

2.4 Multiplying and Dividing Radicals

Tuesday, October 27, 2015 2:19 PM

Pre-Calculus 11 2.4

Name _____

Multiplying and Dividing Radical Expressions

Blk _____

Notes

Example - Multiply $2\sqrt{5}(3\sqrt{5})$ Verify your answer:

$$\begin{aligned} & \underline{2} \cdot \sqrt{5} \cdot \underline{3} \cdot \sqrt{5} \\ &= 2 \cdot 3 \cdot \sqrt{5} \cdot \sqrt{5} \\ &= 6 \cdot \sqrt{25} \\ &= 6 \cdot 5 = \boxed{30} \end{aligned}$$

check using using your calculator.

To multiply radicals:

In general: $(m\sqrt[k]{a})(n\sqrt[k]{b}) = mn\sqrt[k]{ab}$
 where k is a natural number and
 $m, n, a, b \in \mathbb{R}$ - If k is even then
 $a \geq 0, b \geq 0$

Example - Simplify: a) $5\sqrt{3}(\sqrt{6})$

$$\begin{aligned} &= 5\sqrt{18} \\ &= 5\sqrt{9 \cdot 2} \\ &= 5 \cdot 3\sqrt{2} \\ &= \boxed{15\sqrt{2}} \end{aligned}$$

you try b) $-2\sqrt[3]{11}(4\sqrt[3]{2} - 3\sqrt[3]{3})$
 $-8\sqrt[3]{22} + 6\sqrt[3]{33}$

c) $(4\sqrt{2} + 3)(\sqrt{7} - 5\sqrt{14})$ FOIL

$$\begin{aligned} & \underline{4\sqrt{14}} - \underline{20\sqrt{28}} + \underline{3\sqrt{7}} - \underline{15\sqrt{14}} \\ & -11\sqrt{14} - 20\sqrt{28} + 3\sqrt{7} \\ & -11\sqrt{14} - 20\sqrt{4 \cdot 7} + 3\sqrt{7} \\ & -11\sqrt{14} - 40\sqrt{7} + 3\sqrt{7} \\ & \boxed{-11\sqrt{14} - 37\sqrt{7}} \end{aligned}$$

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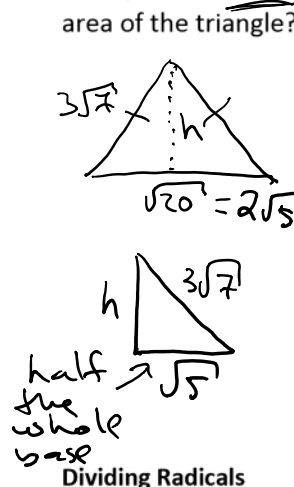
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Example - An isosceles triangle has a base of $\sqrt{20}$ m. Each of the equal sides is $3\sqrt{7}$ m long. What is the exact area of the triangle?



$$A = \frac{bh}{2}$$

$$h^2 + b^2 = c^2$$

$$h^2 + (\sqrt{5})^2 = (3\sqrt{7})^2$$

$$h^2 + 5 = 9 \cdot 7$$

$$h^2 + 5 = 63$$

$$h^2 = 58$$

$$h = \sqrt{58}$$

Dividing Radicals

$$A = \frac{bh}{2}$$

$$= \frac{(\sqrt{20})(\sqrt{58})}{2}$$

$$= \frac{(2\sqrt{5})(\sqrt{58})}{2}$$

$$= \sqrt{290} \text{ m}^2$$

Example - Divide $\frac{6\sqrt{12}}{3\sqrt{6}}$

$$6 \div 3 = 2$$

$$12 \div 6 = 2$$

$$2\sqrt{2}$$

Verify your answer:

put into your calculator.

To divide radicals:

In general:

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

with the same rules for multiplying
 $n \neq 0, b \neq 0$

Example - Simplify: a) $\frac{-24\sqrt[3]{14}}{8\sqrt[3]{2}}$

$$= -3\sqrt[3]{7}$$

you try

b) $\frac{2\sqrt{51}}{\sqrt{3}}$

$$= 2\sqrt{17}$$

c) $\frac{\sqrt{18x^3}}{\sqrt{3x}}, x > 0$

$$= \sqrt{6x^2}$$

$$= x^3$$

$$= x^{3-1}$$

$$= x^2$$

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Notes

Rationalizing the Denominator

You can't leave an answer that has a radical in the denominator. To fix this, you must 'rationalize the denominator' – a process that will eliminate the radical from the denominator without changing the answer.

Rationalize: a) $\frac{6}{7\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$

$$= \frac{6\sqrt{5}}{7\sqrt{25}}$$

$$= \frac{6\sqrt{5}}{7 \cdot 5} = \frac{6\sqrt{5}}{35}$$

If the denominator is a radical monomial, multiply the numerator and denominator by that radical.

b) $\frac{2\sqrt{5}}{3\sqrt{6}} \cdot \frac{(\sqrt{6})^2}{(\sqrt{6})^2}$

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

$$= \frac{2\sqrt{5} \cdot 3\sqrt{6}}{18} = \frac{\sqrt{5} \cdot \sqrt{6}}{3}$$

c) $\frac{3}{\sqrt{x-2}} \cdot \frac{(\sqrt{x+2})^2}{(\sqrt{x+2})^2}$

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

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

If the denominator is a radical binomial, multiply the numerator & denominator by its conjugate.

Simplify: a) $6\sqrt{\frac{3}{4x}}, x \geq 0$

$$\frac{6\sqrt{3} \cdot \sqrt{4x}}{\sqrt{4x} \cdot \sqrt{4x}}$$

$$\frac{6\sqrt{12x}}{4x} = \frac{3\sqrt{12x}}{2x}$$

$$= \frac{3 \cdot 2\sqrt{3x}}{2x} = \frac{3\sqrt{3x}}{x}$$

b) $\frac{-7}{2\sqrt[3]{9p}}, p \geq 0$

$$= \frac{-7\sqrt[3]{9p^2}}{2\sqrt[3]{9p} \cdot (\sqrt[3]{9p})^2}$$

$$= \frac{-21\sqrt[3]{3p^2}}{18p}$$

c) $\frac{2+\sqrt{2}}{3\sqrt{5}-4}$

$$\frac{6\sqrt{5}+8+3\sqrt{10}-4\sqrt{2}}{29}$$

HW: 126 # 6, 9-15
Hw check.

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