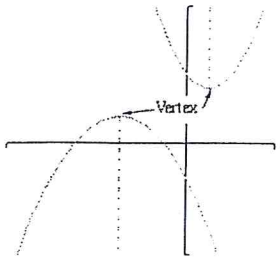
Mr. Ward Answer Key

Vertex of a Parabola

Yesterday we talked about how to find the zeros and the axis of symmetry of a parabola. Today we are going to find the vertex of a parabola.



Vertex – the highest or lowest point on a parabola

- If a parabola opens upward, the vertex is the lowest point.
- If a parabola opens downward, the vertex is the highest point.

Interesting Fact: The x-coordinate of the vertex will always be the same as the axis of symmetry line. (See Picture)

How to Find the Vertex

Step 1: To find the x-coordinate of the vertex, find the axis of symmetry by using zeros or the formula $\frac{-b}{2a}$.

Step 2: To find the corresponding y-coordinate, substitute the x-coordinate of the vertex into the function.

Step 3: Write the vertex as an ordered pair.

Example #1 Find the vertex of $y = -x^2 - 2x$.

Step 1: Find the x-coordinate by first finding the axis of symmetry. (Use $\frac{-b}{2a}$)

What is a? -1

What is b? -2

$\frac{-(-2)}{2(-1)} = \frac{2}{-2} = -1$

Step 2: Plug in the x-value you just got into the equation and find y.

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

$= -1 + 2$

$y = 1$

Step 3: Write your answer as a coordinate point. $(-1, 1)$

Come show me your answer so I know you're on the right track!

Assignment: Practice B Worksheet + pg 604 #13-16 and #29-32

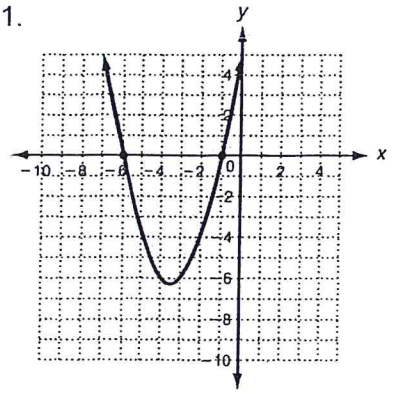
Name Mr. Ward Date _____ Class _____

LESSON 9-2

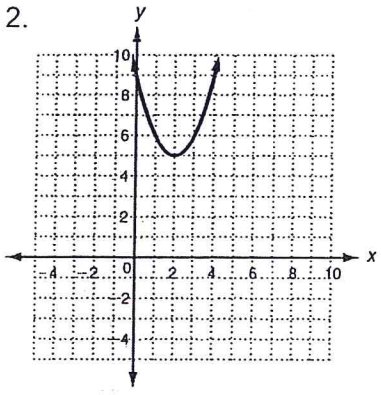
Practice B

Characteristics of Quadratic Functions

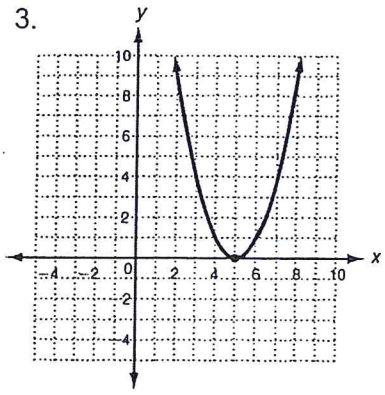
Find the zeros of each quadratic function from its graph.

1. 

-6, -1

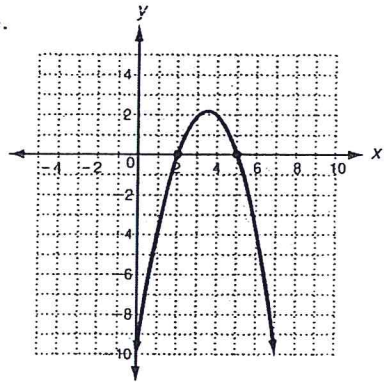
2. 

no zeros

3. 

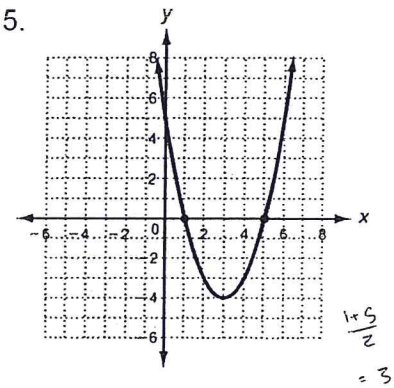
5

Find the axis of symmetry of each parabola.

4. 

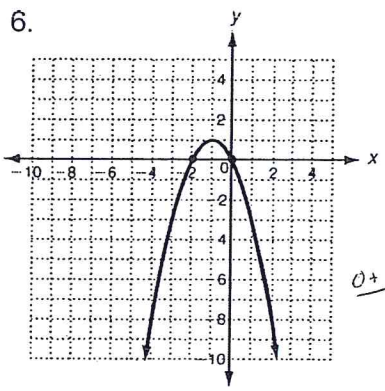
$\frac{2+5}{2} = 3.5$

$x = 3.5$

5. 

$\frac{1+5}{2} = 3$

$x = 3$

6. 

$\frac{0+(-2)}{2} = -1$

$x = -1$

For each quadratic function, find the axis of symmetry of its graph.

