Name _____ Date _____

Master 2.17

Extra Practice 1

Lesson 2.1: What Is a Power?

1. Identify the base of each power.

a) 6^3	**b)** 2^7	**c)** $(-5)^4$	**d)** -7^0
Base:			
Exponent:			

2. Use repeated multiplication to show why 3^5 is not the same as 5^3.

3. Complete this table.

Power	Base	Exponent	Repeated Multiplication	Standard Form
4^4				
$(-10)^3$				
	-6	2		
			$1 \times 1 \times 1 \times 1 \times 1$	

4. Write each product as a power, then evaluate.

a) 6×6

b) $3 \times 3 \times 3 \times 3 \times 3 \times 3$

c) $10 \times 10 \times 10 \times 10$

d) $-(8 \times 8 \times 8)$

e) $(-8)(-8)(-8)$

f) $-(-8)(-8)(-8)$

5. Write each power as repeated multiplication, then evaluate.

a) 7^5 **b)** 4^6 **c)** -9^3 **d)** $(-5)^5$

Name _____ Date _____

6. Evaluate each power. For each power:
- Are the brackets needed?
- If your answer is yes, what purpose do the brackets serve?

a) $(-6)^5$ **b)** $-(6)^5$ **c)** $-(-6)^5$ **d)** (-6^5)

7. Predict whether each answer is positive or negative, then evaluate.

a) $(-3)^2$ **b)** $(-3)^3$ **c)** -3^2 **d)** $-(-3)^3$

8. Is the value of -2^4 different from the value of $(-2)^4$? Explain.

9. Stamps are sold in a 10 by 10 sheet. The total value of a sheet of stamps is $60.00.

a) Express the number of stamps as a power and in standard form.

b) Draw a picture to represent this power.

c) What is the value of one stamp?

Name _____ Date _____

Master 2.18

Extra Practice 2

Lesson 2.2: Powers of Ten and the Zero Exponent

1. Evaluate each power.

a) 4^0 **b)** 23^0 **c)** $(-6)^0$

d) 1^0 **e)** -1^0 **f)** $(-1)^0$

2. Write each number as a power of 10.

a) 10 000 **b)** 1 000 000 **c)** one billion **d)** ten **e)** 1

3. Use powers of 10 to write each number.

a) 700 000 000 000 **b)** 7000

c) 77 077 **d)** 7 000 007

4. Write each number in standard form.

a) (8×10^5)

b) $(9 \times 10^7) + (9 \times 10^6) + (5 \times 10^5)$

c) $(2 \times 10^3) + (2 \times 10^2) + (6 \times 10^0)$

d) $(5 \times 10^5) + (4 \times 10^8) + (8 \times 10^0) + (3 \times 10^4)$

Name _____ Date _____

5. Write these numbers in standard form, then order them from least to greatest.

fifty-five hundred 50 500 $(5 \times 10^6) + (5 \times 10^0)$

five hundred thousand 5×10^4 500 500

6. **a)** Complete this table for a base of 10.

Exponent	Power	Standard Form
6	10^6	
5		
4		
3		
2		
1		
0		

b) Use patterns to describe why the power with an exponent of 0 is equal to 1.

Name _____ Date _____

Master 2.19

Extra Practice 3

Lesson 2.3: Order of Operations with Powers

1. Evaluate.

a) $5^2 + 3$ **b)** $5^2 - 3$ **c)** $5 + 3^2$ **d)** $5 - 3^2$

e) $(5 + 3)^2$ **f)** $(5 - 3)^2$ **g)** $5^2 + 3^2$ **h)** $5^2 - 3^2$

2. Evaluate.

a) $4^3 \times 2$ **b)** $4^3 \div 2$ **c)** 4×2^3 **d)** $4 \div 2^3$

e) $(4 \times 2)^3$ **f)** $(4 \div 2)^3$ **g)** $4^3 \times 2^3$ **h)** $4^3 \div 2^3$

Name _____ Date _____

3. Evaluate.

a) $(18 \div 3^2 + 1)^4 - 4^2$ **b)** $3^3 \div 9(3^0 - 2^2)$ **c)** $(12^2 + 5^3)^0 - 2[(-3)^3]$

d) $(7 - 5)^3 \times (8 + 2)^4$ **e)** $(4^2 \times 1^5)^2$ **f)** $[(-3)^4 - (-2)^3]^0 \div [(-4)^3 - (-3)^2]^0$

5. The formula for the volume, V, of a cylinder with height, h, and radius, r, is $V = \pi r^2 h$. Janet made 3 L of salsa and stores it in jars with a radius of 4 cm and a height of 10 cm.

