

Elementary Algebra
Skill-BUILDER # E – 7
Applying the Distributivity of Exponentiation over Division Rule

For any nonzero real numbers a and b , and positive integer n ,

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}.$$

Examples

1. $\left(\frac{x}{3}\right)^4 = \frac{x^4}{3^4} = \frac{x^4}{81}$

We can combine this rule with other rules.

2. Simplify: $\left(\frac{a^5}{b^{-3}}\right)^2$

Solution: We use this rule combined with the power rule to get

$$\left(\frac{a^5}{b^{-3}}\right)^2 = \frac{a^{10}}{b^{-6}}.$$

Then we apply the negative exponent rule to get the final answer $a^{10}b^6$.

3. Simplify: $\left(\frac{2x^3y}{3z^4}\right)^2$

Solution: We use this rule combined with the distributivity of exponentiation over multiplication and power rules to get

$$\left(\frac{2x^3y}{3z^4}\right)^2 = \frac{2^2x^6y^2}{3^2z^8} = \frac{4x^6y^2}{9z^8}.$$

We can modify the rule to apply to negative exponents.

4. Simplify: $\left(\frac{3^0a^2}{3b^3}\right)^{-2}$

Solution: We can replace 3^0 by 1 and distribute the exponent -2 . Doing these in combination with the power and product rules will give

$$\left(\frac{3^0a^2}{3b^3}\right)^{-2} = \frac{a^{-4}}{3^{-2}b^{-6}}.$$

Then apply the negative exponent rule and evaluate the numeric expression to get $\frac{9b^6}{a^4}$.

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Applying the Distributivity of Exponentiation over Division Rule

Simplify the following using the distributivity of exponentiation over division rule. You may need to combine it with other exponent rules.

1. $\left(\frac{6}{x}\right)^2$

2. $\left(\frac{5a}{2b}\right)^3$

3. $\left(\frac{4x^3y^2}{z}\right)^2$

4. $\left(\frac{2^{-1}x^3}{5^0y^{-2}}\right)^3$

5. $\left(\frac{a^5b^{-3}c^0}{2ab^3c}\right)^{-2}$

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Answer Key:

1. $\frac{36}{x^2}$

2. $\frac{125a^3}{8b^3}$

3. $\frac{16x^6y^4}{z^2}$

4. $\frac{x^9y^6}{8}$

5. $\frac{4b^{12}c^2}{a^8}$

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