# Warm UP

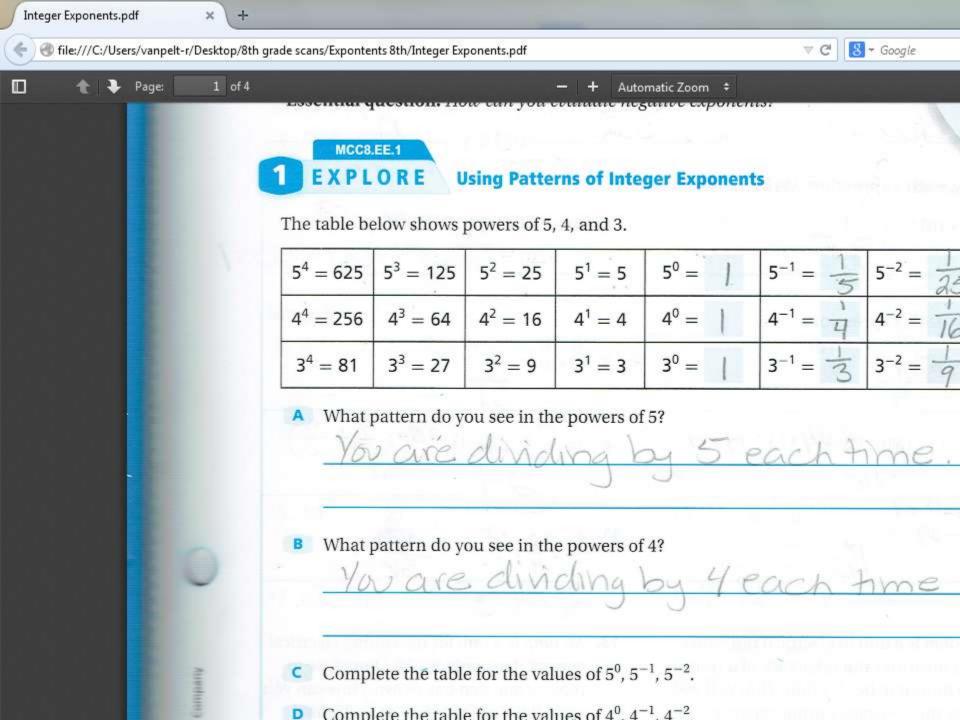
## Workbook Pg. 59 Explore 1. Do this step by step A-F

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#### Pre-requ. Evaluate.

- **1.** 10<sup>3</sup> **1000**
- **2.** 10<sup>1</sup> **1**
- **3.** 10<sup>4</sup> **10,000**
- **4.** 10<sup>5</sup> **100,000**
- **5.** 10<sup>6</sup> 1,000,000

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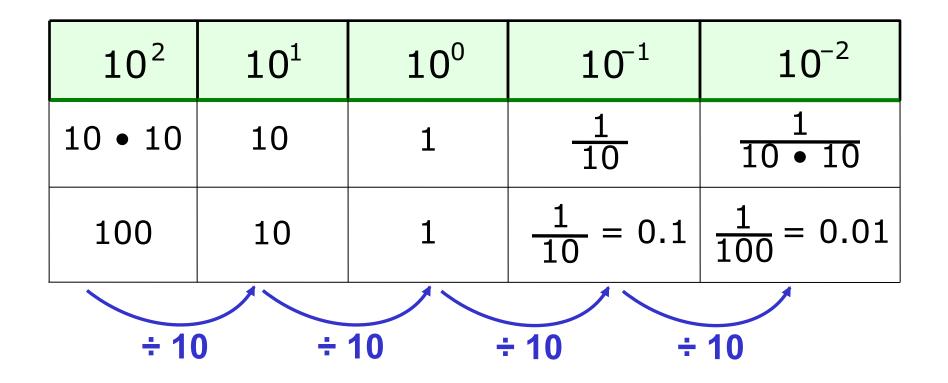
Essential Question: How do you evaluate expressions containing exponents, specifically negative exponents?

