3. Lauren is solving the quadratic equation $x^2 - 7x - 8 = 3$. Her work is shown.

a. Identify Lauren's error.

b. Use the Quadratic Formula correctly to determine the solution to Lauren's quadratic equation. Classify the solutions as rational or irrational.

Lauren

$x^2 - 7x - 8 = 3$

$a = 1, b = -7, c = -8$

$$x = \frac{-(-7) \pm \sqrt{(-7)^2 - 4(1)(-8)}}{2(1)}$$

$$x = \frac{7 \pm \sqrt{49 + 32}}{2}$$

$$x = \frac{7 \pm \sqrt{81}}{2}$$

$$x = \frac{7 \pm 9}{2}$$

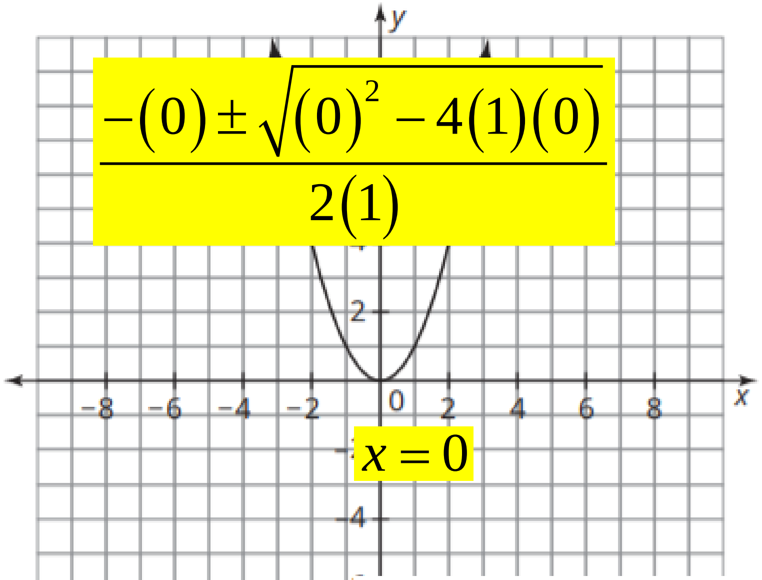
$$x = \frac{7 + 9}{2} \quad \text{or} \quad x = \frac{7 - 9}{2}$$

$$x = \frac{16}{2} = 8 \quad \text{or} \quad x = \frac{-2}{2} = -1$$

The roots are 8 and −1.

Consider three quadratic equations and their graphs.

