

Name: Key Hour: _____ Date: _____

Simplifying Complex Radicals Notes

Recall: Sometimes we need to break down numbers that aren't perfect squares.

Perfect Squares: 4, 9, 16, 25, 36, 49, 64, 81, 100, ...

Simplifying Radicals Review Examples:

$$\begin{aligned} 1) \sqrt{20} \\ &= \sqrt{4} \sqrt{5} \\ &= \pm 2\sqrt{5} \end{aligned}$$

$$\begin{aligned} 2) \sqrt{32} \\ &= \sqrt{16} \sqrt{2} \\ &= \pm 4\sqrt{2} \end{aligned}$$

$$\begin{aligned} 3) \sqrt{45} \\ &= \sqrt{9} \sqrt{5} \\ &= \pm 3\sqrt{5} \end{aligned}$$

Imaginary Numbers: $i = \sqrt{-1}$

Simplifying Square Roots of Negative Numbers:

$$\begin{aligned} 1) \sqrt{-4} \\ &= \sqrt{4} \sqrt{-1} \\ &= \pm 2i \end{aligned}$$

$$\begin{aligned} 2) \sqrt{-16} \\ &= \sqrt{16} \sqrt{-1} \\ &= \pm 4i \end{aligned}$$

$$\begin{aligned} 3) \sqrt{-18} \\ &= \sqrt{9} \sqrt{2} \sqrt{-1} \\ &= \pm 3i\sqrt{2} \end{aligned}$$

$$\begin{aligned} 4) \sqrt{-72} \\ &= \sqrt{36} \sqrt{2} \sqrt{-1} \\ &= \pm 6i\sqrt{2} \end{aligned}$$

$$\begin{aligned} 5) \sqrt{-24} \\ &= \sqrt{4} \sqrt{6} \sqrt{-1} \\ &= \pm 2i\sqrt{6} \end{aligned}$$

$$\begin{aligned} 6) \sqrt{-30} \\ &= \sqrt{30} \sqrt{-1} \\ &= \pm i\sqrt{30} \end{aligned}$$

Solving Quadratics with Complex Numbers:

Recall the Quadratic Formula:

$$x = \frac{-b \pm \sqrt{(b)^2 - 4ac}}{2a}$$

Find the roots of the following quadratic. Your answer should be exact and completely simplified.

$$8x^2 - 4x + 5 = 0 \quad a=8 \quad b=-4 \quad c=5$$

$$x = \frac{4 \pm \sqrt{(-4)^2 - 4(8)(5)}}{2(4)} = \frac{4 \pm \sqrt{16 - 160}}{8} = \frac{4 \pm \sqrt{-144}}{8}$$

$$= \frac{4 \pm \sqrt{144}\sqrt{-1}}{8}$$

$$= \frac{4 \pm 12i}{8} = \frac{4}{8} \pm \frac{12i}{8} = \boxed{\frac{1}{2} \pm \frac{3i}{2}}$$

Find the zeros of the following quadratic. Make sure your answer is exact and fully simplified.

$$2x^2 - 6x + 7 = 0 \quad a=2 \quad b=-6 \quad c=7$$

$$x = \frac{6 \pm \sqrt{(-6)^2 - 4(2)(7)}}{2(2)} = \frac{6 \pm \sqrt{36 - 56}}{4} = \frac{6 \pm \sqrt{-20}}{4}$$

$$= \frac{6 \pm \sqrt{4}\sqrt{5}\sqrt{-1}}{4}$$

$$= \frac{6 \pm 2i\sqrt{5}}{4} = \frac{6}{4} \pm \frac{2i\sqrt{5}}{4} = \boxed{\frac{3}{2} \pm \frac{i\sqrt{5}}{2}}$$