41.) $0 = x^2 + 7x - 30$

$0 = (x + 10)(x - 3)$

$x = -10, 3$

53. $2x^2-4x-8=-\cancel{x^2}+\cancel{x}$

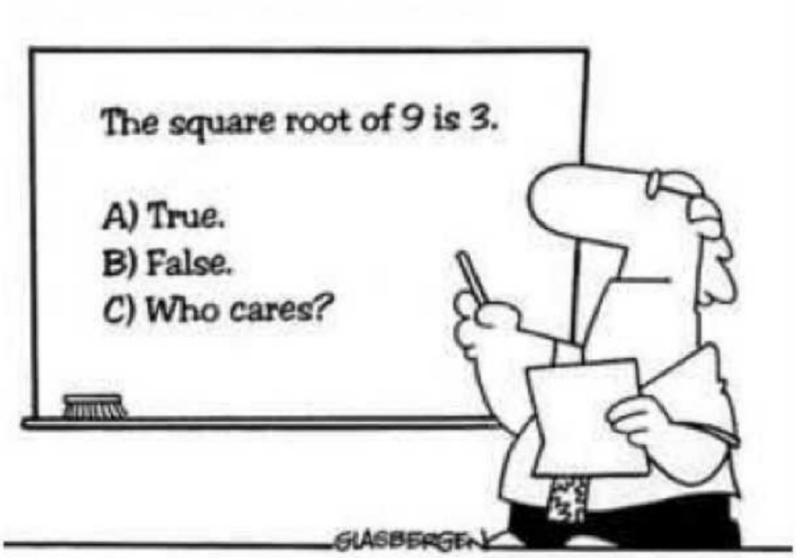
$+x^2 \quad -x \qquad\qquad +\cancel{x^2} \quad -\cancel{x}$

$3x^2-5x-8=0$

$(3x-8)(x+1)=0$

$x=8/3,-1$

Square Root Review
1.6 Complex Numbers



Many students actually look forward to Mr. Atwadder's math tests.

*See printout.

HW: Day 7

Perfect Squares

$1^2 =$ _____	$7^2 =$ _____
$2^2 =$ _____	$8^2 =$ _____
$3^2 =$ _____	$9^2 =$ _____
$4^2 =$ _____	$10^2 =$ _____
$5^2 =$ _____	$11^2 =$ _____
$6^2 =$ _____	$12^2 =$ _____

Square Root Review

radical

$\sqrt{r}$

radicand

Square Root Properties

- Multiplication: $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$
- Division: $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$

*There are NO sum ($\sqrt{a+b}$) or difference ($\sqrt{a-b}$) properties!!!

<u>Simplifying Radicals</u>

$$\sqrt{r}$$

*A radical is fully simplified when...

- the radicand has NO perfect square factors other than 1
- there is NO radical in the denominator
- the radicand does NOT involve decimals
- the radicand is positive

ex: Simplify.

a) $\sqrt{12}$ $= \sqrt{4} \cdot \sqrt{3}$

$= 2\sqrt{3}$

b) $\sqrt{27}$ $= \sqrt{9} \cdot \sqrt{3}$

$3\sqrt{3}$

c) $\sqrt{500}$

$\sqrt{100} \cdot \sqrt{5}$

$10\sqrt{5}$

d) $\sqrt{98}$ $= \sqrt{49} \cdot \sqrt{2}$

$7\sqrt{2}$

$\sqrt{9} \cdot \sqrt{8} = 3\sqrt{8} = 3\sqrt{4}\sqrt{2}$

$6\sqrt{2}$

e) $\sqrt{72}$

$\sqrt{36} \cdot \sqrt{2} = 6\sqrt{2}$

f) $\sqrt{\frac{9}{64}} = \frac{3}{8}$

$\frac{\cancel{10}\sqrt{3}}{\cancel{2}}$

$5\sqrt{3}$

g) $\sqrt{\frac{25}{2}} = \frac{5}{\sqrt{2}} \cdot \left(\frac{\sqrt{2}}{\sqrt{2}}\right) = \frac{5\sqrt{2}}{2}$

h) $\sqrt{\frac{13}{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{\sqrt{65}}{5}$

F~~OI~~L

Conjugate

$(x+y) \rightarrow (x-y)$

$(x+y)(x-y)$

$\downarrow$

$x^2 - \cancel{xy} + \cancel{xy} - y^2$

$x^2 - y^2$

i) $\frac{4}{(2-\sqrt{3})} \cdot \frac{2+\sqrt{3}}{(2+\sqrt{3})}$

$\frac{4(2+\sqrt{3})}{4-3} = 4(2+\sqrt{3})$

or

$8+4\sqrt{3}$

j) $\dfrac{2}{1+\sqrt{5}} \cdot \dfrac{1-\sqrt{5}}{1-\sqrt{5}} = \dfrac{\cancel{2}^{1}(1-\sqrt{5})}{-\cancel{4}\,2}$

$1-5$

$= \dfrac{1-\sqrt{5}}{-2} = -\dfrac{1-\sqrt{5}}{2}$

$= \dfrac{-1+\sqrt{5}}{2}$

k) $\dfrac{\sqrt{2}}{(\sqrt{3}-\sqrt{8})} \cdot \dfrac{(\sqrt{3}+\sqrt{8})}{(\sqrt{3}+\sqrt{8})} = \dfrac{\sqrt{2}(\sqrt{3}+\sqrt{8})}{-5}$

