Name: ______________________________ Date: ________________

Learning Goal 5.3	Apply order of operations to radical expressions.

Recall Multiplying polynomials

$(5x)(8x^2)$

$= 40x^{1+2}$

$= 40x^3$

$7y(6 - 9y)$

$= 42y - 63y^2$

$(z-3)(z+3)$

F O I L

$= z^2 + 3z - 3z - 9$

$= z^2 - 9$

difference of squares

Example Multiply. Simplify the products where possible. State any restrictions on the variable, if any.

a. $(2\sqrt{7})(4\sqrt{75})$

$\sqrt{75} = \sqrt{3 \times 25}$

$= 5\sqrt{3}$

$= (2\sqrt{7})(20\sqrt{3})$

$= 40\sqrt{21}$

b. $7\sqrt{3}(5\sqrt{5} - 6\sqrt{3})$

$= 35\sqrt{15} - 42\sqrt{9}$

$= 35\sqrt{15} - 42 \times 3$

$= 35\sqrt{15} - 126$

$\sqrt{20} = \sqrt{2^2 \times 5} = 2\sqrt{5}$

20 → 4, 5; 4 → 2, 2

c. $(8\sqrt{2} - 5)(9\sqrt{5} + 6\sqrt{10})$

$= \underset{F}{72\sqrt{10}} + \underset{O}{48\sqrt{20}} - \underset{I}{45\sqrt{5}} - \underset{L}{30\sqrt{10}}$

$= 72\sqrt{10} + 96\sqrt{5} - 45\sqrt{5} - 30\sqrt{10}$

$= 42\sqrt{10} + 51\sqrt{5}$

d. $9\sqrt[3]{2w}(\sqrt[3]{4w} + 7\sqrt[3]{28})$

$= 9\sqrt[3]{8w^2} + 63\sqrt[3]{56w}$

56 → 2, 28; 28 → 2, 14; 14 → 2, 7

63×2

$= 18\sqrt[3]{w^2} - 126\sqrt[3]{7w}$

Example Divide. Simplify the products where possible. State any restrictions on the variable, if any.

a. $\dfrac{24\sqrt{x^2}}{\sqrt{3x}}$ ← radical: $x \geq 0$

denominator: $x = 0$

$\Rightarrow x > 0$

$= \dfrac{24\sqrt{x}}{\sqrt{3}} \times \dfrac{\sqrt{3}}{\sqrt{3}}$

$\sqrt{3} \times \sqrt{3}$
$= \sqrt{9}$
$= 3$

$= \dfrac{\cancel{24}^{8}\sqrt{3x}}{\cancel{3}}$

$= 8\sqrt{3x}$

b. $\dfrac{4\sqrt{5n}}{3\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}}$

$= \dfrac{\cancel{4}^{2}\sqrt{10n}}{3 \times \cancel{2}}$

radical: $n \geq 0$

$= \dfrac{2\sqrt{10n}}{3}$

Rationalize

Remove all radicals from the denominator

c. $\dfrac{11}{\sqrt{5}+7} \times \dfrac{\sqrt{5}-7}{\sqrt{5}-7}$

1. $\sqrt{5}$ bump radical to the other term.

2. $\sqrt{5}+7$
$= (\sqrt{5}+7)(\sqrt{5}+7)$
$= 5 + 7\sqrt{5} + 7\sqrt{5} + 49$

$= \dfrac{11\sqrt{5} - 77}{5 - 7\sqrt{5} + 7\sqrt{5} - 49}$

$= \dfrac{11\sqrt{5} - 77}{5 - 49}$

$= \dfrac{11\sqrt{5} - 77}{-44} \; (\div 11) = \dfrac{\sqrt{5} - 7}{-4} = \dfrac{7 - \sqrt{5}}{4}$

d. $\dfrac{4\sqrt[3]{11}}{y\sqrt[3]{6}} \times \dfrac{\sqrt[3]{6^2}}{\sqrt[3]{6^2}}$ ← watch the index

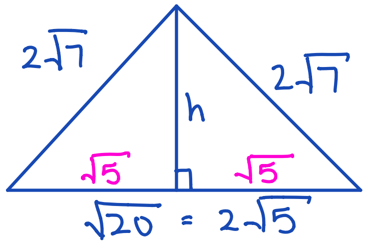
$= \dfrac{4\sqrt[3]{6^2 \times 11}}{y\sqrt[3]{6^3}}$

$= \dfrac{4\sqrt[3]{6^2 \times 11}}{6y}$

Conjugate

A polynomial that will create a difference of squares

Example An isosceles triangle has a base of $\sqrt{20}$ metres. Each of the equal sides is $2\sqrt{7}$ metres long. What is the **exact** area of the triangle?



$A = \dfrac{b \times h}{2}$ $\Rightarrow \dfrac{\cancel{2}\sqrt{5} \times \sqrt{23}}{\cancel{2}}$

$a^2 + b^2 = c^2$

$(\sqrt{5})^2 + h^2 = (2\sqrt{7})^2$

$5 + h^2 = 28$
$-5 \qquad -5$

$h^2 = 23 \Rightarrow h = \pm\sqrt{23}$

$= \sqrt{115}$

The exact area of the triangle is $\sqrt{115}$ metres.