49.) $g(x) = x^2 - 8x$

$0 = x(x-8)$

$x = 0, 8$

59.) $x(x+5) = 36$

$x^2 + 5x - 36 = 0$

$(x+9)(x-4) = 0$

$x = \cancel{-9}, 4$

$x = 4$

17.) $\dfrac{\sqrt{2}}{4+\sqrt{5}} \cdot \dfrac{(4-\sqrt{5})}{(4-\sqrt{5})}$

When you multiply conjugate pairs, you will get a rational number.

FOIL

$$\frac{\sqrt{2}(4-\sqrt{5})}{16-\cancel{4\sqrt{5}}+\cancel{4\sqrt{5}}-\sqrt{25}}$$

$$\frac{\sqrt{2}(4-\sqrt{5})}{11} = \frac{4\sqrt{2}-\sqrt{10}}{11}$$

$.25 = \frac{25}{100}$

1.6 Complex Numbers

ex: Simplify.

a) $\sqrt{0.25} = \sqrt{\frac{1}{4}} = \frac{1}{2}$

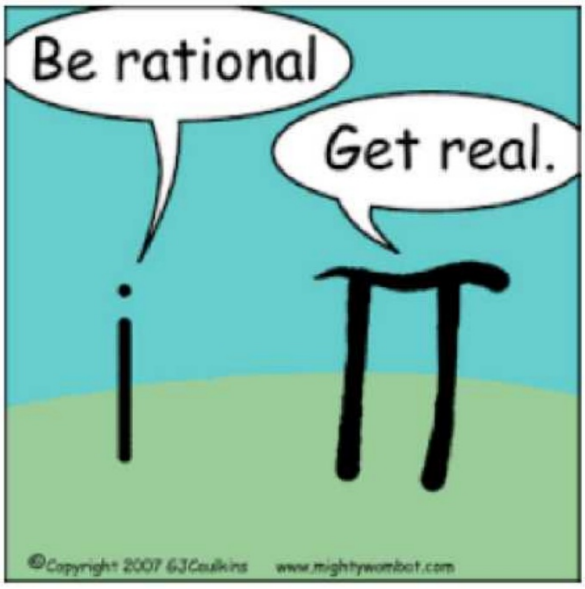
b) $\sqrt{\pi}$ already simplified

c) $\frac{5}{3-\sqrt{2}} \frac{3+\sqrt{2}}{(3+\sqrt{2})} = \frac{15+5\sqrt{2}}{9-2} = \frac{15+5\sqrt{2}}{7}$

d) $\sqrt{-9}$ . . . .

Imaginary Numbers

$\sqrt{-1} =$ i



ex: Simplify.

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

$= i \cdot 3 = 3i$

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

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

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

$= i \cdot \sqrt{16} \cdot \sqrt{2}$

$= 4i\sqrt{2}$

d) $2\sqrt{-45} = 2\sqrt{-1}\sqrt{45}$

$2i\sqrt{9}\sqrt{5}$

$6i\sqrt{5}$

Complex Numbers

Standard Form: $a + bi$

Examples of Complex Numbers:

$10 = 10 + 0i$

$\sqrt{6} = \sqrt{6} + 0i$

$6i = 0 + 6i$

$\frac{2}{3} = \frac{2}{3} + 0i$

$\sqrt{-2} = i\sqrt{2} = 0 + \sqrt{2}\,i$

Real Part: a Imaginary Part: bi

*EVERY NUMBER CAN BE EXPRESSED AS A COMPLEX NUMBER!

ex: Identify the real and imaginary parts.

a) $7 - 2i$

real : 7
imaginary : $-2i$

b) $4 + 3i$

real : 4
imaginary : $3i$

c) 7

real : 7
imaginary : $0i$

d) $6i\sqrt{5}$

real : 0

imaginary : $6\sqrt{5}i$

$2 - 3i\sqrt{7}$

$2 - 3\sqrt{7}i$

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

real : -3

imaginary : $\frac{1}{2}i$

St. form

$-3 + \frac{1}{2}i$

f) $\frac{18 - i}{20} = \frac{18}{20} - \frac{i}{20} = \frac{9}{10} - \frac{1}{20}i$

real: $\frac{9}{10}$

imag: $-\frac{1}{20}i$

ex: Simplify. State the answer in standard form.