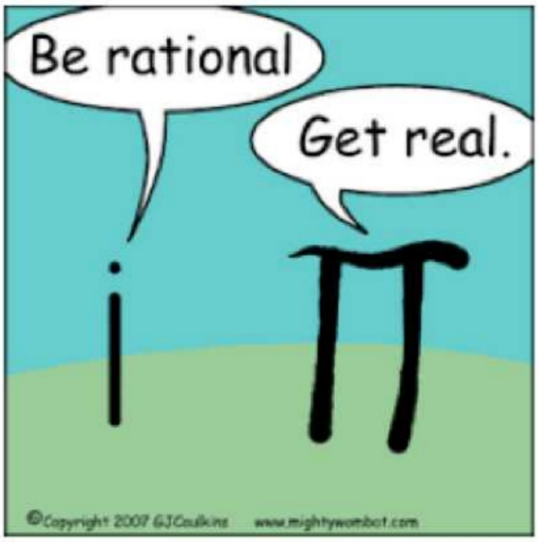
$= \dfrac{\sqrt{6}+\sqrt{16}}{-5} = \dfrac{\sqrt{6}+4}{-5}$

$= -\dfrac{\sqrt{6}+4}{5}$

Imaginary Numbers

$\sqrt{-12}$

$$\boxed{\sqrt{-1} = \underline{\quad i \quad}}$$



ex: Simplify.

a) $\sqrt{-9}$ $= \sqrt{-1} \cdot \sqrt{9}$

$= i\sqrt{9}$

$= 3i$

$7\sqrt{3}\, i$

$7i\sqrt{3}$

b) $\sqrt{-18}$ $= \sqrt{-1} \cdot \sqrt{9} \cdot \sqrt{2}$

$i \cdot 3\sqrt{2}$

$3i\sqrt{2}$

c) $\sqrt{-32}$ $= \sqrt{-1} \cdot \sqrt{16} \cdot \sqrt{2}$

$i \cdot 4\sqrt{2}$

$4i\sqrt{2}$

d) $2\sqrt{-45}$

$2\sqrt{-1}\sqrt{9}\sqrt{5}$

$2i \cdot 3\sqrt{5} = 6i\sqrt{5}$

Complex Numbers

Standard Form: $a+bi$

Examples of Complex Numbers:

$7+4i$ $3-12i$ 12

$12+0i$

Real Part: a Imaginary Part: b

*EVERY NUMBER CAN BE EXPRESSED AS A COMPLEX NUMBER!

ex: Identify the real and imaginary parts.

a) $7 - 2i$

real

imaginary

$a + bi$

b) $4 + 3i$

c) 7

real

0: imaginary

d) $6i\sqrt{5}$

real : 0
imaginary: $6\sqrt{5}$ (or $6i\sqrt{5}$)

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

real imag

f) $\frac{18 - i}{20}$ $= \frac{18}{20} - \frac{1}{20}i$

$= \frac{9}{10} - \frac{1}{20}i$

real imaginary

ex: Simplify. State the answer in standard form.

a) $(3+6i)+(6-42i)$

$9-36i$

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

$(x+y)(3x+2y)$

FOIL

b) $(16-42i)-(3-64i)$

$13+22i$

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

$$i^2 = -1$$

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

$$x^2 + 6x + 9$$

c) $7(3-2i)$

$21-14i$

d) $7i(3-2i)$

$21i-14i^2$

$21i+14 = 14+21i$

e) $(1+2i)(3-5i)$

$3-5i+6i-10i^2$

$3+i+10$

$13+i$

$i^2=-1$

f) $(6-3i)(6+3i)$

conjugates

FOIL

$36-9i^2$

$36+9$

45

g) $\left(1-2i\right)^2$

$(1-2i)(1-2i)$

$1-2i-2i+4i^2$

$1-4i-4 = -3-4i$

h) $\frac{2}{3i} \cdot \frac{-3i}{-3i}$

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

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

$$\frac{5(2-i)}{4-i^2}$$

$$\frac{\cancel{5}(2-i)}{\cancel{5}} = 2-i$$

$$\frac{4+3i}{7}$$

$$\frac{4}{7}+\frac{3}{7}i$$

j) $\dfrac{5+2i}{3-2i}$

Powers of i

$i =$ i

$i^2 =$ -1

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

$i^2 \cdot i^2$ $\quad i^4 =$ 1

$i^5 =$ i

$i^6 =$ -1

$i^7 =$ $-i$

$i^8 =$ 1

$i^9 =$ ______

$i^{10} =$ ______

$i^{11} =$ ______

$i^{12} =$ ______

ex: Simplify. State the answer in standard form.

a) i^{3281}

b) $i^{726} = -1$

$$\begin{array}{r} 181 \\ 4\overline{)726} \\ \underline{4} \\ 32 \\ \underline{32} \\ 06 \\ \underline{4} \\ r.2 \end{array}$$

$i^1 = i$
$i^2 = -1$
$i^3 = -i$
$i^4 = 1$

r.0

Review

ex: Sketch.

a) $y = 3x^2 - 6x$

b) $y = -2\left(x+3\right)^2 - 4$