphs are straight lines.**  
**(not studying today)**
- **The quadratic parent function is  $y = x^2$ .**
  - **All graphs are parabolas.**  
**(will investigate today)**



## **Quadratic Vocabulary**

**Parabola-**

**Vertex -**        **maximum**  
                     **minimum**

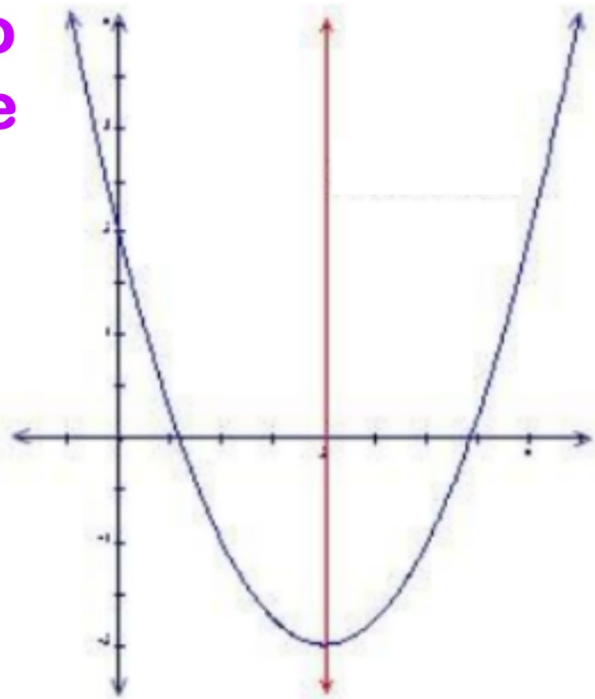
**Axis of Symmetry -**

**x - intercept -**

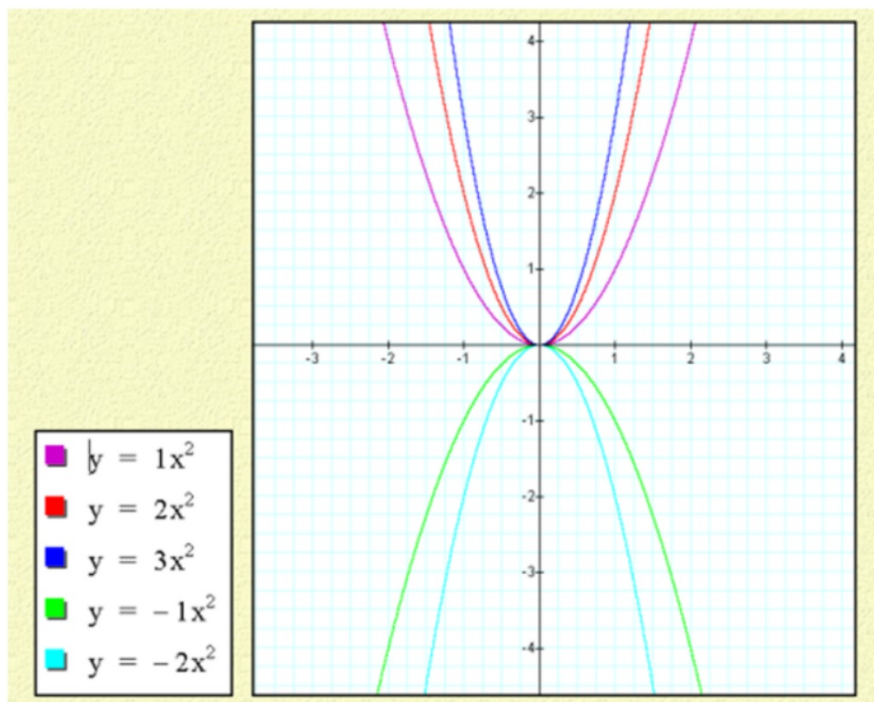
**zeros -**

**roots -**

**Label the graph to  
the right using the  
vocabulary terms**

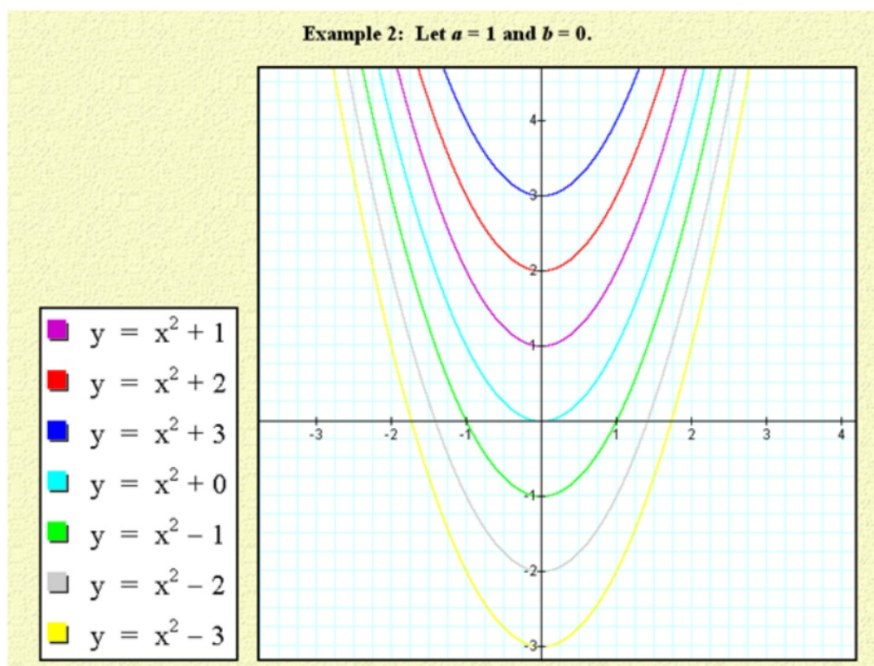


**Changing the value of  $a$  in  $y = ax^2 + c$**



**What happened to the graph as the value of " $a$ " changes?**

## **Changing the value of $c$ in $y = ax^2 + c$**



***What happened to the graph as the value of " $c$ " changes?***

***What is the new equation if the given function is translated down 4 units?***

$$**y = x^2 - 3**$$



$$**y = 6x^2 + 8**$$



**Test your understanding**

**EVERYBODY STAND UP!!!**



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

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

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

$$f(x) = x^2 + 20$$

