

## 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  $x$  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  $n^{\text{th}}$  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

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

#### 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 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

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

#### 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?