Algebra 2

Square Roots and Radicals

A radical symbol $\sqrt{}$ indicates a square root. The expression $\sqrt{16}$ means the principal, or positive, square root of 16. The expression $-\sqrt{16}$ means the negative square root of 16. In general, $\sqrt{x^2} = |x|$ for all real numbers x.

Properties of Square Roots
Multiplication Property of Square Roots

For any number $a \geq 0$ and $b \leq 0$, $\sqrt{ab} = \sqrt{a} \cdot \sqrt{b}$

Division Property of Square Roots

For any number $a \geq 0$ and $b \leq 0$, $\sqrt{\dfrac{a}{b}} = \dfrac{\sqrt{a}}{\sqrt{b}}$

must have same radical!

An expression containing nth roots is in simplest radical form if:

1   No radicand contains a factor (other than 1) that is a perfect nth power.   Pull ➤

2   No fractions or decimals underneath the radicand   Pull ➤

3   No radicand is a fraction and no radical is in a denominator   Pull ➤

You can use the properties of square roots to simplify radical expressions.

Simplify:

1·48
2·24
3·16
4·12
6·8

1. $\sqrt{48}$

$\sqrt{3 \cdot 16}$

$\sqrt{3} \cdot \sqrt{16}$

$\boxed{4\sqrt{3}}$

2. $-\sqrt{\dfrac{5}{7}}$

$\dfrac{-\sqrt{5} \cdot \sqrt{7}}{\sqrt{7} \cdot \sqrt{7}} = \dfrac{-\sqrt{35}}{\sqrt{49}}$

$= \boxed{\dfrac{-\sqrt{35}}{7}}$

Simplify:

3. $\sqrt{56}$ $\begin{array}{l} 1.56 \\ 2.28 \\ \boxed{4.14} \\ 7.8 \end{array}$ 4. $\sqrt{\dfrac{16}{3}}$

$\dfrac{\sqrt{4 \cdot 14}}{\sqrt{4} \ \sqrt{14}}$

$\boxed{2\sqrt{14}}$

$\dfrac{\sqrt{16}}{\sqrt{3}} = \dfrac{4}{\sqrt{3}}\dfrac{\sqrt{3}}{\sqrt{3}} = \dfrac{4\sqrt{3}}{\sqrt{9}} = \boxed{\dfrac{4\sqrt{3}}{3}}$

Simplify:

$5. \left(3\sqrt{7}\right)^2$

$\left(3\sqrt{7}\right)\left(3\sqrt{7}\right)$

$9\sqrt{49}$

$9 \cdot 7 = \boxed{63}$

1. 180
2. 90
3. 60
4. 45
5. 36
6. 30

$6. \quad \sqrt{30} \cdot \sqrt{6}$

$\sqrt{180} = \sqrt{36 \cdot 5}$

$\sqrt{36}\sqrt{5}$

$\boxed{6\sqrt{5}}$

Simplify:

7. $\dfrac{18\sqrt{3}}{\sqrt{3}\sqrt{3}} = \dfrac{18\sqrt{3}}{\sqrt{9}}$

$\dfrac{\overset{6}{\cancel{18}}\sqrt{3}}{\underset{1}{\cancel{3}}} = \boxed{6\sqrt{3}}$

8. $\dfrac{\cancel{15}\,5}{\cancel{3}\sqrt{45}}$

$\dfrac{5}{\sqrt{9\cdot 5}} = \dfrac{5}{\sqrt{9}\sqrt{5}} = \dfrac{5\sqrt{5}}{3\sqrt{5}\sqrt{5}}$

$\dfrac{5\sqrt{5}}{3\sqrt{25}} = \dfrac{5\sqrt{5}}{3\cdot 5} = \dfrac{\cancel{5}\sqrt{5}}{\cancel{15}\,3} = \boxed{\dfrac{\sqrt{5}}{3}}$

Simplify:

9. $\sqrt{a^2 b^2 c^4}$

$\sqrt{a^2} \quad \sqrt{b^2} \quad \sqrt{c^4}$

$a^{1\frac{2}{2}} \cdot b^{1\frac{2}{2}} \cdot c^{2\frac{4}{2}}$

$\boxed{abc^2}$

10. $\sqrt{\dfrac{12}{x^2}}$

$\dfrac{\sqrt{12}}{\sqrt{x^2}} = \dfrac{\sqrt{4 \cdot 3}}{x^{2/2}} = \boxed{\dfrac{2\sqrt{3}}{x}}$

Simplify:

11. $\sqrt{x^6 y^5}$

$\sqrt{x^6 \cdot y^4 \cdot y}$

$x^{\frac{6}{2}} \ y^{\frac{4}{2}} \ \sqrt{y}$

$\boxed{\boxed{x^3 y^2 \sqrt{y}}}$

12. $\sqrt{\dfrac{50}{x^7}}$

$\dfrac{\sqrt{50}}{\sqrt{x^7}} = \dfrac{\sqrt{25 \cdot 2}}{\sqrt{x^6 \cdot x}} = \dfrac{5\sqrt{2}}{x^{\frac{6}{2}} \sqrt{x}}$

$\dfrac{5\sqrt{2} \ \sqrt{x}}{x^3 \sqrt{x} \sqrt{x}} = \dfrac{5\sqrt{2x}}{x^3 \sqrt{x^2}} = \dfrac{5\sqrt{2x}}{x^3 \cdot x}$

$= \boxed{\dfrac{5\sqrt{2x}}{x^4}}$