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

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

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

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

$$f(x) = 1/2x^2$$

$$f(x) = 5x^2$$

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

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

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

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

$$f(x) = \frac{1}{3}x^2 - 3$$

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

$$f(x) = -\frac{1}{2}x^2 - 6$$

$$f(x) = 5x^2 + 27$$

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

# STAAR PRACTICE PROBLEMS

1) Casey conducted an experiment and recorded the data in the table shown below.

Which equation best describes these data?

$x$	$y$
1	1
2	2
3	5
4	10

**F**  $y = x$

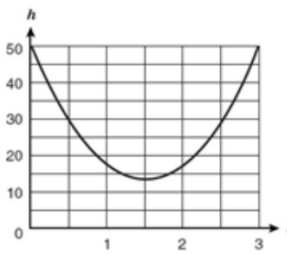
**G**  $y = 2x - 1$

**H**  $y = x^2 + x - 1$

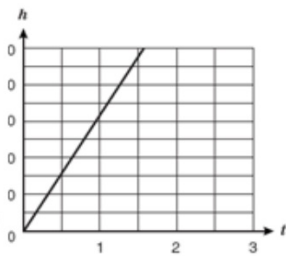
**J**  $y = (x - 1)^2 + 1$

2) The height,  $h$ , of a football when kicked with respect to time,  $t$ , is described by the function  $h = -16t^2 + 48t$ . Which graph shows the correct sketch of this function?

