## Basic Exponents

Writing a number in exponential form means to use a "shorthand" method to tell how many times a factor is being multiplied by itself. For example $2^4$ means that the base, 2, is being multiplied by itself 4 times.

$$2^4 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot \cdot \cdot$$

More examples:

$$22 = 2 \cdot 2 \cdot$$

$$23 = 2 \cdot 2 \cdot 2 \cdot \cdot$$

$$24 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot \cdot \cdot \quad 2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot \cdot \cdot \cdot \quad a \cdot a \cdot a \cdot a \cdot a \quad a^5 = \cdot \cdot \cdot \cdot$$

There is an important difference between $(-4)^2$ and $-4^2$. The difference is the parentheses. In $(-4)^2$ the base is $-4$. We would read this as "negative four squared" or "the square of negative four."

$(-4)^2 = - \; - = (\;4 \cdot 4)(\qquad)$ 16 "The square of negative 4 is 16"

$(- = - \; - \; - \; = -4)^3 \; (\;4 \cdot 4 \cdot 4)()(\qquad)$ 64 "The cube of negative 4 is $-64$"

In $-4^2$, the base is positive four. We could read this as "the negative of four squared" or "the opposite of the square of four."

$-4^2 = -(4 \cdot 4 \cdot) = -16$ "The opposite of the square of 4 is $-16$."

$-4^3 = -(4 \cdot 4 \cdot 4 \cdot \cdot) = -64$ "The opposite of the cube of 4 is $-64$."

NOTICE that when the base is a negative number (inside parentheses) that the answer will be positive if the exponent is <u>even</u> and negative if the exponent is <u>odd</u>. However, when the base is a positive number with a negative sign in front, the answer is <u>always</u> negative.

$(-2)^2 = -(\;2)(-2) = 4$

$(-2)^3 = -(\;2)(-2)(-2) = -8$

$(-2)^4 = -(\;2)(-2)(-2)(-2) = 16$

$(-2)^5 = -(\;2)(-2)(-2)(-2)(-2) = -32$

$-2^2 = (2 \cdot 2 \cdot) = -4$

$-2^3 = (2 \cdot 2 \cdot 2 \cdot \cdot) = -8$

$-2^4 = (2 \cdot 2 \cdot 2 \cdot \cdot \cdot) = -16$

$-2^5 = (2\ 2\ 2\ 2\ 2 \cdot \cdot \cdot \cdot) =$
$-32$

Sometimes we have a problem which has more than one base. When that occurs we must simplify each base separately and then do the operation.

EXAMPLE

$(-2)^3 \cdot 5^2 = -(2)(-2)(-2) \cdot (5)(5)$
$=$
$-8$
$25$
$\cdot =$
$-2$
$00$

EXERCISES: Evaluate

1. $2^6$

2. $(-3)_2$

3. $-3^2$

4. $(-3)_4$

KEY:

1. 64 3. −9
2. 9 4. 81

$\left(\frac{3}{2}\right)^2 \cdot \left(\frac{1}{2}\right)^2 = \frac{3}{2} \cdot \frac{3}{2} \cdot \frac{1}{2} \cdot \frac{1}{2}$

$= \frac{9}{4} \cdot \frac{1}{4}$

$= \frac{9}{16}$

5. $5_3$ 9. $\left(\frac{1}{2}\right)_3$

10. $\left(\frac{5}{2}\right)_2 \cdot 5_2$

7. $(-2)^2 \cdot \frac{1}{4}$

5. 125 7. 1 9. $\frac{1}{8}$

6. −328. −72 10. 4

8. −3 $2_2 \cdot {}_3$