

LessonTitle: Show the Rules of Exponents**Alg 7.4****Utah State Core Standard and Indicators** Algebra Standard 2.2.7 Process Standards 1-4**Summary**

In this lesson, students derive the rules of exponents, compare their rules with the textbook, and come up with ways to differentiate the rules.

Enduring Understanding

Using the rules for operating using exponents is a logical process.

Essential Questions

Why do the rules for operating with exponents work?

Skill Focus

Using the rules of exponents.

Vocabulary Focus

1. Base
2. Exponent

Assessment**Materials****Launch ideas:**

“High school algebra students need many examples and more direction to get started. We talked about what it means to be an exponent: $X^3 = XXX$; $(X^2)(X^3) = (XX)(XXX)$; $X^4 / X^2 = (XXXX) / (XX)$. We wanted to make sure that students would be on track to discover correct rules.”

“Compare $x + x + x + x$ to $x*x*x*x$ and how the $4x$ is different from x^4 . Make sure they know the difference between base and exponent. They need to be able to explain what x^4 represents.”

Explore ideas:

“The students worked in groups to explore the activity. We added more examples so that students could see a pattern. We also added more problems to explore with before trying to write a rule.”

“Try putting the power of a power right after multiplication. Will it make a difference? We don’t want to introduce negative exponents so soon. Take out the division problems that result in negative exponents on problem 2. There is nothing else that refers to it, so it would be better to leave it out.”

“It was better to leave out the number bases and only look at the rules using variables so they weren’t tempted to get an answer. We needed to stress what we were looking for – one base and one exponent. After that it was easy.”

Summarize ideas:

“We worked together as a class to find the textbook rule and check for student understanding. Students did examples on the board to demonstrate understanding by explaining their work. We also discovered the meaning of a negative exponent and a zero exponent as a class.”

Apply

“We all agreed that the activity as written is too open-ended for the lowest math students. They need many examples and more direction on the path to discovery. This is a stepping stone concept that opens the door to more advanced math. We also added a number eleven with a mixture of problems using the rules.”

Alg 7.4

Show the Rules of Exponents

Use graphing calculators or any other method you can think of to develop rules for the given examples.

- Develop numeric problems which are in the form of the examples below. Solve.
- Write your rule for each example.
- Compare your rule to the textbook rules. DO NOT open the textbook until all your rules have been written.

1) $(a^2)(a^3) = \underline{\hspace{2cm}}$ $(x^5)(x^6) = \underline{\hspace{2cm}}$

Write a rule in words for multiplying variables of the same base with exponents.

Write the rule using symbols. _____

Textbook rule _____

- 2) Can you write a similar rule which applies to division?

$(x^5)/(x^2) = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$ $(a^2)/(a^5) = \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$

Write a rule in words for dividing variables of the same base with exponents .

Write the rule using symbols. _____

Textbook rule _____

3) $(a^2)^3 = \underline{\hspace{1cm}}$ $(a^3)^4 = \underline{\hspace{1cm}}$

Write a rule in words.

Write the rule using symbols. _____

Textbook rule _____

- 4) Explain the difference between $(a^2)^3 =$ and $(a^2)(a^3)$

What is a way to remember when to add exponents and when to multiply them?

5) Try this. $(xy)^2 =$ _____ or $(xy)^3 =$ _____

Write a rule in words.

Write the rule using symbols. _____

Textbook rule _____

6) Explain the difference between finding $(xy)^2 =$ _____ and $(x + y)^2 =$ _____

7) What about this? $(a/b)^2 =$ _____ or $(a/b)^3 =$ _____

Write a rule in words.

Write the rule using symbols. _____

Textbook rule _____

8) Explain how to simplify $2^5/2^4$. What is the difference between $2^5/2^4$ and $5^2/4^2$?

How will you remember when you can subtract exponents and when you can't?

9) Use the following table to help you explain the meaning of 1) a negative exponent and 2) a 0 exponent.

10000.	_____	_____	64	_____
1000.	<u>1 thousand</u>	_____	32	_____
100.	_____	_____	16	_____
10.	_____	<u>10^1</u>	8	_____
1.	_____	_____	4	<u>2^2</u>
.1	_____	_____	2	_____
.01	_____	_____	_____	_____
.0001	_____	_____	_____	_____

Explanation:

10) Explain why $5^{-2} = 1/5^2$ $x^{-b} = 1/x^b$