Section A4.2 (Part 1) Activity
Introductory Algebra

Name: _____
Period: _____ Date: _____

Show ALL Work!

Section A4.2 – Discovering the Laws of Exponents: Product of Powers

The first law of exponents deals with multiplying powers. What happens when you multiply powers with the same base? Look for a pattern as you fill in the chart below. Use a calculator to evaluate each example, before and after you simplify it.

Example	Evaluate	Write in Expanded Form	Rewrite using Exponents	Evaluate
$2^3 \cdot 2^4$				
$3^4 \cdot 3^1$				
$5^4 \cdot 5^5$				
$7^2 \cdot 7^3$				
$(-2)^2 \cdot (-2)^3$				
$0.5^3 \cdot 0.5^2$				
$\left(\frac{1}{2}\right)^3 \cdot \left(\frac{1}{2}\right)^4$				
$x^m \cdot x^n$				

What patterns did you notice as you filled in the chart? What "shortcut" could you use for multiplying powers with the same base?

Section A4.2 (Part 2) Activity
Introductory Algebra

Name: _____
Period: _____ Date: _____

Show ALL Work!

Section A4.2 – Discovering the Laws of Exponents: Quotient of Powers

The second law of exponents deals with dividing powers. What happens when you divide powers with the same base? Look for a pattern as you fill in the chart below. Use a calculator to evaluate each example, before and after you simplify it.

Example	Evaluate	Write in Expanded Form	Rewrite using Exponents	Evaluate
$\frac{2^6}{2^4}$				
$\frac{5^7}{5^2}$				
$\frac{8^4}{8^2}$				
$\frac{7^8}{7^3}$				
$\frac{(-2)^9}{(-2)^3}$				
$3^6 \div 3^1$				
$\frac{x^m}{x^n}$				

What patterns did you notice as you filled in the chart? What "shortcut" could you use for dividing powers with the same base?

Section A4.2 (Part 3) Activity
Introductory Algebra

Name: _____
Period: _____ Date: _____

Show ALL Work!

Section A4.2 – Discovering the Laws of Exponents: Power of a Power

The next law of exponents deals with raising a power to a power. What happens when you raise a power to another power? Look for a pattern as you fill in the chart below.

Example	Write in Expanded Form	Rewrite Using Exponents
$(2^3)^2$		
$(3^2)^4$		
$(5^4)^3$		
$(7^2)^2$		
$\left[\left(\frac{1}{2}\right)^2\right]^5$		
$(x^m)^n$		

1. What patterns did you notice as you filled in the chart?

2. How do you think you can use these patterns to make an inference about the rule for raising a power to a power? Explain your thinking.

Section A4.2 (Part 5) Activity
Introductory Algebra

Name: _____
Period: _____ Date: _____

Show ALL Work!

Section A4.2 – Discovering the Laws of Exponents: Power of a Product

This law deals with multiplying expressions with the same exponent. What happens when you multiply expressions with the same exponent? Look for a pattern as you fill in the chart below. Use a calculator to evaluate each example, before and after you simplify it.

Example	Evaluate	Write in Expanded Form	Rewrite using Exponents	Evaluate
$(2\cdot 5)^3$				
$2^3\cdot 5^3$				
$(6\cdot 3)^4$				
$6^4\cdot 3^4$				
$(-4)^3\cdot(-6)^3$				
$(-4\cdot -6)^3$				
$(x\cdot y)^m$				

What patterns did you notice as you filled in the chart? What "shortcut" could you use for multiplying expressions with the same exponent?

Section A4.2 (Part 7) Activity
Introductory Algebra

Name: _____
Period: _____ Date: _____

Show ALL Work!

Section A4.2 – Discovering the Laws of Exponents: Power of a Quotient

This law deals with dividing expressions with the same exponent. What happens when you multiply expressions with the same exponent? Look for a pattern as you fill in the chart below. Use a calculator to evaluate each example, before and after you simplify it.

Example	Evaluate	Write in Expanded Form	Rewrite using Exponents	Evaluate
$\left(\frac{6}{2}\right)^3$				
$\frac{6^3}{2^3}$				
$\left(\frac{12}{4}\right)^4$				
$\frac{12^4}{4^4}$				
$\frac{(-27)^3}{(-3)^3}$				
$\left(\frac{-27}{-3}\right)^3$				
$\left(\frac{x}{y}\right)^m$				

What patterns did you notice as you filled in the chart? What "shortcut" could you use for dividing expressions with the same exponent?

Section A4.2 (Part 9) Activity
Introductory Algebra

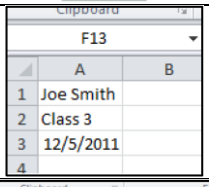
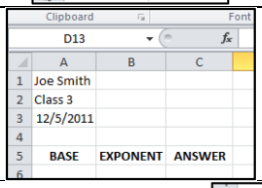
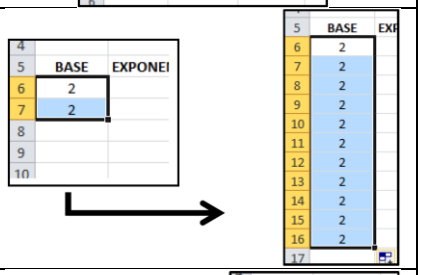
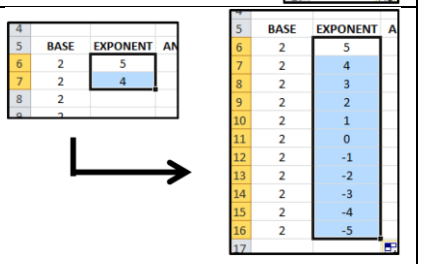
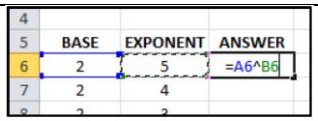
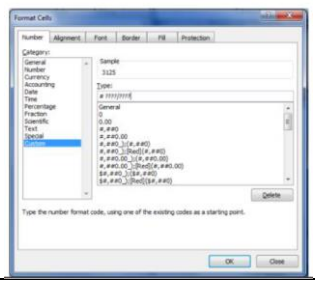
Name: _____
Period: _____ Date: _____

Show ALL Work!

