# COMPEX NUMBERS

## Agenda:

Objective:
- Solve quadratic equations using complex numbers
- Use the discriminant to determine the nature of the solutions to a quadratic equation

(1 presentation for Extra Credit?)

1) Take out HW to be Checked
2) DO NOW
   - solve for Roots using Quadratic Formula
3) Explanation:
   -Discriminant & Relation to # of Roots
4) Practice Problems (Groups)
5) Exit Ticket

HW: "HW Worksheet #3"

# DO NOW

Solve for the roots using the quadratic formula.
Use your knowledge of *i* to simplify completely.

$$x^2 + 5x + 8 = 0$$

$$x = \frac{-5 \pm \sqrt{5^2 - 4(1)(8)}}{2(1)}$$

$$x = \frac{-5 \pm \sqrt{25 - 32}}{2}$$

$$x = \frac{-5 \pm \sqrt{-7}}{2}$$

$$x = \frac{-5 \pm i\sqrt{7}}{2}$$

$$x = \frac{-5 + i\sqrt{7}}{2} \text{ or } \frac{-5 - i\sqrt{7}}{2}$$

## The Discriminant:

Given a quadratic equation: $ax^2 + bx + c = y$

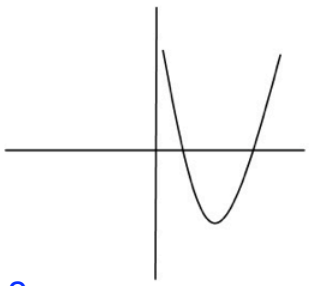
When you apply the quadratic formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

_____ is called the **discriminant**

**The discriminant can tell us**
**HOW MANY x-intercepts (aka roots, zeros, etc) any parabola will have...**

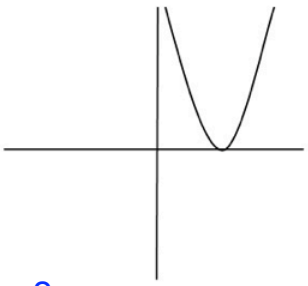
| **Real Numbers** | **Imaginary Numbers** |
|---|---|
| _____ Discriminant $\sqrt{\square}$ | _____ Discriminant $\sqrt{\square}$ |
| Rational No.s: Ex. / Irrational No.s: Ex. | Imaginary No.s: Ex. |
| Number of Roots<br>Rational No.s / Irrational No.s | Number of Roots |

crosses the x-axis twice



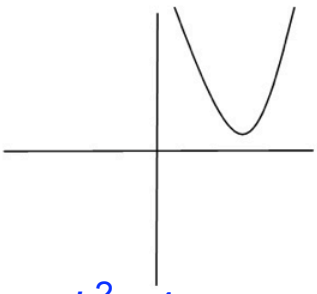
$b^2 - 4ac =$ _____

the vertex is on the x-axis



$b^2 - 4ac =$ _____

does not touch the x-axis



$b^2 - 4ac =$ _____

## The Discriminant:

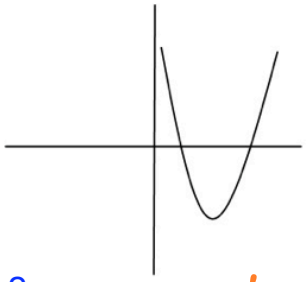
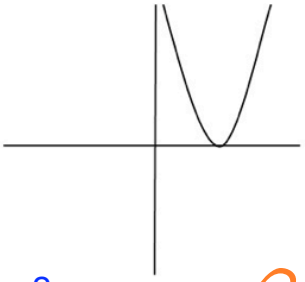
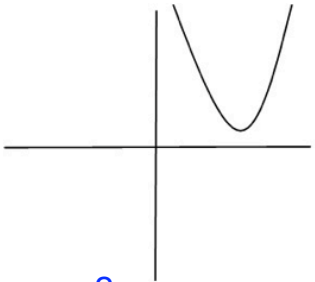
Given a quadratic equation: $ax^2 + bx + c = y$

When you apply the quadratic formula: $\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$b^2 - 4ac$ is called the **discriminant**

**The discriminant can tell us**
**HOW MANY x-intercepts (aka roots, zeros, etc) any parabola will have...**

| **Real Numbers** | **Imaginary Numbers** |
|---|---|
| positive Discriminant $\sqrt{\square}$ | negative Discriminant $\sqrt{\square}$ |
| Rational No.s: Whole numbers or fractions. Ex. 0, ±1, ±½, ±2, ±√9, ±4<br>Irrational No.s: can't be written as a fraction or whole #. Ex. ±√2, ±√5, ±5√21, ±4√33 | Imaginary No.s. Ex. ±i, ±√-3, ±√-9, |
| **Number of Roots** | **Number of Roots** |
| Rational No.s: 0, ±1, ±½, ±√9<br>1 Rational Root<br>2 Rational roots<br>Irrational No.s: ±√5, ±5√21,<br>2 Irrational Roots | ±i, ±√-3, ±√-9<br>2 Imaginary Roots |

| crosses the x-axis twice | the vertex is on the x-axis | does not touch the x-axis |
|---|---|---|
|  |  |  |
| $b^2 - 4ac =$ + | $b^2 - 4ac =$ 0 | $b^2 - 4ac =$ − |