Standard: MCC8.EE.1: Know and apply the properties of integer exponents to generate equivalent numerical expressions.

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Look for a pattern in the table to extend what you know about exponents to include negative exponents.

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#### Additional Example 1: Using a Pattern to Simplify Negative Exponents

### Simplify. Write in decimal form.

**A.**  $10^{-2}$  $10^{-2} = \frac{1}{10 \cdot 10}$  $= \frac{1}{100} = 0.01$ 

**B. 10**<sup>-1</sup>

$$=\frac{1}{10}$$

 $= \frac{1}{10} = 0.1$ 

Extend the pattern from the table.

Multiply. Write as a decimal.

Extend the pattern from the table.

*Multiply. Write as a decimal.* 

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#### **Check It Out: Example 1A**

#### Simplify. Write in decimal form.

**10**<sup>-8</sup>

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Multiply.

$$= \frac{1}{100,000,000}$$

Write as a decimal.

= 0.0000001

**Check It Out: Example 1B** 

**10**<sup>-9</sup> Extend the pattern from example 1A. Multiply.  $=\frac{1}{1,000,000,000}$ Write as a decimal. = 0.00000001

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NEGATIVE EXPONENTS				
Words	Numbers	Algebra		
Any nonzero number raised to a negative power equals 1 divided by that number raised to the opposite (positive) power.	$5^{-3} = \frac{1}{5^3} = \frac{1}{125}$	$b^{-n} = \frac{1}{b^n}$ , if $b \neq 0$		

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THE ZERO POWER			
Words	Numbers	Algebra	
The zero power of any number except 0 equals 1.	$100^0 = 1$ $(-7)^0 = 1$	$a^0 = 1$ , if $a \neq 0$	

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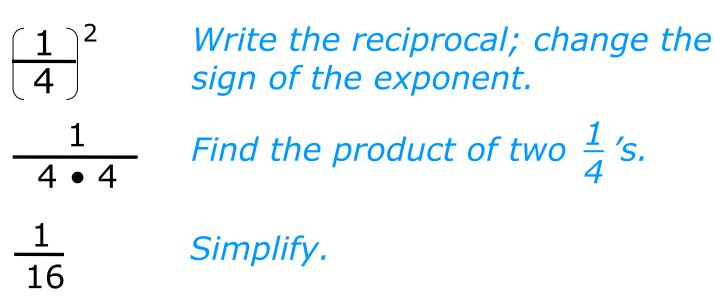
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	-						
TR	Y THIS!						
Find	the value o	of <mark>each pow</mark>	ver.				
<b>1</b> a.	6 <sup>-4</sup>	1b.	12 <sup>0</sup>	1c.	8 <sup>-1</sup>	1d.	7 <sup>-3</sup>
1e.	347 <sup>0</sup>	1f.	15 <sup>-2</sup>	1g.	20 <sup>2</sup>	1h.	6 <sup>-5</sup>
-					2		

#### **Check It Out: Example 2A**

### Simplify.

**4**<sup>-2</sup>



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#### **Additional Example 2A: Evaluating Negative Exponents**

Simplify.

 $\frac{1}{5^3}$ 

125

- 5-3
  - Write the power under 1; change the sign of the exponent. Find the product of three  $\frac{1}{5}$  's. 5 • 5 • 5 Simplify.

