Pick up the

Warm up

HW help

Be prepared to turn in your class notebook anytime over the next week.

(1) What do baby parabolas drink ?

Quadratic formula

(1) What do baby parabolas drink ? ____________

(2) $\boxed{\sqrt{-1} = i}$ $\boxed{i^2 = -1}$

memorize

Simplify

$\sqrt{-7} = i\sqrt{7}$

$\sqrt{-30} = i\sqrt{30}$

$\sqrt{-20} = i\sqrt{4}\sqrt{5} = 2i\sqrt{5}$

$\sqrt{-50} = i\sqrt{25}\sqrt{2} = 5i\sqrt{2}$

$\sqrt{-36} = i\sqrt{36} = 6i$

$(5i)(\sqrt{-1}) = 5i \cdot i = 5i^2 = -5$

$i\sqrt{20}$

$i\sqrt{4}\sqrt{5}$

$i\sqrt{50}$

$i\sqrt{25}\sqrt{2}$

$i\sqrt{36}$

$1\sqrt{\ } i$

(3) List each specific coefficient for the polynomial, a_n to a_0

$f(x) = x^5 - 3x^2 - 6$

$a_5 = 1$

$a_4 = 0$

$a_3 = 0$

$a_2 = -3$

$a_1 = 0$

$a_0 = -6$

(4) Later in class you will learn a shortcut to create a quadratic function from its two non-real roots. To do so, you will need to add the two roots and multiply them.

First root: $2+i$ Second root: $2-i$

a) Add the roots $2+i + 2-i = \underline{4}$

b) multiply them (practice w/o calculator) $(2+i)(2-i) = 5$

$4 - i^2$

$4-(-1)$

$4+1$

5. Find both the sum and the product of each pair (w/o calculator)

	Sum	Product
$3-5i$ and $3+5i$	6	34
$-4+i$ and $-4-i$	-8	17

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

$9-25i^2$

$9+25$

$(-4+i)(-4-i)$

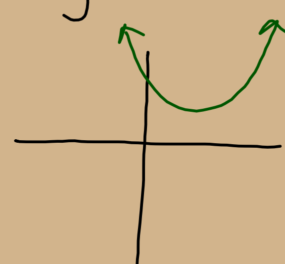
$16-i^2$

$16-(-1)$

$16+1$

Some equations have imaginary solutions

$y = x^2-4x+5$



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

should not have real solutions

(6) Find the non-real roots of the following quadratic functions
(by solving for x when $y=0$)

$y = x^2 - 4x + 5$

$y = (x+5)^2 + 9$

0

root equation

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

$a = 1$

$b = -4$

$c = 5$

Quadratic formula

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

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

$$= \frac{4 \pm \sqrt{-4}}{2}$$

$$= \frac{4 \pm 2i}{2}$$

$i\sqrt{4}$

$\frac{4}{2} \pm \frac{2i}{2}$

$$= 2 \pm i$$

$2+i \quad 2-i$

$\sqrt{4}$

$a = 1$

$b = -4$

$c = 5$

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

$$= \frac{4 \pm \sqrt{-4}}{2} = \frac{4 \pm 2i}{2} = 2 \pm i$$

$x = 2 \pm i$ are the two non-real roots

$\therefore$ no x-intercepts

$$y = (x+5)^2 + 9$$

$\uparrow 0$

root equation

$(x+5)^2 + 9 = 0$

$(x+5)^2 = -9$

$\sqrt{} \qquad \sqrt{}$

$i\sqrt{9}$

$x + 5 = \pm\sqrt{-9}$

$x + 5 = \pm 3i$

$x = -5 \pm 3i$

HW
Questions

$\boxed{72}$ $f(x) = x^2 + 7x - 9$

a $f(-3)$ b $f(i)$ c $f(-3+i)$

73 $5+2i$ $x^2-10x=-29$

$(5+2i)^2-10(5+2i)$ | -29

$(5+2i)(5+2i)-50-20i$

$25+\cancel{10i+10i}+4i^2-50-\cancel{20i}$

$25+\cancel{20i}+4(-1)-50-\cancel{20i}$

-29 | -29

70b $\frac{2\pm\sqrt{-16}}{2}$

$\boxed{70}$

(a)

$-18 - \sqrt{-25}$

$-18 - \sqrt{25(-1)}$

$-18 - \sqrt{25} \cdot i$

$-18 - 5i$

(b)

$\frac{2 \pm \sqrt{-16}}{2}$

$\frac{2 \pm 4i}{2}$

$\frac{\cancel{2}(1 \pm 2i)}{\cancel{2}}$

$1 \pm 2i$

(c)

