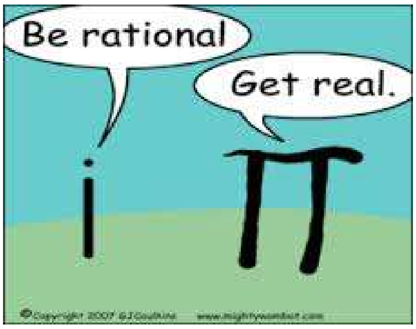
Complex Numbers

- Complex Numbers
- Operations with Complex Numbers
- Complex Conjugates and Divsion
- 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

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3) $4x^2 - 8x + 3 = 0$

$(4)(3) = 12$

1	12
2	6
3	4

$4x^2$	$-2x$
$-6x$	3

$2x(2x-1)$

$-3(2x-1)$

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

$3(-2x+1)$

$-3(2x-1)$

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

$3x^2+11x=20$

$3x^2+11x-20=0$

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

1	60
2	30
3	20
4	15
-4	+15

$3x^2$	$15x$	$3x(x+5)$
$-4x$	-20	$-4(x+5)$

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

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

$2x+3=\pm 13$

$2x+3=13$
$-3 \quad -3$
$2x=10$
$x=5$

$2x+3=-13$
$-3 \quad -3$
$2x=-16$
$x=-8$

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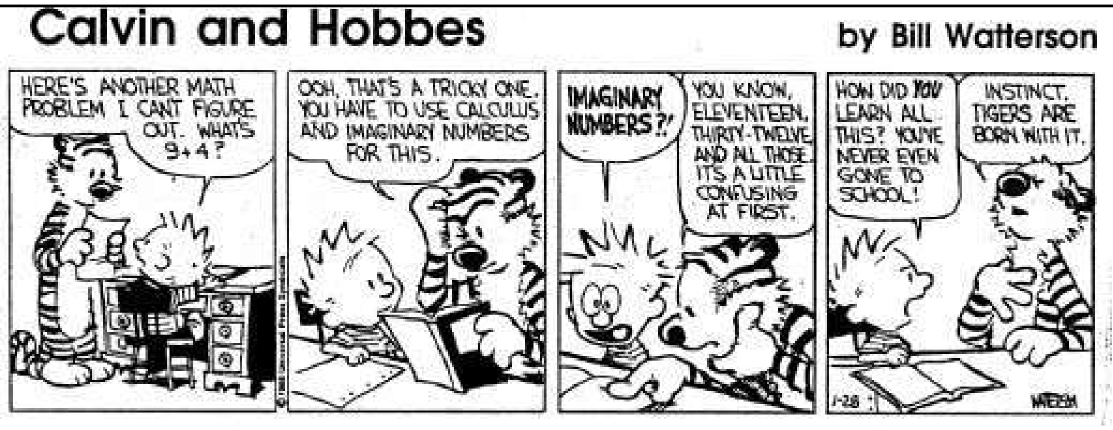

Complex Numbers

$a + bi$

↑ real ↑ imaginary

$\sqrt{-1} = i$

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Adding and Subtracting Complex Numbers

Perform the indicated operation.

Real ± Real

Imag ± Imag

$a + bi \quad a + bi$

$(7 - 3i) + (4 + 5i)$

$7 + 4 - 3i + 5i$

$11 + 2i$

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

$-8 + 3i$

$2 - 8 - i + 3i$

$-6 + 2i$

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Multiplying Complex Numbers

Find the product

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

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

$$12 - 9i + 8i - 6i^2 \qquad i^2 = -1$$

$$-6(-1)$$

$$+6$$

$$18 - i$$

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Dividing Complex Numbers

Write the complex number in standard form $a + bi$

1st term squared − last term squared

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

$i^2 = -1$

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

$$= \frac{3}{5} + \frac{1}{5}i$$

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

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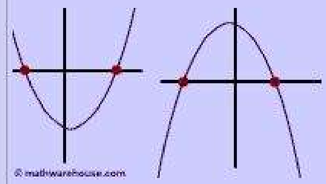
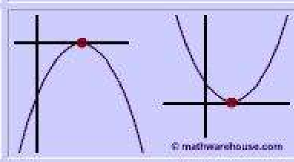
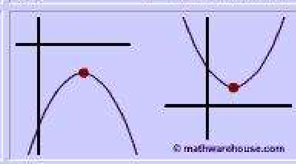
Nature of the Solutions

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

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Determining the Number and Types of Solutions

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

$2x^2 + 3x - 1$
A B C

$3^2 - 4(2)(-1)$
$9 - -8$
17

2 real soln

$3x^2 + 2x + 2$

$2^2 - 4(3)(2)$
$4 - 24$
-20

no real soln
imag.

$x^2 + 4x + 4$

$4^2 - 4(1)(4)$
$16 - 16$
0

1 real soln
repeated

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Solving a Quadratic Equation
Solve

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

A = 1
B = 1
C = 1

$b^2 - 4ac$

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

$1 - 4$

-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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