Important Concepts . . .

Preview Review

Mathematics   Grade 9   TEACHER KEY

W1 - Lesson 1:   Powers

Important Concepts of Grade 9 Mathematics

Materials Required

Paper
Pencil
Calculator

No Textbook Required

This is a stand-alone course.

LEARNING ANYTIME ANYWHERE

Alberta Distance Learning Centre has an Internet site that you may find useful. The address is as follows: **http://www.adlc.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Preview/Review Concepts
for
Grade Nine Mathematics
Teacher Key

W1 – Lesson 1:

Powers

OBJECTIVES

By the end of this lesson, you will be able to:

- Explain, using repeated multiplication, the difference between two given powers in which the exponent and base are interchanged; e.g., 10^3 and 3^{10}.

- Express a given power as a repeated multiplication.

- Express a given repeated multiplication as a power.

GLOSSARY

Power: Has two parts:

$$\text{Base}^{\text{ exponent}} = 3^4$$

Base: The number being multiplied in a power.

Exponent: The number of times a number is being multiplied by itself in a power.

Repeated Multiplication: A longer way to express a power.

$$\text{ex. } 6^4 = 6 \times 6 \times 6 \times 6$$

W1 – Lesson 1: Perfect Squares and Square Roots

Materials required:

- Paper, Pencil, and Calculator

Part 1: Bases and Exponents

Powers have two parts: a base and an exponent.

Example: 2^5

The number 2 is the base. The number 5 is the exponent.

The exponent tells you how many times to multiply the base by itself.

$$2^5$$

Exponent

Two to the fifth power

Base

There are different ways of "saying" a power:

- The fifth power of two
- Two raised to the fifth power
- Two to the power of five
- Two to the fifth
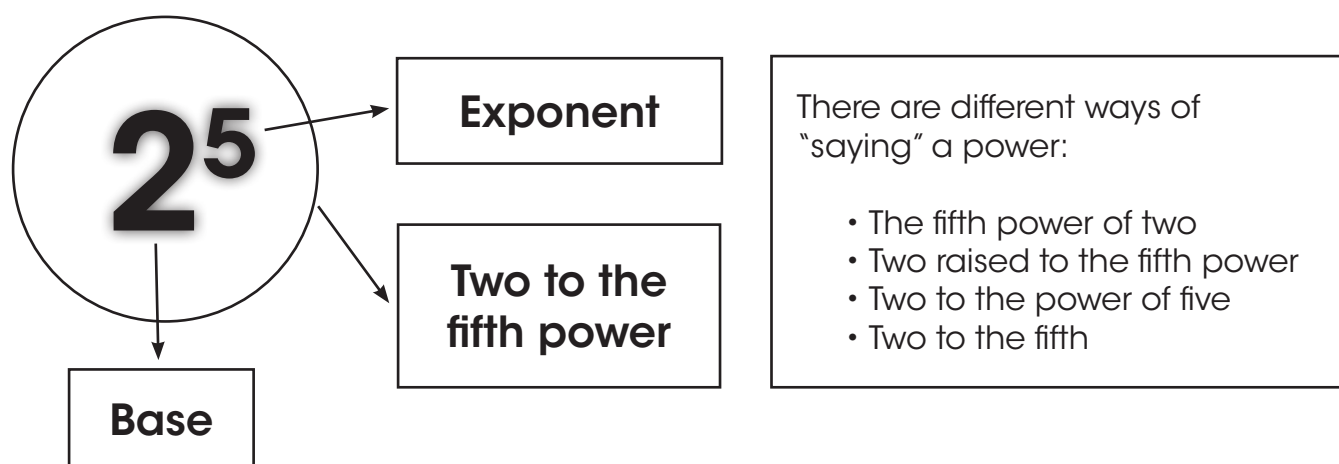
This means $2 \times 2 \times 2 \times 2 \times 2 = 32$

Note: 2^5 does NOT mean '2 times 5'. It means 'multiply 2 by itself 5 times'.

