**Math 2**
**Unit 3 – Rational Exponents and Solving Quadratics**
**Lesson 5 → Discriminant & Quadratic Formula**

Name____________________________
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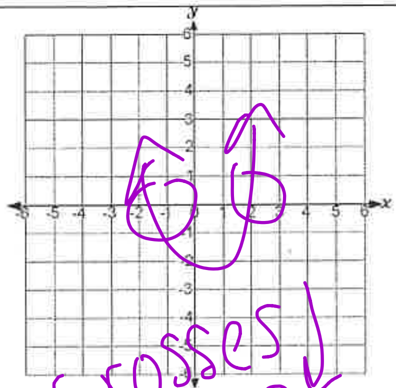
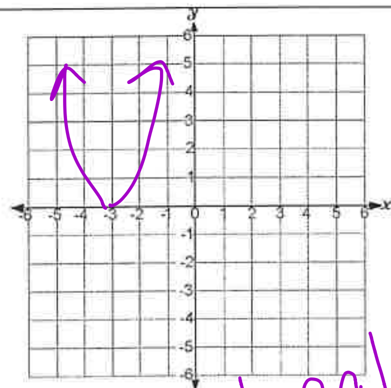
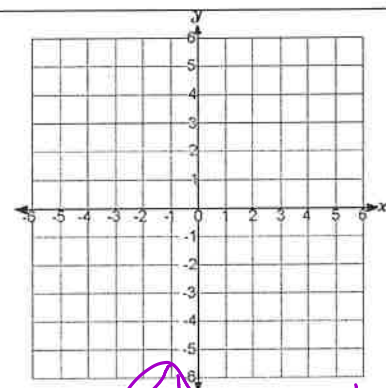
- ❖ Solve the following equations by factoring.
- ❖ Graph the equation.

| 1. $x^2 + x - 6 = 0$ | 2. $x^2 + 6x + 9 = 0$ | 3. $x^2 + 4 = 0$ |
|---|---|---|
|  crosses |  |  |
| Number of Solutions: 2 real | Number of Solutions: 1 real | Number of Solutions: 0 real |

2 complex

➢ **Quadratic Equation**: $\boxed{ax^2 + bx + c = 0}$

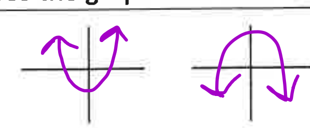
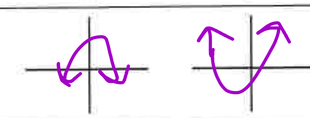
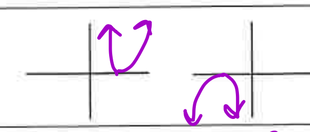
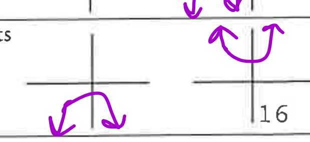
➢ **The Discriminant**: $\boxed{b^2 - 4ac}$ $x^2+2x+3$

✓ The discriminant is used to determine the **number** and **type** of solutions (roots) of a quadratic equation.

❖ Using the same three examples from above, find the value of the discriminant and describe the roots.

| 1. $1x^2 + x - 6 = 0$ $b^2-4ac$ | 2. $x^2 + 6x + 9 = 0$ | 3. $x^2 + 4 = 0$ |
|---|---|---|
| A=1 B=1 C=−6 $(1)^2-4(1)(-6)$ | A=1 B=6 C=9 $(6)^2-4(1)(9)$ B A C | A=1 B=0 C=4 $(0)^2-4(1)(4)$ |
| D = 25 # of Roots: 2 | D = 0 # of Roots: 1 | D = −16 # of Roots: 0 Real 2 imaginary |
| Type of Roots: real | Type of Roots: Real | Type of Roots: imaginary complex |

➢ Discriminant Conclusions:

| Value of the Discriminant: $b^2 - 4ac$ | Number and Type of Roots | What does the graph look like? |
|---|---|---|
| $b^2 - 4ac$ is **POSITIVE** and a **PERFECT SQUARE** $\boxed{b^2 - 4ac > 0}$ | 2 real rational (no radical) | Intersects the x – axis twice  |
| $b^2 - 4ac$ is **POSITIVE** and **NOT a PERFECT SQUARE** $\boxed{b^2 - 4ac > 0}$ | 2 real irrational | Intersects the x – axis twice  |
| $\boxed{b^2 - 4ac = 0}$ | 1 real solution | Intersects the x – axis once  |
| $b^2 - 4ac$ is **NEGATIVE** $\boxed{b^2 - 4ac < 0}$ | 0 real 2 imaginary | Never Intersects the x – axis  |

❖ **Classwork:** Find the value of the discriminant and state the number and type of roots.