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

$\sqrt{-1}=i$

$9-36i$

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

$16-42i-3+64i$

$13+22i$

c) $7(3-2i)$

$21-14i$

$\sqrt{-1}=i$

$i^2=-1$

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

$21i-14i^2$

$21i-14(-1)$

$21i+14 = 14+21i$

$i^2 = -1$

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

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

$3 + i + 10$

$13 + i$

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

$36 - 9i^2$

$36 - 9(-1)$

45

g) $(1-2i)^2$

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

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

$-3-4i$

h) $\frac{2}{3i} \cdot \frac{i}{i} = \frac{2i}{3i^2} = \frac{2i}{3(-1)} = \frac{-2i}{3} = \frac{-2}{3}i$

rationalizing

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

$= 2-i$

$\frac{10-5i}{5} = \frac{10}{5} - \frac{5}{5}i = 2-i$

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

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

$i^2 = -1$

$$\frac{15+10i+6i+4i^2}{9-4i^2} = \frac{15+16i-4}{9+4}$$

$$= \frac{11+16i}{13} = \frac{11}{13} + \frac{16}{13}i$$

Powers of i

	$i = i$	$i^7 = -i$	$i^6 \cdot i^1$
	$i^2 = -1$	$i^8 = 1$	
$i^2 \cdot i^1$	$i^3 = -i$	$i^9 = i$	
$i^2 \cdot i^2$	$i^4 = 1$	$i^{10} = -1$	
$i^4 \cdot i^1$	$i^5 = i$	$i^{11} = -i$	
$i^5 \cdot i^1$	$i^6 = -1$	$i^{12} = 1$	

ex: Simplify. State the answer in standard form.

a) i^{3281}

$$\begin{array}{r} 820 \\ 4\overline{)328} \\ 32 \\ \hline 8 \\ -8 \\ \hline 01 \\ -0 \\ \hline 1 \end{array}$$

$\boxed{i}$

3281 is NOT a multiple of 4. But, since the remainder is 1, we know that the 'power' is 1.

$i^1 = i$

$i^2 = -1$

$i^3 = -i$

$i^4 = 1$

b) i^{726}

$$\begin{array}{r} 181 \\ 4\overline{)726} \\ 4 \\ \hline 32 \\ 32 \\ \hline 6 \\ -4 \\ \hline 2 \end{array}$$

-1

Review

ex: Rewrite in vertex form.

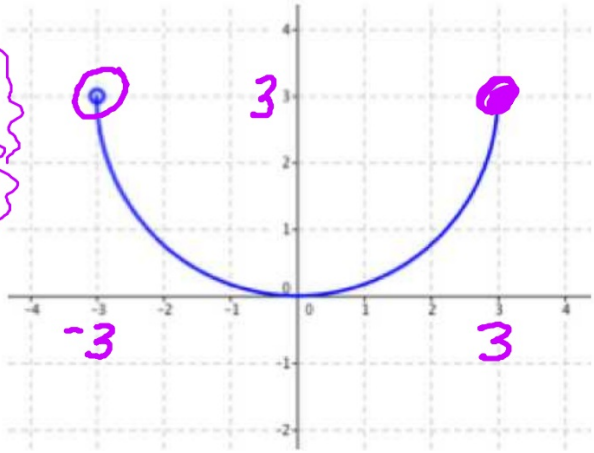
$$y = 2x^2 + 8x + 1$$

$$y = 2(x^2 + 4x \underline{+4}) + 1 \underline{-8}$$

$$y = 2(x+2)^2 - 7$$

Review

ex: Express the domain and range in set notation.

D: $\{x \mid -3 < x \leq 3\}$

R: $\{y \mid 0 \leq y \leq 3\}$