Example 1

The base is **4** and the exponent is **3**. The power would be represented like this:

$$4^3$$

This one means 'multiply 4 by *itself* 3 times. So it's **4 × 4 × 4 = 64**

Practice Questions

1. Identify the base in each of the following powers.

   a. 5^4

      5

   b. 3^7

      3

   c. -4^3

      4

   d. $(-6)^5$

      −6 or (−6)

2. Identify the exponent in each of the following powers.

   a. b^7

      7

   b. 9^1
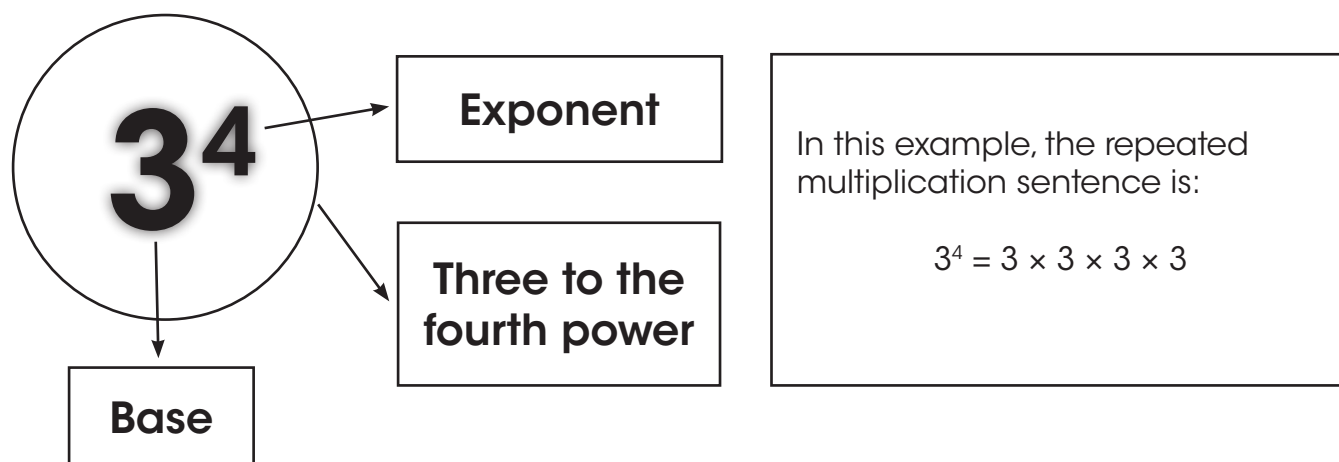
      1

   c. 5^4

      4

   d. -6^2

      2

3. Write the power for each of the following.

   a. Two to the third _____**2^3**_____

   b. Seven to the power of four _____**7^4**_____

Part 2: Repeated Multiplication

3^4

→ **Exponent**

→ **Three to the fourth power**

↓ **Base**

In this example, the repeated multiplication sentence is:

$$3^4 = 3 \times 3 \times 3 \times 3$$

The base represents the number that is in the repeated multiplication sentence. The exponent represents how many times the base is being multiplied. In the example, 3^4, think as 3 multiplied by itself 4 times.

Example 1

Power: 3^5
Repeated Multiplication: $3 \times 3 \times 3 \times 3 \times 3$

Example 2

Power: b^4
Repeated Multiplication: $b \times b \times b \times b$

Example 3

Power: $(-3)^4$
The base is (-3) and the exponent is 4.
Repeated Multiplication: $(-3) \times (-3) \times (-3) \times (-3)$

Example 4

Power: -3^4
The base is 3 and the exponent is 4.
Repeated Multiplication: $-(3 \times 3 \times 3 \times 3)$