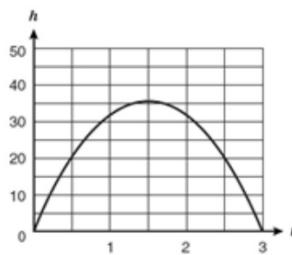
A



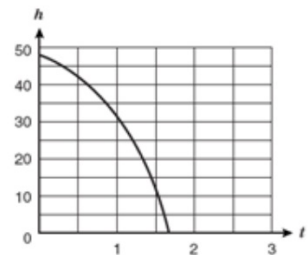
B



C



D



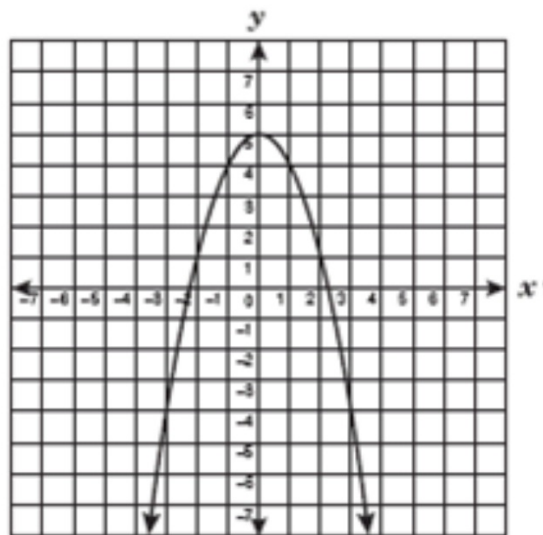
3) Which quadratic equation best represents the parabola shown below?

**A**  $y = x^2 + x + 5$

**B**  $y = x^2 + 5$

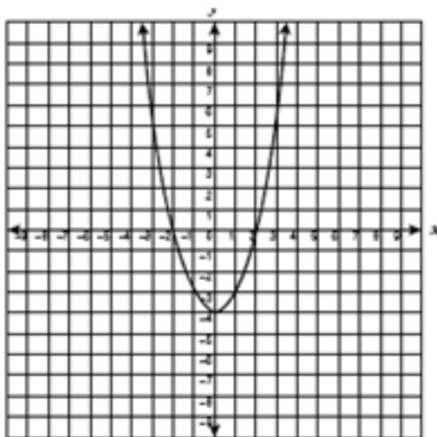
**C**  $y = -x^2 + 5$

**D**  $y = -x^2 + x + 5$



**5)** Jake studied the parabola shown below.

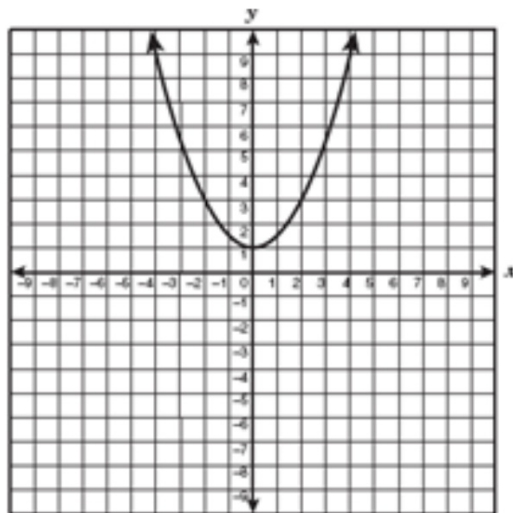
Which is an accurate conclusion that Jake could make about this parabola?



- A** The vertex is at  $(-2, 0)$ .
- B** The minimum value is at  $(0, -4)$ .
- C** The maximum value is at  $(2, 0)$ .
- D** The axis of symmetry is the  $x$ -axis.

6) What is the parent function of the graph shown on the grid below?

- A**  $y = -x$
- B**  $y = -x^2$
- C**  $y = x^2 + 1$
- D**  $y = x^2$



7) Which of these are characteristics of the parent function of a quadratic equation?

