

4.3 Multiplying and Dividing Radicals

Multiplying: Do NOT have to be like radicals, but do have to have same index.

If the index is the same, multiply the "coefficients" together and multiply the radicands together. Note: It's a good idea to simplify first, if possible. Also, don't forget to simplify after multiplying.

$$\text{Ex: } 3\sqrt{2} \times 5\sqrt{2} = 3 \cdot 5 \sqrt{2 \cdot 2} = 15\sqrt{4} \\ = 15 \cdot 2 = 30$$

$$\text{Ex: } 5\sqrt{7} \times 4\sqrt{3} = 5 \cdot 4 \sqrt{7 \cdot 3} = 20\sqrt{21}$$

$$\text{Ex: } \sqrt{80} \times \sqrt{48} \\ \sqrt{16 \cdot 5} \times \sqrt{16 \cdot 3} = (\sqrt{16 \cdot 16 \cdot 5 \cdot 3}) \\ 4\sqrt{5} \times 4\sqrt{3} \\ 16\sqrt{15}$$

$$\text{Ex: } 2\sqrt{3} \times 5\sqrt{6} \times 4\sqrt{2} \\ = 40\sqrt{3 \cdot 3 \cdot 2 \cdot 2} \\ = 40\sqrt{3 \cdot 2} = 240$$

$$\text{Ex: } \sqrt{50} \times \sqrt{40} \times \sqrt{18} \\ \sqrt{5 \cdot 5 \cdot 2} \times \sqrt{2 \cdot 2 \cdot 2 \cdot 5} \times \sqrt{2 \cdot 3 \cdot 3} \\ \sqrt{5 \cdot 5 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 5 \cdot 2 \cdot 3 \cdot 3} \\ \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 \cdot 5 \cdot 5} \\ 2 \cdot 2 \cdot 3 \cdot 5 \sqrt{2 \cdot 5} \\ 60\sqrt{10}$$

$$\sqrt{48} \times \sqrt{80}$$

$$\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3} \times \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}$$

$$2 \cdot 2 \sqrt{3} \times 2 \cdot 2 \cdot \sqrt{5}$$

$$16\sqrt{15}$$

$$\sqrt{48} \times \sqrt{80}$$

$$\sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3} \times \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 5}$$

$$2 \cdot 2 \cdot 2 \cdot 2 \sqrt{3 \cdot 5}$$

$$16\sqrt{15}$$

Ex 4: $2\sqrt{3} \times 5\sqrt{6} \times 4\sqrt{2}$

$$2 \cdot 5 \cdot 4 \sqrt{3 \cdot 6 \cdot 2}$$

$$40 \sqrt{3 \cdot 3 \cdot 2 \cdot 2}$$

$$40 \sqrt{36}$$

$$40 \cdot 6$$

$$40 \cdot 3 \cdot 2$$

$$240$$

$$40 \sqrt{6 \cdot 6}$$

$$40 \cdot 6 = 240$$

More multiplying:

$$\underline{\text{Ex:}} \quad \sqrt{2} (\sqrt{6} + \sqrt{3}) \quad (\text{Distributive Property})$$

$$\sqrt{2} \times \sqrt{6} + \sqrt{2} \times \sqrt{3}$$

$$\sqrt{12} + \sqrt{6}$$

$$\sqrt{2 \cdot 2 \cdot 3} + \sqrt{2 \cdot 3}$$

$$2\sqrt{3} + \sqrt{6}$$

$$\underline{\text{Ex (2)}} \quad (\sqrt{3} + 2\sqrt{2})(\sqrt{15} - \sqrt{10})$$

$$\sqrt{3}(\sqrt{15} - \sqrt{10}) + 2\sqrt{2}(\sqrt{15} - \sqrt{10})$$

$$\sqrt{3} \times \sqrt{15} - \sqrt{3} \times \sqrt{10} + 2\sqrt{2} \times \sqrt{15} - 2\sqrt{2} \times \sqrt{10}$$

$$\sqrt{3 \times 15} - \sqrt{3 \times 10} + 2\sqrt{2 \times 15} - 2\sqrt{2 \times 10}$$

$$\sqrt{3 \times 3 \times 5} - \sqrt{3 \times 2 \times 5} + 2\sqrt{2 \times 3 \times 5} - 2\sqrt{2 \times 2 \times 5}$$

$$3\sqrt{5} - \sqrt{30} + 2\sqrt{30} - \cancel{2 \times 2} \sqrt{5}$$

$$3\sqrt{5} - 4\sqrt{5} - \sqrt{30} + 2\sqrt{30}$$

$$-1\sqrt{5} + 1\sqrt{30}$$

$$= \sqrt{30} - \sqrt{5}$$

Ex ③ multiply and simplify:

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

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

$$5\sqrt{49} + 20\sqrt{21} - 2\sqrt{21} - 8\sqrt{9}$$

$$5(7) + 18\sqrt{21} - 8(3)$$

$$35 - 24 + 18\sqrt{21}$$

$$11 + 18\sqrt{21}$$

Ex ④ Simplify: $(5\sqrt{2} - 3\sqrt{6})^2$

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

$$104 - 60\sqrt{3}$$