PreCalculus 11 Date ________________

Unit 4: Radical Expressions & Equations
4.2 Working With Radicals

Radicals are roots, and are accepted as exact answers, instead of rounded decimals.

ex.

$\sqrt{5}$ $3\sqrt{2}$ $\sqrt[3]{14x}$ $\sqrt[5]{16x^3y}$

A radical may have different parts: index $\sqrt[4]{\boxed{50x}}$ radical sign radicand

$\sqrt{5} = \sqrt[2]{5}$

$\sqrt[3]{2} \neq 3\sqrt{2}$

Like Radicals: Use the information in the table to describe *like radicals*.

Pairs of Like Radicals	Pairs of Unlike Radicals
$5\sqrt{7}$ and $-\sqrt{7}$	$2\sqrt{5}$ and $2\sqrt{3}$
$\frac{2}{3}\sqrt[3]{5x^2}$ and $\sqrt[3]{5x^2}$	$\sqrt[4]{5a}$ and $\sqrt[5]{5a}$

Like radicals have the same index and radicand (differ only by their coefficient)

Recall: Evaluate:

a) $\sqrt{-100}$ no real root
b) $\sqrt[3]{-64}$ $= -4$
c) $\sqrt[5]{-32}$ $= -2$
d) $\sqrt[4]{-81}$ no real root

In your own words, describe when it is possible to evaluate a radical with a negative radicand.

only when the index is odd

Restrictions on Variables: Sometimes we have variables under a radical sign. When this happens, we need to state any restrictions there may be on the variable(s).

If a radical has an even **index, then the** radicand **must be non-negative.** ≥ 0

State the restrictions (if necessary) on the following:

a) $\sqrt{x-2}$

$x - 2 \geq 0$

$\boxed{x \geq 2}$

b) $\sqrt[3]{3x+5}$

odd index

$\therefore$ $\boxed{\text{no restrictions}}$

c) $\sqrt{8-x}$

$8 - x \geq 0$
$-8 \quad -8$
$-x \geq -8$
$\div -1 \quad \div -1$

$\boxed{x \leq 8}$

d) $\sqrt[4]{2x-1}$

$2x - 1 \geq 0$

$\boxed{x \geq \frac{1}{2}}$

$-2 < 1$
$+2 \quad +2$
$1 \quad 2 \quad 4$

$-2 < 1$
$-2 \quad -2$
$-4 < -1$

$-2 < 1$
$\div 2 \quad \div 2$
$-1 < \frac{1}{2}$

$-2 < 1$
$\div -2 \quad \div -2$
$1 > -\frac{1}{2}$

$-2\sqrt{5}$ $\quad -2\sqrt[3]{5}$

$-\sqrt{4}\sqrt{5}$ $\quad \sqrt[3]{-8}\sqrt[3]{5}$

$-\sqrt{20}$ $\quad \sqrt[3]{-40}$

Convert Mixed Radicals to Entire Radicals.

a) $7\sqrt{2}$

$=\sqrt{49}\sqrt{2}$

$=\boxed{\sqrt{98}}$

b) $a^3\sqrt{a}$

$=\sqrt{a^6}\sqrt{a}$

$(a^3)^2 = a^{3\cdot 2}$

$=\sqrt{a^7}$

c) $5b\sqrt{b^3}$

$\sqrt{25b^2}\sqrt{b^3}$

$=\boxed{\sqrt{25b^5}}$

d) $2x^2\sqrt[3]{3x}$

$\sqrt[3]{8x^6}\cdot\sqrt[3]{3x}$

$=\boxed{\sqrt[3]{24x^7}}$

Express Entire Radicals as Mixed Radicals. (Simplify)

a) $\sqrt{300}$

$=\sqrt{100\cdot 3}$

$=\boxed{10\sqrt{3}}$

b) $3\sqrt{75x^6}$

$3\sqrt{25\cdot 3}\sqrt{x^6}$

$5\sqrt{3} \quad x^3$

$\boxed{15x^3\sqrt{3}}$

c) $2x\sqrt{x^7}$

$\sqrt{x^6\cdot x}$

$2x\cdot x^3\sqrt{x}$

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

d) $\sqrt{48y^5}$

$\sqrt{16\cdot 3}\sqrt{y^4\cdot y}$

$4\sqrt{3} \quad y^2\sqrt{y}$

$=\boxed{4y^2\sqrt{3y}}$

e) $\sqrt[3]{16b^{11}}$

$\sqrt[3]{8\cdot 2}\ \sqrt[3]{b^9\cdot b^2}$

$2\sqrt[3]{2} \quad b^3\sqrt[3]{b^2}$

$=\boxed{2b^3\sqrt[3]{2b^2}}$

f) $\sqrt[4]{48y^5}$

$\sqrt[4]{16\cdot 3}\ \sqrt[4]{y^4\cdot y}$

$2\sqrt[4]{3} \quad y\sqrt[4]{y}$

$=\boxed{2y\sqrt[4]{3y}}$

Compare and Order Radicals:

a) Comparing mixed radicals with like radicands: Write in ascending order:

$3\sqrt{2}, 5\sqrt{2}, 2\sqrt{2}, 10\sqrt{2}, -\sqrt{2}$:

$\boxed{-\sqrt{2},\ 2\sqrt{2},\ 3\sqrt{2},\ 5\sqrt{2},\ 10\sqrt{2}}$

b) Comparing radicals that do not have like radicands: Write in descending order:

$4(13)^{\frac{1}{2}},\ 8\sqrt{3},\ 14,\ \sqrt{202},\ 10\sqrt{2}$

$4\sqrt{13} \quad \sqrt{8^2\cdot 3} \quad \sqrt{14^2} \quad \sqrt{10^2\cdot 2}$

$\sqrt{4^2\cdot 13}$

$\sqrt{208} \quad \sqrt{192} \quad \sqrt{196} \quad \sqrt{202} \quad \sqrt{200}$

$\boxed{4(13)^{1/2},\ \sqrt{202},\ 10\sqrt{2},\ 14,\ 8\sqrt{3}}$

$* \quad b^{m/n} = \sqrt[n]{b^m}$

or

$\left(\sqrt[n]{b}\right)^m$

202

2 $\quad$ 101

50

2 $\quad$ 25

5 $\quad$ 5

Practice: pg. 278/ #1 – 6, 11, 12, 14, 20

& Worksheet(207) – on sheet