Lesson 1: Exponential Notation

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 $\boldsymbol{x}$ and any positive integer n,

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

The number x^n is called $\boldsymbol{x}$ **raised to the** $\boldsymbol{n}^{\text{th}}$ **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

$3.6 \times \cdots \times 3.6 = 3.6^{47}$

_____ times

Exercise 3

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

Exercise 4

$12 \times \cdots \times 12 = 12^{15}$

_____times

Exercise 5

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

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 8

$\underbrace{-\frac{1}{14} \times \cdots \times -\frac{1}{14}}_{10 \text{ times}} =$

Exercise 9

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

Exercise 10

$x \cdot x \cdots x = x^n$

_____times

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 about 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.

$-5 \times \cdots \times -5 =$ (17 times)

$3.7 \times \cdots \times 3.7 = 3.7^{19}$ (____ times)

$7 \times \cdots \times 7 = 7^{45}$ (____ times)

$6 \times \cdots \times 6 =$ (4 times)

$4.3 \times \cdots \times 4.3 =$ (13 times)

$(-1.1) \times \cdots \times -1.1 =$ (9 times)

$\frac{2}{3} \times \cdots \times \frac{2}{3} =$ (19 times)

$-\frac{11}{5} \times \cdots \times -\frac{11}{5} = -\frac{11}{5}^{x}$ (____ times)

$(-12) \times \cdots \times (-12) = -12^{15}$ (____ times)

$a \times \cdots \times a =$ (m times)

2. Write an expression with (-1) as its base that will produce a positive product.

3. Write an expression with (-1) as its base that will produce a negative product.

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?

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