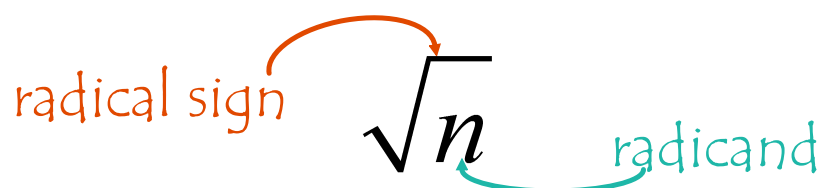


Radicals

Radicals are expressions that involve a root sign.

\sqrt{n} is called a radical.



Addition and Subtraction

Adding and subtracting radicals is like algebra - they have to be "like terms"; that is, the radicals must match.

Examples: $6\sqrt{7} - 4\sqrt{7} = 2\sqrt{7}$

$$5\sqrt{2} + 3\sqrt{2} = 8\sqrt{2}$$

$$\sqrt{3} + 2\sqrt{5} + 10\sqrt{5} = \sqrt{3} + 12\sqrt{5}$$



Multiplication and División

Properties: 1) $\sqrt{m} \times \sqrt{n} \Leftrightarrow \sqrt{m \times n}$ 2) $\frac{\sqrt{m}}{\sqrt{n}} \Leftrightarrow \sqrt{\frac{m}{n}}$

Example: $4\sqrt{2} \times 3\sqrt{6}$

Multiply/divide the coefficients and multiply/divide the radicands. Like terms are not necessary.

$$\begin{aligned} &12\sqrt{4 \cdot 3} \\ &12 \cdot \sqrt{4} \cdot \sqrt{3} \\ &12 \cdot 2 \cdot \sqrt{3} \end{aligned}$$

$$\begin{aligned} 4\sqrt{2} \times 3\sqrt{6} &= (4 \times 3)\sqrt{2 \times 6} \\ &= 12\sqrt{12} \Rightarrow 24\sqrt{3} \end{aligned}$$

Examples:

$$\begin{aligned}5\sqrt{20} \div 3\sqrt{10} &= (5 \div 3)\sqrt{20 \div 10} \\ &= \frac{5}{3}\sqrt{2}\end{aligned}$$

$$\begin{aligned}\underline{2\sqrt{3} \times 6\sqrt{8}} \div 4\sqrt{12} &= 3\sqrt{2} \\ 12\sqrt{3 \cdot 8} \div 4\sqrt{12} & \\ 12\sqrt{24} \div 4\sqrt{12} & \\ 3\sqrt{24 \div 12} &\end{aligned}$$



Simplifying Radicals

Many radicals can be simplified.

Example: $\sqrt{27}$

1. Break down the radicand into two factors - one of which is a perfect square.

$$\sqrt{27} = \underline{\sqrt{9 \cdot 3}}$$

2. Apply the multiplication property of radicals to create a coefficient times a radical.

$$\underline{\sqrt{9 \cdot 3} = \sqrt{9} \cdot \sqrt{3} = 3 \cdot \sqrt{3} = 3\sqrt{3}}$$

Example: $3\sqrt{72}$

$$3 \cdot \sqrt{9 \cdot 8}$$

$$3 \cdot \sqrt{9} \cdot \sqrt{8}$$

$$3 \cdot 3 \cdot \sqrt{8}$$

$$9\sqrt{8}$$

$$9\sqrt{4 \cdot 2}$$

$$9 \cdot \sqrt{4} \cdot \sqrt{2}$$

$$9 \cdot 2 \cdot \sqrt{2}$$

$$18\sqrt{2}$$

$$\text{or } 3\sqrt{36 \cdot 2}$$

$$3\sqrt{36} \cdot \sqrt{2}$$

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



Example: $4\sqrt{48} + 2\sqrt{12}$

$$4\sqrt{16 \cdot 3} + 2\sqrt{4 \cdot 3}$$

$$4 \cdot \sqrt{16} \cdot \sqrt{3} + 2 \sqrt{4} \cdot \sqrt{3}$$

$$4 \cdot 4 \cdot \sqrt{3} + 2 \cdot 2 \cdot \sqrt{3}$$

$$16\sqrt{3} + 4\sqrt{3}$$

$$20\sqrt{3}$$

Try these!

1. $3\sqrt{5} \times (-2\sqrt{3})$

2. $2\sqrt{3}(5\sqrt{3} + \sqrt{5})$

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

4. $12\sqrt{30} \div 4\sqrt{5}$

5. $2\sqrt{75} - 2\sqrt{108} + 5\sqrt{75} - \sqrt{108} + 3\sqrt{12}$

Simplify

$$1. \quad 3\sqrt{5} \times -2\sqrt{3} = -6\sqrt{15}$$

$$2. \quad 2\sqrt{3}(5\sqrt{3} + \sqrt{5}) = 2\sqrt{3} \cdot 5\sqrt{3} + 2\sqrt{3} \cdot \sqrt{5}$$

$$= 10\sqrt{9} + 2\sqrt{15}$$

$$= 10 \cdot 3 + 2\sqrt{15}$$

$$= 30 + 2\sqrt{15}$$

$$3. \quad (4\sqrt{5} + 3)(4\sqrt{5} - 3) = 4\sqrt{5} \cdot 4\sqrt{5} + 4\sqrt{5} \cdot (-3) + 3 \cdot 4\sqrt{5} + 3 \cdot (-3)$$

$$= 16\sqrt{25} - 12\sqrt{5} + 12\sqrt{5} - 9$$

$$= 16(5) - 9$$

$$= 80 - 9$$

$$= 71$$

$$4. \quad 2\sqrt{75} - 2\sqrt{108} + 5\sqrt{75} - \sqrt{108} + 3\sqrt{12}$$

$$= 7\sqrt{75} - 3\sqrt{108} + 3\sqrt{12}$$

$$= 7\sqrt{25 \cdot 3} - 3\sqrt{36 \cdot 3} + 3\sqrt{4 \cdot 3} = 35\sqrt{3} - 18\sqrt{3} + 6\sqrt{3}$$

$$5. \quad 12\sqrt{30} \div 4\sqrt{5} = \frac{12\sqrt{30}}{4\sqrt{5}}$$

$$= 3\sqrt{\frac{30}{5}}$$

$$= 3\sqrt{6}$$

Work Book

Pages 15 -18

Questions 3, 4, 5, 6, 7 & 9

Text Book 1

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Questions 1, 2 & 3