AChor/MPM1D **Name: _____**
Date: _____

Worksheet 2-5: Negative Powers and Power of Powers

Part 1: Negative Power vs. Negative Base

Negative Powers are negative values. They are powers of positive base with a negative sign.
Examples:

(a) -3^6	(b) -5^5	(c) -9^2	(d) -4^3
Base =	Base =	Base =	Base =
Exponent =	Exponent =	Exponent =	Exponent =
Value =	Value =	Value =	Value =

However, powers with negative base do not always have negative values.
Examples:

(a) $(-3)^6$	(b) $(-5)^5$	(c) $(-9)^2$	(d) $(-4)^3$
Base =	Base =	Base =	Base =
Exponent =	Exponent =	Exponent =	Exponent =
Value =	Value =	Value =	Value =

Powers with negative base have positive values when they have <u>even</u> exponents i.e. when the exponent is an even number.
Investigation:

Power	Value
$(-1)^4$	
$(-1)^3$	
$(-1)^2$	
$(-1)^1$	
$(-1)^0$	
$(-1)^{-1}$	
$(-1)^{-2}$	
$(-1)^{-3}$	
$(-1)^{-4}$	

Power	Value
$(-2)^4$	
$(-2)^3$	
$(-2)^2$	
$(-2)^1$	
$(-2)^0$	
$(-2)^{-1}$	
$(-2)^{-2}$	
$(-2)^{-3}$	
$(-2)^{-4}$	

Power	Value
$(-5)^4$	
$(-5)^3$	
$(-5)^2$	
$(-5)^1$	
$(-5)^0$	
$(-5)^{-1}$	
$(-5)^{-2}$	
$(-5)^{-3}$	
$(-5)^{-4}$	

Assigned Work: WS 2-5; Textbook: p. 126 C1 and C2; p. 127 #5-6, #7 (c, d), #8 (d), #12

Part 2: Power of a Power

Exponent Law 3 - The Product of Exponent Rule For a Power of a Power

$$(a^m)^n = a^{m \times n}$$

$(a^m)^n$ **is called "a power of a power" because for exponent *n*, its base is** a^m **which is also a power.**

To simplify a power of a power, keep the base the same and multiply the exponents.

Example 1: $(2^2)^3 = 2^2 \times 2^2 \times 2^2 = (2 \times 2) \times (2 \times 2) \times (2 \times 2) = 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$

$2^{2 \times 3} = 2^6$

Example 2: $(x^3)^5 = (x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x) \cdot (x \cdot x \cdot x) = x^{15}$

$x^{3 \times 5} = x^{15}$

Example 3: $(x^2 y^3)^2 = (x \cdot x \cdot y \cdot y \cdot y)(x \cdot x \cdot y \cdot y \cdot y) = (x \cdot x \cdot x \cdot x)(y \cdot y \cdot y \cdot y \cdot y \cdot y) = x^4 y^6$

$x^{2 \times 2} y^{3 \times 2} = x^4 y^6$

Practice:

1. Simplify. (i.e. write as a single power)

(a) $(3^2)^5$ (b) $(4^5)^2$ (c) $(5^4)^3$

(d) $(x^3)^6$ (e) $((-2)^3)^3$ (f) $(2^{-3})^{-2}$

2. Express as a single power **then** evaluate.

(a) $(6^2)^2$ (b) $((-7)^{-2})^{-1}$

(c) $((3^2))^3 \times 3^2$ (d) $((-2)^{-2})^{-3} \div (-2)^4$

Answers: 1. (a) 3^{10}, (b) 4^{10}, (c) 5^{12}, (d) x^{18}, (e) $(-2)^9$, (f) 2^6**;**

2. (a) 6^4, 1296, (b) $(-7)^2$, 49, (c) 3^8, 6561, (d) $(-2)^2$, 4**.**