MCF3M **Negative and Zero Exponents** **Name:** ______________

We know that exponents are used to simplify repeated multiplication expressions. For example,

$$3\times3\times3\times3\times3\times3\times3=3^7$$

But what do expressions like 2^{-5} or 8^0 mean? Let's work backwards to figure this out.

2^3	$2\times2\times2=8$ $\div 2$
2^2	$2\times2=4$ $\div 2$
2^1	2 $\div 2$
2^0	1 $\div 2$
2^{-1}	$\frac{1}{2}$ $\div 2$
2^{-2}	$\frac{1}{4}=\frac{1}{2^2}$
2^{-3}	$\frac{1}{8}=\frac{1}{2^3}$

Rewrite each power with a positive exponent, then evaluate.

$7^{-2}=\frac{1}{7^2}=\frac{1}{49}$

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

$3^0=1$

$0^{-8}=0$

$(-2)^{-5}=\frac{1}{(-2)^5}=\frac{1}{-32}$

$(-2)^{-4}=\frac{1}{(-2)^4}=\frac{1}{16}$

$-9^{-2}=-\frac{1}{9^2}=-\frac{1}{81}$

$\left(\frac{1}{2}\right)^{-3}=\left(\frac{2}{1}\right)^3=\frac{8}{1}=8$

$\left(-\frac{3}{4}\right)^{-1}=\left(-\frac{4}{3}\right)^1=-\frac{4}{3}$

$\left(\frac{2}{3}\right)^{-3}=\left(\frac{3}{2}\right)^3=\frac{3^3}{2^3}=\frac{27}{8}$

if exponent is an odd number, negative sign stays

$\left(-\frac{2}{3}\right)^{-3}=\left(-\frac{3}{2}\right)^3=-\frac{27}{8}$

even number $\therefore$ positive answer

$\left(-\frac{2}{3}\right)^{-2}=\left(-\frac{3}{2}\right)^2=\frac{9}{4}$

$5^{-1}+(6-2)^0=\frac{1}{5}+4^0$

$=\frac{1}{5}+1$

$=1\frac{1}{5}$ or $\frac{6}{5}$

Write the fraction $\frac{1}{16}$ as a power of 2.

$2\times2\times2\times2=16$

$2^4=16 \rightarrow \frac{1}{16}=\frac{1}{2^4}=2^{-4}$