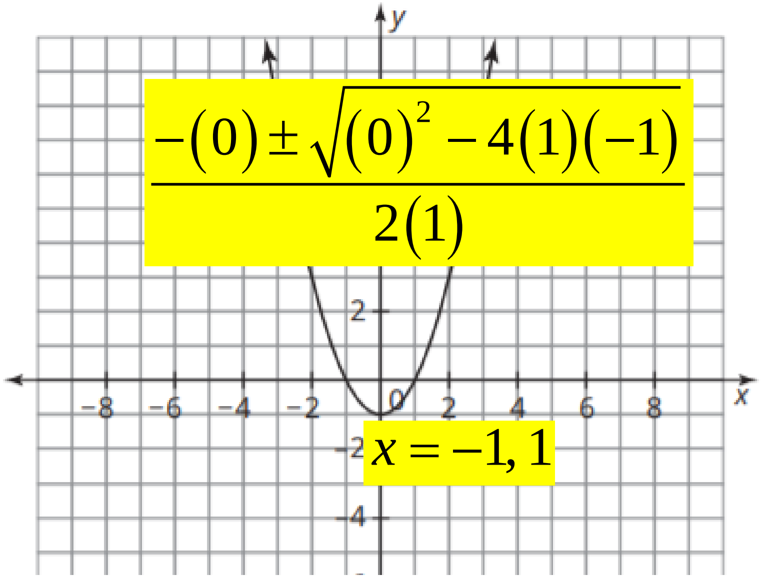
$y = x^2$



$$\frac{-(0) \pm \sqrt{(0)^2 - 4(1)(0)}}{2(1)}$$

$x = 0$

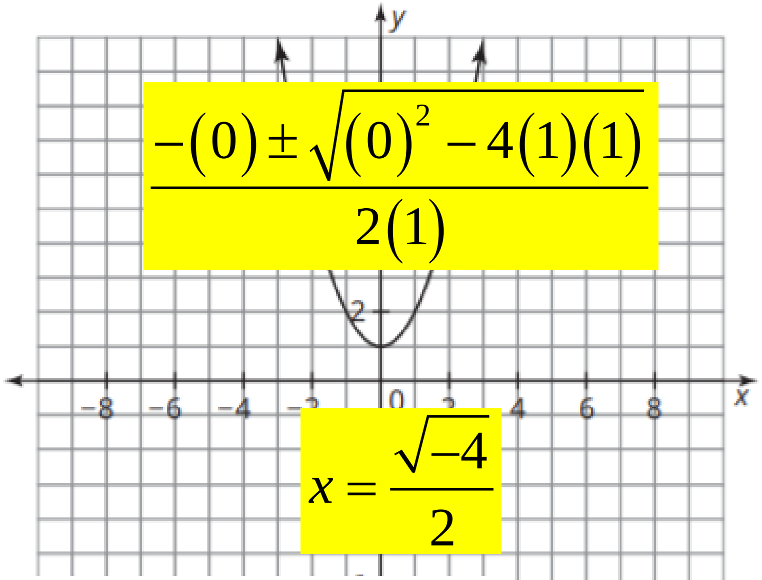
$y = x^2 - 1$



$$\frac{-(0) \pm \sqrt{(0)^2 - 4(1)(-1)}}{2(1)}$$

$x = -1, 1$

$y = x^2 + 1$



$$\frac{-(0) \pm \sqrt{(0)^2 - 4(1)(1)}}{2(1)}$$

$$x = \frac{\sqrt{-4}}{2}$$

1. Use the Quadratic Formula to solve each quadratic equation. Show your work.

Because this portion of the formula "discriminates" the number of real zeros, or roots, it is called the **discriminant.**

3. Using the discriminant, write an inequality to describe when a quadratic function has each solution.

a. no real roots/zeros

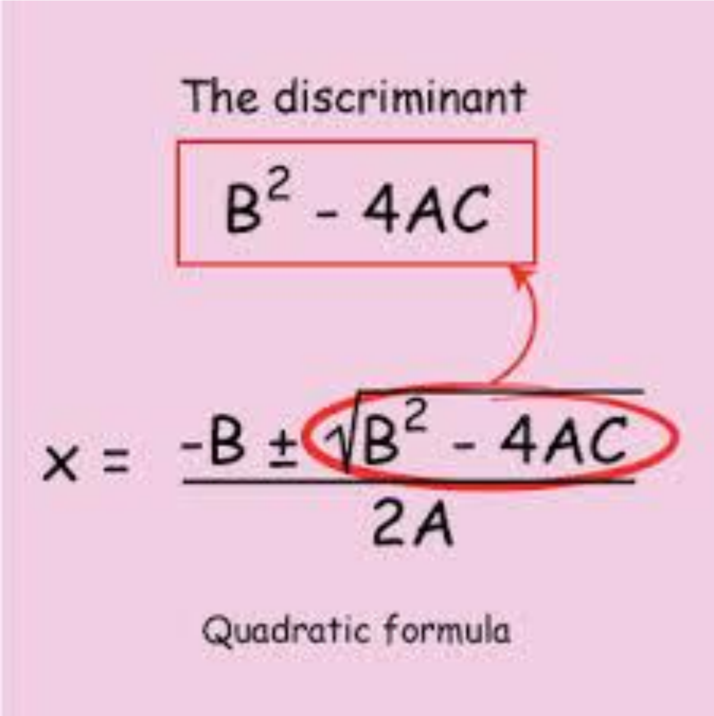
$$\text{if, } b^2 - 4ac < 0$$

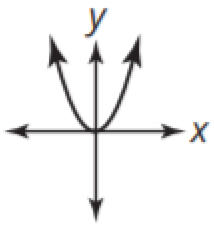
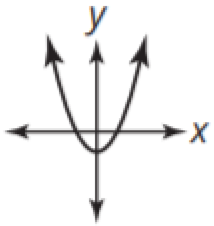
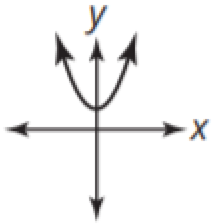
b. one unique real root/zero

$$\text{if, } b^2 - 4ac = 0$$

c. two unique real roots/zeros

$$\text{if, } b^2 - 4ac > 0$$



Equation/ Function	Solutions	Number of Unique Real Zeros	Number of *x*-Intercepts	Sketch
$f(x) = x^2$	$x = \frac{-0 \pm \sqrt{0^2 - 4(1)(0)}}{2(1)}$ $= \frac{0 \pm \sqrt{0}}{2}$ $= 0 \pm \sqrt{0}$	1	1	
$g(x) = x^2 - 1$	$x = \frac{-0 \pm \sqrt{0^2 - 4(1)(-1)}}{2(1)}$ $= \frac{0 \pm \sqrt{4}}{2}$ $= 0 \pm 1$	2	2	
$h(x) = x^2 + 1$	$x = \frac{-0 \pm \sqrt{0^2 - (4)(1)(1)}}{2(1)}$ $= \frac{0 \pm \sqrt{-4}}{2}$	0	0	

4. Use the discriminant to determine the number of real roots for each equation. Then solve for the roots/zeros.

$$b^2 - 4ac$$

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

$(12)^2 - 4(2)(-2)$

$144 + 16$

160

2 real irrational solutions

b. $0 = 2x^2 + 12x + 20$

$(12)^2 - 4(2)(20)$

$144 - 160$

-16

no real solutions!

c. $y = x^2 + 12x + 36$

$(12)^2 - 4(1)(36)$

$144 - 144$

0

1 real rational solutions

d. $y = 3x^2 + 7x - 20$

$(7)^2 - 4(3)(-20)$

$49 + 240$

289

2 real rational solutions

e. $y = 4x^2 - 9$

$(0)^2 - 4(4)(-9)$

144

2 real rational solutions

f. $0 = 9x^2 + 12x + 4$

$(12)^2 - 4(9)(4)$

$144 - 144$

0

1 real rational solutions