Unit 1 – Lesson 1 **Name:** _____

Exponential Notation **Date:** _____ **Period:** _____

Focus Standards:	8.EE.A.1	Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

Student Outcomes

- Students know what it means for a number to be raised to a power and how to represent the repeated multiplication symbolically.
- Students know the reason for some bases requiring parentheses.

Classwork

5^6 means $5 \times 5 \times 5 \times 5 \times 5 \times 5$, and $\left(\frac{9}{7}\right)^4$ means $\frac{9}{7} \times \frac{9}{7} \times \frac{9}{7} \times \frac{9}{7}$.

You have seen this kind of notation before; it is called exponential notation. In general, for any number x and any positive integer n,

$$x^n = \underbrace{(x \cdot x \cdots x)}_{n \text{ times}}.$$

The number x^n is called x raised to the n^{th} power, where n is the exponent of x in x^n and x is the base of x^n.

Exercise 1

$\underbrace{4 \times \cdots \times 4}_{7 \text{ times}} =$

Exercise 2

$\underbrace{3.6 \times \cdots \times 3.6}_{\_\_\_\_ \text{ times}} = 3.6^{47}$

Exercise 6

$\underbrace{\frac{7}{2} \times \cdots \times \frac{7}{2}}_{21 \text{ times}} =$

Exercise 7

$\underbrace{(-13) \times \cdots \times (-13)}_{6 \text{ times}} =$

Exercise 3

$\underbrace{(-11.63) \times \cdots \times (-11.63)}_{34 \text{ times}} =$

Exercise 4

$\underbrace{12 \times \cdots \times 12}_{\_\_\_\_\text{times}} = 12^{15}$

Exercise 5

$\underbrace{(-5) \times \cdots \times (-5)}_{10 \text{ times}} =$

Exercise 8

$\underbrace{\left(-\frac{1}{14}\right) \times \cdots \times \left(-\frac{1}{14}\right)}_{10 \text{ times}} =$

Exercise 9

$\underbrace{x \cdot x \cdots x}_{185 \text{ times}} =$

Exercise 10

$\underbrace{x \cdot x \cdots x}_{\_\_\_\_\text{times}} = x^n$

Exercise 11

Will these products be positive or negative? How do you know?

$\underbrace{(-1) \times (-1) \times \cdots \times (-1)}_{12 \text{ times}} = (-1)^{12}$

$\underbrace{(-1) \times (-1) \times \cdots \times (-1)}_{13 \text{ times}} = (-1)^{13}$

Exercise 12

Is it necessary to do all of the calculations to determine the sign of the product? Why or why not?

$$\underbrace{(-5) \times (-5) \times \cdots \times (-5)}_{95 \text{ times}} = (-5)^{95}$$

$$\underbrace{(-1.8) \times (-1.8) \times \cdots \times (-1.8)}_{122 \text{ times}} = (-1.8)^{122}$$

Exercise 13

Fill in the blanks indicating whether the number is positive or negative.

If n is a positive even number, then $(-55)^n$ is _____.

If n is a positive odd number, then $(-72.4)^n$ is _____.

Exercise 14

Josie says that $\underbrace{(-15) \times \cdots \times (-15)}_{6 \text{ times}} = -15^6$. Is she correct? How do you know?

Problem Set

1. Use what you know about exponential notation to complete the expressions below.

$\underbrace{(-5) \times \cdots \times (-5)}_{17 \text{ times}} =$

$\underbrace{3.7 \times \cdots \times 3.7}_{\_\_\_ \text{ times}} = 3.7^{19}$

$\underbrace{7 \times \cdots \times 7}_{\_\_\_ \text{ times}} = 7^{45}$

$\underbrace{6 \times \cdots \times 6}_{4 \text{ times}} =$

$\underbrace{4.3 \times \cdots \times 4.3}_{13 \text{ times}} =$

$\underbrace{(-1.1) \times \cdots \times (-1.1)}_{9 \text{ times}} =$

$\underbrace{\left(\frac{2}{3}\right) \times \cdots \times \left(\frac{2}{3}\right)}_{19 \text{ times}} =$

$\underbrace{\left(-\frac{11}{5}\right) \times \cdots \times \left(-\frac{11}{5}\right)}_{\_\_\_ \text{ times}} = \left(-\frac{11}{5}\right)^{x}$

$\underbrace{(-12) \times \cdots \times (-12)}_{\_\_\_ \text{ times}} = (-12)^{15}$

$\underbrace{a \times \cdots \times a}_{m \text{ times}} =$

2. Write an expression with (-1) as its base that will produce a positive product, and explain why your answer is valid.

3. Write an expression with (-1) as its base that will produce a negative product, and explain why your answer is valid.

4. Rewrite each number in exponential notation using 2 as the base.

$8 =$ $16 =$ $32 =$

$64 =$ $128 =$ $256 =$

5. Tim wrote 16 as $(-2)^4$. Is he correct? Explain.

6. Could -2 be used as a base to rewrite 32? 64? Why or why not?