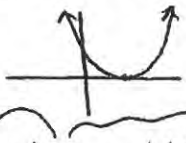
2-6 **Algebra 2 Notes** **Name** Key

## Use the Quadratic Formula and the Discriminant

**Quadratic Equation:** $ax^2 + bx + c = 0$

**Quadratic Formula:** $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For any quadratic equation in the form $ax^2 + bx + c = 0$, the quantity $b^2 - 4ac$ is called the Discriminant.

| Quadratic Equation | Discriminant | Nature of the Roots | Related Graph and Number of x-intercepts |
|---|---|---|---|
| $3x^2 + 2x - 8 = 0$ | $(2)^2 - 4(3)(-8)$<br>$4 + 96$<br>100 | 2 real, rational | 2 x int. @ roots  |
| $-3x^2 + 5x + 5 = 0$ | $(5)^2 - 4(-3)(5)$<br>$25 + 60$<br>85 | 2 real irrational |  2 x int. @ roots |
| $x^2 - 4x + 4 = 0$ | $(-4)^2 - 4(1)(4)$<br>$16 - 16$<br>0 | 1 Real, Rational (Double Root) |  1 x int. Vertex |
| $2x^2 + x + 1 = 0$ | $(1)^2 - 4(2)(1)$<br>$1 - 8$<br>-7 | Complex 2 imaginary | No x int.  |

~What do you notice about the value of the discriminant for a quadratic equation that has **2 rational roots?** Positive Perfect Square

~What do you notice about the value of the discriminant for a quadratic equation that has **2 irrational roots?** Positive Non-Perfect Square

~What do you notice about the value of the discriminant for a quadratic equation that has **1 rational root?** Zero

~What do you notice about the value of the discriminant for a quadratic equation that has **2 imaginary roots (0 real roots)?** Negative

**Find the discriminant, describe the nature of the roots, and solve for x.**

**1.** $2x^2 + x - 15 = 0$

$a=2 \quad b=1 \quad c=-15$

$\frac{-1 \pm \sqrt{(1)^2-4(2)(-15)}}{2(2)}$

$\frac{-1 \pm \sqrt{1+120}}{4}$

$\frac{-1 \pm \sqrt{121}}{4}$

$\frac{-1 \pm 11}{4}$

$\frac{10}{4} = \frac{5}{2}$ or $\frac{-12}{4} = -3$

Disc: 121
Nat: 2 Real Rat.
Sol: $\frac{5}{2}$ or $-3$

**2.** $2x^2 - 9x + 8 = 0$

$a=2 \quad b=-9 \quad c=8$

$\frac{9 \pm \sqrt{(-9)^2-4(2)(8)}}{2(2)}$

$\frac{9 \pm \sqrt{81-64}}{4}$

$\frac{9 \pm \sqrt{17}}{4}$

Disc: 17
Nat: 2 Real Irr.
Sol: $\frac{9+\sqrt{17}}{4}, \frac{9-\sqrt{17}}{4}$

**3.** $7\left(\frac{5}{7}x^2 + \frac{4}{7} = \frac{2}{7}x\right)$

$5x^2 + 4 = 2x \rightarrow 5x^2 - 2x + 4 = 0$

$a=5 \quad b=-2 \quad c=4$

$\frac{2 \pm \sqrt{(-2)^2-4(5)(4)}}{2(5)}$

$\frac{2 \pm \sqrt{4-80}}{10}$

$\frac{2 \pm \sqrt{-76}}{10} \rightarrow \frac{2 \pm 2i\sqrt{19}}{10} \rightarrow \frac{1 \pm i\sqrt{19}}{5}$

Disc: -76
Nat: 2 imag
Sol: $\frac{1 \pm i\sqrt{19}}{5}$

**4.** $x^2 = 8x - 16$

$x^2 - 8x + 16 = 0$

$a=1 \quad b=-8 \quad c=16$

$\frac{8 \pm \sqrt{(-8)^2-4(1)(16)}}{2(1)}$

$\frac{8 \pm \sqrt{64-64}}{2}$

$\frac{8 \pm \sqrt{0}}{2}$

$\frac{8}{2} = 4$

Disc: 0
Nat: 1 Real Dbl
Sol: 4

**On a separate sheet of paper, solve the following using the Quadratic Formula. Be sure to include all 3 parts in your final answer.**

**1.** $x^2 + 12x + 32 = 0$ Factor

$(x+8)(x+4) \quad x=-8 \quad x=-4$

**2.** $x^2 - 4x + 1 = 0$

$\frac{4 \pm \sqrt{12}}{2} = 2 \pm \sqrt{3}$

**3.** $\frac{1}{5}x^2 + 1 = \frac{2}{5}x$

$x^2 + 5 = 2x$

$x^2 - 2x + 5 = 0$

$1 \pm 2i$

**4.** $x^2 = 12x - 42$

$6 \pm i\sqrt{6}$

**5.** $2x^2 - 11 = -7x$

$\frac{-7 \pm \sqrt{137}}{4}$

**6.** $x^2 - 16x + 4 = 0$

$8 \pm 2\sqrt{15}$