7. $y = 3x^2 - 6x + 4$

$\frac{-(-6)}{2(3)} = \frac{6}{6}$

$x = 1$

8. $y = -x^2 + 4x$

$\frac{-4}{2(-1)} = \frac{-4}{-2}$

$x = 2$

9. $y = 4x^2 + \frac{1}{2}x + 3$

$\frac{-1/2}{2(4)} = \frac{-1}{16}$

$x = -1/16$

Find the vertex of each parabola.

10. $y = 3x^2 - 6x - 2$

(1, -5)

$\frac{-(-6)}{2(3)} = \frac{6}{6}$ $x = 1$

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

$= 3 - 6 - 2$

$y = -5$

11. $y = 3x^2 + 12x - 10$

(-2, -22)

$\frac{-(12)}{2(3)} = \frac{-12}{6}$ $x = -2$

$y = 3(-2)^2 + 12(-2) - 10$

$= 12 - 24 - 10$

12. $y = x^2 + 2x - 35$

(-1, -36)

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

$y = (-1)^2 + 2(-1) - 35$

$= 1 - 2 - 35$

$y = -36$

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13. $y = -5x^2 + 10x + 3$

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

$y = -5(1)^2 + 10(1) + 3$

$= -5 + 10 + 3$

$= 8$

$(1, 8)$

14. $y = x^2 + 4x - 7$

$\frac{-b}{2a} = \frac{-4}{2(1)} = \frac{-4}{2} = -2$

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

$= 4 - 8 - 7$

$= -11$

$(-2, -11)$

15. $y = \frac{1}{2}x^2 + 2x$

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

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

$= 2 - 4$

$= -2$

$(-2, -2)$

16. $y = -x^2 + 6x + 1$

$\frac{-b}{2a} = \frac{-6}{2(-1)} = \frac{-6}{-2} = 3$

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

$= -9 + 18 + 1$

$= 10$

$(3, 10)$

29. $y = x^2 + 7x$

$\frac{-b}{2a} = \frac{-7}{2(1)} = -3.5$

$y = (-3.5)^2 + 7(-3.5)$

$= 12.25 - 24.5$

$= -12.25$

$(-3.5, -12.25)$

30. $y = -x^2 + 8x + 16$

$\frac{-b}{2a} = \frac{-8}{2(-1)} = \frac{-8}{-2} = 4$

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

$= -16 + 32 + 16$

$= 32$

$(4, 32)$

31. $y = -2x^2 - 8x - 3$

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

$y = -2(-2)^2 - 8(-2) - 3$

$= -8 + 16 - 3$

$= 5$

$(-2, 5)$

32. $y = -x^2 + \frac{1}{2}x + 2$

$\frac{-b}{2a} = \frac{-1/2}{2(-1)} = \frac{-1/2}{-2/1} = \frac{-1}{2} \cdot \frac{1}{-2} = \frac{1}{4}$ or 0.25

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

$= -\frac{1}{16} + \frac{1}{8} + 2$

$= -\frac{1}{16} + \frac{2}{16} + 2$

$= 2\frac{1}{16}$

$(\frac{1}{4}, 2\frac{1}{16})$

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3. zero: $x = -1$

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

$= 1 - 2 + 1$

$= 0$ ✓

4. zeros: $-3, 3$

$y = 9 - (-3)^2$

$= 9 - 9$

$= 0$ ✓

$y = 9 - (3)^2$

$= 9 - 9$

$= 0$ ✓

5. no zeros

6. (zeros: $x = -4$ and 1)

$\frac{-4+1}{2} = \frac{-3}{2}$ $\boxed{x = -3/2}$

7. (zeros: $x = 0$ and 4)

$\frac{0+4}{2} = 2$ $\boxed{x = 2}$

8. (zero: $x = -4$)

$\boxed{x = -4}$

9. $x = -b/2a$

$x = -(4)/2(1)$

$\boxed{x = -2}$

10. $x = -b/2a$

$x = -(-18)/2(3)$

$\boxed{x = 3}$

11. $x = -b/2a$

$x = -(3)/2(2)$

$\boxed{x = -3/4}$

12. $x = -b/2a$

$x = -(-1)/2(-3)$

$\boxed{x = -1/6}$

19. no zeros

20. zero: $x = 0$

$y = -\frac{1}{3}(0)^2$

$y = 0$ ✓

21. zeros: $x = -8$ and -2

$y = (-8)^2 + 10(-8) + 16$

$= 64 - 80 + 16$

$= 0$ ✓

$y = (-2)^2 + 10(-2) + 16$

$= 4 - 20 + 16$

$= 0$ ✓

22. (zeros: $x = -3$ and 1)

$\frac{-3+1}{2} = -1$ $\boxed{x = -1}$

23. (zero: $x = 6$)

$\boxed{x = 6}$

24. (zeros: $x = -3$ and 0)

$\frac{-3+0}{2} = \frac{-3}{2}$ $\boxed{x = -3/2}$

25. $x = -b/2a$

$x = -(1)/2(1)$

$\boxed{x = -1/2}$

26. $x = -b/2a$

$x = -(-2)/2(3)$

$x = 2/6$

$\boxed{x = 1/3}$

27. $x = -b/2a$

$x = -(-5)/2(1/2)$

$\boxed{x = 5}$

28. $x = -b/2a$

$x = -(1/3)/2(-2)$

$x = \frac{-1/3}{-4}$ → $\boxed{x = 1/12}$