## Practice Problems

Directions:
a) Find the discriminant
b) Determine the number of rational, irrational, or imaginary roots.
c) Solve for the roots

#1) $-6x^2 - 6 = -7x - 9$

#2) $4x^2 + 5x + 4 = -3x$

## Practice Problems

Directions:
a) Find the discriminant
b) Determine the number of rational, irrational, or imaginary roots.
c) Solve for the roots

#3) $-10x^2 - 3x - 9 = -2x$

#4) $2x^2 = 10x + 5$

Name_____

Score:_____/7

Block_____

# Exit Ticket

| | |
|---|---|
| 1) Determine the Discriminant: $y= -2x^2 - 3x - 4$ | 2) If the discriminant of a quadratic equation = 0 how many roots are there? (Circle the correct answer<br><br>a) 2 rational roots<br><br>b) 1 rational root<br><br>c) 2 irrational roots<br><br>d) None of the above |

Name_____

Score:_____/7

# Exit Ticket

Block_____

| | |
|---|---|
| 1) Determine the Discriminant: $y= -3x^2 - 4x - 2$ | 3) If the discriminant of a quadratic equation = -4 how many roots are there? (Circle the correct answer<br><br>e) 2 rational roots<br><br>f) 1 rational root<br><br>g) 2 irrational roots<br><br>h) None of the above |

Name_____

Score:_____/7

Block_____

# Exit Ticket

| 1) Determine the Discriminant: $y = -2x^2 - 3x - 4$ | 2) If the discriminant of a quadratic equation = 0 how many roots are there? (Circle the correct answer |
|---|---|
| $b^2 - 4ac$<br>$= (-3)^2 - 4(-2)(-4)$<br>$= 9 - 32$<br>$= -23$ | a) 2 rational roots<br>b) 1 rational root<br>c) 2 irrational roots<br>d) None of the above |

Name_____

Score:_____/7

# Exit Ticket

Block_____

| 1) Determine the Discriminant: $y = -3x^2 - 4x - 2$ | 3) If the discriminant of a quadratic equation = -4 how many roots are there? (Circle the correct answer |
|---|---|
| $b^2 - 4ac$<br>$= (-4)^2 - 4(-3)(-2)$<br>$= 16 - 24$<br>$= -8$ | e) 2 rational roots<br>f) 1 rational root<br>g) 2 irrational roots<br>h) None of the above |

HW Worksheet #3 Name_____

Solving for x-intercepts with imaginary units Block_____

*Solve for the roots with any method you wish (quadratic formula, factoring, complete the square, square root). Express your answers with simplified radicals (no decimals). Express imaginary units in terms of i. Circle your final answers.*

1. $x^2 + 4x + 10 = 0$
2. $x^2 = -36$
3. $-80 = 4x^2$
4. $(x- 3)^2 = - 5$
5. $x^2 = -8x- 20$
6. $x^2 + 18 = 0$
7. $x^2 + 13 = - 10x$
8. $y = x^2 – 14x + 49$
9. $7x^2 = 21$

HW Worksheet #3 Name_____

Solving for x-intercepts with imaginary units Block_____

*Solve for the roots with any method you wish (quadratic formula, factoring, complete the square, square root). Express your answers with simplified radicals (no decimals). Express imaginary units in terms of i. Circle your final answers.*

1. $x^2 + 4x + 10 = 0$

Results:

$x = -2 - i\sqrt{6}$

$x = -2 + i\sqrt{6}$

2. $x^2 = -36$

Result:

$x = \pm(6\,i)$

3. $-80 = 4x^2$

$x = \pm(2\,i\sqrt{5})$

4. $(x- 3)^2 = - 5$

Results:

$x = 3 - i\sqrt{5}$

$x = 3 + i\sqrt{5}$

5. $x^2 = -8x- 20$

Results:

$x = -4 - 2\,i$

$x = -4 + 2\,i$

6. $x^2 + 18 = 0$

Result:

$x = \pm(3\,i\sqrt{2})$

7. $x^2 + 13 = - 10x$

Results:

$x = -5 - 2\sqrt{3}$

$x = 2\sqrt{3} - 5 \approx$

8. $y = x^2 - 14x + 49$

Result:

$x = 7$

9. $7x^2 = 21$

Result:

$x = \pm\sqrt{3}$