Warmup!

Don't copy - lets do them together!

Review: tricky negatives ...evaluate each of the following.

a) $(-2)^4$ b) -2^4 c) -3^2 d) $(-3)^2$ e) $-(-5)^2$

$= 16$ $= -16$ $= -9$ $= 9$ $= -25$

$= -(-5)(-5)$

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Don't write - just follow.....

Complete the following chart. Evaluate each to standard form. Leave as whole numbers or fractions.

Expression to be Simplified	Write in Expanded Form	Using Exponent Laws
$\frac{2^3}{2^1}$	$= \frac{2 \times 2 \times \cancel{2}}{\cancel{2}}$ $= 4$	$2^{3-1} = 2^2$ $= 4$
$\frac{2^3}{2^2}$	$= \frac{2 \cdot \cancel{2} \cdot \cancel{2}}{\cancel{2} \cdot \cancel{2}} = 2$	$2^{3-2} = 2^1$ $= 2$
$\frac{2^3}{2^3}$	$= \frac{2 \cdot 2 \cdot 2}{2 \cdot 2 \cdot 2}$ $= 1$	$2^{3-3} = 2^0$ $= 1$
$\frac{2^3}{2^4}$	$= \frac{\cancel{2} \cdot \cancel{2} \cdot \cancel{2}}{\cancel{2} \cdot \cancel{2} \cdot \cancel{2} \cdot 2}$ $= \frac{1}{2}$	$2^{3-4} = 2^{-1}$ $= \frac{1}{2}$

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Now write...

3.2 Zero and Negative Exponents

Zero Exponents: Any base to the exponent 0 equals 1

ex. $4^0 = 1$ ex. $(-3)^0 = 1$

note your BASE cannot be 0

Ex. 1 Evaluate each of the following:

a) 5^0 b) 4^0 c) $(-3)^0$ d) -4^0

$= 1$ $= 1$ $= 1$ $= -1$

Negative Exponents:

Any base to a negative exponent ...

invert (flip) the base and make the exponent positive.

ex. 4^{-1}

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

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

$= \frac{1}{4}$

ex. $\left(\frac{1}{3}\right)^{-1}$

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

$= 3$

ex. $\left(\frac{3}{4}\right)^{-2}$

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

$= \frac{4^2}{3^2}$

$= \frac{16}{9}$

Ex. 2 Evaluate. No decimals.

a) 8^{-2} b) $(-3)^{-4}$ c) -3^{-2} d) 1^{-7}

$= \frac{1}{8^2}$ $= \frac{1}{(-3)^4}$ $= -\frac{1}{3^2}$ $= \frac{1}{1^7}$

$= \frac{1}{64}$ $= \frac{1}{81}$ $= -\frac{1}{9}$ $= 1$

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Ex. 3 Evaluate. No decimals.

a) $\left(\frac{1}{4}\right)^{-2}$

$= \left(\frac{4}{1}\right)^{2}$

$= 4^2$

$= 16$

b) $\left(\frac{2}{5}\right)^{-1}$

$= \left(\frac{5}{2}\right)^{1}$

$= \frac{5}{2}$

c) $\left(\frac{3}{7}\right)^{-2}$

$= \left(\frac{7}{3}\right)^{2}$

$= \frac{7^2}{3^2}$

$= \frac{49}{9}$

Ex. 4 Use exponent laws to write as a single power, then evaluate. No decimals.

a) $5^3 \times 5^{-5}$

$= 5^{3+(-5)}$

$= 5^{-2}$

$= \frac{1}{5^2}$

$= \frac{1}{25}$

b) $(2^3)^{-2}$

$= 2^{-6}$

$= \frac{1}{2^6}$

$= \frac{1}{64}$

c) $4^{-3} \div 4^{-5}$

$= 4^{-3-(-5)}$

$= 4^{-3+5}$

$= 4^2$

$= 16$

d) $\left(\frac{1}{3^2}\right)\left(\frac{1}{3^{-6}}\right)$

$= \frac{1}{3^2 \cdot 3^{-6}}$

$= \frac{1}{3^{2+(-6)}}$

$= \frac{1}{3^{-4}}$

$= 3^4$

$= 81$

e) $\frac{7^2}{7^4}$

$= 7^{2-4}$

$= 7^{-2}$

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

$= \frac{1}{49}$

f) $(-2)^3(-2)^{-4}$

$= (-2)^{3+(-4)}$

$= (-2)^{-1}$

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

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

g) $\frac{12^6}{12^6}$

$= 12^{6-6}$

$= 12^0$

$= 1$

h) $\left(\frac{1}{2}\right)^{-5}\left(\frac{1}{2}\right)^{3}$

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

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

$= 2^2$

$= 4$

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Ex. 5 Write each number as a power with the stated base

25 (with base of 5)

$= 5^2$

32 (with base of 2)

$= 2^5$

Ex. 6

Write each numerator and denominator as a power with the same base, then use exponent laws to simplify.

Write your answer as a power with positive exponents.

hint try base of 3

a) $\frac{64}{16}$

$= \frac{4^3}{4^2}$

$= 4^{3-2}$

$= 4$

b) $\frac{243}{2187}$

$= \frac{3^5}{3^7}$

$= 3^{5-7}$

$= 3^{-2}$

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

$= \frac{1}{9}$

c) $\frac{1}{25} \times \frac{1}{125}$

$= 5^{-2} \times 5^{-3}$

$= 5^{-2+(-3)}$

$= 5^{-5}$

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

$= \frac{1}{3125}$

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#2$_{ag}$, 3$_{\text{left column}}$, 8$_{\text{left column}}$

#11$_{ac}$, 12-15, 16$_{dh}$

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