I. The parent function of a quadratic equation has the vertex at  $(0, 0)$ .

II. The parent function of a quadratic equation opens downward.

III. The parent function of a quadratic equation has the  $y$ -axis as its line of symmetry.

**F** I and II only

**G** I and III only

**H** II and III only

**J** I, II, and III



**8)** What is the effect on the graph of the equation  $y = -4x^2$  when the equation is changed to  $y = 4x^2$ ?

**A** The graph of  $y = 4x^2$  is translated 8 units down.

**B** The graph of  $y = 4x^2$  is a reflection of  $y = -4x^2$  across the  $x$ -axis.

**C** The graph of  $y = 4x^2$  is translated 8 units up.

**D** The graph of  $y = 4x^2$  is a reflection of  $y = -4x^2$  across the  $y$ -axis.

9) The graph of  $y = 0.2x^2$  is shown below.

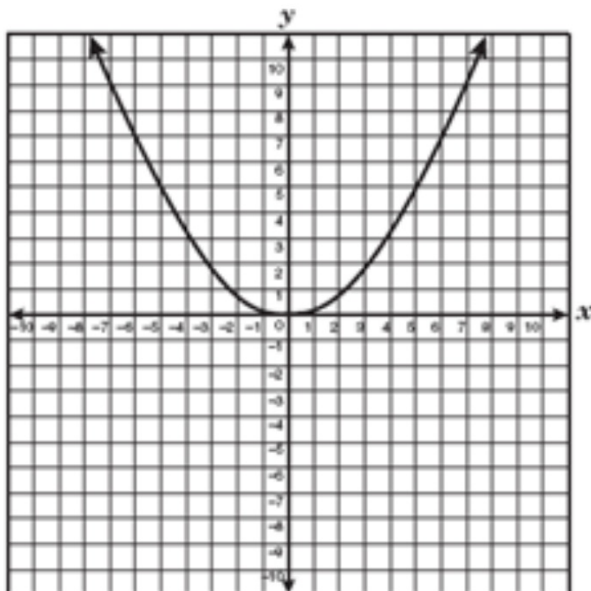
Which of the following equations represents a graph that is wider than the graph of  $y = 0.2x^2$ ?

**A**  $y = 0.3x^2$

**B**  $y = 0.2x^2 + 1$

**C**  $y = 0.1x^2$

**D**  $y = 0.2x^2 - 1$



**10)** Which equation will produce the widest parabola when graphed?

**A**  $y = 2x^2$    **C**  $y = -0.6x^2$

**B**  $y = -6x^2$    **D**  $y = 0.2x^2$

**11)** Which statement describes what happens to the graph of  $y = ax^2$  when the value of  $a$  is changed from 1 to 6?

- A** The graph translates 6 units up.
- B** The graph translates 6 units to the right.
- C** The graph narrows.
- D** The graph widens.

12) How does the graph of  $y = -\frac{3}{4}x^2$  differ from the graph of  $y = \frac{4}{3}x^2$ ?

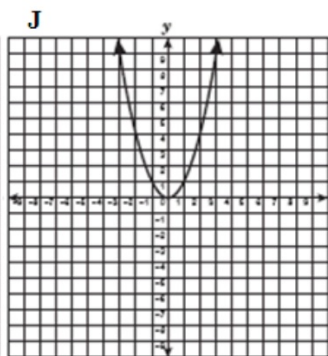
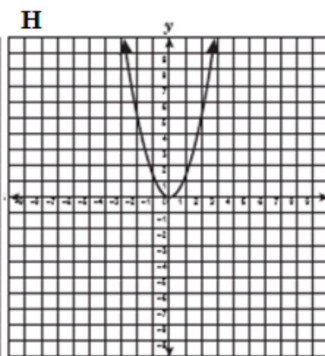
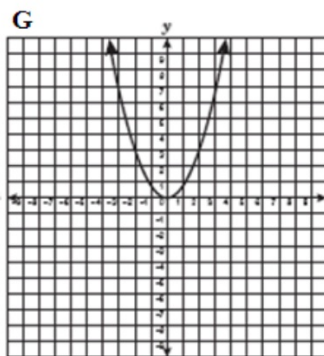
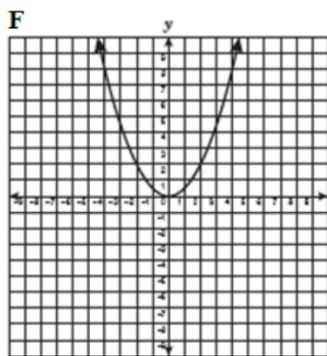
F The graph of  $y = -\frac{3}{4}x^2$  opens downward and is wider than the graph of  $y = \frac{4}{3}x^2$ .

