

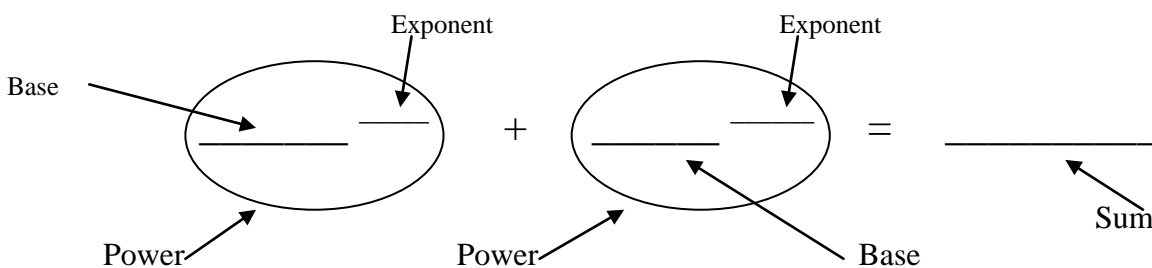
Concept: The Exponent Rules

Name: _____

Warm Up

In pairs:

Play Finding Products of Powers. Using just the twos to the nines cards from a deck of cards, students form the following equations and find the sum of the two exponential terms: The game is over once the team has achieved a goal of 200. But they must not go over 200 or they forfeit the game.



Instructions

1. Shuffle the cards
2. Turn over the top card and use it to fill in one of the blank in the either of the exponential terms. This card can be either the base or the exponent of one of the powers.
3. Continue to draw cards until all powers are formed.
4. Cards can be rearranged to assist in achieving a sum that will assist the students achieving their goal.
5. Calculators may be used.
6. Keep track of equations used and how many were needed to reach the goal of 200.
7. Student pairs with the closest total to the 200 goal without going over and using the fewest number of equations win.
8. Explain what strategies were used to place the numbers to achieve the goal.

Whole class

Discuss what strategies were used to place the numbers to achieve the goal.

COMPUTER COMPONENT

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

Exponents > The Exponent Rules



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

- *In This Topic*
- *Multiplication of Powers with the Same Base*
- *Division of Powers with the Same Base*
- *Raising a Power to an Exponent*
- *Raising a Product to an Exponent*

NOTE: You will not be finishing the entire section before stopping to complete some **OFF COMPUTER EXERCISES**.

Additional Required Materials: *Scientific calculator*



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

When you reach the end of the lesson *Raising a Product to an Exponent* on the computer, move on to the **OFF COMPUTER EXERCISES** below.

NOTES

Exponent Rule 1

When multiplying powers with the same base:

- Rewrite the base
- Add the exponents

$$x^a \times x^b = x^{a+b}$$

Practice:

$$4^2 \times 4^3 = 4^5 = 1,024$$

Exponent Rule 2

When dividing powers with the same base:

- Rewrite the base
- Subtract the exponents

$$x^a \div x^b = x^{a-b}$$

Practice:

$$5^8 \div 5^6 = 5^2 = 25$$

Exponent Rule 3

When raising a power to an exponent:

- Rewrite the base
- Multiply the exponents

$$(x^a)^b = x^{a \times b}$$

Practice:

$$(4^2)^5 = 4^{10}$$

Exponent Rule 4

When raising a product to an exponent:

- Raise each factor to the exponent.
- Multiply out the resulting terms.

$$(xy)^a = x^a y^a$$

$$(pqrs)^a = p^a q^a r^a s^a$$

Practice:

$$(2y)^6 = 2^6 y^6$$

OFF COMPUTER EXERCISES
1. Fill in the chart.

- In the first column, give the question.
- In the second column, expand the question.
- In the third column, find the answer by using the rules for exponent.

Question	Expansion	Answer (<i>Use the rules for exponents</i>)
$2^5 \times 2^3$	$(2 \times 2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2)$	$2^{5+3} = 2^8$ $= 256$
$2^4 \times 2^3$	$(2 \times 2 \times 2 \times 2) \times (2 \times 2 \times 2)$	$2^{4+3} = 2^7$ $= 128$
$4^4 \times 4^5$	$(4 \times 4 \times 4 \times 4) \times (4 \times 4 \times 4 \times 4 \times 4)$	$4^{4+5} = 4^9$ $= 262,144$
$3^2 \times 3^5$	$(3 \times 3 \times 3) \times (3 \times 3 \times 3 \times 3 \times 3)$	$3^{2+5} = 3^7$ $= 2,187$
$2^5 \div 2^3$	$\frac{2 \times 2 \times 2 \times 2 \times 2}{2 \times 2 \times 2}$	$2^{5-3} = 2^2$ $= 4$

Question	Expansion	Answer (Use the rules for exponents)
$3^4 \div 3^2$	$\frac{3 \times 3 \times 3 \times 3}{3 \times 3}$	$3^{4-2} = 3^2$ $= 9$
$5^6 \div 5^2$	$(5 \times 5 \times 5 \times 5 \times 5 \times 5) \times (5 \times 5)$	$5^{6-2} = 5^4$ $= 625$
$d^5 \div d^2$	$\frac{d \times d \times d \times d \times d}{d \times d}$	$d^{5-2} = d^3$
$(2^4)^3$	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	4096
$(M^3)^5$	$m \times m \times m \times m \times m \times m \times m \times m \times m \times m \times m$	m^{15}
$(5c)^3$	$5 \times 5 \times 5 \times c \times c \times c$	$125c^3$
$(2wz)^4$	$2 \times 2 \times 2 \times 2 \times w \times w \times w \times w \times z \times z \times z \times z$	$16w^4z^4$

2. Emanuel was working on solving $2^2 \times 2^5$. His solution was $2^2 \times 2^5 = 4^7 = 16\,384$.

(a) *What mistake did he make?*

Emanuel added his base, when he should have only added his exponents.

- (b) Calculate $2^2 \times 2^5$

$$2^7 = 128$$