Essential Questions: In how many ways can we write a quadratic function? What information do the different forms of quadratic functions tell us?

Do Now:

Consider the quadratic equation $y = x^2 + 4x - 12$ *written in standard form.*

a) Rewrite the equation in vertex form.

b) Determine the vertex of the function. _____

Think About This…

Is there another way to write the quadratic function from the Do Now?

Terry says the function $y = x^2 + 4x - 12$ can be written in ***factored form***.

What do you think the function looks like in factored form?

Factored Form _____

What does this equation tell us about the graph of the function?

Standard Form $y = x^2 + 4x - 12$	**Vertex Form** _____	**Factored Form** _____
• Opens _____	• Opens _____	• Opens _____
• y-intercept _____	• Vertex _____	• Roots _____

Let's Review – There are three ways we can represent a quadratic function.

STANDARD FORM

$$f(x) = ax^2 + bx + c$$

where a, b, & c are real numbers

When a quadratic function is written in **standard** form, we find the

- **vertex** by using $x = \frac{-b}{2a}$ to find the x-coordinate. By substituting the x value into the function, we find the y-coordinate of the vertex.
- **roots** by solving the quadratic equation algebraically when f(x) = 0 or by graphing and finding the zeros of the function (locate x-intercepts).
- **y-intercept** by identifying the c value.

VERTEX FORM

$$f(x) = a(x - h)^2 + k$$

where a, h and k are real numbers, (h, k) is the vertex

When a quadratic function is written in **vertex** form, we can determine the

- **vertex** by identifying (h, k) from the equation.

FACTORED FORM

$$f(x) = a(x - r_1)(x - r_2)$$

where a is a real number and r_1 and r_2 are real roots

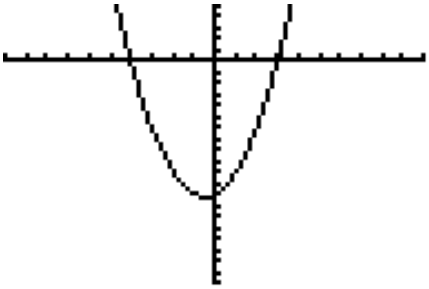
When a quadratic function is written in **factored** form, we can determine the

- **roots** by identifying r_1 and r_2 from the equation.

1. The roots for two quadratic functions are given. Write the equation of each function in **factored form** if the a value equals -5.

   (a) $r_1 = -2,\ r_2 = 3$ (b) $r_1 = -6,\ r_2 = -1$

2. Write the equation for the function of the graph given below in **factored form** (a = 1).



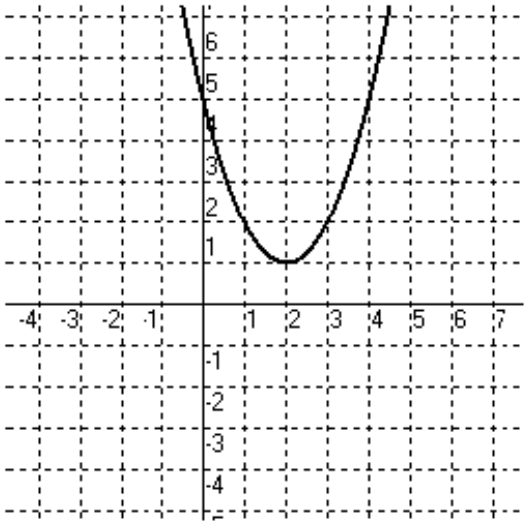
3. Write the equation for each function in **vertex form** given a and the vertex.

   (a) $a = 1$, vertex: (-2, -7) (b) a = -2, vertex: (4, 0)

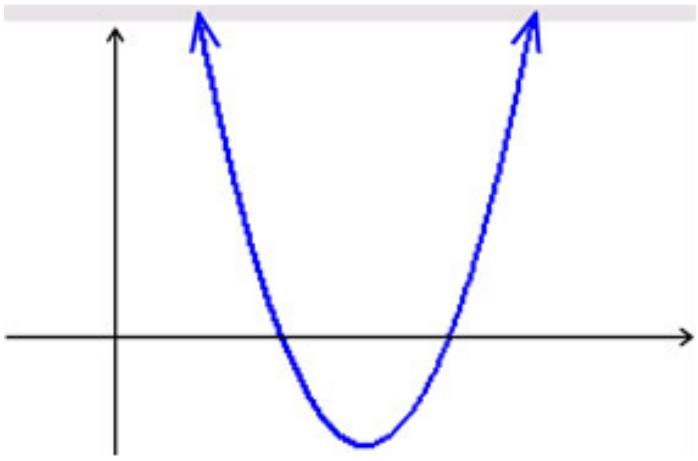
4. Find the vertex of the following parabolas.

   (a) $f(x) = (x - 7)^2 - 4$ (b) $f(x) = 3(x + 4)^2 + 6$

5. Write the equation, in **vertex form**, of the function shown in the graph below if a = 1.



6. Which of the following equations could describe the function seen in the graph at the right? Select all that apply.



A. $y = (x + 2)(x - 5)$

B. $y = -2x^2 + 4x - 1$

C. $y = (x - 6)(x - 10)$

D. $y = (x + 5)^2 + 4$

E. $y = (x - 8)^2 - 6$

Think about this…

Any equation written in the form $y = a(x^2 + x - 12)$, where a is a constant, has the same solution set as the equation $y = x^2 + x - 12$.

For example, graph the equations $y = x^2 + x - 12$ and $y = 3x^2 + 3x - 36$ on your calculator. What do you notice?

There are three forms in which to write the equation of a quadratic function:

- _____ form: $y =$ _____
- _____ form: $y =$ _____
- _____ form: $y =$ _____

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Fill in the blanks.

1. The _____ form of a quadratic function identifies the **turning point**.

2. The _____ form of a quadratic function identifies the **roots** (*zeros*).

3. The _____ form of a quadratic function identifies the **y-intercept**.

4. For the functions below, complete **a** and **b**.

   a) Is the vertex of the function a ***minimum*** or ***maximum*** value?

   b) State the vertex (*show all <u>necessary</u> work*).

$y = \frac{1}{5}x^2 - 5x - 1$ $y = -3(x - 7)^2$

5. Rewrite the function $\boldsymbol{y = x^2 + 10x - 3}$ in ***vertex form*** by completing the square. State the vertex of the function.

6. Rewrite the function $\boldsymbol{y = 3x^2 - 48}$ in ***factored form***. State the zeros of the function.

7. Rewrite the quadratic function $y = -3(x-1)^2 + 5$ in ***standard form***. State the y-intercept of the graph.

8. Write a quadratic function in ***vertex form*** given that $a = 1$ and the vertex is (-3, 4).

9. Write a quadratic function in ***factored form*** given that $a = -10$, $r_1 = -5$ and $r_2 = 9$.

10. For which function below is the zeros of the function -2 and 5?

    A. $f(x) = 4(x-2)(x+5)$

    B. $f(x) = 10x^2 + 30x - 100$

    C. $f(x) = (x-1.5)^2 - 12.25$

    D. $f(x) = (x+2)^2 + 5$