

**Exploring Rules of Exponents:** How can you use patterns to discover rules for multiplying with exponents?

Expression	Expanded form	Product as a power
$(4 \cdot 3)^5$	$(4 \cdot 3)(4 \cdot 3)(4 \cdot 3)(4 \cdot 3)(4 \cdot 3)$ $4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 \cdot 3 \cdot 3 \cdot 3 \cdot 3 \cdot 3$	$4^5 \cdot 3^5$
$(6 \cdot 2)^4$	$(6 \cdot 2)(6 \cdot 2)(6 \cdot 2)(6 \cdot 2)$	$6^4 \cdot 2^4$
$(2x^3)^2$	$(2x^3)(2x^3)$ $(2 \cdot x \cdot x \cdot x)(2 \cdot x \cdot x \cdot x)$	$2^2 \cdot x^6$

**Power of a Product Property:**

To find a power of a product, find the power of each factor and multiply.

$(a \cdot b)^m = a^m \cdot b^m$

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

Example:  
 $(2x^4y)^3 = 2^3 \cdot (x^4)^3 \cdot y^3 = 8x^{12}y^3$

**Examples:**

1.  $(3 \cdot 4)^2 = 3^2 \cdot 4^2$  evaluate:  $9 \cdot 16 = 144$

2.  $(3x^2y^3)^4 = 3^4 (x^2)^4 (y^3)^4 = 3^4 x^8 y^{12} = 81x^8y^{12}$

3.  $(-3y)^2 = (-3y)(-3y) = 9y^2$

4.  $-(3y^5)^2 = -3^2 (y^5)^2 = -9y^{10}$   
 $(y \cdot y \cdot y \cdot y \cdot y)(y \cdot y \cdot y \cdot y \cdot y)$

**Put it all together... Simplify:**

- $(4x^2y)^3 \cdot x^5 = 4^3 (x^2)^3 y^3 \cdot x^5 = 64x^6y^3x^5 = 64x^{11}y^3$   
 $x^6 \cdot x^5 = x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x \cdot x$
- $(3x^4y^3)^2 \cdot y^5 = 3^2 (x^4)^2 (y^3)^2 \cdot y^5 = 9x^8y^6 \cdot y^5 = 9x^8y^{11}$
- $(2x^2y)^5 \cdot x^6 = 2^5 (x^2)^5 y^5 \cdot x^6 = 32x^{10}y^5x^6 = 32x^{16}y^5$   
 $(x^2)^5 = x^2 \cdot x^2 \cdot x^2 \cdot x^2 \cdot x^2$