G The graph of  $y = -\frac{3}{4}x^2$  opens upward and is wider than the graph of  $y = \frac{4}{3}x^2$ .

H The graph of  $y = -\frac{3}{4}x^2$  opens upward and is narrower than the graph of  $y = \frac{4}{3}x^2$ .

J The graph of  $y = -\frac{3}{4}x^2$  opens downward and is narrower than the graph of  $y = \frac{4}{3}x^2$ .

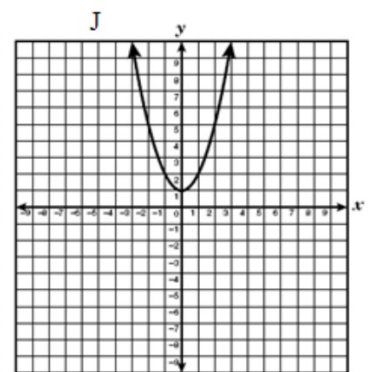
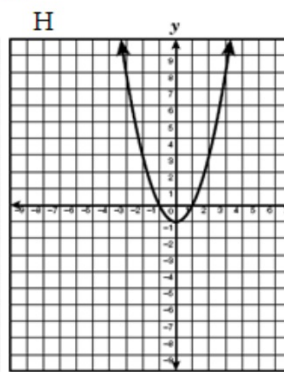
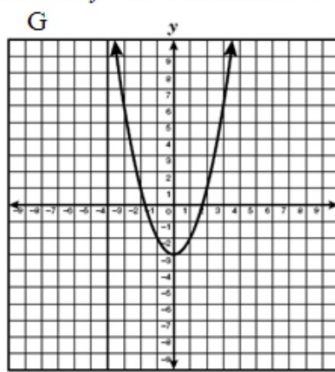
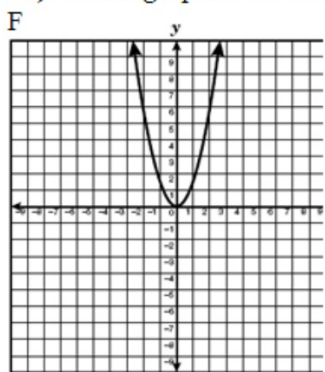
13) The graphs below represent functions of the form  $y = ax^2$ . In which of the following graphs does  $a$  have the smallest value?



**14)** In the graph of the function  $y = x^2 + 5$ , which describes the shift in the vertex of the parabola if, in the function, 5 is changed to  $-2$ ?

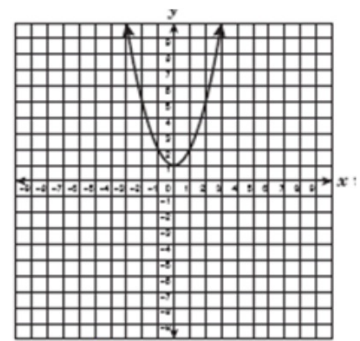
- A** 3 units up
- B** 7 units up
- C** 3 units down
- D** 7 units down

15) Which graph shows a function  $y = x^2 + c$  when  $c < -1$ ?

