Algebra RH

Essential Question: How are quadratic equations in standard form written in vertex form?

Do Now:

Given the following equations, identify the vertex, axis of symmetry, and direction of the parabola.

vertical line through vertex

(a) $y = (x-5)^2 - 1$

Vertex: (5,-1)

Axis of Symmetry: x = 5

Opens: up   a = 1

(b) $y = -(x-6)^2 + 2$

Vertex: (6,2)

Axis of Symmetry: x = 6

Opens: down   a = -1

VERTEX FORM OF A QUADRATIC FUNCTION

$$\boxed{f(x) = a(x-h)^2 + k}$$

where h and k are real numbers, (h, k) is the vertex and $x = h$ is the axis of symmetry

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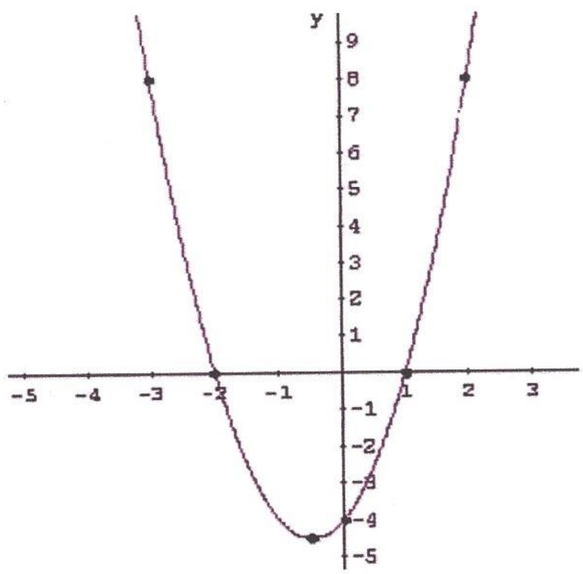
If you have the graph of a parabola, can you determine the exact equation of the function that created the graph?



(1) Let's look at the graph at the right.

The x-intercepts are integer values,

-2 and 1.

so we know that the roots (zeros) of the equation will be x = -2 and x = 1.

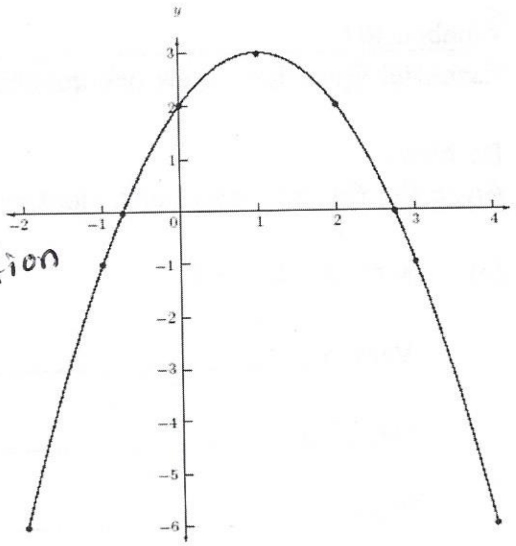
With this information we can write the equation of the quadratic in factored form, y = (x+2)(x-1).

BEWARE

You cannot assume that the a-value will always be 1.

How can we determine the numeric factor, a, for this equation? (Hint... we need to check another point, i.e. the y-intercept)

(2) Given the parabolic graph at the right, the vertex is $(1,3)$ and another random point on the graph is $(0,2)$. Write the equation of the function which created the graph.



$y = x^2$ a parabola shows a quadratic equation

It does not appear that the roots (zeros) of this parabola cross the x-axis at integer values, so we will not be able to write the equation in factored form. However, we can write the equation in vertex form,

$y =$ $a(x-1)^2+3$.

using $(0,2)$

Now, determine the value of a.

$y = a(0-1)^2+3$

$2 = a(-1)^2+3$

$2 = a(1)+3$

$2 = a+3$ $a=-1$

final equation

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

Reminder: The zeros obtained from the x-intercepts of a graph can determine the equation of a "family" of graphs. But, ONE MORE POINT is needed to guarantee a specific, individual function's equation.

Match the following equations to their graphs.

