# OCTOBER 21, 2015

# UNIT 2: POWERS AND EXPONENT LAWS

## SECTION 2.4:
## EXPONENT LAWS I


**M. MALTBY INGERSOLL**
*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.**

# 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 |
|---|---|---|
| $2^3 \times 2^4$ | $2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$ | $2^7$ |
| $4^2 \times 4^1 \times 4^8$ | $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4$ | $4^{11}$ |
| $(-7)^3 \times (-7)^5$ | $(-7)(-7)(-7)(-7)(-7)(-7)(-7)(-7)$ | $(-7)^8$ |

**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 |
|---|---|---|
| $5^6 / 5^2$ | $\frac{5 \cdot 5 \cdot 5 \cdot 5 \cdot 5 \cdot 5}{5 \cdot 5}$ | $5^4$ |
| $8^7 / 8^4$ | $\frac{8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8 \cdot 8}{8 \cdot 8 \cdot 8 \cdot 8}$ | $8^3$ |
| $(-9)^5 / (-9)^3$ | $\frac{(-9)(-9)(-9)(-9)(-9)}{(-9)(-9)(-9)}$ | $(-9)^2$ |

$\frac{5}{5} = 1$

**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.: $2^7 / 2^2 = 2^{5}$

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

# CONCEPT REINFORCEMENT:

## *MMS9:*
## PAGE 76: #4 and #5