

## Multiplying/Dividing Radicals

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⊛ When multiplying ⊛ dividing radicals,  
you multiply ⊛ divide the roots  
and coefficients (numbers out front)  
separately

Ex 1 simplify

$$\begin{aligned} \text{a) } -3\sqrt{6x} \cdot 5\sqrt{3x} &= -15\sqrt{18x^2} \\ &= -15 \cdot 3x\sqrt{2} = -45x\sqrt{2} \end{aligned}$$

$$\begin{array}{c} 18 \\ \wedge \\ 2 \quad 9 \\ \wedge \\ 3 \quad 3 \end{array}$$

$$\text{b) } (2\sqrt{3} - 3\sqrt{2})(4\sqrt{3} + \sqrt{2})$$

$$= 8\sqrt{9} + 2\sqrt{6} - 12\sqrt{6} - 3\sqrt{4}$$

$$= 24 - 10\sqrt{6} - 6$$

$$= \boxed{18 - 10\sqrt{6}}$$

$$\sqrt[n]{a^m} = a^{\frac{m}{n}}$$

$$\begin{aligned}
 c) \quad \frac{\sqrt[2]{x^3}}{\sqrt[3]{x^2}} &= \frac{x\sqrt{x}}{\sqrt[3]{x^2}} = \frac{x \cdot x^{\frac{1}{2}}}{x^{\frac{2}{3}}} \\
 &= x^1 \cdot x^{\frac{1}{2}} \cdot x^{-\frac{2}{3}} = x^{1 + \frac{1}{2} - \frac{2}{3}} \\
 &= x^{\frac{6}{6} + \frac{3}{6} - \frac{4}{6}} = x^{\frac{5}{6}} = \boxed{\sqrt[6]{x^5}}
 \end{aligned}$$

NB: when we have roots with different indices, we have to convert them to exponents to simplify

## Rationalizing the Denominator

rational numbers  $\Rightarrow$  fractions but no roots

"No roots in the denominator"

Ex 2 Rationalize the denominator

$$a) \quad \sqrt{\frac{2}{7}} = \frac{\sqrt{2}}{\sqrt{7}} = \frac{\sqrt{2}}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{\sqrt{14}}{\sqrt{49}} = \boxed{\frac{\sqrt{14}}{7}}$$

$\frac{2 \cdot 2}{3 \cdot 2} = \frac{4}{6}$

$$b) \sqrt[3]{\frac{2}{x}} = \frac{\sqrt[3]{2}}{\sqrt[3]{x}} \cdot \frac{\sqrt[3]{x^2}}{\sqrt[3]{x^2}} = \frac{\sqrt[3]{2x^2}}{\sqrt[3]{x^3}} = \boxed{\frac{\sqrt[3]{2x^2}}{x}}$$

↑  
we need  $\sqrt[3]{x^2}$   
to make a  
perfect cube

$$c) \frac{3}{(2-\sqrt{3})} \cdot \frac{2+\sqrt{3}}{2+\sqrt{3}} = \frac{6+3\sqrt{3}}{(4+\cancel{2\sqrt{3}}-\cancel{2\sqrt{3}}-3)} = \frac{6+3\sqrt{3}}{1}$$

$$(x+y)(x-y) = x^2 - y^2$$

Diff of  
Sq

$$= \boxed{6+3\sqrt{3}}$$

Conjugate

"the conjugate of  $2-\sqrt{3}$  is  $2+\sqrt{3}$ "

$$d) \frac{\sqrt{x}-1}{\sqrt{x}+2} \cdot \frac{\sqrt{x}-2}{\sqrt{x}-2} = \frac{x-\sqrt{x}-2\sqrt{x}+2}{x-4}$$

↑  
conjugate  
of denominator

$$= \boxed{\frac{x-3\sqrt{x}+2}{x-4}}$$