Adding and Subtracting Radicals

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Objectives

✓ Students will

- Add radicals
- Subtract radicals

✓ Pre-requisite / Prior Knowledge

- Simplify radicals
- Add and subtract integers
- Add and subtract variables
- Factorization of expressions

Review

- $\sqrt{4} = 2$ because
- $\sqrt{4} = (4)^{1/2} = (2^2)^{1/2} = 2^1 = 2$
- $\sqrt{8} = \sqrt{4} * \sqrt{2} = 2\sqrt{2}$
- $\sqrt{x} = x^{1/2} = \sqrt{x}$
- $\sqrt{x^2} = (x^2)^{1/2} = x^1 = x$
- $\sqrt{x^4} = (x^4)^{1/2} = x^2$
- $\sqrt{x^3} = \sqrt{x^2} * \sqrt{x} = x\sqrt{x}$
- $\sqrt{x^5} = \sqrt{x^4} * \sqrt{x} = x^2\sqrt{x}$
- Whenever we have an odd variable exponent, we have to simplify it by expressing it as a product of even products and the least odd exponent. You can notice this in the last two examples above.

Examples

- (1.) 4√5 - 10√5
- We can do this question in two ways:
- Factorization: √5 is common in both terms so we can factorize. This gives
- √5(4 – 10) = √5 * -6 = -6√5
- We can also assume √5 to be dollars or cups or whatever same items that you like
- 4 dollars – 10 dollars = -6 dollars
- Then remember what you assumed. Substitute it back to mean √5. This gives us
- -6√5 as our answer.
- For the remaining examples, we shall **factorize**.

(2.) -3 √11 - 8 √11

- √11 is common, so we factor it out
- √11(-3 – 8) = √11 * -11 = -11 √11.
- NOTE: It is preferred to write the integer first before the radical rather than to write the radical before the integer. This is done to eliminate any confusion. It is better to write the answer as
- -11 √11 rather than
- √11 *-11

(3.) 8 √y + 12 √y

- √y (8 + 12) = √y * 20 = 20 √y

- (4.) 6 √15 - 10 √5 + 7 √15
- In this example, we notice that √15 is not the same as √5. We should combine the like terms first, we simplify, then we factorize
- This gives 6 √15 + 7 √15 - 10 √5
- 13 √15 - 10 √5 = 13* √5 * √3 - 10 √5
- = √5 (13 √3 – 10)

(5.) -8 √12 + 2 √18

- In this example, we simplify the radicals before we factorize
- -8 * √4 * √3 + 2 * √9 * √2
- = -8 * 2 * √3 + 2 * 3 * √2
- = -16 √3 + 6 √2
- = 2(-8 √3 + 3 √2)

- (6.) -2 √3b - 9 √3b
- = √3b (-2 – 9)
- = √3b * -11
- = -11 √3b

(7.) $4\sqrt{128} + 3\sqrt{32}$

- $4 * \sqrt{64} * \sqrt{2} + 3 * \sqrt{16} * \sqrt{2}$
- $= 4 * 8 * \sqrt{2} + 3 * 4 * \sqrt{2}$
- $= 32\sqrt{2} + 12\sqrt{2}$
- $= 44\sqrt{2}$

- (8.) $4y\sqrt{8y^3} - 7\sqrt{18y^5}$
- $= 4y * \sqrt{4} * \sqrt{2} * \sqrt{y^2} * \sqrt{y} - 7 * \sqrt{9} * \sqrt{2} * \sqrt{y^4} * \sqrt{y}$
- $= 4y * 2 * \sqrt{2} * y * \sqrt{y} - 7 * 3 * \sqrt{2} * y^2 * \sqrt{y}$
- $= 8y^2 * \sqrt{2} * \sqrt{y} - 21y^2 * \sqrt{2} * \sqrt{y}$
- $= 8y^2\sqrt{2y} - 21y^2\sqrt{2y}$
- $= -13y^2\sqrt{2y}$

(9.) $2a\sqrt{8ab^2} + 2b\sqrt{2a^3}$

- $2a * \sqrt{4} * \sqrt{2} * \sqrt{a} * \sqrt{b^2} + 2b * \sqrt{2} * \sqrt{a^2} * \sqrt{a}$
- $= 2a * 2 * \sqrt{2a} * b + 2b * \sqrt{2a} * a$
- $= 4ab\sqrt{2a} + 2ab\sqrt{2a}$
- $= 6ab\sqrt{2a}$

- (10.) $b^2\sqrt{a^5b} + 3a^2\sqrt{ab^5}$
- $= b^2 * \sqrt{a^4} * \sqrt{a} * \sqrt{b} + 3a^2 * \sqrt{a} * \sqrt{b^4} * \sqrt{b}$
- $= b^2 * a^2 * \sqrt{a} * \sqrt{b} + 3a^2 * \sqrt{a} * b^2 * \sqrt{b}$
- $= a^2b^2\sqrt{ab} + 3a^2b^2\sqrt{ab}$
- $= 4a^2b^2\sqrt{ab}$

(11.) 3 √3x - 8 √75x + √27x

- 3 √3x – 8 * √25 * √3x + √9 * √3x
- = 3 √3x – 8 * 5 * √3x + 3 * √3x
- = 3 √3x - 40 √3x + 3 √3x = -34 √3x OR
- = √3x (3 – 40 + 3)
- = √3x * -34
- = -34 √3x

(12.) $2\sqrt{4a^2b^2} - 3a\sqrt{9ab^2} + 4b\sqrt{a^2b}$

- $2*\sqrt{4}*\sqrt{a^2}*\sqrt{b^2} - 3a*\sqrt{9}*\sqrt{a}*\sqrt{b^2} + 4b*\sqrt{a^2}*\sqrt{b}$
- $= 2 * 2 * a * b - 3a * 3 * \sqrt{a} * b + 4b * a * \sqrt{b}$
- $= 4ab - 9ab\sqrt{a} + 4ab\sqrt{b}$
- $= ab(4 - 9\sqrt{a} + 4\sqrt{b})$

- (13.) $5\sqrt{x+2} + 3\sqrt{x+2}$
- $= 8\sqrt{x+2}$ OR
- $\sqrt{x+2}(5 + 3)$
- $= \sqrt{x+2} * 8$
- $= 8\sqrt{x+2}$

(14.) 2 √8x+4y - 5 √18x+9y

- 2 √4(2x+y) - 5 √9(2x+y)
- = 2* √4 * √2x+y – 5 * √9 * √2x+y
- = 2 * 2 * √2x+y – 5 * 3 * √2x+y
- = 4 √2x+y - 15 √2x+y
- = -11 √2x+y

(15.) $3\sqrt{a^3+a^2} + 5\sqrt{4a^3+4a^2}$

- $3 * \sqrt{a^2(a+1)} + 5 * \sqrt{4a^2(a+1)}$
- $= 3 * \sqrt{a^2} * \sqrt{a+1} + 5 * \sqrt{4a^2} * \sqrt{a+1}$
- $= 3 * a * \sqrt{a+1} + 5 * 2a * \sqrt{a+1}$
- $= 3a\sqrt{a+1} + 10a\sqrt{a+1}$
- $= 13a\sqrt{a+1}$

- Please ask your questions

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- Then click on “Math”
- Under the “Algebra” Video section, locate “Add and Subtract Radicals”
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- Thank you for listening. Have a nice day!!!