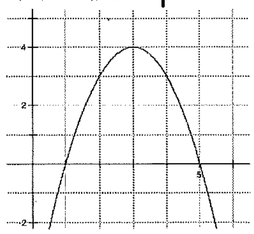
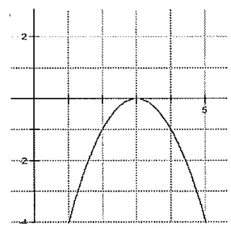
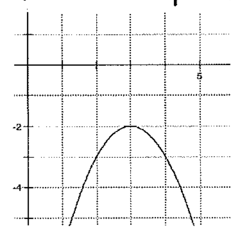
Day8-MCR3U

Name:______________________________
Date:_______________________________

Zeros of Quadratic Functions

From a Graph

There are 3 possible parabola events. Determine the number of x-intercepts for each:

x-intercepts = 2   # x-intercepts = one   # x-intercepts = 0

From Factored Form

$y = a(x - p)(x - q)$ means 2 zeros: 1 at p and 1 at q
$y = a(x - p)^2$ means 1 zero at p

Ex. $y = 4(x - 2)(x + 3)$ has 2 zero(s)

From Vertex Form

$y = a(x - h)^2 + k$ means the vertex is at (h, k) and "a" indicates the direction of opening.
If k = 0, there is 1 zero.
If a and k have the same sign, there are no zeros.
If a and k have opposite signs, there are 2 zeros.

Ex. $y = 3(x - 4)^2 + 5$ has 0 zero(s) since a, k have different signs.
$y = -2(x + 3)^2$ has 1 zero(s) since k = 0.
$y = (x - 2)^2 - 5$ has 2 zero(s) since a, k have different signs.

From Standard Form

The function $y = ax^2 + bx + c$ has zeros at $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, while the equation $ax^2 + bx + c = 0$ has roots at $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
We call $b^2 - 4ac$ the discriminant.
If $b^2 - 4ac > 0$, there are 2 zeros or roots.
If $b^2 - 4ac = 0$, there is 1 zero or root.
If $b^2 - 4ac < 0$, there are no zeros or real roots. (roots are complex - see teacher for more info)

Ex. $y = 3x^2 + 2x - 4$. $b^2 - 4ac = 4 - 4(3)(4) > 0$, so it has 2 zero(s).
$x^2 + 4x + 10 = 0$. $b^2 - 4ac = 16 - 4(10) < 0$, so it has 0 root(s).

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Example 1: Determine the nature of the roots of the following quadratics by evaluating the discriminant.

a. $8x^2 - 56x + 98 = 0$

$D = (-56)^2 - 4(8)(98)$

$= 3136 - 3136$

$= 0$

$\therefore$ one real zero.

b. $2x^2 = 3x - 6$

$2x^2 - 3x + 6 = 0$

$D = b^2 - 4ac$

$= 9 - 4(2)(6)$

$= 9 - 48$

< 0

$\therefore$ No real zero.

c. $5x^2 - 3x = 4$

$5x^2 - 3x - 4 = 0$

Example 2: Find the value(s) of the constant k for the given types of roots.

a. $x^2 - kx + 16 = 0$ (one real root)

$D = 0 \Rightarrow b^2 - 4ac = 0$

$k^2 - 4(1)(16) = 0$

$k^2 - 64 = 0$

$k^2 = +64$

$k = \pm 8.$

(In other words, $k = \pm 8$ will make it a perfect square trinomial)

b. $2x^2 - 3x + k + 1 = 0$ (no real roots)

$a = 2 \quad b = -3 \quad c = k + 1$

$b^2 - 4ac < 0$

$9 - 4(2)(k+1) < 0$

$9 - 8k - 8 < 0$

$-8k + 1 < 0$

$-8k < -1$

$k > \frac{1}{8}$

change the inequality sign from $<$ to $>$

c. $kx^2 = 6x + 9$ (2 real roots) $(k \neq 0)$

$kx^2 - 6x - 9 = 0$

$b^2 - 4ac > 0$

$36 - 4(k)(-9) > 0$

$36 + 36k > 0$

$36k > -36$

$k > -1$

Homework: p. 185 #(1-2)cd,3-11,16

Note: Multiplying or dividing both sides will FLIP the inequality sign!!