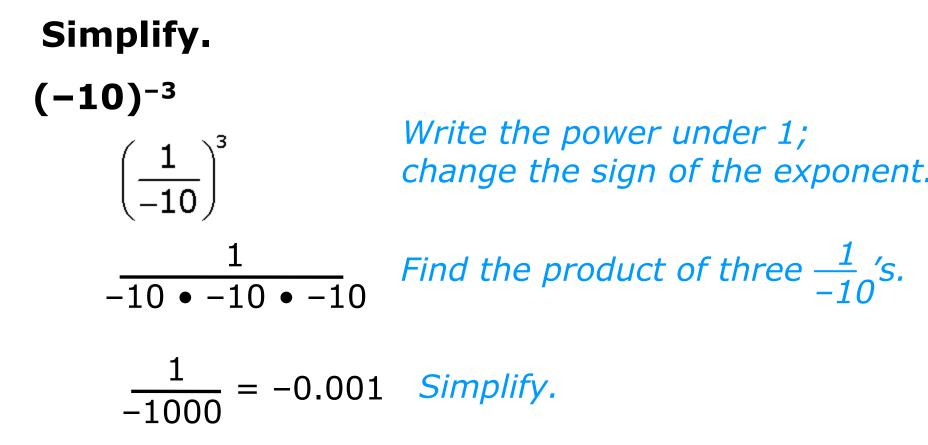
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#### Additional Example 2B: Evaluating Negative Exponents



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#### **Check It Out: Example 2B**

### Simplfy.

 $\left(\frac{1}{-7}\right)^4$ 

2401

 $(-7)^{-4}$ 

Write the reciprocal; change the sign of the exponent.

$$\frac{1}{-7 \bullet -7 \bullet -7 \bullet -7}$$

Find the product of four  $\frac{1}{-7}$ 's.

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Simplify.

If the negative sign is outside, leave it outside. If it is inside () it stays inside.

Sign Outside

-24

If the negative sign is outside, you leave it outside and complete the exponent. Then bring the negative along.

Remember the understood 1. This is like -1(2<sup>4</sup>)

Sign Inside

(-2)4

 $(-2 \times -2 \times -2 \times -2) = 16$ 

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If the negative is inside (), then this is -2 multiplied by itself 4 times.

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If the negative sign is outside, leave it outside. If it is inside () it stays inside.

$$(-10)^{-3} -10^{-3}$$

$$\left(\frac{1}{-10}\right)^{3} -\left(\frac{1}{10}\right)^{3}$$

$$\frac{1}{(-10 \cdot -10 \cdot -10)} -\frac{1}{-(10 \cdot 10 \cdot 10)}$$

$$\frac{1}{-1000} = -0.001 -\frac{1}{-(1000)} = -0.001$$

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**Additional Example 3: Using the Order of Operations** 

Evaluate 5 - 
$$(6 - 4)^{-3} + (-2)^{0}$$
  
5 -  $(6 - 4)^{-3} + (-2)^{0}$   
= 5 -  $(2)^{-3} + (-2)^{0}$  Subtract inside the parentheses.  
= 5 -  $\frac{1}{8} + 1$  Evaluate the exponents.  
=  $5\frac{7}{8}$  Add and subtract from left to right.

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#### **Check It Out: Example 3**

Evaluate  $3 + (7 - 4)^{-2} + (-8)^{0}$ .

 $3 + (7 - 4)^{-2} + (-8)^{0}$ 

 $= 3 + (3)^{-2} + (-8)^{0}$  Subtract inside the parentheses.

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 $= 3 + \frac{1}{9} + 1$  Evaluate the exponents.  $= 4 \frac{1}{9}$  Add. udent/osp/g8/data/unit02/mod03/lesson01/exploration\_core\_lesson.pdf - Google Chrome

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	15. $10 - (3 + 2)^0 + 2^{-1}$	16. $15 + 6^0 + 3^{-2}$
51	10.10 (012) 12	
1	17. $6(8-2)^0 + 4^{-2}$	18. $2^{-2} + 4^{-1}$
Anedmo	19. $3(1+2)^{-2} + 9^{-1} + 12^{0}$	20. $9^0 + 64(3+5)^{-2}$
© Houghton Mifflin Harcourt Publishing Company	21. One milliliter equals 10 <sup>-3</sup> liter.	Simplify 10 <sup>-3</sup> .
Aifflin Harcou	22. The volume of a cube is 10 <sup>6</sup> c	ubic feet. Simplify 10 <sup>6</sup> .

## Class work/Homework: Text book pg. 62 13-24

