

## Concept: The Exponent Rules

Name:

- You should have completed Exponents - Section 3 Part A: The Exponent Rules before beginning this handout.

### Warm Up

Complete the following. Show all your steps.

(a)  $2^3 \times 2^6 =$

(b)  $4^9 \div 4^7 =$


(c)  $4^{15} \div 4^5 =$

(d)  $(2^2)^4 =$

(e)  $(3^4)^3 =$

(f)  $(4ab)^3 =$

### COMPUTER COMPONENT

**Instructions:** In  follow the **Content Menu** path:

**Exponents > The Exponent Rules**

NOTE: Use the **Menu** button in order to get to the lesson where you left off.



Work through all Sub Lessons of the following Lessons **in order**:

- *A Power with Exponent Zero*
- *A Power with a Negative Exponent*
- *Summary of Exponent Rules*
- *Powers with Rational Bases*
- *Example Questions*

Additional Required Materials: *Scientific calculator*



As you work through the computer exercises, you will be prompted to make notes in your notebook/math journal.

**NOTES:**
**Exponent Rule 5**

When calculating a power with exponent \_\_\_\_\_:

- The base \_\_\_\_\_ equal \_\_\_\_\_ because we cannot \_\_\_\_\_ by \_\_\_\_\_.

$$x^0 = \underline{\hspace{2cm}}$$

Practice:

$$4^0 =$$

**Exponent Rule 6**

When calculating a power with a \_\_\_\_\_ exponent:

- When there is a negative exponent, we need to create a fraction and put the exponential expression in the denominator and make the exponent positive. For example,

$$x^{-a} = \frac{1}{x^{\underline{\hspace{1cm}}}}$$

Practice:

$$4^{-7} =$$

**Summary of Rules for Exponents**

Match the Rules:

$x^0$

$x^{m-n}, \quad x \neq 0$

$\frac{x^m}{x^n}$

$x^m y^m$

$x^1$

$x^{m \times n}$

$(x^m)^n$

$\frac{1}{x^m}, \quad x \neq 0$

$(xy)^m$

$x$

$x^{-m}$

$1, \quad x \neq 0$

**Exponent Rule 7**

When raising a \_\_\_\_\_ base to an exponent:

- raise \_\_\_\_\_ the \_\_\_\_\_ and \_\_\_\_\_ to the exponent

$$\left(\frac{x}{y}\right)^2 = \underline{\hspace{2cm}}$$

Practice:

$$\left(\frac{3}{5}\right)^4 =$$

**OFF COMPUTER EXERCISES**

1. Simplify. *Remember to use the Rules for Exponents.*

(a)  $(2^5)^3 =$

(b)  $(-14)^0 =$

(c)  $2^5 \times 2^4 \div 2^3 =$

(d)  $3^8 \div 3^2 \times 3^3 =$

(e)  $(6^0)^4 =$

(f)  $(16m^5) \div (8m^3) =$

(g)  $2^4 \div 2^5 =$

(h)  $3^3 - 2^4 =$

(i)  $5^2 \div 5^{-3} =$

(j)  $(z^4)^5 \div (z^1)^4 =$

2. A colony of cells triples every hour. The current population is 243 cells.

*Complete the chart below in order to determine:*

- (a) The cell population 3 hours from now.
- (b) The cell population 4 hours ago.
- (c) The equation involving P (population) and T (time) that represents the information.

| Time (hours) (T) | Population (P) | Population as a Power of 3 |
|------------------|----------------|----------------------------|
| -4               |                |                            |
| -3               | 9              |                            |
| -2               |                |                            |
| -1               |                |                            |
| 0                | 243            |                            |
| 1                |                | $243 \times 3^1$           |
| 2                |                | $243 \times 3^2$           |
| 3                |                |                            |
| 4                |                |                            |

3. Write each as a power with a positive exponent.

Example:  $3^{-6} = \frac{1}{3^6}$

(a)  $2^{-3} =$

(b)  $(-3)^{-2} =$

(c)  $-5^{-3} =$

(d)  $6^{-2} =$

4. Evaluate.

(a)  $(-2)^{-3} =$

(b)  $-2^{-4} =$

(c)  $8^0 =$

(d)  $(3)^{-2} =$

(e)  $(4^{-3})^{-2} =$

(f)  $15c^{-0} =$

(g)  $(15c)^{-0} =$

(h)  $5^{-1} =$

(i)  $(9)^{-3} \div (9)^{-6} =$

(j)  $4w^2 \times 5w^6 =$

5. Evaluate. *Remember the rule to follow when the base is a rational number.*

Example 1:  $\left(\frac{1}{9}\right)^2 = \frac{1^2}{9^2} = \frac{1}{81}$

Example 2:  $\left(\frac{3}{4}\right)^{-2} = \frac{1}{\left(\frac{3}{4}\right)^2} = \frac{1}{\left(\frac{9}{16}\right)} = 1 \div \frac{9}{16} = \frac{16}{9}$

(a)  $\left(\frac{2}{5}\right)^2$

(b)  $\left(\frac{1}{4}\right)^3$

(c)  $\left(\frac{1}{5}\right)^{-3}$

(d)  $\left(\frac{1}{6}\right)^{-1}$

(e)  $\left(\frac{2}{3}\right)^{-4}$

(f)  $\left(\frac{4}{5}\right)^{-2}$

6. Review the rules of exponents and decide which one you found most difficult. Explain why it was more difficult. *Give examples to support your answer.*

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