Algebra 2.4 Complex Numbers

$i^2 = -1$
$i = \sqrt{-1}$

Complex Number → $a + bi$

real part, imaginary part

ex. $3+2i$, $-1-i\sqrt{3}$, 3 (ok, no imaginary part), $-2i$ (ok, no real #)

add $(-7-4i)+(5-2i) = -2-6i$

Mult $(-7-4i)\cdot(5-2i) = -35-20i+14i+8i^2 = -35-6i+8i^2 = -35-6i-8 = -43-6i$

$2(3-5i)^2 = 2(3-5i)(3-5i) = 2(9-15i-15i+25i^2) = 2(9-30i+25i^2) = 18-60i+50i^2$
$= 18-60i-50 = -32-60i$

Cycle of i

$i = \sqrt{-1}$	$i^5 = \sqrt{-1}$	(divide by four use remainder)
$i^2 = -1$	$i^6 = -1$	
$i^3 = i \cdot i^2 = -i$	$i^7 = -i$	Simplify i^{23} $\quad 4\overline{)23}$ 5 remainder 3
$i^4 = i^2 \cdot i^2 = 1$	$i^8 = 1$	$i^{23} = -i$

Complex Conjugates

EX $2+7i$, $2-7i$

EX $-1-i\sqrt{2}$, $-1+i\sqrt{2}$

EX $-9i$, $9i$

EX 10, (no complex conjugate)

add $(2+7i)+(2-7i) = 4$ (adding 2 complex conjugates gives a real #)

Mult $(2+7i)\cdot(2-7i) = 4-49i^2 = 4+49 = 53$ (multiplying c.c. gives a real #)

Put in $a+bi$ format

EX $\frac{5}{2+i}$ $\quad \frac{5}{2+i} \cdot \frac{2-i}{2-i} = \frac{5(2-i)}{4-i^2} = \frac{5(2-i)}{4+1} = \frac{5(2-i)}{5} = 2-i$

Algebra 2.4 cont.

Simplify $\sqrt{-9} = \sqrt{-1} \cdot \sqrt{9} = i \cdot 3 = 3i$

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

Solve using Quadratic Formula

$x^2 + 3x + 8 = 0$ $\quad \frac{-3 \pm \sqrt{3^2 - 4(1)(8)}}{2(1)} = \frac{-3 \pm \sqrt{9-32}}{2} = \frac{-3 \pm \sqrt{-23}}{2} = \frac{-3 \pm i\sqrt{23}}{2}$

$a=1 \;\; b=3 \;\; c=8$

Simplify $\sqrt{-9} \cdot \sqrt{-4} = 3i \cdot 2i = 6i^2 = -6$

real

$1 + (x+7y)i = x + 22i$

imaginary

combine imaginary w/ imaginary & real w/ real part

so...

$1 = x$ $\quad$ (since $x=1$)

$(x+7y)i = 22i$

$1 + 7y = 22$

$7y = 21$

$y = 3$