Section A4.2 – Discovering the Laws of Exponents: Zero and Negative

The next laws of exponents deal with zero and negative exponents. What happens when you raise a number to a power of zero? What happens when you raise a number to a negative power? Look for a pattern as you complete the activity below.

Part I: Creating the Excel Spreadsheet

Step	Directions	Picture
1	Open up Microsoft Excel.	
2	Type the following into the corresponding cells on the spreadsheet: • In cell **A1**, type your name • In cell **A2**, type the class period • In cell **A3**, type today's date	
3	In row five, label these 3 columns and format in **BOLD**: • In cell **A5**, type "BASE" • In cell **B5**, type "EXPONENT" • In cell **C5**, type "ANSWER"	
4	Fill in the column for **BASE** (the base will always be the same number): • In cell **A6**, type "2" • In cell **A7**, type "2" again • Click and drag to select both cells • Put your cursor at the lower right corner of the highlighted area (a plus sign should appear) • Drag down to **A16** to fill the other cells in this column with a 2	
5	Fill in the column for the **EXPONENT** (this will range from -5 to 5) • In cell **B6**, type "5" • In cell **B7**, type "4" • Click and drag to select both cells • Put your cursor at the corner of the highlighted area (a plus sign should appear) • Drag down to **B16** to fill the other cells in this column from -5 to 5	
6	Fill in the column for the **ANSWER** • In cell **C6**, type =A6^B6 and hit enter • Select **C6** and drag down to **C16** to fill the cells. Each value in the "Answer" cell is what you get when you evaluate that power. • With cells **C6** to **C16** still highlighted, tap the Right mouse button and click the **Format Cells…** section. • Select **Custom** under the **Category** and type # ????/???? under **Type**. • Click "**OK**"	 

<u>Part II</u>: Discovering the Laws

Experiment with the spreadsheet by changing the base and recording your answers in the table below. Look for patterns that will allow you to find the rule for evaluating zero and negative exponents.

	Base				
Exponent	**2**	**3**	**4**	**5**	**6**
5	$2^5 = 32$				
4	$2^4 =$				
3					
2					
1					
0					
-1					
-2					
-3					
-4					
-5					

1. What patterns did you notice as you filled in the chart?

2. What do you think the rule is for evaluating powers with **zero exponents**?

3. What do you think the rule is for evaluating powers with **negative exponents**?

4. Use the rules you have discovered to evaluate the following:

   a. $x^0 =$ b. $x^{-2} =$

When you are finished, email your Excel document to tocchiz@hoban.org

EXAMPLES:

a) $(-4)^2 \cdot (-4)^5$

b) $(2x)^3 \cdot (2x)$

c) $2x^4y^2 \cdot 3x^2y^6$

PRODUCT OF POWERS PROPERTY

When finding the **product** of powers with the **same base**, _____

_____.

$$a^m \cdot a^n =$$

QUOTIENT OF POWERS PROPERTY

When finding the **quotient** of powers with the **same base**, _____

_____.

$$\frac{a^m}{a^n} =$$

EXAMPLES:

a) $\frac{2^9}{2^6}$

b) $\left(\frac{5}{8}\right)^6 \div \left(\frac{5}{8}\right)$

c) $h^6k^2 \div h^5k$

EXAMPLES:

a) $(3^4)^2$

b) $[(-x)^4]^3$

c) $[(-4)^2 \cdot (-4)^3]^6$

POWER OF A POWER PROPERTY

When you **raise a power to a power**, keep the _____ and multiply the _____.

$$(a^m)^n =$$

POWER OF A PRODUCT

When finding a **product raised to a power**, you find the power of each factor and then **multiply**.

$$(a \cdot b)^m =$$

EXAMPLES:

a) $(3 \cdot 7)^4$

b) $\left(-\frac{1}{3} \cdot -\frac{2}{5}\right)^5$

c) $(2r \cdot 7s)^2$

EXAMPLES:

a) $\left(\frac{-8}{-2}\right)^5$

b) $(p \div q)^6$

c) $\frac{4^5 \cdot 4^3}{2^2 \cdot 2^6}$

POWER OF A QUOTIENT PROPERTY

When finding the **quotient** of two algebraic expressions, you raise both the numerator and the denominator to the power.

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

ZERO EXPONENT PROPERTY

Any **nonzero** number raised to the **zero power** is equal to _____.

$$a^0 = \qquad , a \neq 0$$

EXAMPLES:

a) 3^0

b) $7^3 \cdot 7^0$

c) $(a^4 \div a^0) \cdot a^3$

EXAMPLES:

a) 5^{-2}

b) $\frac{x^{-7}}{x^4}$

c) $9m \div 3m^{-2}$

ZERO EXPONENT PROPERTY

When finding **negative exponent**, take the _____ of the base and raise it to the positive power.

$$a^{-n} = \qquad , a \neq 0$$