MULTIPLYING & DIVIDING

Radical Expressions

When multiplying radicals, multiply the coefficients and multiply the radicands. We can only multiply radicals if they have the same index.

Ex. 1: $(2\sqrt{7})(4\sqrt{75})$

$(2\sqrt{7})(4\sqrt{25x3})$

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

$(40\sqrt{21})$

Ex. 2: Multiply the following. Remember to simplify the products when possible.

a) $5\sqrt{3}(\sqrt{6})$

b) $(-3\sqrt{2x})(4\sqrt{6})$

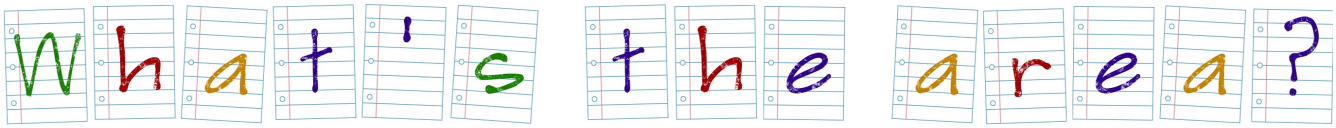
c) $7\sqrt{3}(5\sqrt{5}-6\sqrt{3})$

d) $-2\sqrt[3]{11}(4\sqrt[3]{2}-3\sqrt[3]{3})$

Ex. 3: Multiply the following binomials.

a) $(8\sqrt{2}-5)(9\sqrt{5}+6\sqrt{10})$ b) $(4\sqrt{2}+3)(\sqrt{7}-5\sqrt{14})$

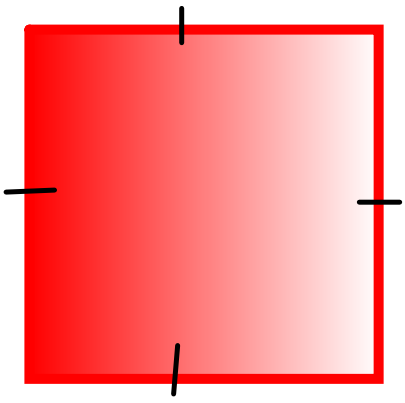
Multiplying and Dividing Radicals



$7\sqrt{2} + 5\sqrt{3}$

$2\sqrt{2} - \sqrt{3}$

$6\sqrt{3} + 2$



When dividing radicals, divide the coefficients and then divide the radicands. Remember, you can only divide radicals that have the same index.

Ex. 1: $\dfrac{4\sqrt[3]{6}}{2\sqrt[3]{3}} = 2\sqrt[3]{2}$

There are several levels of difficulty when dividing radicals:

Level 1: "Just Do It"

1. $\frac{\sqrt{100}}{\sqrt{25}} =$

2. $\frac{\sqrt{21}}{\sqrt{3}} =$

3. $\frac{\sqrt{20}}{\sqrt{5}} =$

4. $\frac{4\sqrt{3}}{\sqrt{3}} =$

5. $\frac{24\sqrt[3]{21}}{6\sqrt[3]{3}} =$

Level 2: Doesn't work out evenly - rationalize the denominator

http://www.khanacademy.org/math/algebra/exponents-radicals

1. $\frac{4\sqrt{3}}{\sqrt{2}} =$

2. $\frac{2\sqrt{2}}{\sqrt{3}} =$

3. $\frac{2\sqrt{6}}{\sqrt{5}} =$

5. $\frac{3\sqrt{5}}{2\sqrt{6}} =$

Rationalize: to convert to a rational number without changing the value of the expression.

Level 3: Rationalizing with binomials as numerators

1. $\frac{2\sqrt{2} + 3\sqrt{3}}{3\sqrt{6}} =$

2. $\frac{\sqrt{7} - 4}{2\sqrt{3}} =$

3. $\frac{2\sqrt{3} - 3\sqrt{2}}{\sqrt{2}} =$

Level 4: Rationalizing with binomials as denominator (Conjugate Method)

1. $\frac{3\sqrt{2}}{2\sqrt{2}-3} =$

2. $\frac{3}{\sqrt{5}-\sqrt{2}} =$

3. $\frac{2}{\sqrt{2}+\sqrt{3}} =$

4. $\frac{\sqrt{5}}{\sqrt{2}+3\sqrt{3}} =$

Conjugates: two binomial factors whose product is a difference of squares.

Level 5: Binomials as Numerator & Denominator

1. $\dfrac{3\sqrt{2} + 2\sqrt{3}}{\sqrt{12} - \sqrt{18}} =$

2. $\dfrac{3\sqrt{5} - 2\sqrt{3}}{3\sqrt{5} + 2\sqrt{3}} =$

Multiplying and Dividing Radicals

Key Ideas

- When multiplying radicals with identical indices, multiply the coefficients and multiply the radicands:

  $(m\sqrt[k]{a})(n\sqrt[k]{b}) = mn\sqrt[k]{ab}$

  where k is a natural number, and m, n, a, and b are real numbers. If k is even, then $a \geq 0$ and $b \geq 0$.

- When dividing two radicals with identical indices, divide the coefficients and divide the radicands:

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

  where k is a natural number, and m, n, a, and b are real numbers. $n \neq 0$ and $b \neq 0$. If k is even, then $a \geq 0$ and b > 0.

- When multiplying radical expressions with more than one term, use the distributive property and then simplify.

- To rationalize a monomial denominator, multiply the numerator and denominator by an expression that produces a rational number in the denominator.

  $$\frac{2}{\sqrt[5]{n}}\left(\frac{(\sqrt[5]{n})^4}{(\sqrt[5]{n})^4}\right) = \frac{2(\sqrt[5]{n})^4}{n}$$

- To simplify an expression with a square-root binomial in the denominator, rationalize the denominator using these steps:
  - Determine a conjugate of the denominator.
  - Multiply the numerator and denominator by this conjugate.
  - Express in simplest form.