

### Exponents: Power to a Power

When exponents are applied to exponential expressions, multiply the exponents.

e.g. (1)  $(4^2)^3 = 4^{2 \cdot 3} = 4^6$   
 (2)  $(x^3)^3 = x^{3 \cdot 3} = x^9$   
 (3)  $(m^{-6})^2 = m^{-6 \cdot 2} = m^{-12}$

When you have a power to a power it means the exponential expression in the brackets is the base of the exponent. The coefficient and the variables are being multiplied by itself the number of times indicated by the exponent.

$(5^2x^4)^3$ <p>We will work it out using the properties of multiplying exponents</p> $(5^2x^4)(5^2x^4)(5^2x^4)$ $5^6x^{12}$ $15625x^{12}$	$\longleftrightarrow$ <b>SAME ANSWER</b>	$(5^2x^4)^3$ <p>Now we will work it out using the rules for a power to a power</p> $(5^2x^4)^3$ $5^{2 \cdot 3}x^{4 \cdot 3}$ $5^6x^{12}$ $15625x^{12}$
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Remember a coefficient that does not have a visible exponent is to the power of 1.

$$\begin{array}{c}
 (2x^5)^3 \\
 \swarrow \quad \searrow \\
 (2^1x^5)^3 \\
 \swarrow \quad \searrow \\
 (2^1)^3 \quad (x^5)^3 \\
 (2^{1 \cdot 3})(x^{5 \cdot 3}) \\
 2^3x^{15} \\
 8x^{15}
 \end{array}$$

**Examples:**

(a)	$(x^4)^{-2}$ $x^{4 \cdot (-2)}$ $x^{-8}$	(b)	$(m^2)^6$ $m^{2 \cdot 6}$ $m^{12}$	(c)	$(3^{-4})^6$ $3^{(-4) \cdot 6}$ $3^{-24}$
(d)	$(5^1 a^4 b^3)^2$ $(5^2)(a^8)(b^6)$ $25a^8b^6$	(e)	$(6^0)^0$ $(1)^1$ $1$	(f)	$(2^{-3})^{-4}$ $2^{(-3) \cdot (-4)}$ $2^{12}$