$b^2 - 4ac$

| Equation | Discriminant | Number and Type of Roots | Rational or Irrational |
|---|---|---|---|
| A=8 B=2 C=-1<br>1. $8x^2 + 2x - 1 = 0$ | $(2)^2 - 4(8)(-1)$<br>$= 36$ | 2 real<br>rational | |
| 2. $x^2 + x + 1 = 0$ | Skip | | |
| 3. $x^2 - 27 = 0$ | | | |
| 4. $x^2 - 8x = -16$ | | | |
| $x^2 + 4x - 1 = 0$<br>5. $x^2 + 4x + 9 = 10$<br>$-10 \quad -10$ | A=1<br>B=4<br>C=-1<br>$(4)^2 - 4(1)(-1)$<br>20 | 2 real<br>irrational | |
| 6. $3x^2 + 5x - 12 = 0$ | A=3<br>B=5<br>C=-12<br>$(5)^2 - 4(3)(-12)$<br>169 | 1 real<br>rational | |

➢ Solving Quadratic Equations using the Quadratic Formula

- $ax^2 + bx + c = 0$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- $\boxed{x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}}$
- The Quadratic Formula is used to solve any quadratic equation, especially those that will not factor.
- Examples: Solve using the Quadratic Formula → $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

| | | |
|---|---|---|
| 1. $x^2 - 5x - 24 = 0$<br>$(x-8)(x+3) = 0$<br>$\boxed{x = 8 \quad x = -3}$<br>A=1 B=-5 C=-24 | $\frac{-b \pm \sqrt{(b)^2 - 4ac}}{2a}$<br>$\frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-24)}}{2(1)}$<br>$\frac{5 \pm \sqrt{121}}{2} = \frac{5 \pm 11}{2}$<br>$\frac{5+11}{2} = \boxed{8}$ $\frac{5-11}{2} = \boxed{-3}$ | 2. $x^2 + 5x + 5 = 0$<br>A=1 B=5 C=5<br>$\frac{-(5) \pm \sqrt{(5)^2 - 4(1)(5)}}{2(1)}$<br>$\frac{-5 \pm \sqrt{5}}{2}$ |

3. $4x^2 + 8x - 1 = 0$

$A=4 \quad B=8 \quad C=-1$

$$\frac{-(8)\pm\sqrt{(8)^2-4(4)(-1)}}{2(4)} = \frac{-8\pm\sqrt{80}}{8}$$

$2|80$, $2|40$, $2|20$, $2|10$, $5$

$$\frac{-8\pm4\sqrt{5}}{8} = \frac{-2\pm\sqrt{5}}{2}$$

4. $4x^2 = -11x + 20$

$4x^2+11x-20=0$

$x^2+11x-80=0$

$(x+\frac{16}{4})(x-\frac{5}{4})=0$

$(x+4)(4x-5)=0$

$\boxed{x=-4}$ $\boxed{x=5/4}$

$A=4$
$B=11$
$C=-20$

$$\frac{-(11)\pm\sqrt{(11)^2-4(4)(-20)}}{2(4)}$$

$$\frac{-11\pm\sqrt{441}}{8} = \frac{-11\pm21}{8}$$

$$\frac{-11+21}{8} = \boxed{\frac{5}{4}} \qquad \frac{-11-21}{8} = \boxed{-4}$$

5. $x^2 + 25 = 10x$

$x^2-10x+25=0$

$(x-5)(x-5)=0$

$x=5$

$$\frac{10\pm\sqrt{(100)-4(1)(25)}}{2}$$

$$\frac{10}{2} = 5$$

6. $x^2 + 2x + 4 = 0$

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$2|12$, $2|6$, $3$

$A=1 \quad B=2 \quad C=4$

$$\frac{-(2)\pm\sqrt{(2)^2-4(1)(4)}}{2(1)} = \frac{-2\pm\sqrt{-12}}{2} = \frac{-2\pm2i\sqrt{3}}{2}$$

$\boxed{-1\pm i\sqrt{3}}$

$$x = \left\{ \begin{matrix} -1+i\sqrt{3} \\ -1-i\sqrt{3} \end{matrix} \right\}$$