EXAMPLES:

a) $(-4)^2 \cdot (-4)^5 = (-4)^{2+5} = \boxed{(-4)^7}$

b) $(2x)^3 \cdot (2x)^1 = (2x)^{3+1} = \boxed{(2x)^4}$

c) $2x^4y^2 \cdot 3x^2y^6$

$\boxed{6x^6y^8}$

PRODUCT OF POWERS PROPERTY

When finding the **product** of powers with the **same base**, add the exponents.

$$a^m \cdot a^n = a^{m+n}$$

QUOTIENT OF POWERS PROPERTY

When finding the **quotient** of powers with the **same base**, Subtract the exponents.

$$\frac{a^m}{a^n} = a^{m-n}$$

EXAMPLES:

a) $\frac{2^9}{2^6}$ $\quad 2^{9-6} = \boxed{2^3}$

b) $\left(\frac{5}{8}\right)^6 \div \left(\frac{5}{8}\right)^1 = \frac{5}{8}^{6-1} = \boxed{\left(\frac{5}{8}\right)^5}$

c) $h^6k^2 \div h^5k^1 = h^{6-5}k^{2-1}$

$\frac{h^6k^2}{h^5k^1} = \boxed{h^1k^1}$

EXAMPLES:

a) $(3^4)^2 = \boxed{3^8}$

b) $[(-x)^4]^3 = \boxed{-x^{12}}$

c) $[(-4)^2 \cdot (-4)^3]^6 =$

$-4^2 \cdot (-4)^{18} = \boxed{-4^{20}}$

POWER OF A POWER PROPERTY

When you **raise a power to a power**, keep the base and multiply the exponents.

$$(a^m)^n = a^{m \cdot n}$$

POWER OF A PRODUCT PROPERTY

When finding the **product** of two algebraic expressions with the **same exponent**, you can multiply their bases, and keep the exponent in place.

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

EXAMPLES:

a) $3^4 \cdot 7^4 = (3 \cdot 7)^4 = \boxed{21^4}$

b) $\left(-\frac{1}{3}\right)^5 \cdot \left(-\frac{2}{5}\right)^5 = \left(-\frac{1}{3} \cdot -\frac{2}{5}\right)^5 = +\left(\frac{2}{15}\right)^5 = \boxed{\left(\frac{2}{15}\right)^5}$

c) $(2r)^5 \cdot (7s)^5$

$(2r \cdot 7s)^5 = \boxed{(14rs)^5}$

EXAMPLES:

a) $\frac{(-8)^5}{(-2)^5} = \left(\frac{-8}{-2}\right)^5 = \boxed{4^5}$

b) $p^6 \div q^6$ $\quad \frac{p^6}{q^6} = \left(\frac{p}{q}\right)^6$

c) $\frac{4^5 \cdot 4^3}{2^2 \cdot 2^6} = \frac{4^8}{2^8} = \left(\frac{4}{2}\right)^8 = \boxed{2^8}$

POWER OF A QUOTIENT PROPERTY

When finding the **quotient** of two algebraic expressions with the **same exponent**, you can divide their bases, and keep the exponent in place.

$$\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m, b \neq 0$$

ZERO EXPONENT PROPERTY

Any **nonzero** number raised to the **zero power** is equal to 1.

$$a^0 = 1 \quad , a \neq 0$$

EXAMPLES:

a) $3^0 = \boxed{1}$

b) $7^3 \cdot 7^0 = 7^3 \cdot 1 = \boxed{7^3}$

c) $(a^4 \div a^0) \cdot a^3$

$a^4 \cdot a^3 = \boxed{a^7}$

EXAMPLES:

a) 5^{-2} $\quad \frac{1}{5^2} = \boxed{\frac{1}{25}}$

b) $\frac{x^{-7}}{x^4}$ $\quad x^{-7-4} = \boxed{x^{-11}}$

c) $9m \div 3m^{-2}$ $\quad \frac{9m^1}{3m^{-2}} = 3 \cdot m^{1-(-2)} = 3 \cdot m^{1+2} \; \boxed{3m^3}$

NEGATIVE EXPONENT PROPERTY

When finding **negative exponent**, take the reciprocal of the base and raise it to the positive power.

$$a^{-n} = \frac{1}{a^n}, a \neq 0$$

fractional exponents

$$a^{\frac{m}{n}} = \sqrt[n]{(a)^m}$$

or $\left(\sqrt[n]{a}\right)^m$

whichever makes sense - depending on base

a) $4^{1/2} = \sqrt[2]{4} = \boxed{2}$

b) $8^{1/3} = \sqrt[3]{8} = \boxed{2}$

c) $81^{3/4} = \left(\sqrt[4]{81}\right)^3 = \boxed{27}$