Note: *Notice that – is not a part of the base in the last example.*

Practice Questions

1. Express each power as repeated multiplication.

    a. 6^3

    __*6 × 6 × 6*__

    b. 3^5

    __*3 × 3 × 3 × 3 × 3*__

    c. -8^4

    __*–(8 × 8 × 8 × 8)*__

    d. $(-9)^6$

    __*(–9) × (–9) × (–9) × (–9) × (–9) × (–9)*__

2. Express each repeated multiplication sentence as a power.

    a. $d \times d \times d \times d$

    __*d⁴*__

    b. $(-8) \times (-8) \times (-8)$

    __*(–8)³*__

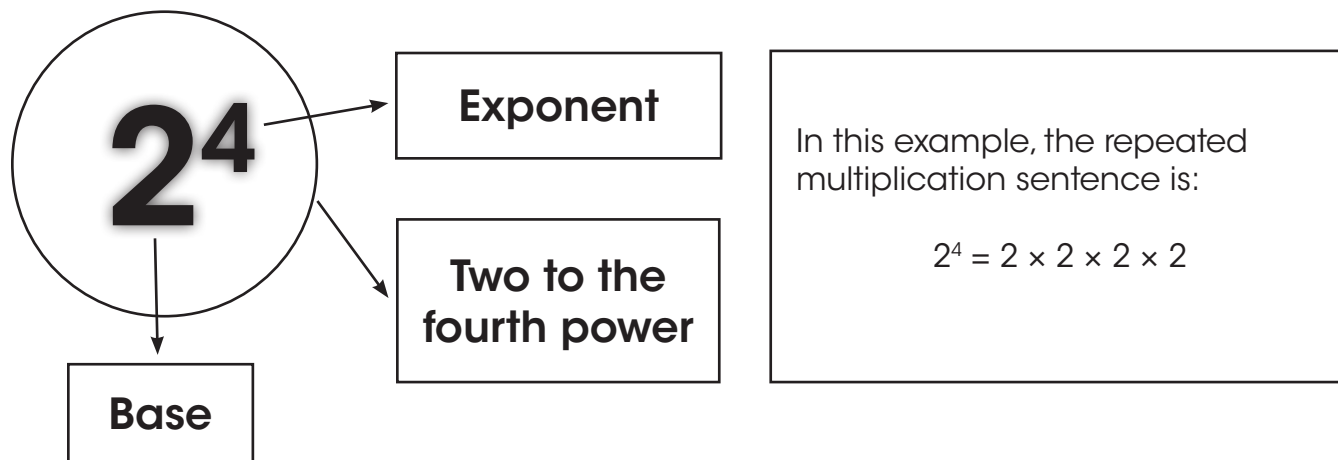   c. $-(5 \times 5 \times 5 \times 5)$

    __*–5⁴ or –(5)⁴*__

    d. $(-y) \times (-y) \times (-y) \times (-y) \times (-y)$

    __*(–y)⁵*__

3. Complete the chart

Power	Base	Exponent	Repeated Mulitplication
7^5	*7*	*5*	*7 × 7 × 7 × 7 × 7*
9³	*9*	*3*	9 × 9 × 9
(–8)⁴	–8	4	*(–8) × (–8) × (–8) × (–8)*

Part 3: Evaluating Powers

$$2^4$$

Exponent

Two to the fourth power

In this example, the repeated multiplication sentence is:

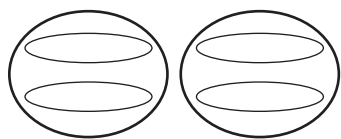$$2^4 = 2 \times 2 \times 2 \times 2$$

Base

The base represents the number that is in the repeated multiplication sentence.
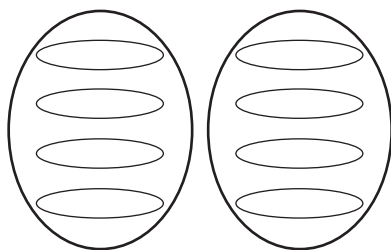The exponent represents how many times the base is being multiplied.
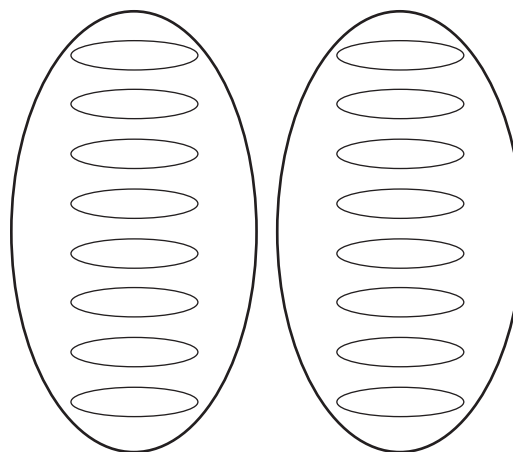
In our example:

2^4, think as

$2 \times 2 = 4$　　　　　　　　$\times 2 = 8$　　　　　　　　$\times 2 = 16$

Example 1

Evaluate 4^3.

Think: repeated multiplication = $4 \times 4 \times 4$

$4 \times 4 = 16 \times 4 = 64$

Example 2

Evaluate $(-5)^4$.

