Operating with Radical Expressions Class Work

✌ **Objective:** *You will be able to add, subtract, multiply, and divide radicals.*

★ ADDITION & SUBTRACTION:

Adding and subtracting radical expressions is similar to combining like terms!

*Guided Example A: $\sqrt{25x^3} + 5\sqrt{x} + 3\sqrt{3x} - 12\sqrt{x} - \sqrt{48x}$

✏ **Now You Try Some!** *Simplify each expression.*

1. $\sqrt{72p^5} + p^2\sqrt{2p} - 3\sqrt{p}$

2. $\sqrt{169y^3} - 4\sqrt{y^5} - 12\sqrt{y}$

3. $\sqrt{12m} - \sqrt{mn} + 2\sqrt{3m} - 12\sqrt{mn}$

4. $\sqrt{27h} - \sqrt{h} + 3\sqrt{h} - 4\sqrt{48h}$

★ **MULTIPLICATION (SAME ROOTS):**

You may multiply any coefficients together, and multiply any expressions under the radical symbol together to create one radical expression (if roots are the same).
Then simplify as much as possible! ☺ You may want to also simplify first!

*Guided Example B: $-2\sqrt{2x^3y^2} * 5\sqrt{6x^2y}$

*Guided Example C: $3\sqrt[3]{4w}\left(\sqrt[3]{-2w} - 4\sqrt[3]{w}\right)$

✏ *Now You Try Some! Simplify each expression.*

5. $3\sqrt{12x^2y} * -4\sqrt{6x^7y^3} * \sqrt{xy}$

6. $\sqrt[5]{s^3}\left(\sqrt[5]{-32s} - 3\sqrt[5]{s}\right)$

7. $\sqrt[3]{27x^4} * 3\sqrt[3]{-8x} * \sqrt[3]{x^7}$

8. $2\sqrt{w}\left(3\sqrt{wxy} - \sqrt{16w^3}\right)$

★ **MULTIPLICATION (DIFFERENT ROOTS):**

Use your knowledge of rational exponents to rewrite the expression. Multiply, and then convert back to root form!

*Guided Example D: $2\sqrt{b}\,(10\sqrt[5]{b} - 3\sqrt[3]{b^2}\,)$

🖉 **Now You Try Some!** *Simplify each expression.*

9. $4\sqrt{x}\,(\sqrt[3]{x^2} - 2\sqrt[3]{x^4}\,)$

10. $\sqrt[3]{mn}\,(\sqrt{m} + \sqrt{n}\,)$

11. $\sqrt[3]{wv}\,(\sqrt[5]{v^3} + 3\sqrt{w^3 v}\,)$

12. $\sqrt[5]{r^2 s^2}\,(\sqrt{r^3} + \sqrt{s^3}\,)$

13. $\sqrt[7]{r^4 s^4}\,(\sqrt[7]{r^3} - \sqrt[7]{s^3} + \sqrt{s}\,)$

14. $-2\sqrt{b^3 c^3}\,(3\sqrt{c^2} - \sqrt[3]{b^2} + 2\sqrt{bc}\,)$

★ **DIVISION:**

The same rules apply for division!

*Guided Example E: $\dfrac{\sqrt[4]{480x^{11}y^5}}{\sqrt[4]{30x^3y}}$

*Guided Example F: $\dfrac{5\sqrt{x^3y}}{\sqrt[3]{xy^2}}$

🖊 ***Now You Try Some!*** *Simplify each expression.*

15. $\dfrac{3\sqrt{r^9s^7}}{\sqrt[5]{r^4s^3}}$

16. $\dfrac{\sqrt[8]{512x^{14}y^{11}}}{\sqrt[8]{2x^3y^3}}$

17. $\dfrac{18\sqrt{f^3 d^2}}{4\sqrt[3]{fd}}$

18. $\dfrac{\sqrt[3]{-54m^{-5}n^{20}}}{\sqrt[3]{2m^{-8}n}}$

★ <u>**Rationalizing the Denominator:**</u>

A general guideline for mathematics is that irrational numbers may not exist in the denominator of any simplified expression. Therefore, we must "rationalize" the denominator in order to correctly simplify such cases.

*Guided Example G: $\dfrac{\sqrt{108x^{12}}}{\sqrt{2x^2 y}}$

*Guided Example H: $\dfrac{3\sqrt{x} - \sqrt{12}}{8 - \sqrt{z}}$

✏ ***Now You Try Some!*** *Simplify each expression.*

19. $\dfrac{\sqrt{2x^{22}y}}{\sqrt{162x^2}}$

20. $\dfrac{8\sqrt{r} - 2\sqrt{s}}{7 + \sqrt{t}}$

21. $\dfrac{r\sqrt{27q^3r^{-5}}}{\sqrt{108}}$

22. $\dfrac{3\sqrt{v}}{1 - \sqrt{v}}$

23. $\dfrac{\sqrt[3]{27}}{7 - \sqrt{32}}$

24. $\dfrac{-\sqrt{10}}{6 + \sqrt{12}}$

*Reminder, Question, or Create & Solve!