She uses this expression to determine the number of jars she will need: $\dfrac{3000}{\pi(4)^2 \times 10}$

About how many jars will Janet need for the salsa?

6. Aftab, Shane, and Kyra got different answers when they evaluated this expression: $(-4)^2 - 3[(-9) \div 3]^2$ Aftab's answer was 97, Shane's answer was 43, and Kyra's answer was 19.

a) Show the correct solution.

Extra Practice 4

Name: _____

Lesson 2.4: Exponent Laws 1

1. Write each product as a single power.

a) $4^3 \times 4^2$ **b)** $5^0 \times 5^0$ **c)** $(-2)^2 \times (-2)^4$

d) $-6^3 \times 6^1$ **e)** $(-7)^0 \times (-7)^2$ **f)** $(-9)^6 \times (-9)^3$

2. Write each quotient as a single power.

a) $8^7 \div 8^5$ **b)** $10^4 \div 10^0$ **c)** $(-1)^6 \div (-1)^3$

d) $\dfrac{-3^4}{3^4}$ **e)** $\dfrac{(-9)^{10}}{(-9)^5}$ **f)** $\dfrac{11^9}{11^6}$

3. Express as a single power.

a) $2^3 \times 2^6 \div 2^9$ **b)** $(-5)^8 \div (-5)^4 \times (-5)^3$ **c)** $\dfrac{6^3 \times 6^5}{6^2 \times 6^4}$

4. Simplify, then evaluate.

a) $2^2 - 2^0 \times 2 + 2^3$ **b)** $(-2)^6 \div (-2)^5 - (-2)^5 \div (-2)^3$ **c)** $-2^2(2^3 \div 2^1) - 2^3$

5. Simplify, then evaluate.

a) $4^3 \div 4^2 + 2^4 \times 3^2$ **b)** $3^2 + 4^2 \times 4^1 \div 2^3$ **c)** $\frac{3^4}{3^3} + \frac{4^2 \times 4^0}{2^4}$

6. Write each relationship as a product of powers or a quotient of powers.

a) One million is 1000 times as great as one thousand.

b) One billion is 1000 times as great as one million.

c) One hundred is one-tenth of one thousand.

d) One is one-millionth of one million.

e) One trillion is 1000 times as great as one thousand million.

7. Identify, then correct any errors in these answers.
Explain how you think the errors occurred.

a) $5^3 \times 5^2 = 5^6$ **b)** $2^3 \times 4^2 = 8^5$ **c)** $(-3)^8 \div (-3)^4 = (-3)^4$

d) $1^2 \times 1^4 - 1^3 = 1^3$ **e)** $\frac{4^2 \times 4^4}{4^2 \times 4^1} = 4^2$

Extra Practice 5

Name : _____

Lesson 2.5: Exponent Laws II

1. Write each expression as a product of powers or a quotient of powers.

a) $(3 \times 2)^4$ **b)** $[(-4) \times 3]^2$ **c)** $[(-2) \times (-4)]^3$ **d)** $(7 \times 11)^0$

e) $(10 \div 5)^3$ **f)** $[(-12) \div (-6)]^2$ **g)** $\left(\frac{8}{4}\right)^4$ **h)** $\left(\frac{1}{10}\right)^6$

2. Write as a power.

a) $(3^4)^2$ **b)** $(5^0)^3$ **c)** $-(7^2)^2$ **d)** $[(-3)^3]^2$

3. Why is the value of $[(-3)^3]^2$ positive and the value of $[(-3)^3]^3$ negative?

4. Simplify, then evaluate.

a) $(2^3 \times 2^1)^2$ **b)** $(5^4 \div 5^2)^2$ **c)** $[(-3)^0 \times (-3)^3]^2$ **d)** $(10^2)^4 \div (10^3)^2$

