Name: ___________________________ Date: ________________

Learning Goal 5.1	Express an entire radical as a simplified mixed radical and vice versa. Identify and order irrational numbers.

Example Order these numbers least to greatest.

$4\sqrt{13}$, $8\sqrt{3}$, 14, $\sqrt{202}$, $10\sqrt{2}$

Change them all to entire radicals

$4\sqrt{13} = \sqrt{4^2 \times 13}$
$= \sqrt{16 \times 13}$
$= \sqrt{208}$

$14 = \sqrt{14^2}$
$= \sqrt{196}$

$8\sqrt{3} = \sqrt{8^2 \times 3}$
$= \sqrt{64 \times 3}$
$= \sqrt{192}$

$10\sqrt{2} = \sqrt{10^2 \times 2}$
$= \sqrt{100 \times 2}$
$= \sqrt{200}$

1. $8\sqrt{3}$
2. 14
3. $10\sqrt{2}$
4. $\sqrt{202}$
5. $4\sqrt{13}$

If the radicals all have the same index, change them to entire radicals to compare.

Example Order these numbers least to greatest.

$\sqrt[3]{2}$, $8\sqrt{2}$, 2, $\sqrt[4]{20}$, $\sqrt[5]{20}$

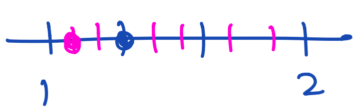
$\sqrt[3]{1} < \sqrt[3]{2} < \sqrt[3]{8}$
$1 < \sqrt[3]{2} < 2$
$\sqrt[3]{2} \doteq 1.1$

$\sqrt[4]{16} < \sqrt[4]{20} < \sqrt[4]{81}$
$2 < \sqrt[4]{20} < 3$
$\sqrt[4]{20} \doteq 2.1$

$\sqrt[5]{1} < \sqrt[5]{20} < \sqrt[5]{32}$
$1 < \sqrt[5]{20} < 2$
$\sqrt[5]{20} \doteq 1.6$

$\sqrt{1} < \sqrt{2} < \sqrt{4}$
$1 < \sqrt{2} < 2$
$\sqrt{2} \doteq 1.4$

$8\sqrt{2} \doteq 9$



1. $\sqrt[3]{2}$
2. $\sqrt[5]{20}$
3. 2
4. $\sqrt[4]{20}$
5. $8\sqrt{2}$

Recall like terms in algebra:

$$5a + 4c + 3a - 9c + 2b$$

$= 8a - 5c + 2b$

Because we don't know the value of a, b and c, this is as far as we can go.

Extend to radicals:

$$\sqrt{27} + \sqrt{3} = \sqrt{3^3} + \sqrt{3}$$

$= 3\sqrt{3} + \sqrt{3}$

$= 4\sqrt{3}$

27: 9, 3; 9: 3, 3

Example Simplify radicals and combine like terms.

a. $-\sqrt{27} + 3\sqrt{5} - \sqrt{80} - 2\sqrt{12}$

$= -3\sqrt{3} + 3\sqrt{5} - \sqrt{2^4 \times 5} - 2\sqrt{2^2 \times 3}$

$= -3\sqrt{3} + 3\sqrt{5} - \cancel{2^2}\,4\sqrt{5} - 4\sqrt{3}$

$= -7\sqrt{3} - \sqrt{5}$

80: 8, 10; 8: 4, 2; 4: 2, 2; 10: 5, 2

12: 3, 4; 4: 2, 2

b. $\sqrt{4c} - 4\sqrt{9c}, \quad c \geq 0$

$= \sqrt{2^2 \times c} - 4\sqrt{3^2 \times c}$

$= 2\sqrt{c} - 4 \times 3\sqrt{c}$

$= 2\sqrt{c} - 12\sqrt{c}$

$= -10\sqrt{c}$

Example The speed, v, in kilometres per hour, of a car before a collision can be approximated from the length, d, in metres, of the skid mark left by the tire. On a dry day, one formula that approximates this speed is

$$v = \sqrt{169d}, \quad d \geq 0$$

a. Rewrite the formula as a mixed radical.

$V = \sqrt{13^2 \times d}$

$= 13\sqrt{d}$

b. What is the approximate speed of a car if the skid mark measures 13.4 m? Express your answer to the nearest kilometre per hour.

$V = 13\sqrt{13.4} \doteq 13 \times 4.6$

$\doteq 60$ km/h.

$\sqrt{9} < \sqrt{13} < \sqrt{16}$

$3 < \sqrt{13} < 4$

$16 - 9 = 7$