Powers of Products

Rule:

For all numbers *x* and *y*, and integers *n*,

$$(xy)^n = x^n y^n$$

"Notice: each factor of the product gets raised to the new power."

"Be sure to notice that this rule ONLY works when the inside of the parentheses is a single term (a product). "
"(no + signs or - signs separating the items)."

Consider:

$$\begin{aligned}(3x)^3 &= 3x \cdot 3x \cdot 3x \\ &= (3 \cdot 3 \cdot 3)(x \cdot x \cdot x) \\ &= 3^3 \cdot x^3 \\ &= 27x^3\end{aligned}$$

...when in doubt, expand terms to see what is happening.

Check out these examples of this rule at work:

$$(ab)^2 = a^2 \cdot b^2 = a^2 b^2$$

$$(2x^2)^3 = (2)^3 \cdot (x^2)^3 = 8x^6$$

... notice how the 2 was also affected by the power of 3 since it was inside the parentheses.

$2(3a^2)^3 = 2 \cdot 3^3 \cdot (a^2)^3$ $= 2 \cdot 27 \cdot a^6 = 54a^6$ Notice that the 2 is not affected by the power of 3 since it is not within the parentheses.
$(-x^2)^3 = (-1)^3 \cdot (x^2)^3$ $= -1 \cdot x^6 = -x^6$ Remember that -1 to a power of 3 is -1.
$(2a^{-3})^2 = 2^2 \bullet a^{-6} = \frac{4}{a^6}$ Be careful when working with negative exponents.
$4(-2x^3)^3 = 4 \cdot (-2)^3 \cdot (x^3)^3$ $= 4 \cdot (-8) \cdot x^9 = -32x^9$ Be sure to cube the -2 value.
$(ab^3c^2)(2ab)^3 - (ab)^2(3ab^2c)^2$ $= (ab^3c^2)(8a^3b^3) - (a^2b^2)(9a^2b^4c^2)$ $= 8a^4b^6c^2 - 9a^4b^6c^2$ $= -1a^4b^6c^2 = -a^4b^6c^2$ Did you notice the subtraction in this problem?
$P = (2K)^2W = (2)^2(K)^2W$ $= 4K^2W$ Formulas often involve working with powers.