

Mathematics

Quarter 2- Module 3: Zero, Negative, and Rational Exponents



AIRs - LM

MATHEMATICS 9

Quarter 2 - Module 3: Zero, Negative and Rational Exponents

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Region I

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Jumpstart

*For you to understand the lesson well, do the following activities.
Have fun and good luck!*

Activity 1: Remember Me and My Exponents!

Directions: Simplify the following expression using the laws of exponent. Write your answers on the space provided.

$c^3 (c^2)$	-9^0	5^{-1}	$a^{-1/2}$	$a^2 b^{-3} c^0$

Questions:

- How did you solve the given problem?
- What concept have you applied?
- How did you apply your knowledge of the laws of integral exponent in answering the questions?

Activity 2: Fill My Emptiness!

Directions: Fill in the missing parts of the solution in simplifying the given expression. Assume that c , a , l , and $r \neq 0$. Answer the question that follows.

- $\frac{c^2}{c^4} = \frac{1}{c^{4-2}} = \underline{\hspace{2cm}}$
- $\frac{a^9}{a} = \underline{\hspace{2cm}} = a^{10}$
- $\frac{l^{-2}}{l^{-4}} = \frac{l^4}{l^2} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$
- $\underline{\hspace{2cm}} = \frac{1}{c^2}$
- $\underline{\hspace{2cm}} = \left(\frac{1}{c^2}\right)^{1/2} = \underline{\hspace{2cm}}$

Questions:

- What did you observe about the exponent?
- How were the problems solved?
- What can you conclude from the process of solving the activity?

Were you able to simplify the given expressions? In the next activity, you will encounter and get familiarized with another kind of exponents.

Activity 3: My Super Power!

Directions: Fill in the table below. One is already done as an example.

Set A	Set B	Set C
$p^{1/n}$	$(p^{1/n})^n$	Values of $p^{1/n}$ that satisfy the equation in Set B
1. $36^{1/2}$	$(36^{1/2})^2$	6 and -6
2. $121^{1/2}$		
3. $4^{1/2}$		
4. $16^{1/4}$		
5. $36^{1/5}$		

Questions:

- What did you multiply to the exponent?
- How did you arrive Set C?
- What can you conclude from the process of solving the activity?

Were you able to fill in the table. If YES then a new set of activity awaits you for the mastery of the subject matter in this module.

Activity 4: Understand Me More and More!

Directions: In this activity, you will learn the definition of $p^{m/n}$. If we assume that the rules for integral exponents can be applied to rational exponent, how will the following expression be simplified? One example is done as your basis.

- | | |
|--|-----------------------------|
| 1. $(2^{1/2}) (2^{1/2})$ | $= 2^{1/2 + 1/2} = 2^1 = 2$ |
| 2. $(4^{1/2}) (4^{1/2}) (4^{1/2}) (4^{1/2})$ | _____ |
| 3. $(6^{1/3}) (6^{1/3}) (6^{1/3}) (6^{1/3}) (6^{1/3}) (6^{1/3})$ | _____ |
| 4. $(w^{2/3}) (w^{2/3}) (w^{2/3})$ | _____ |
| 5. $(S^{2/5}) (S^{2/5}) (S^{2/5}) (S^{2/5}) (S^{2/5})$ | _____ |

Questions:

- What operation did you apply to simplify the following expressions?
- What did you make to simplify the exponents?
- What can you conclude from the process of solving the activity?

Were you able to simplify the expressions? From the activities you have done, you will be able to apply the laws involving positive integral to zero and negative integral exponent. Before doing the next activities, read and understand first some important notes on zero, negative and rational exponents.



Discover

ZERO, NEGATIVE, AND RATIONAL EXPONENTS

In simplifying zero, negative, and rational exponents we will start recalling the laws of exponents which will be your guide in simplifying expressions.

Recall on this so that you will be guided on the next activities:

If a and b are real numbers and m and n are positive integers, then

$$a^m \cdot a^n = a^{m+n}$$

$$(a^m)^n = a^{mn}$$

$$(ab)^n = a^n b^n$$

$$\left(\frac{a}{b}\right)^m = \left(\frac{a^m}{b^m}\right) \text{ if } b \neq 0$$

$$\left(\frac{a^m}{a^n}\right) = a^{m-n} \text{ if } m > n \text{ and } a \neq 0$$

$$\left(\frac{a^m}{a^n}\right) = \frac{1}{a^{n-m}} \text{ if } n > m \text{ and } a \neq 0$$

So, Let us try the following examples.

1. Simplify $\left(\frac{11}{m}\right)^0$

Note: If a is a real number, then $a^0 = 1$

$$\left(\frac{11}{m}\right)^0 = \frac{11^0}{m^0} = \frac{1}{1} = 1$$

2. Simplify $2x^{-2}y^4x^0$

Note: If n is a positive integer, then $a^{-n} = \frac{1}{a^n}$

$$2x^{-2}y^4x^0 = \frac{2y^4(1)}{x^2} = \frac{2y^4}{x^2}$$

3. Simplify $\frac{(-2)(3^{-2})}{4^{-2}}$

$$= \frac{(-2)(4^2)}{3^2}$$

$$= \frac{(-2)(16)}{9}$$

$$= \frac{-32}{9}$$

4. Simplify $\frac{(-d)(3c^{-2})}{33r^{-2}}$

$$= \frac{(-d)(3r^2)}{33c^2}$$

$$= \frac{-3dr^2}{33c^2}$$

$$= \frac{-dr^2}{11c^2}$$

Now that you have learned on the application of the laws involving positive integral to zero and negative integral exponent, so you can proceed to the next activities.



Explore

Here are some enrichment activities for you to work on to master and strengthen the basic concepts you have learned from this lesson.

Activity 5: Me and My Power!

Directions: Complete the table below and observe the pattern given. Answer the questions that follow.

A	B	C	D	E	F	G	H
4^0	1	4^{-1}	$1/4$	4^{-2}	$1/16$	4^{-3}	$1/64$
5^0							
6^0							
7^0							
8^0							

Questions:

1. What can you say if the expression is raised to positive integral exponent?
2. What did you observe if the expression is raised to negative integral exponent?
3. What can you conclude if the expression is raised to Zero exponent?

Did you determine the pattern in the activity? I know you did it! So, let us proceed to the next activity.

Activity 6: Let Us Play With Negative!

Directions: Study the situation below and answer the questions that follow.

A grain of rice has a volume of 20^{-9} m^3 . A box full of rice has a volume of 20^{-3} m^3 . How many grains of rice are there in the box?

Questions:

1. What did you noticed from the values given in the problem?
2. What have you done to simplify these values?
3. How did you solve the problem?

Rubric	
POINTS	CRITERIA
5	correct representation of equation, correct solution, & correct answer
4	correct representation of equation, correct solution, & incorrect answer
3	correct representation of equation, incorrect solution, & incorrect answer
2	incorrect representation of equation, incorrect solution, & incorrect answer
1	unfinished solution

Great job! You have understood the lesson. Are you now ready to summarize?

Reflect on the activities you have done in this lesson by completing the following sentences. Write your answers on your journal notebook

I learned that I _____
I was surprised that I _____
I noticed that I _____
I discovered that I _____
I was pleased that I _____