

PRINCIPLES - LESSON 10D

NEGATIVE AND ZERO EXPONENTS

$$2^3 = 8$$

$\div 2$

$$2^2 = 4$$

$\div 2$

$$2^1 = 2$$

$$2^0 = 1$$

$$2^{-1} = \frac{1}{2}$$

$$2^{-2} = \frac{1}{4}$$

$$2^{-3} = \frac{1}{8}$$

$$3^3 = 27$$

$\div 3$

$$3^2 = 9$$

$\div 3$

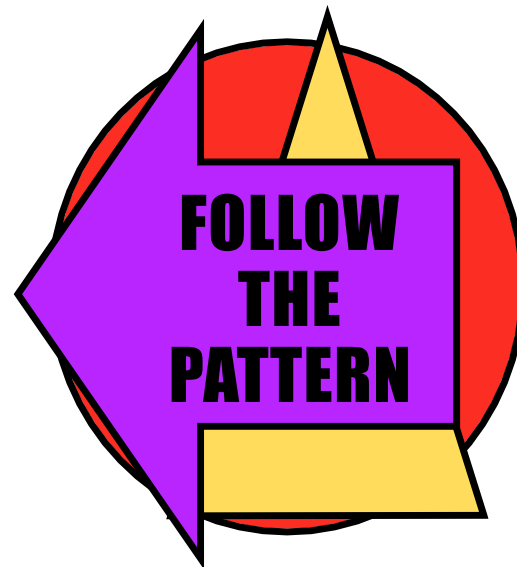
$$3^1 = 3$$

$$3^0 = 1$$

$$3^{-1} = \frac{1}{3}$$

$$3^{-2} = \frac{1}{9}$$

$$3^{-3} = \frac{1}{27}$$



WHAT DOES A NEGATIVE EXPONENT DO?

WHAT DOES A ZERO EXPONENT DO?



NEGATIVE & ZERO EXPONENTS

ZERO EXPONENTS

anything to the zero power = 1

$$\text{ex1) } 192^0 = \boxed{1}$$

$$\text{ex2) } (\text{abcdefg}^2)^0 = \boxed{1}$$

$$\text{ex3) } (6)^{-1} \\ = \frac{1}{6^1} = \boxed{\frac{1}{6}}$$

$$\text{ex4) } (6)^{-2} \\ = \frac{1}{6^2} = \boxed{\frac{1}{36}}$$

NEGATIVE EXPONENTS
flip fractions (produce reciprocals)

$$\text{ex5) } x^{-4} \\ = \boxed{\frac{1}{x^4}}$$

$$\text{ex6) } \frac{1}{n^{-3}} = \frac{1}{\frac{1}{n^3}} = 1 \div \frac{1}{n^3} \\ = 1 \cdot \frac{n^3}{1} = \boxed{n^3}$$

NEGATIVE & ZERO EXPONENTS

Simplify.

$$\begin{aligned} \text{ex7) } -x^{-2}x^{-3} &= -x^{-2+(-3)} = \frac{-1x^{-5}}{x^5} \\ &= \boxed{\frac{-1}{x^5}} \end{aligned}$$

NEGATIVE & ZERO EXPONENTS

Simplify.

$$\text{ex8)} \quad (m^{-5} n^{-3})^{-4} \underbrace{(m^{12} n^{-13})^0}_{=1}$$

$$= m^{20} n^{12} \cdot 1$$

$$= \boxed{m^{20} n^{12}}$$

NEGATIVE & ZERO EXPONENTS

Simplify.

$$\text{ex9)} \quad \frac{y^{-6}}{y^2} = \frac{\overbrace{y^{-6}}^{y^6}}{y^2 \underbrace{y^6}_{y^6}}$$

$$= \boxed{\frac{1}{y^8}}$$

$$\text{ex10)} \quad \frac{3z^{-9}}{6z^{-12}} = \frac{\overbrace{3z^{-9}}^{z^9}}{\underbrace{6z^{-12}}_{z^{12}}}$$

$$= \boxed{\frac{3z^3}{2}}$$

NEGATIVE & ZERO EXPONENTS

Simplify.

$$\text{ex11) } \frac{15r^{-9}s^{-12}t^0p^{-5}}{9rs^{19}t^{-6}p^{-3}}$$

$$\frac{15}{9} = \frac{5}{3}$$

$$= \frac{15r^{-9}s^{-12}t^0p^{-5}}{9r^1s^{19}t^{-6}p^{-3}}$$

$$= \frac{5 \cdot t^0 \cdot t^6 \cdot p^3}{3r \cdot r^9 \cdot s^{19} \cdot s^{12} \cdot p^5}$$

$$= \boxed{\frac{5t^6}{3r^{10}s^{31}p^2}}$$

NEGATIVE & ZERO EXPONENTS

Simplify.

$$\begin{aligned} \text{ex12)} \quad & \left(\frac{-4a^{-3}b^6c}{10a^5b^{-2}c^{-2}} \right)^{-2} = \left(\frac{-4 \underbrace{a^{-3}}_a \underbrace{b^6}_{b^2} c}{10 \underbrace{a^5}_{a^3} \underbrace{b^{-2}}_b \underbrace{c^{-2}}_c} \right)^{-2} \\ & \frac{-4}{10} = \frac{-2}{5} = \left(\frac{-2 \cdot \underbrace{b^6 \cdot b^2}_{b^8} \cdot \underbrace{c \cdot c^2}_{c^3}}{5 \cdot \underbrace{a^3 \cdot a^5}_{a^8}} \right)^{-2} \\ & = \left(\frac{-2b^8c^3}{5a^8} \right)^{-2} \xrightarrow{\text{change sign of exponent and flip fraction}} \left(\frac{5a^8}{-2b^8c^3} \right)^2 = \frac{(5a^8)^2}{(-2b^8c^3)^2} \\ & = \boxed{\frac{25a^{16}}{4b^{16}c^6}} \end{aligned}$$