

Section 5.5 - Operations with Radical Expressions

I can simplify nth root problems using the product property.

I can rationalize the denominator of a fraction by getting rid of the radical.

I can multiply and divide radicals

I can add and subtract radicals

I can add and subtract radicals

Step 1 *Simplify Radicals*

Step 2: *Combine "Like" radicals*

Like radicals are radicals with same root and same radicand

Add the radical expressions.

$$4\sqrt{12} + 3\sqrt{20} + \sqrt{75}$$

$$\boxed{8\sqrt{3}} \quad \boxed{6\sqrt{5}} \quad \boxed{5\sqrt{3}}$$

Simplify each radical.

$$\boxed{13\sqrt{3}} + \boxed{6\sqrt{5}}$$

Combine like terms.

$$\boxed{13\sqrt{3} + 6\sqrt{5}}$$

$$4\sqrt{12} \\ 4\sqrt{2 \cdot 2 \cdot 3} \\ 8\sqrt{3}$$

$$3\sqrt{20} \\ 3\sqrt{2 \cdot 2 \cdot 5} \\ 6\sqrt{5}$$

$$\sqrt{75} \\ \sqrt{5 \cdot 5 \cdot 3} \\ 5\sqrt{3}$$

1. $6\sqrt{20} + 8\sqrt{5} - 5\sqrt{45}$

$$6\sqrt{2 \cdot 2 \cdot 5} + 8\sqrt{5} - 5\sqrt{3 \cdot 3 \cdot 5} \\ 12\sqrt{5} + 8\sqrt{5} - 15\sqrt{5} = \boxed{5\sqrt{5}}$$

2. $5\sqrt{18} + 8\sqrt{108} - 3\sqrt{32}$

$$5\sqrt{3 \cdot 3 \cdot 2} + 8\sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3} - 3\sqrt{2 \cdot 2 \cdot 2 \cdot 2} \\ 15\sqrt{2} + 48\sqrt{3} - 12\sqrt{2} \\ \boxed{3\sqrt{2} + 48\sqrt{3}}$$

You try ☺

3. $\sqrt{243} + 2\sqrt{24} - 3\sqrt{54}$

4. $2\sqrt{48} - 4\sqrt{75} + \sqrt{28}$

I can simplify nth root problems using the product property.

Step 1: Multiply the radical expressions:

Rules for Multiplying Radical Expressions

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

*n must be same
need to be same root to multiply*

Step 2: Simplify the radicals.

5. $(3\sqrt{15})(-4\sqrt{45})$

$$-12\sqrt{3 \cdot 5} \cdot 4\sqrt{3 \cdot 5} \\ = \boxed{-180\sqrt{5}}$$

6. $(2\sqrt{24})(7\sqrt{18})$

$$14\sqrt{2 \cdot 2 \cdot 2 \cdot 3} \cdot 7\sqrt{2 \cdot 3 \cdot 3} \\ = \boxed{168\sqrt{3}}$$

7. $(6\sqrt{3ab})(4\sqrt{24ab^3})$

$$24\sqrt{3 \cdot 2 \cdot 2 \cdot 3} a^2 b^4 \\ = \boxed{144 a^2 b^2 \sqrt{2}}$$

8. $(-2\sqrt{20})(5\sqrt{40})$

9. $(3\sqrt{8})(2\sqrt{98})$

I can multiply and divide radicals

$$(a+b)(a-b) = a^2 - b^2$$

10. $(3 - \sqrt{2})(4 + \sqrt{3})$

11. $(\sqrt{2} + \sqrt{10})(\sqrt{2} - \sqrt{10})$

$$2 + 3\sqrt{3} - 4\sqrt{2} - \sqrt{6}$$

$$(\sqrt{2})^2 - (\sqrt{10})^2$$

12. $(3\sqrt{2} + 2\sqrt{3})^2 = (3\sqrt{2} + 2\sqrt{3})(3\sqrt{2} + 2\sqrt{3})$ $2 - 10 = -8$

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

$$18 + 6\sqrt{6} + 6\sqrt{6} + 12 =$$

$$30 + 12\sqrt{6}$$

* You try ☺

13. $(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})$

14. $(2\sqrt{3} - \sqrt{5})^2$

Rules for Dividing Radical Expressions:

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

again the roots, n, need to match

Rationalizing the denominator:

Eliminate the radicals from the denominator or fractions from the radicand.

I can rationalize the denominator of a fraction by getting rid of the radical.

15. $\sqrt{\frac{75}{18}} = \frac{\sqrt{75}}{\sqrt{18}} = \frac{\sqrt{3 \cdot 5 \cdot 5}}{\sqrt{2 \cdot 3 \cdot 3}} = \frac{5\sqrt{3}}{3\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}}$

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

16. $\sqrt{\frac{9a^5}{64b^4}} = \frac{\sqrt{9a^5}}{\sqrt{64b^4}} = \frac{3a^2\sqrt{a}}{8b^2}$

17. $\sqrt[3]{\frac{27}{4}} = \frac{\sqrt[3]{27}}{\sqrt[3]{4}} = \frac{\sqrt[3]{3 \cdot 3 \cdot 3}}{\sqrt[3]{2 \cdot 2}} = \frac{3}{\sqrt[3]{2 \cdot 2}}$

$$\frac{\sqrt[3]{3} \cdot \sqrt[3]{2}}{\sqrt[3]{2 \cdot 2}} = \frac{\sqrt[3]{3} \sqrt[3]{2}}{2}$$

18. $\sqrt{\frac{5b^3}{3a}} = \frac{\sqrt{5b^3}}{\sqrt{3a}} = \frac{b\sqrt{5b}}{\sqrt{3a}} \cdot \frac{\sqrt{3a}}{\sqrt{3a}}$

$$= \frac{b\sqrt{15ab}}{3a}$$

19. $\frac{6}{\sqrt{2}-1} \cdot \frac{\sqrt{2}+1}{\sqrt{2}+1} = \frac{6(\sqrt{2}+1)}{(\sqrt{2})^2 - (1)^2}$

$$= \frac{6\sqrt{2} + 6}{2 - 1} = 6\sqrt{2} + 6$$

20. $\frac{5+\sqrt{3}}{4+\sqrt{3}} \cdot \frac{4-\sqrt{3}}{4-\sqrt{3}} = \frac{(5+\sqrt{3})(4-\sqrt{3})}{(4+\sqrt{3})(4-\sqrt{3})} = \frac{20 - 5\sqrt{3} + 4\sqrt{3} - 3}{(4)^2 - (\sqrt{3})^2} = \frac{17 - \sqrt{3}}{16 - 3}$

$$= \frac{17 - \sqrt{3}}{13}$$

* You try ☺

21. $\sqrt{\frac{25x^4}{2y}}$

22. $\frac{5}{\sqrt{3}-2}$