The Factored Form of a Quadratic Function

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PRE-CALCULUS 11
QUADRATIC FUNCTIONS
THE FACTORED FORM OF A QUADRATIC FUNCTION

A. Definitions

1. **general form:** any quadratic function that can be written in the form:
$y = ax^2 + bx + c$ or $f(x) = ax^2 + bx + c$.

2. **standard form:** any quadratic function that can be written in the form:
$y = a(x-p)^2 + q$ or $f(x) = a(x-p)^2 + q$

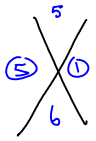
3. **factored form:** any quadratic function that can be written in the form:
$y = a(x-r_1)(x-r_2)$ or $f(x) = a(x-r_1)(x-r_2)$
↑ roots!

B. The Factored Form of a Quadratic Function

The factored form of the quadratic function $y = a(x-r_1)(x-r_2)$, easily allows us to find the x-intercepts of the function as well as the expansion/compression value and whether the function is upright or inverted.

1) Change the following function into the factored form and then describe the characteristics of the graph.

a) $y = 2x^2 + 12x + 10$

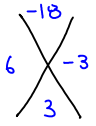


$y = 2(x^2 + 6x + 5)$

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

- x-int $(-5,0)$ & $(-1,0)$
- upright & vertically expanded.

b) $y = -\frac{1}{3}\left(x + \frac{3}{2}\right)^2 + \frac{27}{4}$



$y = -\frac{1}{3}\left(x + \frac{3}{2}\right)\left(x + \frac{3}{2}\right) + \frac{27}{4}$

$y = -\frac{1}{3}\left(x^2 + 3x + \frac{9}{4}\right) + \frac{27}{4}$

$y = -\frac{1}{3}x^2 - x - \frac{3}{4} + \frac{27}{4}$

$y = -\frac{1}{3}x^2 - x + 6$

$y = -\frac{1}{3}(x^2 + 3x - 18)$

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

- x-int $(-6,0)$ & $(3,0)$
- inverted & vertically compressed.

2) Write the factored form equation $y = a(x - r_1)(x - r_2)$ of a quadratic function that has zeros of -3 and 5 and passes through the point $A(2,-10)$.

roots

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

$y = a(x + 3)(x - 5)$

$(-10) = a((2)+3)((2)-5)$

$-10 = a(5)(-3)$

$\frac{-10}{-15} = \frac{-15a}{-15}$

$a = \frac{2}{3}$

$y = \frac{2}{3}(x + 3)(x - 5)$

3) Write the general form equation $y = ax^2 + bx + c$ of a quadratic function that has zeros of 1 and 7 and passes through the point $B(3,16)$.

roots

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

$y = a(x - 1)(x - 7)$

$(16) = a((3)-1)((3)-7)$

$16 = a(2)(-4)$

$\frac{16}{-8} = \frac{-8a}{-8}$

$a = -2$

$y = -2(x - 1)(x - 7)$

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

$y = -2x^2 + 16x - 14$

4) Write the factored form equation $y = a(x - r_1)(x - r_2)$ of a quadratic function that has a vertex of $(1,-18)$ and an x-intercept of $(4,0)$.

$y = a(x - p)^2 + q$

$y = a(x - 1)^2 - 18$

$(0) = a((4)-1)^2 - 18$

$0 = 9a - 18$

$+18 \quad +18$

$\frac{18}{9} = \frac{9a}{9}$

$a = 2$

$y = 2(x - 1)^2 - 18$

$y = 2(x - 1)(x - 1) - 18$

$y = 2(x^2 - 2x + 1) - 18$

$y = 2x^2 - 4x + 2 - 18$

$y = 2x^2 - 4x - 16$

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

-8

$-4 \quad 2$

-2

$y = 2(x - 4)(x + 2)$

Assignment: Pg. 306 #3, 4, 5, 8, 9, 10, 12