NAME_____

Module 5 **Decimal Operations, Exponents, and Powers**
Lesson 6 **Powers and Exponents**

Lesson Notes 5.6

Lesson Objectives

- Use factors of numbers to introduce exponents and powers.
- Demonstrate an understanding of exponents and powers and an understanding of when to use exponents and powers in expressions.
- Define negative exponents.
- Solve problems with exponents and powers.

Subtopic 1 Exponents and Powers

- An **exponent** is a number that tells how many times a **base** is used as a factor.
- 4 is used as a factor **3** times, so 4 to the 3rd power is written as **4^3**.
- A **power** is a number raised to an exponent.
- In $4^3 = 64$, 4 is the **base** and 3 is the **exponent**.
- A negative number raised to a positive odd power has a **negative** value.
- A negative number raised to a positive even power has a **positive** value.

1 Write in exponential form.

$(-6) \times (-6) \times (-6) \times (-6) \times (-6)$
-6 is used as a factor 5 times.
$(-6)^5$
$(-6)^5 = -7{,}776$

2 Evaluate 7^3.

Use 7 as a factor 3 times
$7 \times 7 \times 7$
343

3 Evaluate 2 to the 6th power.

2^6
$2 \times 2 \times 2 \times 2 \times 2 \times 2$
64

Subtopic 2 Using Exponents and Powers in Expressions

Evaluate each expression.

4 $(-4)^2 \times (-3)^3$

16×-27

-432

5 $2\,(9-6)^2$

$2(3)^2$

$2(9)$

18

6 $3^3 - 2^3$

$27 - 8$

19

Subtopic 3 Zero and Negative Exponents

- Any nonzero number raised to the zero power equals 1.
- $b^0 =$ 1 $(b \neq$ 0$)$
- Any nonzero number raised to a negative power is the same as one over the number raised to the positive power.
- $b^{-n} = \dfrac{1}{b^n}$ $(b \neq 0)$

Evaluate each expression.

7 3^{-4}

$\dfrac{1}{3^4}$

$\dfrac{1}{3\times3\times3\times3}$

$\dfrac{1}{9\times9}$

$\dfrac{1}{81}$

8 $2^6 \times 8^0$

64×1

64

Subtopic 4 Solving Problems with Exponents and Powers

9 Computer memory can be measured in bits, bytes, or kilobytes. There are 2^3 bits in a byte and 2^{10} bytes in a kilobyte. How many bits are there in a kilobyte?

2^3 bits = 1 byte

2^{10} bytes = 1 kilobyte

$2^3 \times 2^{10}$

$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$

2^{13}

There are 8,192 bits in a kilobyte.

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Module 5 Decimal Operations, Exponents, and Powers
Lesson 6 Powers and Exponents

Irma won a math contest. On the first day she received $4. Then, for each day after the first day, she received double the preceding day's amount. How much money did Irma receive on the fifth day?

Day 1: $4
Day 2: $4 × 2
Day 3: $4 × 2 × 2
Day 4: $4 × 2 × 2 × 2
Day 5: $4 × 2 × 2 × 2 × 2
$4 × 2^4
$4 × 16
$64
Irma received $64.