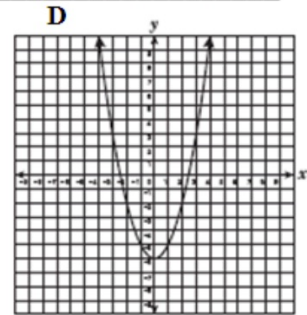
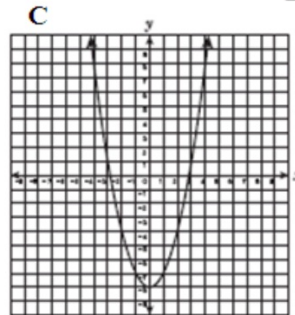
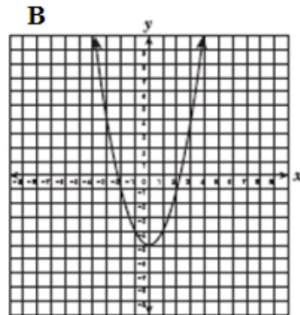
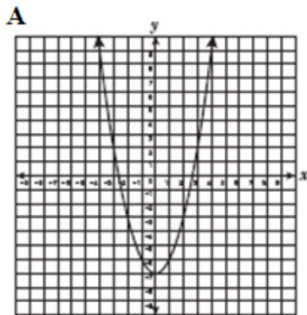




16) The graph of a function is shown below.



If the graph is translated 7 units down, which of the following best represents the resulting graph?



**17** The graph of  $y = 11x^2 + c$  is a parabola with a vertex at the origin. Which of the following is true about the value of  $c$ ?

**A**  $c > 0$

**B**  $c < 0$

**C**  $c = 0$

**D**  $c = 11$

18) If the graph of  $y = 19x^2 + 31$  is translated up 15 units, which of the following equations will best describe the resulting graph?

**F**  $y = 34x^2 + 31$

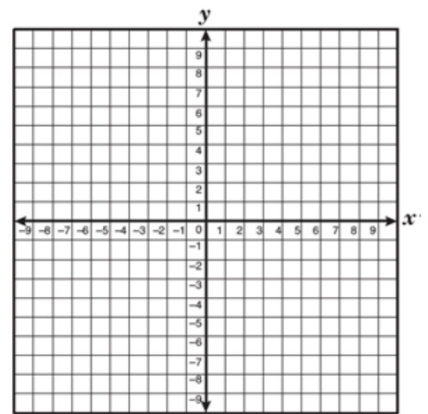
**G**  $y = 34x^2 + 46$

**H**  $y = 19x^2 + 46$

**J**  $y = 19x^2 + 16$

19) Which of the following is the vertex of the graph of  $y = 3x^2 - 8x + 4$ ?

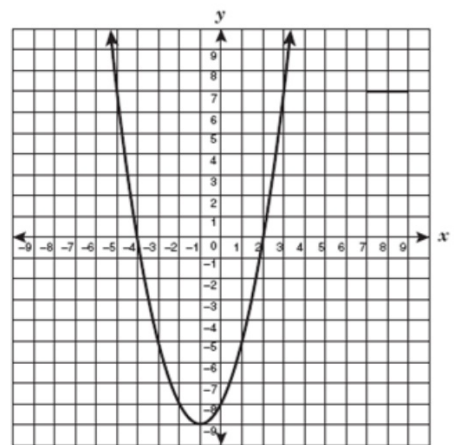
- A  $\left(\frac{4}{3}, -\frac{4}{3}\right)$
- B  $\left(\frac{1}{2}, 0\right)$
- C  $(0, 4)$
- D  $\left(\frac{2}{3}, 2\right)$



20) The graph of  $y = x^2 + 2x - 8$  is shown below.

Which coordinate pair best represents the vertex of this graph?

- F  $(-4, 0)$
- G  $(2, 0)$
- H  $(0, -8)$
- J  $(-1, -9)$



**21)** Which of the following is the vertex of the graph of the equation  $y = -x^2 + 2x + 3$ ?

**A** (0, 3)

**B** (-1, 0)

**C** (1, 4)

**D** (3, 0)

**22)** If the graph of a function of the form  $y = ax^2 + c$  has a vertex located above the origin and opens downward, which of the following must be true about the values of  $a$  and  $c$ ?

**A**  $a < 0$  and  $c > 0$

**B**  $a > 0$  and  $c > 0$

**C**  $a < 0$  and  $c < 0$

**D**  $a > 0$  and  $c < 0$

