

Multiplying and Dividing Radicals

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Properties of Radicals

$$\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{a \cdot b}$$

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

Multiply Radicals

- Apply the distributive property
 - $a(b + c) = ab + ac$
- Multiply two binomials
 - $(a + b)(c + d) = ac + ad + bc + bd$
- Square a binomial

Examples

$$\begin{aligned}\sqrt{6}(3 + \sqrt{2}) &= \sqrt{6}(3) + \sqrt{6}(\sqrt{2}) \\ &= 3\sqrt{6} + \sqrt{12} \\ &= 3\sqrt{6} + \sqrt{4 \cdot 3} = \underline{3\sqrt{6}} + \underline{2\sqrt{3}}\end{aligned}$$

$$\begin{aligned}(\sqrt{7} + 4)(\sqrt{7} - 4) &= \sqrt{7}(\sqrt{7}) - \underline{4\sqrt{7}} + \underline{4\sqrt{7}} - 16 \\ &= \sqrt{49} - 16 \\ &= 7 - 16 \\ &= -9\end{aligned}$$

conjugates
 $a+b, a-b$

More Examples

$$(2\sqrt{3} + \sqrt{5})(3\sqrt{3} - 2\sqrt{5}) = 2\sqrt{3}(3\sqrt{3}) - 2\sqrt{3}(2\sqrt{5}) + \sqrt{5}(3\sqrt{3}) - \sqrt{5}(2\sqrt{5})$$

$$= 6\sqrt{9} - 4\sqrt{15} + 3\sqrt{15} - 2\sqrt{25}$$

$$= 6(3) - \sqrt{15} - 2(5)$$

$$= 18 - \sqrt{15} - 10 = \boxed{8 - \sqrt{15}}$$

$$(\sqrt{6} - \sqrt{2})^2$$

$$(\sqrt{6} - \sqrt{2})(\sqrt{6} - \sqrt{2})$$

$$\begin{aligned} \sqrt{6} \cdot \sqrt{6} - \sqrt{6} \cdot \sqrt{2} - \sqrt{2} \cdot \sqrt{6} + \sqrt{2} \cdot \sqrt{2} \\ \sqrt{36} - \sqrt{12} - \sqrt{12} + \sqrt{4} &= 6 - 2\sqrt{12} + 2 \\ &= 8 - 2\sqrt{12} = 8 - 2\sqrt{4 \cdot 3} \\ &= 8 - 4\sqrt{3} \end{aligned}$$

Dividing Radicals

$$\frac{\sqrt{24m^3}}{\sqrt{6m}} = \sqrt{\frac{24m^3}{6m}} = \sqrt{4m^2} = 2m$$

~~$16\sqrt{2}$~~

$$\frac{16 - 4\sqrt{8}}{12} = \frac{16 - 4\sqrt{4 \cdot 2}}{12} = \frac{16 - 4(2)\sqrt{2}}{12} = \frac{16 - 8\sqrt{2}}{12}$$

$$= \frac{8(2 - \sqrt{2})}{12} = \frac{2}{3} \frac{8(2 - \sqrt{2})}{4 \cdot 3} = \boxed{\frac{4 - 2\sqrt{2}}{3}}$$

Rationalizing Radicals

- You will not be tested on this topic. It is not one of the outcomes of the course.

$$\frac{5+10\sqrt{3}}{5} = \frac{5}{5} + \frac{10\sqrt{3}}{5} *$$
$$= 1 + 2\sqrt{3}$$