$5 + \sqrt{-6}$

$5 + \sqrt{6}\sqrt{-1}$

$5 + \sqrt{6} \cdot i$

$5 + i\sqrt{6}$

$\boxed{74}$ Solve $(16)^{x+2} = (8)^{x}$

76c

$(4i)^2$

d

$(3i)^3$

77b

$f(x) = (x-3)^2 + 2$

$x = (y-3)^2 + 2$

$\sqrt{(y-3)^2} = \sqrt{x-2}$

$y - 3 = \pm\sqrt{x-2}$

$f^{-1}(x) = 3 \pm \sqrt{x-2}$

Notes

Complex Roots

also called non-real

- Polynomials have roots, sometimes many.
- Sometimes the roots are real
- Sometimes those roots are non-real
- Non-real roots are also called "imaginary" or "complex" at times which is confusing

· Non-real roots come in pairs.

as you saw in the warm up

$5+6i \quad 5-6i$

$3 \pm 7i$

$0+8i$

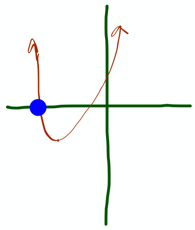
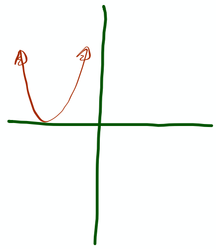
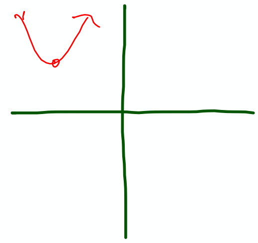
$0-8i$

$\pm 8i$

The vocabulary

example of degree 2 polynomial

a $y=(x+3)^2-4$ b $y=(x+3)^2$ c $y=(x+3)^2+4$

	a	b	c	
# roots	2 single root	1 double	2	$5+2i$ $5-2i$
roots are:	Real	Real	Non-real	

Factors of Polynomials look like

$$y = (x - \text{root})(x - \text{root})$$

Factors of Polynomials look like

$y = (x - \text{root})(x - \text{root})\ldots$

can be real or non-real

5 -13

$(x - 5)(x - {}^-13)$

$(x + 13)$

Aim Create a quadratic function given its non-real roots

Two non-real roots $\rightarrow$ quadratic function

the longer way $y = (x - \text{root})(x - \text{root})$

the short cut $y =$

Given roots $7 \pm 4i$

Create a quadratic function

long way $y = [x - (7+4i)][x - (7-4i)]$

$y = [x - 7 - 4i][x - 7 + 4i]$

standard form: $y = x^2 - 14x + 65$

	x	-7	$4i$
x	x^2	$-7x$	$\cancel{4ix}$
-7	$-7x$	49	$\cancel{-28i}$
$-4i$	$\cancel{-4ix}$	$\cancel{28i}$	$-16i^2$ 16

$$y = x^2 - 14x + 65$$

Shortcut

There is a link between the roots of 2nd degree polynomial (in the form $y=x^2+bx+c$) and its function in standard form.

It's not obvious at first

function		roots	
$y = x^2 - 6x + 25$	$\leftarrow$	$3 \pm 4i$	$3+4i$ $3-4i$
$y = x^2 - 4x + 5$	$\leftarrow$	$2 \pm i$	$2+i$ $2-i$

HINT:

It has to do with the SUM and PRODUCT of the roots shortcut $7+4i$ $7-4i$

Sum 14

Product $(7+4i)(7-4i)$

$49-16i^2$

$49+16$

65

$y = x^2 - 14x + 65$

To Create a quadratic function $x^2 + bx + c$

the linear coefficient, b, is the opposite of the sum of the roots

the constant, c, is the product of the roots.

Practice

$(x - root)$

Given roots

Function

$0, 3, -8$ $\quad y = x(x-3)(x+8)$

$-6 \pm 2i$ $\quad y = x^2 + 12x + 40$

$3i, -3i$ $\quad y = x^2 + 9$

$(-3 + i\sqrt{2}, -3 - i\sqrt{2})$ $\quad y = x^2 + 6x + 11$

$9 - i^2(2)$

$9 + 2$

$0, 3, -8$

$-6 \pm 2i$

$3i$, $-3i$

$-3+i\sqrt{2}$, $-3-i\sqrt{2}$

B.B.

Assignment

8.......87ac, 88, 93,94

i^2 $i^{2/3}$

Notebook Check

1. turn in your notebook
2. be sure your name is clearly visible and period

   If turnining in a spiral, then have your name visible on top or inside the front cover.

3. Mark the beginning of Ch. 5 with a Post -It Note