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

C

vertex $(-1,2)$
turns down
("a" value is -4)

4) $y = -\frac{1}{4}(x+1)^2+2$

B

vertex $(-1,2)$
$a = -\frac{1}{4}$
turns down

5) $y = (x+3)^2-1$

A

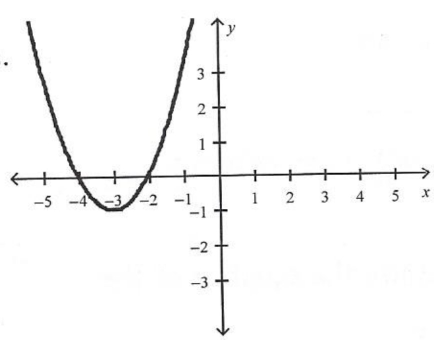
vertex $(-3,-1)$
$a=1$
opens up

6) $y = (x-3)^2-1$

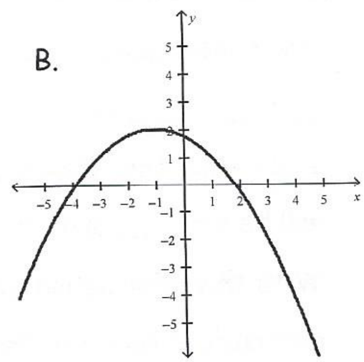
D

vertex $(3,-1)$
$a=1$
opens up

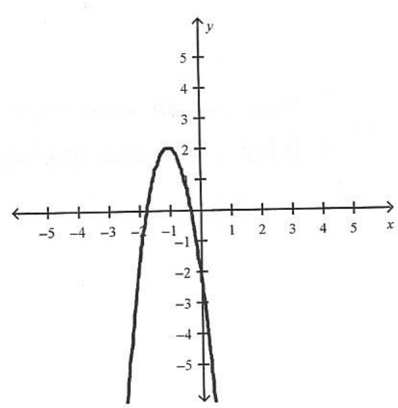
A.



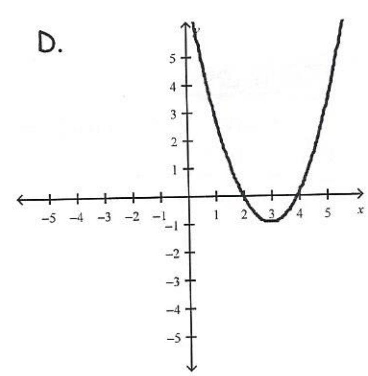
B.



C.



D.



what it should look like ✓ procedure to use also include ✓

Convert the following equations into vertex form by completing the square and identify the vertex.

7) $y = x^2 + 2x - 4$

$y + 4 = x^2 + 2x$

$y + 4 + \boxed{1} = x^2 + 2x + \boxed{1}$

$\left(\frac{2}{2}\right)^2$

$y + 5 = (x+1)^2$

$y = (x+1)^2 - 5$

vertex: $(-1, -5)$

8) $y = x^2 + 16x + 71$

$y - 71 = x^2 + 16x$

$y - 71 + \boxed{64} = x^2 + 16x + \boxed{64}$

$\left(\frac{16}{2}\right)^2$

$y - 7 = (x+8)^2$

$y = (x+8)^2 + 7$

vertex $(-8, 7)$

9) $y = x^2 - 2x - 5$

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

$y + 5 + \boxed{1} = x^2 - 2x + \boxed{1}$

$\left(\frac{-2}{2}\right)^2$

$y + 6 = (x-1)^2$

$y = (x-1)^2 - 6$

vertex $(1, -6)$

10) $y = x^2 - 12x + 46$

$y - 46 = x^2 - 12x$

$y - 46 + \boxed{36} = x^2 - 12x + \boxed{36}$

$\left(\frac{-12}{2}\right)^2$

$y - 10 = (x + 6)^2$

$y = (x-6)^2 + 10$

vertex $(6, 10)$

PiPS Place

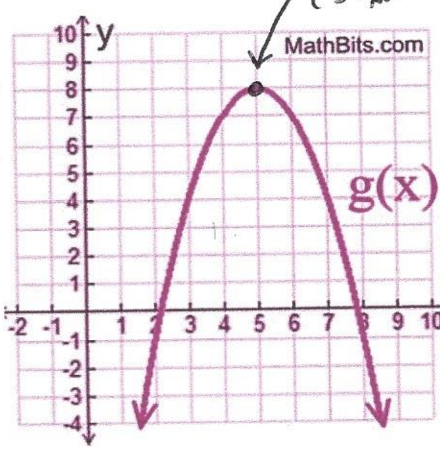
Shown below is the equation for function $f(x)$, and the graph of parabolic function $g(x)$. Which function has the larger maximum?

greater y value of vertex

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

vertex $(4, 5)$

vertex $(5, 8)$



g(x) has the larger maximum because $8 > 5$