

TOPIC: POWER RULES

Power of a Product Rule

◆ Use the **Power of a Product Rule** (a.k.a. the product to a power rule) to distribute an exponent to a product.

EXPONENT RULES			
Name	Example	Rule	Description
Power of a Product Rule	$(3 \cdot 4)^2 = \qquad \qquad \qquad = 3^2 \cdot 4^2$	$(a \cdot b)^m = a^m \cdot b^m$	Distribute exponent to each _____ in parenthesis

EXAMPLE

Use the power of a product rule to evaluate or simplify each exponential expression.

(A) $(5 \cdot 3^2)^2$

(B) $(xy)^5$

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PRACTICE

Simplify each expression.

(A) $(4z^2)^3$

(B) $(-6^5)^5$

(C) $(x^2z^5)^4$

PRACTICE

Simplify each expression.

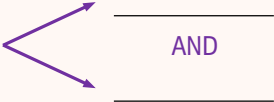
(A) $(-2x^4y^5)^4$

(B) $(4x^3y^2z^3)^2$

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Power of a Quotient Rule

◆ Use the **Power of a Quotient Rule** (a.k.a. the quotient to a power rule) to distribute an exponent to a fraction.

Name	Example	Rule	Description
Power of a Product	$(3 \cdot 4)^2 = 3 \cdot 4 \times 3 \cdot 4 = 3^2 \cdot 4^2$	$(a \cdot b)^m = a^m \cdot b^m$	Distribute exponent to each factor in parentheses
Power of a Quotient	$\left(\frac{3}{4}\right)^2 =$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	Distribute exponent to  AND

EXAMPLE

Use the power of a quotient rule to evaluate or simplify each exponential expression.

(A) $\left(\frac{p}{2}\right)^4$

(B) $\left(\frac{-2}{5}\right)^3$

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PRACTICE

Simplify the expressions using the quotient to a power property.

(A) $\left(\frac{p}{q}\right)^7$

(B) $\left(\frac{8}{11}\right)^2$

(C) $\left(\frac{a}{-3}\right)^4$

PRACTICE

Simplify.

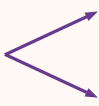
(A) $\left(\frac{x}{4y}\right)^3$

(B) $\left(\frac{y^4}{5}\right)^3$

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

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CHAPTER RESOURCE: RULES OF EXPONENTS

EXPONENT RULES		
Name	Rule	Description
Product Rule	$a^m \times a^n = a^{m+n}$	<i>Multiply</i> terms w/ same base $\Rightarrow$ [ADD SUBTRACT] exp.
Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}$	<i>Divide</i> terms w/ same base $\Rightarrow$ [ADD SUBTRACT] exp. ALWAYS <u>top</u> - <u>bottom</u>
Zero Exp. Rule	$a^0 = 1$	ANYTHING (except 0) raised to <u>0</u> exponent = <u>1</u>
Power Rule	$(a^m)^n = a^{m \cdot n}$	<i>Power</i> to another power $\Rightarrow$ <u>multiply</u> exponents
Power of a Product	$(a \cdot b)^m = a^m \cdot b^m$	<i>Distribute</i> exponent to each <u>factor</u> in parenthesis
Power of a Quotient	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	<i>Distribute</i> exponent to  <u>numerator</u> AND <u>denominator</u>
Neg Exp Rule	$a^{-n} = \frac{1}{a^n}$ $\frac{1}{a^{-n}} = a^n$	Neg exp in top $\Rightarrow$ flip to [BOTTOM TOP] with pos exp Neg exp in bottom $\Rightarrow$ flip to [BOTTOM TOP] with pos exp

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Simplifying Exponential Expressions

◆ You'll often have to use multiple exponent rules to fully simplify expressions. Use this checklist!

► There's no "correct" order in using rules but *usually* it's easiest to simplify from inner-most expression outward.

EXAMPLE: Simplify the expressions.

(A) $(3x^{-5})^2 \cdot (-2x^4)^3$

(B) $\left(\frac{x^2y^7}{x^5y^4}\right)^{-1}$

Expressions are fully simplified when:	Name	Rule
✓ No <u>powers</u> raised to other <u>powers</u>	Power Rules	$(a^m)^n = a^{m \cdot n}$
		$(a \cdot b)^m = a^m \cdot b^m$
✓ No <u>parentheses</u>		$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
✓ No <u>same bases</u> multiplied or divided (e.g. $x^2 \cdot x^4$, $\frac{y^7}{y^4}$)	Product & Quotient Rules	$a^m \times a^n = a^{m+n}$
		$\frac{a^m}{a^n} = a^{m-n}$
✓ No <u>zero</u> exponents	Zero Exp. Rule	$a^0 = 1$
✓ No <u>negative</u> exponents	Negative Exp. Rule	$a^{-n} = \frac{1}{a^n}$
✓ All numbers with exponents <u>evaluated</u>	Base 1	$1^n = 1$
	Neg to Even Power	$(-a)^{even} = a^{even}$
	Neg to Odd Power	$(-a)^{odd} = -a^{odd}$
✓ All operations ($\times, \div, +, -$) performed		