Rational Exponents and Radical Expressions

Algebra Worksheet · Grade 8–10

Name: _____ Date: _____

Learning Objectives

- Convert expressions with rational exponents into radical form and vice versa
- Apply the laws of exponents (product rule, power rule, quotient rule) to simplify expressions with rational exponents
- Simplify radical and rational exponent expressions involving real numbers and variables

Problems

1. Rewrite the expression below in radical form:

$x^{\frac{1}{2}}$

2. Rewrite the expression below in radical form:

$x^{\frac{1}{3}}$

3. Convert the expression below from rational exponent form to radical form:

$x^{\frac{3}{5}}$

4. Evaluate the expression below by first converting it to radical form:

$16^{\frac{1}{2}}$

5. Evaluate the expression below by converting it to radical form:

$27^{\frac{1}{3}}$

6. Rewrite the radical expression below using a rational exponent:

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$\sqrt[4]{x^3}$

7. Use the product rule for exponents to simplify the expression below:

$x^{\frac{1}{2}} \cdot x^{\frac{1}{3}}$

8. Simplify the expression below using the laws of exponents:

$x^{\frac{2}{3}} \cdot x^{\frac{1}{2}}$

9. Use the power rule to simplify the expression below, then convert to radical form:

$\left(x^{\frac{2}{3}}\right)^3$

10. Simplify the expression below using the quotient rule for exponents:

$\frac{x^{\frac{3}{4}}}{x^{\frac{1}{4}}}$

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Rational Exponents and Radical Expressions — Answer Key

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Answer Key

1. Answer: Square root of x
- The denominator of the rational exponent becomes the index of the radical.
- The numerator becomes the power of the base inside the radical.
- x^(1/2) = \sqrt{x}

2. Answer: Cube root of x
- The denominator 3 becomes the index of the radical.
- The numerator 1 means x is raised to the first power inside.
- x^(1/3) = \sqrt[3]{x}

3. Answer: Fifth root of x cubed
- The denominator 5 becomes the index of the radical.
- The numerator 3 is the power of x inside the radical.
- x^(3/5) = \sqrt[5]{x^3}

4. Answer: 4
- 16^(1/2) is the same as the square root of 16.
- The square root of 16 = 4.
- Answer: 4

5. Answer: 3
- 27^(1/3) is the same as the cube root of 27.
- The cube root of 27 = 3 because 3 x 3 x 3 = 27.
- Answer: 3

6. Answer: x raised to the power 3/4
- The index of the radical (4) becomes the denominator of the rational exponent.
- The power inside the radical (3) becomes the numerator.
- \sqrt[4]{x^3} = x^(3/4)

7. Answer: x raised to the power 5/6
- Apply the product rule: add the exponents.
- 1/2 + 1/3 = 3/6 + 2/6 = 5/6.
- x^(1/2) times x^(1/3) = x^(5/6)

8. Answer: x raised to the power 7/6
- Apply the product rule: add the exponents.

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- 2/3 + 1/2 = 4/6 + 3/6 = 7/6.
- x^(2/3) times x^(1/2) = x^(7/6)

9. Answer: x squared

- Apply the power rule: multiply the exponents.
- (2/3) times 3 = 6/3 = 2.
- Result: x^2

10. Answer: x raised to the power 1/2, which equals the square root of x

- Apply the quotient rule: subtract the exponents.
- 3/4 - 1/4 = 2/4 = 1/2.
- x^(3/4) divided by x^(1/4) = x^(1/2) = \sqrt{x}

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