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.

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

More examples:

$$2^2 = 2 \cdot 2$$
$$2^3 = 2 \cdot 2 \cdot 2$$
$$2^4 = 2 \cdot 2 \cdot 2 \cdot 2$$
$$2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2$$
$$a^5 = a \cdot a \cdot a \cdot a \cdot a$$

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."

$(-4)^2 = (-4)(-4) = 16$	"The square of negative 4 is 16"
$(-4)^3 = (-4)(-4)(-4) = -64$	"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."

$-4^2 = -(4 \cdot 4) = -16$	"The opposite of the square of 4 is –16."
$-4^3 = -(4 \cdot 4 \cdot 4) = -64$	"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.

$(-2)^2 = (-2)(-2) = 4$	$-2^2 = (2 \cdot 2) = -4$
$(-2)^3 = (-2)(-2)(-2) = -8$	$-2^3 = (2 \cdot 2 \cdot 2) = -8$
$(-2)^4 = (-2)(-2)(-2)(-2) = 16$	$-2^4 = (2 \cdot 2 \cdot 2 \cdot 2) = -16$
$(-2)^5 = (-2)(-2)(-2)(-2)(-2) = -32$	$-2^5 = (2 \cdot 2 \cdot 2 \cdot 2 \cdot 2) = -32$

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

$$\begin{aligned}(-2)^3\cdot 5^2 &= (-2)(-2)(-2)\cdot(5)(5)\\ &= -8\cdot 25\\ &= -200\end{aligned}$$

EXAMPLE

$$\begin{aligned}\left(\frac{3}{2}\right)^2\cdot\left(\frac{1}{2}\right)^2 &= \frac{3}{2}\cdot\frac{3}{2}\cdot\frac{1}{2}\cdot\frac{1}{2}\\ &= \frac{9}{4}\cdot\frac{1}{4}\\ &= \frac{9}{16}\end{aligned}$$

EXERCISES: Evaluate

1. 2^6
2. $(-3)^2$
3. -3^2
4. $(-3)^4$
5. 5^3
6. -2^5
7. $(-2)^2\cdot\frac{1}{4}$
8. $-3^2\cdot 2^3$
9. $\left(\frac{1}{2}\right)^3$
10. $\left(\frac{2}{5}\right)^2\cdot 5^2$

KEY:

1. 64	3. –9	5. 125	7. 1	9. $\frac{1}{8}$
2. 9	4. 81	6. –32	8. –72	10. 4

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