### **B: Exponent Laws Continued**

#### **Powers raised to an Exponent**

 $(a^{m})^{n} = a^{m \times n}$   $(3^{2})^{3} = 3^{2 \times 3} = 3^{6}$   $(3 \times 3)^{3}$   $(3 \times 3) \times (3 \times 3) \times (3 \times 3)$  $=3^{6}$ 

#### Examples:

1. Write as a single power & evaluate.

a.  $(4^3)^4$ =  $(4)^{3\times4}$ 

= 412

=16777216

b.  $((-8)^2)^3$ =  $(-8)^{2x3}$ 

=(-8)°

=262144

## 2. Write as a power raised to an exponent.

a. (3x3x3) x(3x3x3) x (3x3x3) x (3x3x3)

$$= (3^3) \times (3^3) \times (3^3) \times (3^3)$$

 $= (3^3)^4$ 

b. (4x4) x (4x4) x (4x4)

$$= (42) \times (42) \times (42)$$
$$= (42)3$$

# **Quotients Raised to an Exponent**

$$\left(\begin{array}{c} \underline{\mathbf{a}} \\ \underline{\mathbf{b}} \end{array}\right)^{\mathbf{m}} = \underline{\mathbf{a}}^{\mathbf{m}}$$

Bring the exponent onto everything in the brackets!

### Examples:

1. Write as a quotient of two powers & evaluate.

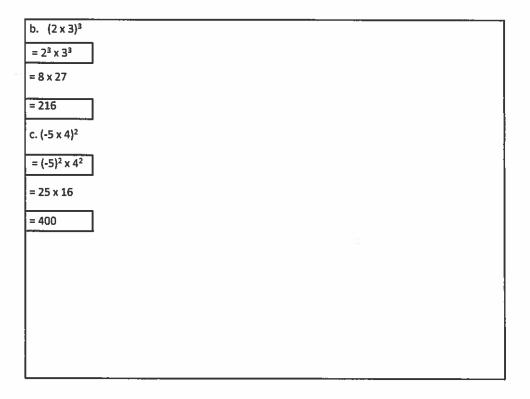
$$a.\left(\frac{4}{5}\right)$$

 $= \frac{(4)^3}{(5)^3}$ =  $\frac{64}{}$ 

125

Reduce if you can!

b. $(-2)^{6}$	
3 <sup>6</sup> = <u>64</u> 729	Reduce if you can!
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Product Raised to an exponent	
$(a \times b)^m = a^m \times b^m$	
$(4 \times 5)^3 = 4^3 \times 5^3$	
Examples:  1. Write as the product of two powers and evaluate.  a. [6 x (-2)] <sup>4</sup> Bring the exponent onto everything in the brackets!	
$= 6^4 \times (-2)^4$	
= 1296 x 81	
= 104976	



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Combining Laws
Examples:
1. Express as a single power & evaluate.
a. (2^2)^4 \times 2^3
                                                               c. (-3<sup>3</sup>)<sup>4</sup>
= 2^{2x4} \times 2^3
                                                                  =(-1 \times 3^3)^5
=2^8 \times 2^3
                                                                  = (-1)^5 \times (3^3)^5
=28+3
                                                                  = -1 \times 3^{3x5}
                                              100
=211
                                                                 = -1 \times 3^{15}
                                                                   = -1 x 14348907
=2048
                                                                  ***If you forget about the negative sign
b. [(-3)^2]^4 \times (-3)^4
       (-3)^3
                                                                   your answer may have the wrong sign! ***
= (-3)^{2\times4} \times (-3)^4
        (-3)^3
= (-3)^8 \times (-3)^4
      (-3)3
=(-3)^{8+4}
  (-3)3
=(-3)^{12}
                                                      Assignment: Page 106 # 14 - 23
 (-3)^3
= (-3)12-3
= (-3)<sup>9</sup> = -19683
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