PRINCIPLES - LESSON 10D
NEGATIVE AND ZERO EXPONENTS

$2^3 =$	8	$3^3 =$	27
	$\div 2$		$\div 3$
$2^2 =$	4	$3^2 =$	9
	$\div 2$		$\div 3$
$2^1 =$	2	$3^1 =$	3
$2^0 =$	1	$3^0 =$	1
$2^{-1} =$	$\frac{1}{2}$	$3^{-1} =$	$\frac{1}{3}$
$2^{-2} =$	$\frac{1}{4}$	$3^{-2} =$	$\frac{1}{9}$
$2^{-3} =$	$\frac{1}{8}$	$3^{-3} =$	$\frac{1}{27}$

FOLLOW THE PATTERN

WHAT DOES A NEGATIVE EXPONENT DO?

WHAT DOES A ZERO EXPONENT DO?

NEGATIVE & ZERO EXPONENTS

ZERO EXPONENTS
anything to the zero power = 1

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

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

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

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

NEGATIVE EXPONENTS
flip fractions (produce reciprocals)

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

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.

ex7) $-1x^{-2}x^{-3} = -1x^{-2+(-3)} = \frac{-1x^{-5}}{1} = \frac{-1}{x^5}$

NEGATIVE & ZERO EXPONENTS

Simplify.

ex8) $(m^{-5}n^{-3})^{-4}(m^{12}n^{-13})^{0}$ → $= 1$

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

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

NEGATIVE & ZERO EXPONENTS

Simplify.

ex9) $\dfrac{y^{-6}}{y^{2}} = \dfrac{y^{-6}}{y^{2}y^{6}}$

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

ex10) $\dfrac{3z^{-9}}{6z^{-12}} = \dfrac{3z^{-9}}{6z^{-12}} \cdot z^{12} \cdot z^{9}$

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

NEGATIVE & ZERO EXPONENTS

Simplify.

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

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

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

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

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

NEGATIVE & ZERO EXPONENTS

Simplify.

ex12) $\left(\dfrac{-4a^{-3}b^{6}c}{10a^{5}b^{-2}c^{-2}}\right)^{-2}$ $= \left(\dfrac{-4\,a^{-3}\,b^{6}\,c}{10\,a^{5}\,b^{-2}\,c^{-2}}\right)^{-2}$ (b^{2}, c^{2}, a^{3})

$\dfrac{-4}{10} = \dfrac{-2}{5}$ $= \left(\dfrac{-2\cdot b^{6}\cdot b^{2}\cdot c\cdot c^{2}}{5\cdot a^{3}\cdot a^{5}}\right)^{-2}$

change sign of exponent and flip fraction

$= \left(\dfrac{-2b^{8}c^{3}}{5a^{8}}\right)^{-2} = \left(\dfrac{5a^{8}}{-2b^{8}c^{3}}\right)^{2} = \dfrac{(5a^{8})^{2}}{(-2b^{8}c^{3})^{2}}$

$= \boxed{\dfrac{25a^{16}}{4b^{16}c^{6}}}$