10/30/2012 - Sec 8.7 Math 1010

#24
#42
#54

$$(x)^2 = \left(\sqrt{x^2 - 3x + 18}\right)^2$$

$$\cancel{x^2} = \cancel{x^2} - 3x + 18$$
$$-\cancel{x^2} \quad -\cancel{x^2}$$

$$0 = -3x + 18$$
$$+3x \quad +3x$$

$$\frac{3x}{3} = \frac{18}{3}$$

$$\boxed{x = 6}$$

Check

$$6 = \sqrt{6^2 - 3(6) + 18}$$

$$6 = \sqrt{36 - \cancel{18 + 18}}$$

$$6 = \sqrt{36}$$

$$6 = 6 \checkmark$$

#42

$$\left(\sqrt[3]{2k - 11}\right)^3 = \left(\sqrt[3]{5k + 1}\right)^3$$

$$2k - 11 = 5k + 1$$
$$-5k + 11 \quad -5k + 11$$

$$\frac{-3k}{-3} = \frac{12}{-3}$$

$$\boxed{k = -4}$$

Check

$$\sqrt[3]{2(-4) - 11} = \sqrt[3]{5(-4) + 1}$$

$$\sqrt[3]{-8 - 11} = \sqrt[3]{-20 + 1}$$

$$\sqrt[3]{-19} = \sqrt[3]{-19} \checkmark$$

#54

$$\sqrt{4x+5} - \sqrt{2x+2} = 1$$

$$+\sqrt{2x+2} \qquad + \sqrt{2x+2}$$

$$\left(\sqrt{4x+5}\right)^2 = \left(1+\sqrt{2x+2}\right)^2$$

$$4x+5 = 1+2\sqrt{2x+2} + 2x+2$$

$$4x+5 = 3+2x+2\sqrt{2x+2}$$

$$-2x \quad -3 \quad -3 \quad -2x$$

$$\frac{2x}{2}+\frac{2}{2} = \frac{2\sqrt{2x+2}}{2}$$

$$(x+1)^2 = \left(\sqrt{2x+2}\right)^2$$

$$x^2+\cancel{2x}+1 = 2x+2$$

$$-\cancel{2x} \; -2 \; -2x \; -2$$

$$x^2-1 = 0$$

$$(x+1)(x-1) = 0$$

$$x+1=0 \qquad x-1=0$$

$$-1 \quad -1$$

$$\boxed{x=-1,\ x=1}$$

Check

Ephraim $x=-1$ ✓

Richfield $x=1$ ✓

## Sec 8.7 Complex Numbers

$\sqrt{-1} = i$

### The Imaginary Unit

The imaginary unit $i$ is defined as

$$i = \sqrt{-1}, \text{ where } i^2 = -1$$

That is, $i$ is the principal square root of $-1$

$$\sqrt{-b} = \sqrt{-1 \cdot b} = \sqrt{-1}\,\sqrt{b} = i\sqrt{b}$$

Ex: $\sqrt{-16} = i\sqrt{16} = 4i$

Ex: $\sqrt{-50} = i\sqrt{50} = 5i\sqrt{2}$

50
2 25
5 5

Note: we prefere $i$ at the end of the Number
put the $i$ inbetween the # & Sqroot

When simplifying we must remove $i$'s before anything else

$\sqrt{-4} \cdot \sqrt{-9}$ Not same $\Rightarrow$ $\sqrt{(-4)(-9)}$

$i\sqrt{4} \cdot i\sqrt{9}$ $\qquad$ $\sqrt{36}$

$i \cdot 2 \cdot i \cdot 3$ $\qquad$ $6$

$2 \cdot 3 \cdot i^2$

$6(-1)$

$-6$

#20 $\sqrt{-10} \cdot \sqrt{2}$

$i\sqrt{10} \cdot \sqrt{2}$

$i\sqrt{10 \cdot 2}$

$i\sqrt{20}$

$\boxed{2i\sqrt{5}}$

20
2 10
2 5

## Defn of Complex Numbers

If a and b are Real Number then any Number of the form $a + bi$ is called a complex Number

$a+bi$ $\leftarrow$ Standard form

Real $\qquad$ imaginary

# Complex Numbers

Real Number

$a + bi$

$b = 0$

Ex: $2 = 2 + 0i$

Rational

Integers

Whole #

Irrational

Imaginary Numbers

when $b \neq 0$

add, subtract, mulltiply, divide

adding / subtracting: Gather Like Parts

$$(2 + 3i) + (5 - i)$$

$$2 + 5 + 3i + -i$$

$$7 + 2i$$

$(8-5i) + {}^{-1}(2+3i)$

$8 - 5i + {}^{-}2 + {-3i}$

$8 + {}^{-}2 + {}^{-}5i + {-3i}$

$6 + {}^{-}8i$

or

$6 - 8i$

Multiply: Distribute Everything

\# 44 $(5i)(125i)$

$5 \cdot 125 \cdot i \cdot i$

$625 \cancel{i^2}(-1)$

$-625$

\# 47 $5i(-6+2i)$

$-6 \cdot 5i + 2i \cdot 5i$

$-30i + 10\cancel{i^2}(-1)$

$-30i - 10$

$\boxed{-10 - 30i}$

\# 50 $(7-2i)(3+i)$

$7(3)+7i-6i+2\cancel{i^2}$

$21+i+2$

$\boxed{23+i}$

Divide: No $i$'s in Denominators!

to Help: Every complex Number has a complex conjugate

$(a+bi)(a-bi)$

$a^2-\cancel{abi}+\cancel{abi}-b^2\cancel{i^2}(-1)$

$a^2+b^2$

\# 64 $\dfrac{2}{(1+i)}\dfrac{(1-i)}{(1-i)}=\dfrac{2-2i}{1-\cancel{i}+\cancel{i}-\cancel{i^2}(-1)}$

$=\dfrac{2-2i}{1+1}$

$=\dfrac{2-2i}{2}$

$=\dfrac{\cancel{2}(1-i)}{\cancel{2}}$

$=\boxed{1-i}$

#67 $\dfrac{(-7+4i)(3-2i)}{(3+2i)(3-2i)}$

$$\frac{-21+14i+12i-8\cancel{i^2}(-1)}{9-\cancel{6i}+\cancel{6i}-4\cancel{i^2}(-1)}$$

$$\frac{-21+26i+8}{9+4}$$

$$\frac{-1\cancel{3}+26i}{1\cancel{3}} = -1+26i$$

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

$$-1+2i$$

power is div by 4

<u>Powers of $i$</u> cycle through $i, -1, -i, 1$

$i^1 = i$

$i^2 = -1$

$i^3 = i \cdot i^2$

$= i(-1)$

$= -i$

$i^4 = i^2 \cdot i^2$

$(-1)(-1) = 1$

$i^5 = i^4 \cdot i^1$

$= i$

$i^6 = -1$

$i^7 = -i$

$i^8 = 1$