5. Simplify, then evaluate each expression.

a) $(3^2 \times 4^3)^2 - (4^4 \div 4^2)^2$ **b)** $(2^3 \div 2^2)^3 + (7^4 \times 7^3)^0$

c) $[(-1)^3]^4 - [(-1)^4 \div (-1)^3]^2$ **d)** $(4^2 \times 4^3)^0 - (3^2)^2$

e) $(5^2 \times 5^0)^3 + (2^5 \div 2^3)^3$

f) $(10^6 \div 10^3)^2 + (2^3 \div 2^1)^4$

6. Find and correct any errors in each solution.

a) $(4^3 \times 2^2)^2 = (8^5)^2$
$= 8^{10}$
$= 1\ 073\ 741\ 824$

You try $(4^3 \times 2^2)^2 = (8^5)^2$

b) $[(-10)^3]^4 = (-10)^7$
$= -10\ 000\ 000$

You try $[(-10)^3]^4 = (-10)^7$

c) $(2^2 + 2^3)^2 = (2^5)^2$
$= 2^{10}$
$= 1024$

You try $(2^2 + 2^3)^2 = (2^5)^2$

Math 9

Name_____ ID: 1

Laws of Exponents (Review)

Date_____ Period____

Simplify. Your answer should contain only one base.

1) $\left[5^2 \times (5^4)\right]^6$

2) $\left[6^3 \times 6^3 \times 6^2\right]^2$

3) $5^3 \times 5^2 \times (5^0)^3$

4) $6^4 \times (6^2)^3$

5) $(4^3)^2 \times 4^2$

6) $6 \times (6^3)^2$

7) $\frac{3^3 \times 3^3}{3^3}$

8) $\frac{2^0 \times 2^3}{2^2}$

9) $\frac{6^3 \times 6^9}{6^5}$

10) $\frac{4 \times 4^3}{4^2 \times 4^2}$

11) $\frac{6^2 \times 6^0}{6^2}$

12) $\frac{3^{12}}{3 \times 3^0}$

13) $\left(\frac{5^4}{5^3}\right)^3$

14) $\frac{6^{22}}{6^{15}}$

15) $\left(\frac{5^2}{5^3}\right)^0$

16) $\left(\frac{4^2}{(4^0)^2}\right)^3$

17) $\left(\frac{4^3}{4^2}\right)^3$

18) $\frac{(2^3)^2}{2^3}$

19) $\frac{(3^2)^8}{3^2 \times 3^5}$

20) $\frac{4^3 \times (4^2)^2}{4^2}$

21) $\frac{(2^2)^5}{2^4 \times 2^2}$

22) $\frac{\left[5^3 \times 5^2\right]^2}{5}$

23) $\frac{6^3 \times (6^3)^3}{6^0}$

24) $\frac{\left[2 \times (2^3)^0 \times (2^3)^2\right]^3}{2^6}$

Powers and Exponent laws

Simplify each of the following

1) $201^6 \times 201^3$

2) $9^{18} \div 9^{12}$

3) $6^8 \times 6^{15} \div 6^7$

4) $(-7)^{11} \div (-7)^4 \times (-7)^5$

5) $\frac{3^{13} \times 3^{11}}{3^{20}}$

6) $\frac{10^{11}}{10^6} \times 10^2$

7) $2 \times 2^5 \times 2 \times 2^3 + 3^7 \times 3^{11} \div 3^2 \times 3$

For each of the following questions SIMPLIFY then evaluate

1) $7^{12} \times 7 \div 7^9 + 7^4$

2) $\frac{10^{15} \times 10^2}{10^8}$

3) $3^{27} \div 3^{22} - 3^2 \times 3$

4) $-2^9 \times 2^{11} \div 2^6 - 2^7 + 5$

5) $4^3(4^{12} \div 4^7) + 4^2$

6) $(-5)^9 \div (-5)^6 \times (-5)^1 + (-5)^{10} \div (-5^9)$