2.3 Notes

Bell work

Simplify the following:

$\sqrt{32}$

$\sqrt{8}$

$2 \cdot 2\sqrt{8}$

$\sqrt{2}$

$4\sqrt{2}$

$\sqrt{12}$ $\sqrt{4}\,3$ $2\sqrt{3}$

$\sqrt{20}$ $\sqrt{4}\,5$ $2\sqrt{5}$

$\sqrt{18}$ $\sqrt{9}\cdot 2$ $3\sqrt{2}$

$\sqrt{32}$ $\sqrt{16}\,2$ $4\sqrt{2}$

Solve the following for x:

$x^2 = 4$ $x = 2, -2$ $(2)^2 = 4$ $(-2)^2 = 4$

$x^2 = 9$ $x = 3, -3$

$x^2 = 25$ $x = 5, -5$

$x^2 = 20$ $\underbrace{(\sqrt{20})^2, (-\sqrt{20})^2}_{20}$ $\rightarrow$ $2\sqrt{5}, -2\sqrt{5} = x$

Solve for x:

$\boxed{x^2} - 7 = 0$

$+7 \quad +7$

$\sqrt{x^2} = \sqrt{7}$

$x = \pm\sqrt{7}$

$x^2 - 12 = 0$

$+12 \quad +12$

$\sqrt{x^2} = \sqrt{12}$

$x = \pm\sqrt{12}$

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

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

$2x^2 - 8 = 0$

$+8 \quad +8$

$\frac{2x^2}{2} = \frac{8}{2}$

$\sqrt{x^2} = \sqrt{4}$

$x = \pm 2$

$\frac{1}{2}x^2 - 7 = 13$

$+7 \quad +7$

$\cancel{\frac{2}{1}} \cdot \frac{1}{\cancel{2}}x^2 = 20 \cdot \frac{2}{1}$

$x^2 = 40$

$x = \pm\sqrt{40}$

$x = \pm 2\sqrt{10}$

Solve :

$x^2 + 12 = 3$

$-12 \quad -12$

$x^2 = -9$?

$(3)^2 = 9$

$(-3)^2 = 9$

$3x^2 - 7 = -31$

$+7 \quad +7$

$\frac{3x^2}{3} = \frac{-24}{3}$

$x^2 = -8$?

Complex Number System

What happens when you end up with the square root of a negative number?

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

i can be used to simplify the following radicals.

$$\sqrt{-9}$$

$\sqrt{-1 \cdot 9}$

$i\sqrt{9}$

$3i$

$(3i)^2 = 9i^2$

$= 9(-1)$

$= -9$

$$\sqrt{-8}$$

$\sqrt{-1 \cdot 8}$

$i\sqrt{8}$

$i2\sqrt{2}$

$2i\sqrt{2} \leftrightarrow 2\sqrt{2}\,i$

Go back and finish these problems.

Solve :

$x^2 + 12 = 3$

$-12 \qquad -12$

$\sqrt{x^2} = \sqrt{-9}$

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

$x = \pm i\sqrt{9}$

$x = \pm 3i$

$3x^2 - 7 = -31$

$+7 \qquad +7$

$3x^2 = -24$

$\sqrt{x^2} = \sqrt{-8}$

$x = \pm\sqrt{-8}$

$x = \pm 2i\sqrt{2}$

or

$\pm 2\sqrt{2}\,i$

Solve :

$4x^2 + 34 = 2$

$-34 \qquad -34$

$4x^2 = -32$

$\sqrt{x^2} = \sqrt{-8}$

$x = \pm\sqrt{-8}$

$x = \pm i\sqrt{8}$

$x = \pm 2i\sqrt{2}$

$x^2 + 15 = 3$

$-15 \qquad -15$

$\sqrt{x^2} = \sqrt{-12}$

$x = \pm\sqrt{-12}$

$x = \pm i\sqrt{12}$

$x = \pm 2i\sqrt{3}$

$\frac{1}{4}x^2 + 4 = -1$

$-4 \qquad -4$

$\cancel{\frac{4}{1}}\,\frac{1}{\cancel{4}}x^2 = -5\left(\frac{4}{1}\right)$

$x^2 = -20$

$x = \pm\sqrt{-20}$

$x = \pm i\sqrt{20}$

$x = \pm 2i\sqrt{5}$

Complex number in standard form:

$$a + bi$$

real imaginary

Conjugate of a complex number

$$a + bi \Rightarrow a - bi$$

opposite of the imaginary part

	complex #	conjugate
Examples:	4	4
	$4+2i$	$4-2i$
	$-5i$	$5i$
	$-7-6i$	$-7+6i$

Add and subtract complex numbers

(combine like terms)

$(8 - i) + (5 + 4i)$

$13+3i$

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

$4+0i$

4

$\cancel{10} - (\cancel{6} + -7i) + \cancel{4}$

$8-7i$

$\cancel{-4} - (\cancel{1} + \cancel{-i}) + (\cancel{5} + \cancel{9i})$

$0+8i$

$8i$

Multiply complex numbers

Distribute

$i^2 = -1$

$4i(-6 + i)$

$-24i + 4i^2$

$-24i + 4(-1)$

$\underbrace{-4 - 24i}_{\text{standard form}}$

$(9 - 2i)(-4 + 7i)$

$-36 + 63i + 8i - 14i^2$

$-36 + 71i - 14i^2$

$-14(-1)$

$-36 + 71i + 14$

$-22 + 71i$

Dividing complex numbers

$\frac{\cancel{6}}{\cancel{2}i} = \frac{3}{i}\left(\frac{i}{i}\right) = \frac{3i}{i^2}$

$\frac{3i}{-1} = -3i$

$7 + 28i + 5i + 20i^2$

$\frac{(7 + 5i)}{(1 - 4i)}\frac{(1 + 4i)}{(1 + 4i)} = \frac{-13 + 33i}{17}$

$1 + \cancel{4i} - \cancel{4i} - 16i^2$

(-1)

Simplifying higher powers of i

i^{10} Remainder $i^2 = -1$

$$\begin{array}{r} 2 \\ 4\overline{)10} \\ -8 \\ \hline \boxed{2} \end{array}$$

$(i^2)^5 \Rightarrow (-1)^5 = -1$

$i^{147} \rightarrow i^3 = -i$

$$\begin{array}{r} 36 \\ 4\overline{)147} \\ -12 \\ \hline 27 \\ -24 \\ \hline \boxed{3} \end{array}$$

$(i^2)^{73} i$

$(-1)^{73} i = -i$

$i^0 = 1$

$i = i$

$i^2 = -1$

$i^3 = -i$

$i^4 = 1$

$i^5 = i$

$i^6 = -1$

$i^7 = -i$

$i^8 = 1$

Assignment:
Complex Numbers WS 1