

TOPIC: EXPONENT RULES

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
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

TOPIC: EXPONENT RULES

The Product Rule of Exponents

♦ Recall: An **exponent** represents *repeated multiplication*: $3^2 = 3 \cdot 3$

EXPONENT RULES			
Name	Example	Rule	Description
Product Rule	$4^2 \times 4^1 =$ $= 4^{\quad} = 4^{\quad}$	$a^m \times a^n = a^{m+n}$	<i>Multiply</i> terms w/ same base $\Rightarrow$ [ADD SUBTRACT] exp.

EXAMPLE Use the product rule to evaluate or simplify each exponential expression.

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

(B) $x^{30} \cdot x^{70}$

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PRACTICE

Simplify each expression using the product rule if possible.

(A) $12^3 \cdot 12^9$

(B) $(-4)^6(-4)$

(C) $z \cdot z^6 \cdot z^4$

PRACTICE

Simplify each expression.

(A) $xy \cdot 3x^2$

(B) $(-5a^2)(3a^8)$

(C) $(2s^3t)(3s^4t^2)$

EXAMPLE

Find the area of a square with side length $5x^3$ centimeters.

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The Quotient Rule for Exponents

EXPONENT RULES			
Name	Example	Rule	Description
Product Rule	$4^2 \times 4^1 = 4 \times 4 \times 4 = 4^3 = 4^{2+1}$	$a^m \times a^n = a^{m+n}$	Multiply terms w/ same base $\Rightarrow$ [ADD SUBTRACT] exp.
Quotient Rule	$\frac{4^3}{4^1} = \qquad \qquad \qquad = 4^{\quad} = 4^{\quad}$	$\frac{a^m}{a^n} = a^{m-n}$	Divide terms w/ same base $\Rightarrow$ [ADD SUBTRACT] exp. ALWAYS $\quad - \quad$

EXAMPLE

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

(A)

$$\frac{y^7}{y^5}$$

(B)

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

♦ Zero Exponent Rule: *ANYTHING* (except 0) raised to $\quad$ exponent = $\quad$

TOPIC: EXPONENT RULES**Recall**

$$\frac{a^m}{a^n} = a^{m-n}$$
$$a^0 = 1$$

PRACTICE

Simplify each expression.

(A) $\frac{y^{27}}{y^9}$

(B) *Hint: rewrite using exponents first.*

$$\frac{64}{16}$$

(C) $(-4t)^0, t \neq 0$

EXAMPLE

Use the quotient rule to rewrite the expression, then simplify.

$$\frac{9}{16} \div \frac{3}{4}$$

PRACTICE

Use the quotient rule to rewrite each expression, then simplify.

(A) $\frac{12b^{11}}{4b^7}$

(B) $\frac{9x^2y^8}{3xy^2}$

(C) $\frac{30x^5y^3z^3}{-15x^2y^3z}$

TOPIC: EXPONENT RULES

Negative Exponents

♦ A **negative** exponent tells us to _____ the expression (write as *reciprocal*).

Name	Example	Rule	Description
Negative Exp. Rule	$\frac{2^2}{2^5} =$	$a^{-n} = \frac{1}{a^n}$ $\frac{1}{a^{-n}} = a^n$	Neg exp in top $\Rightarrow$ flip to [BOTTOM TOP] with pos exp Neg exp in bottom $\Rightarrow$ flip to [BOTTOM TOP] with pos exp

EXAMPLE

Simplify each exponential expression without any negative exponents.

(A) 6^{-2}

(B) $\frac{1}{x^{-3}}$

PRACTICE

Rewrite the expression with **NO** negative exponents.

(A) 10^{-1}

(B) y^{-8}

(C) $\frac{1}{5^{-3}}$

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PRACTICE

Simplify (**NO** negative exponents).

(A) -6^{-2}

(B) $9z^{-6}$

(C) $2^{-1} + 4^{-1}$

PRACTICE

Simplify (**NO** negative exponents).

(A) $2^{-1} \cdot 2^4$

(B) $a^3 \cdot a^{-7} \cdot a^5$

(C) $\frac{3^{-4}}{5^{-2}}$

EXAMPLE

Simplify.

$$(7x^{-4}y)(-x^{-3}y^{-2})$$

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The Power Rule for Exponents

EXPONENT RULES			
Name	Example	Rule	Description
Product Rule	$4^2 \times 4^1 = 4 \times 4 \times 4 = 4^3 = 4^{2+1}$	$a^m \times a^n = a^{m+n}$	Multiply terms w/ same base $\Rightarrow$ [ADD SUBTRACT] exp.
Power Rule	$(4^3)^2$	$(a^m)^n = a^{m \cdot n}$	Power to another power $\Rightarrow$ _____ exponents

EXAMPLE

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

(A) $((-2)^3)^5$

(B) $(y^8)^4$

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PRACTICE

Simplify each expression, but don't evaluate.

(A) $(4^{15})^3$

(B) $(100^{26})^0$

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

EXAMPLE

Evaluate each expression using a calculator, then compare the answers. Which is larger?

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

(B) $(3^2)^4$

EXAMPLE

Fill in the blanks to make the statement true.

$$(x \text{ ---})^{\text{---}} = x^{15}$$