Algebra RH

Essential Question: What are the three forms of a quadratic function?

Do Now:

Graph each of the following on the graphing calculator and identify the vertex and roots.
(Remember...to find the roots on the calculator, press 2nd Calc -> 2:zero)

(a) $r(x) = x^2 + 14x + 13$ vertex = $(-7, -36)$ roots = $\{-13, -1\}$

(b) $v(x) = x^2 - 2x - 5.25$ vertex = $(1, -6.25)$ roots = $\{-1.5, 3.5\}$

(c) $u(x) = x^2 - 11x + 28$ vertex = $(5.5, -2.25)$ roots = $\{4, 7\}$

Which form of a quadratic function do we recognize?

STANDARD FORM OF A QUADRATIC FUNCTION

$f(x) = ax^2 + bx + c$, where a, b, & c are real numbers

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

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

Two other forms of a quadratic function give some of this information just by looking at the equation!

FACTORED FORM OF A QUADRATIC FUNCTION

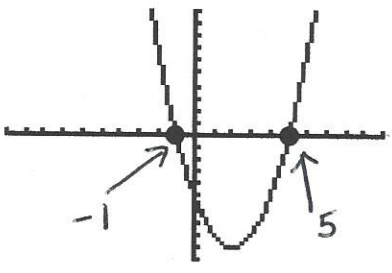
↙ opposite of the root ↘

$f(x) = a(x - r_1)(x - r_2)$, where a is a real number and r_1 and r_2 are real roots

Example: $f(x) = (x+1)(x-5)$

$x+1=0$	$x-5=0$
$x=-1$	$x=5$

$\{-1, 5\}$



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

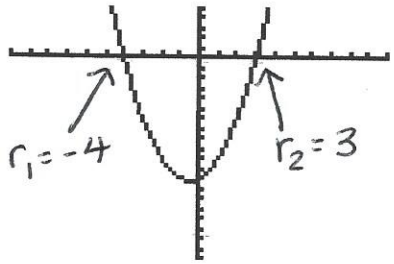
1. The roots for a quadratic function are given. Write an equation for each function in factored form. (when $a = 1$)

(a) $r_1 = -2,\ r_2 = 3$ $\quad y = (x+2)(x-3)$

(b) $r_1 = -6,\ r_2 = -1$ $\quad y = (x+6)(x+1)$

(c) $r_1 = 2.5,\ r_2 = 5$ $\quad y = (x-2.5)(x-5)$

2. Write an equation for the function of the graph given below in factored form.



$y = (x+4)(x-3)$

VERTEX FORM OF A QUADRATIC FUNCTION

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

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

h, k

Example: If $a = 1$ and the vertex is (5, 4), write the equation of the quadratic function in vertex form.

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

$y = 1(x-5)^2 + 4$

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

h, k

(a) $a = 1$, vertex: (-2, -7) $\quad y = (x+2)^2 - 7$

h, k

(b) a = -2, vertex: (4, 0) $\quad y = -2(x-4)^2$

4. Find the vertex of the following parabolas.

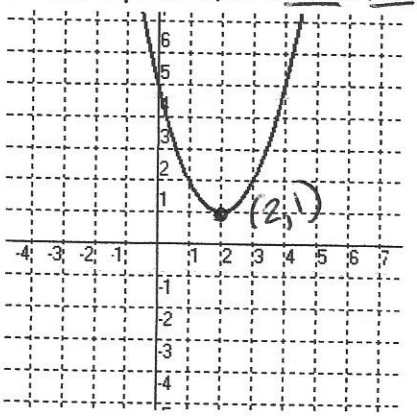
h k

(a) $f(x) = (x - 7)^2 - 4$ $\quad (7, -4)$

h k

(b) $f(x) = 3(x + 4)^2 + 6$ $\quad (-4, 6)$

5. Write the equation, in vertex form, of the function shown in the graph below.



h, k
(2, 1)

$a = 1$

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

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

why couldn't this equation be written in factored form?
(there are no real roots shown)

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

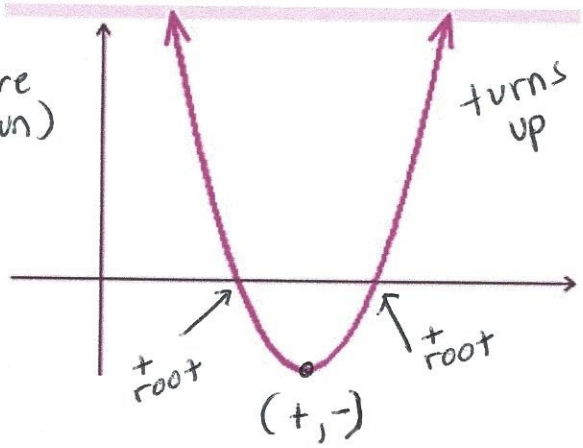
X $y = (x + 2)(x - 5)$ roots $\{-2, 5\}$

X $y = -2x^2 + 4x - 1$ "a" value is negative (graph would turn down)

✓ $y = (x - 6)(x - 10)$ roots $\{6, 10\}$

X $y = (x + 5)^2 + 4$ vertex $(-5, 4)$

✓ $y = (x - 8)^2 - 6$ vertex $(8, -6)$



Think about this?

Working backwards will create an equation, but remember that **there are other equations that will also have that same set of solutions**.

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

roots

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

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

- roots are the same
- vertices are different
- $y = 3(x^2+x-12)$ is more narrow

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

- factored form: $y =$ $a(x-r_1)(x-r_2)$
- vertex form: $y =$ $a(x-h)^2 + k$
- standard form: $y =$ $ax^2 + bx + c$

Take Away