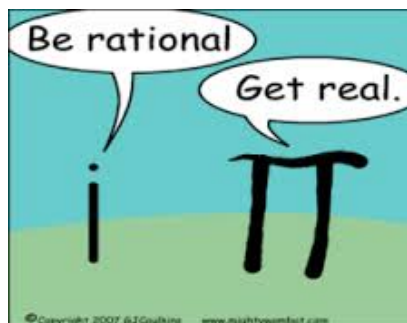


# Complex Numbers

- Complex Numbers
- Operations with Complex Numbers
- Complex Conjugates and Division
- Complex Solutions of Quadratic Equations

~The zeros of polynomials are complex numbers



Sections P6:

HW: Pg 52 #'s 1, 4, 5, 9, 11, 17, 20, 30, 35, 41, 43

Aug 20-7:12 AM

$$3) \quad \underline{4x^2} - \underline{8x} + \underline{3} = 0$$

$$(4)(3) = 12$$

<u>4</u> x <sup>2</sup>	-2x	(2x)(2x-1)
-6x	<u>3</u>	

$$\begin{array}{r} 1 \quad 12 \\ \hline 2 \quad 6 \\ 3 \quad 4 \end{array}$$

$$\begin{array}{l} 3(-2x+1) \\ -3(\underline{2x-1}) \end{array}$$

$$(2x-1)(2x-3) = 0$$

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$$6) \quad x(3x+11) = 20$$

$$3x^2 + 11x = 20$$

$$3x^2 + \underline{11x} - 20 = 0$$

<u><math>3x^2</math></u>	$15x$	$3x(x+5)$
$-4x$	<u><math>-20</math></u>	$-4(x+5)$

$(x+5)(3x-4)$

$$(3)(-20) = -60$$

/	\
1	60
2	30
3	20
<u>4</u>	<u>15</u>
-4	+15

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$$12) \quad (2x+3)^2 = 169$$

$$2x+3 = \pm 13$$

$$\begin{array}{r} 2x+3 = 13 \\ -3 \quad -3 \\ \hline \end{array}$$

$$2x = 10$$

$$x = 5$$

$$\begin{array}{r} 2x+3 = -13 \\ -3 \quad -3 \\ \hline \end{array}$$

$$2x = -16$$

$$x = -8$$

Aug 28-11:28 AM

**Calvin and Hobbes** by Bill Watterson

HERE'S ANOTHER MATH PROBLEM I CAN'T FIGURE OUT. WHAT'S  $9+4$ ?

OOH, THAT'S A TRICKY ONE. YOU HAVE TO USE CALCULUS AND IMAGINARY NUMBERS FOR THIS.

IMAGINARY NUMBERS? YOU KNOW, ELEVENTEEN, THIRTY-TWO AND ALL THOSE. IT'S A LITTLE CONFUSING AT FIRST.

HOW DID YOU LEARN ALL THIS? YOU'VE NEVER EVEN GONE TO SCHOOL!

INSTINCT. TIGERS ARE BORN WITH IT.

## Complex Numbers

$a + bi$

Real Part  $\rightarrow$   $a$     Imaginary Part  $\rightarrow$   $bi$

$\sqrt{-1}$      $\sqrt{-1} = i$

$a + bi$   
 $\uparrow$      $\uparrow$   
 real    imaginary

Aug 20-11:53 AM

### Adding and Subtracting Complex Numbers

Perform the indicated operation.

$a + bi$      $a + bi$     Real  $\pm$  Real  
 $(7 - 3i) + (4 + 5i)$     Imag  $\pm$  Imag

$7 + 4 - 3i + 5i$   
 $11 + 2i$

$(2 - i) - (8 - 3i)$   
 $2 - 8 - i + 3i$   
 $-6 + 2i$

Aug 20-8:43 AM

## Multiplying Complex Numbers

Find the product

$$(3 + 2i)(4 - 3i)$$

$$(3)(4) + (3)(-3i) + (2i)(4) + (2i)(-3i)$$

$$\underline{12} - 9i + 8i - 6i^2 \quad i^2 = -1$$

$$-6(-1) \\ \underline{+6}$$

$$18 - i$$

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## Dividing Complex Numbers

Write the complex number in standard form

$a + bi$

$$\frac{2}{3-i} \frac{(3+i)}{(3+i)} = \frac{6+2i}{9-i^2}$$

1st term squared  
- last term squared

$$= \frac{6+2i}{10}$$

$$\frac{5+i}{2-3i} \frac{(2+3i)}{(2+3i)} = \frac{3}{5} + \frac{1}{5}i$$

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Nature of the Solutions		
Value of the discriminant	Type and number of Solutions	Example of graph
Positive Discriminant $b^2 - 4ac > 0$	<b>Two Real Solutions</b>  If the discriminant is a perfect square the roots are rational. Otherwise, they are irrational.	
Discriminant is Zero $b^2 - 4ac = 0$	<b>One Real Solution</b>	
Negative Discriminant $b^2 - 4ac < 0$	<b>No Real Solutions</b> Two <b>Imaginary</b> Solutions	

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### Determining the Number and Types of Solutions

Using the discriminant, determine the nature of the solutions to the quadratic.

$$\begin{array}{l}
 2x^2 + 3x - 1 \\
 \text{A} \quad \text{B} \quad \text{C}
 \end{array}
 \quad
 \begin{array}{l}
 3^2 - 4(2)(-1) \\
 9 - -8 \\
 17
 \end{array}
 \quad
 \begin{array}{l}
 2 \text{ real soln}
 \end{array}$$

$$\begin{array}{l}
 3x^2 + 2x + 2
 \end{array}
 \quad
 \begin{array}{l}
 2^2 - 4(3)(2) \\
 4 - 24 \\
 -20
 \end{array}
 \quad
 \begin{array}{l}
 \text{no real soln} \\
 \text{imag.}
 \end{array}$$

$$\begin{array}{l}
 x^2 + 4x + 4
 \end{array}
 \quad
 \begin{array}{l}
 4^2 - 4(1)(4) \\
 16 - 16 \\
 0
 \end{array}
 \quad
 \begin{array}{l}
 1 \text{ real soln} \\
 \text{repeated}
 \end{array}$$

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## Solving a Quadratic Equation

Solve

$$A=1$$

$$B=-1$$

$$C=1$$

$$x^2 + x + 1 = 0$$

$$b^2 - 4ac$$

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

$$1 - 4$$

$$-3$$

no real soln

$$\frac{-1 \pm \sqrt{-3}}{2(1)}$$

$$\frac{-1 \pm \sqrt{3}i}{2}$$

$$-\frac{1}{2} + \frac{\sqrt{3}}{2}i$$

$$-\frac{1}{2} - \frac{\sqrt{3}}{2}i$$

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Aug 28-11:46 AM