Zero Exponents, Negative Exponents, and Square Roots

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Learning Objectives

- Apply zero, negative, product, and quotient rules of exponents
- Simplify expressions using exponential notation
- Evaluate fractional (rational) exponents
- Simplify square roots using perfect-square factors

Simplify each expression using the appropriate exponent or radical rule and write the final answer with only positive exponents.

1. Write the expression in exponential notation.

$5 \cdot 5 \cdot 5 \cdot 5$

Answer: _____

2. Simplify the exponential expression.

2^5

Answer: _____

3. Simplify using the zero exponent rule.

$(7x)^0$

Answer: _____

4. Rewrite using only positive exponents and simplify.

3^{-2}

Answer: _____

5. Simplify using the product rule of exponents.

$x^4 \cdot x^3$

Answer: _____

6. Simplify using the product rule.

$2a^5 \cdot 4a^2$

Answer: _____

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7. Simplify using the quotient rule of exponents.

$$\frac{y^8}{y^3}$$

Answer: _____

8. Simplify and write with positive exponents only.

$$\frac{m^2}{m^6}$$

Answer: _____

9. Evaluate the fractional (rational) exponent.

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

Answer: _____

10. Simplify the square root by factoring out perfect squares.

$$\sqrt{72}$$

Answer: _____

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ANSWER KEY & SOLUTIONS

Covers exponential notation, simplifying exponents, zero exponents, negative exponents, the product rule, the quotient rule, mixed practice on simplifying, fractional (rational) exponents, the role of the multiplication table, and simplifying square roots.

Solutions

1. Write the expression in exponential notation.

$5 \cdot 5 \cdot 5 \cdot 5$

→ *Count how many times the base 5 is multiplied by itself.*
→ *The base 5 appears four times, so write it as 5 raised to the fourth power.*

Answer: 5^4

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2. Simplify the exponential expression.

2^5

→ *Multiply the base 2 by itself five times.*
→ *Two times two is four, times two is eight, times two is sixteen, times two is thirty-two.*

Answer: 32

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3. Simplify using the zero exponent rule.

$(7x)^0$

→ *Any nonzero quantity raised to the zero power equals one.*
→ *Since the entire expression seven x is raised to the zero power, the result is one.*

Answer: 1

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4. Rewrite using only positive exponents and simplify.

3^{-2}

→ *A negative exponent means take the reciprocal of the base raised to the positive exponent.*
→ *Three to the negative two becomes one over three squared, which is one over nine.*

Answer: $\frac{1}{9}$

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5. Simplify using the product rule of exponents.

$x^4 \cdot x^3$

→ *When multiplying like bases, keep the base and add the exponents.*
→ *Four plus three equals seven, so the answer is x to the seventh.*

Answer: x^7

Scan to watch

6. Simplify using the product rule.

$2a^5 \cdot 4a^2$

→ *Multiply the numerical coefficients two and four to get eight.*
→ *Add the exponents on a: five plus two is seven, giving eight a to the seventh.*

Answer: $8a^7$

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7. Simplify using the quotient rule of exponents.

$\frac{y^8}{y^3}$

→ *When dividing like bases, keep the base and subtract the exponents.*
→ *Eight minus three equals five, so the answer is y to the fifth.*

Answer: y^5

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8. Simplify and write with positive exponents only.

$\frac{m^2}{m^6}$

→ *Subtract the exponents: two minus six equals negative four.*
→ *Rewrite m to the negative four as one over m to the fourth.*

Answer: $\frac{1}{m^4}$

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9. Evaluate the fractional (rational) exponent.

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

→ *A one-half exponent means the square root of the base.*
→ *The square root of sixteen is four.*

Answer: 4

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10. Simplify the square root by factoring out perfect squares.

$\sqrt{72}$

→ *Factor seventy-two as thirty-six times two, where thirty-six is a perfect square.*
→ *Take the square root of thirty-six, which is six, and leave the two under the radical to get six times the square root of two.*

Answer: $6\sqrt{2}$