Think: repeated multiplication = $(-5) \times (-5) \times (-5) \times (-5)$

$(-5) \times (-5) = (25) \times (-5) = (-125) \times (-5) = (600)$

It can also be thought of like this:

$(-5) \times (-5) \times (-5) \times (-5)$

$(25) \quad \times \quad (-5)$

$(-125) \times (-5)$

600

Example 3

Using your calculator, evaluate 7^4.

Solution 1:

Type in [7] [×] [7] [×] [7] [×] [7] [=]

The screen will show an answer of 2401.

Solution 2 (using a scientific calculator):

Type in [7] [y^x] [4] [=]

The screen will show an answer of 2401.

Note: On some scientific calculators, the [y^x] could also appear as [x^y] or as [^]. Play with your calculator to see which function is present.

Example 4

Using your calculator, evaluate 7^0, $(-5)^0$, and 101^0. What do you notice?

Solution:

Any base with exponent zero gives an answer of 1.

Practice Questions

1. Write each power as a repeated multiplication sentence and then evaluate.

    a. 5^6

    = 5 × 5 × 5 × 5 × 5 × 5

    = 15 625

    b. -3^4

    = –(3) × (3) × (3) × (3)

    = –81

    c. $(-8)^5$

    = (–8) × (–8) × (–8) × (–8) × (–8)

    = –32 768

    d. 2^0

    = 1

2. Complete the chart

Power	Base	Exponent	Repeated Mulitplication	Value
3^6	*3*	*6*	*3 × 3 × 3 × 3 × 3 × 3*	*729*
5^3	*5*	*3*	5 × 5 × 5	*125*
$(-4)^3$	(–4)	3	*(–4) × (–4) × (–4)*	*–64*
$-b^4$	*b*	*4*	–(b × b × b × b)	*$-b^4$*
3^3	3	*3*	*3 × 3 × 3*	27

3. Which is greater? Circle the greater power and explain your answer.

    a. 5^3 or $\boxed{4^4}$

    5 × 5 × 5 = 125

    4 × 4 × 4 × 4 = 256

    b. -3^4 or $\boxed{(-3)^4}$

    –(3 × 3 × 3 × 3) = –81

    (–3) × (–3) × (–3) × (–3) = 81

Lesson 1 Assignment

1. Identify the base in each of the following powers.

    a. 6^9

    b. -7^4

    <u>   **6**   </u>

    <u>   **7**   </u>

2. Identify the exponent in each of the following powers.

    a. 5^3

    b. $(-8)^5$

    <u>   **3**   </u>

    <u>   **5**   </u>

3. Express each power as repeated multiplication.

    a. r^4

    b. $-(6)^8$

    <u>**= r × r × r × r**</u>

    <u>**= −(6 × 6 × 6 × 6 × 6 × 6 × 6 × 6)**</u>

    c. $(-d)^5$

    d. 6^3

    <u>**= (−d) × (−d) × (−d) × (−d) × (−d)**</u>

    <u>**= 6 × 6 × 6**</u>

4. Evaluate each power.

    a. 3^6

    b. -4^0

    <u>**= 729**</u>

    <u>**= −1**</u>

    c. $(-8)^3$

    d. -5^4

    <u>**= −512**</u>

    <u>**= −625**</u>

5. Complete each number sentence by using either <, > or =.

   a. 5^6 **>** 6^5 b. -2^4 **<** $(-2)^4$

   c. $(-8)^5$ **<** $(-5)^8$ d. 2^0 **=** $(-5)^0$

6. Look at the power and answer the following questions.

   $(-5)^3$

   a. What is the base? _____ **_−5_** _____

   b. What is the exponent? _____ **_3_** _____

   c. Write the repeated multiplication sentence. **_= (−5) × (−5) × (−5)_**

   d. Evaluate the power. _____ **_− 125_** _____

7. Explain the following:

   a. $(-3) \times (-3) \times (-3) \times (-3) \neq -3^4$

   (−3)⁴ = 81 and −3⁴= −(3 × 3 × 3 × 3) = −81, so they are not equal.

   b. $-4^4 \neq 64$

   −4⁴ = −(4 × 4 × 4× 4) = −64, so they are not equal.

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