OCTOBER 9, 2018

UNIT 2: POWERS AND EXPONENT LAWS

SECTION 2.4: EXPONENT LAWS I

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MATH 9

WHAT'S THE POINT OF TODAY'S LESSON?

We will continue working on the Math 9 Specific Curriculum Outcome (SCO) "Numbers 1" OR "N1" which states:

"Demonstrate an understanding of powers with integral bases (excluding base 0) and whole number exponents by: representing repeated multiplication using powers; using patterns to show that a power with an exponent of zero is equal to one; solving problems involving powers."

We will also continue working on the Math 9 Specific Curriculum Outcomes (SCOs) "Numbers 2" and "Numbers 4" OR "N2" and "N4" which state:

"Demonstrate an understanding of operations on powers with integral bases (excluding base 0) and whole number exponents."

AND

"Explain and apply the order of operations, including exponents, with and without technology."

What does THAT mean???

SCO N1 means that we will learn about the two parts of a power (the base, or "the big number", and the exponent, or "the little number"). We will show what a power means when we write it out using multiplication (ex: $3^2 = 3 \times 3$), and we will use patterns to prove, for example, that $3^0 = 1$. Finally, we will use what we know about powers to solve problems.

SCO N2 means that we will learn rules to work with powers with integer bases (other than 0) and exponents of 0 or higher.

SCO N4 means that we will use order of operations (as always) to solve problems that include powers both with and without calculators.

HOMEWORK QUESTIONS?
(Page 69, #1 to #10; page 149, #13)

13. Write each number using powers of 10.

b) $52\,000 = 5 \times 10\,000 + 2 \times 1000$
$= (5 \times 10^4) + (2 \times 10^3)$

QUIZ TIME: 10 MINUTES

SECTION 2.4: EXPONENT LAWS I

(Products and Quotients of Powers)

Let's complete the following table together:

Product of Powers	Product as Repeated Multiplication	Product as a Single Power
$2^3 \times 2^4$	$2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$	2^7
$4^2 \times 4 \times 4^8$	$4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$	4^{11}
$(-7)^3 \times (-7)^5$	$-7 \times -7 \times -7 \times -7 \times -7 \times -7 \times -7 \times -7$	$(-7)^8$

Is there an easier way to express a product of powers as a single power other than writing out the product as a repeated multiplication?

Yes - as long as the bases are the same, we can simply add their exponents.

2. EXPONENT LAW FOR PRODUCT OF POWERS: To multiply powers with the same base, add the exponents. We express this law as:

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

where "a" is any integer other than 0, and "m" and "n" are any whole numbers.

Ex.: $2^2 \times 2^3 = 2^{\boxed{5}}$

$(-4)^5 \times (-4)^4 = (-4)^{\boxed{9}}$

Clarification:

When I write $5^4 / 5^2$, I mean $5^4 \div 5^2$.

Let's complete the following table together:

Quotient of Powers	Quotient as Repeated Multiplication	Quotient as a Single Power
$5^6 / 5^2$	$\frac{\cancel{5} \times \cancel{5} \times 5 \times 5 \times 5 \times 5}{\cancel{5} \times \cancel{5}}$	5^4
$8^7 / 8^4$	$\frac{\cancel{8} \times \cancel{8} \times \cancel{8} \times \cancel{8} \times 8 \times 8 \times 8}{\cancel{8} \times \cancel{8} \times \cancel{8} \times \cancel{8}}$	8^3
$(-9)^5 / (-9)^3$	$\frac{\cancel{(-9)}\cancel{(-9)}\cancel{(-9)}(-9)(-9)}{\cancel{(-9)}\cancel{(-9)}\cancel{(-9)}}$	$(-9)^2$

Is there an easier way to express a quotient of powers as a single power other than writing out the quotient as a repeated multiplication?

Yes - as long as the bases are the same, we can simply subtract their exponents.

3. EXPONENT LAW FOR QUOTIENT OF POWERS: To divide powers with the same base, subtract the exponents. We express this law as:

$$a^m \div a^n = a^{m-n}, \; m \geq n$$

where "a" is any integer other than 0, and "m" and "n" are any whole numbers.

Ex.: $2^7 / 2^2 = 2^{\boxed{5}}$

$(-4)^{10} / (-4)^8 = (-4)^{\boxed{2}}$

EXAMPLES: **Write each expression as a single power, then evaluate. (NOTE: The order of operations applies.)**

a) $10^2 \times 10^3$

$= 10^5$

$= 100\,000$

b) $3^2 \times 3^4 \div 3^3$

$= 3^6 \div 3^3$

$= 3^3$

$= 27$

EXAMPLE: **Evaluate using exponent laws and the order of operations:**

$(-4)^3 [(-4)^7 \div (-4)^6] - (-4)^2$

$= (-4)^3 (-4)^1 - (-4)^2$

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

$= 256 - 16$

$= 240$

EXAMPLE: Evaluate. Use exponent laws where possible.

a) $6^2 \times 6^3$
$= 6^5$
$= 7776$

b) $6^2 + 6^3$
$= 36 + 216$
$= 252$

CONCEPT REINFORCEMENT:

MMS9:
PAGE 76: #4 and 5
PAGE 77: #6, 7, 8, 10, and 13
PAGE 78: #15, 16, 17, 18, and 19