

## 4.8.a Negative Exponents

### Need To Know



- Review Exponents Properties
- Idea of Negative Exponents
- Negative Exponent Properties and Calculation

## Review Exponent Properties

Recall:

The Product Rule	$a^m \cdot a^n = a^{m+n}$
The Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}$
The Power Rule	$(a^m)^n = a^{mn}$
Raising a Product to a power	$(ab)^n = a^n b^n$
Raising a quotient to a power	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

## Idea of Negative Exponents

Look at the pattern and draw a conclusion.

$3^4$	
$3^3$	
$3^2$	
$3^1$	

Definitions:

for all real numbers ( $a \neq 0$ ),

$$a^0 = 1 \text{ and } a^1 = a$$

Definition:

for  $a \neq 0$  and  $n$  is a positive,

## Practice – Simplify Each

$$5^{-3} \qquad \left(\frac{2}{5}\right)^{-1}$$

$$(-2)^{-2} \qquad \frac{y^{-3}}{y^{-5}}$$

$$5x^{-4} \qquad \frac{2^{-3}}{A^{-5}}$$

Generalize

## Exponent Properties

Exponent of 1	$a^1 = a$	The Product Rule	$a^m \cdot a^n = a^{m+n}$
Exponent of 0	$a^0 = 1$	The Quotient Rule	$\frac{a^m}{a^n} = a^{m-n}$
Negative Exponents	$a^{-n} = \frac{1}{a^n}$	The Power Rule	$(a^m)^n = a^{mn}$
Think – <b>RECIPROCAL</b>	$\frac{a^{-n}}{b^{-m}} = \frac{b^m}{a^n}$	Raising a Product to a power	$(ab)^n = a^n b^n$
	$\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n$	Raising a quotient to a power	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

## Practice - Simplify

1.  $\frac{11^7}{11^9}$

3.  $x^{-6} \cdot x^2$

2.  $\frac{3^{-4}}{3^{-6}}$

4.  $(2x^4)^{-2}$



## Practice Exponents Properties

Simplify:

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

6.  $\frac{x^{-6}}{(x^3)^4}$

Simplify:

7.  $\left(\frac{y^{-8}}{y^{-3}}\right)^2$

8.  $\frac{a^5(a^{-2})^4}{(a^{-3})^2}$

end



## 4.8.B Scientific Notation

### Need To Know

- What is Scientific Notation?
- How to write numbers in Scientific Notation
- How to do calculations in Scientific Notation







## Scientific Notation

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### Recall - Powers of Ten

$$3.8497 \times 100$$

$$3.8497 \times 100,000$$

$$3.8497 \div 100$$

$$3.8497 \div 100,000$$



## Scientific Notation

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Converting: Scientific notation into expanded form.

$$9.2 \times 10^{-5}$$

$$7.083 \times 10^7$$

Converting: Expanded form into scientific notation.

$$35,900,000$$

$$0.000029$$



## Scientific Notation–Computation

We use the exponent properties to multiply and divide number in scientific notation.

Examples:

$$(2.3 \times 10^5)(1.5 \times 10^{-8})$$

$$\frac{8 \times 10^{12}}{4 \times 10^{-3}}$$

end