

Reminder:

- When you are multiplying like bases, you add the exponents.
- When you are dividing like bases, you subtract the exponents.
- When an exponent is taken to another exponent, you multiply the exponents.
- Anything to a zero power is always one.

OBJECTIVE 1: Simplifying Expressions Containing Negative Exponents

Remember exponents only affect what it is touching () matter!

Negative exponents are “happier or more positive” anywhere else. So if you change the location (denominator or numerator) of anything with a negative exponent, it changes to positive.

$$\frac{x^2}{x^5} = x^{2-5} = x^{-3}, x \neq 0$$

$$\frac{x^2}{x^5} = \frac{\overset{1}{x} \cdot \overset{1}{x}}{\underset{1}{x} \cdot \underset{1}{x} \cdot \underset{1}{x} \cdot \underset{1}{x} \cdot \underset{1}{x}} = \frac{1}{x^3}$$

So...
 $a^{-n} = \frac{1}{a^n}$ OR $\frac{1}{a^{-n}} = a^n$
 Move everything the negative exponent is touching, and change the exponent to positive.

TASK 2: Simplify by writing each expression with positive exponents only.

a) 3^{-2}

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

b) $2x^{-3}$

$$\frac{2}{x^3}$$

c) $2^{-1} + 4^{-1}$

$$\frac{2}{2} + \frac{1}{4} = \frac{2}{2} + \frac{1}{4} = \boxed{\frac{3}{4}}$$

d) $(-2)^{-4}$

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

TASK 3: Simplify each expression. Write results using positive exponents only.

a) $\frac{1}{x^{-3}}$ x^3

b) $\frac{1}{3^{-4}}$

$3^4 = \boxed{81}$

c) $\frac{p^{-4}}{q^{-9}}$

$\frac{q^9}{p^4}$ $\frac{q^9}{p^4}$

d) $\frac{5^{-3}}{2^{-5}}$ = $\frac{2^5}{5^3}$ = $\frac{32}{125}$

TASK 4: Simplify each expression. Write answers with positive exponents.

a) $\frac{y}{y^{-2}} = y^{1-(-2)} = y^3$ y^3

b) $\frac{3}{x^{-4}} = \boxed{3x^4}$

c) $\frac{x^{-5}}{x^7}$

$\frac{1}{x^{7+5}} = \frac{1}{x^{12}}$ $\frac{1}{x^{12}}$

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

TASK 5: Simplify the following expressions. Write each result using positive exponents only.

a) $(y^{-3}z^6)^{-6}$

$(y^{-3 \cdot -6})(z^{6 \cdot -6}) = y^{18}z^{-36} = \frac{y^{18}}{z^{36}}$ $\frac{y^{18}}{z^{36}}$

b) $\frac{(2x^3)^4}{x^7}$

$\frac{2^4(x^{3 \cdot 4})}{x^7} = \frac{16x^{12}}{x^7} = 16x^5$ $16x^5$

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

$\left(\frac{b}{3a^2}\right)^3 = \frac{b^3}{(3^3)(a^{2 \cdot 3})} = \frac{b^3}{27a^6}$ $\frac{b^3}{27a^6}$

d) $\frac{4^{-1}x^{-3}y}{4^{-3}x^2y^{-6}}$

$\frac{4^3 y y^6}{4 x^2 x} = \frac{4^3 y^7}{4 x^3}$ $\frac{16y^7}{x^3}$

e) $\left(\frac{-2x^3y}{xy^{-1}}\right)^3$

$= \frac{(-2)^3(x^3)^3(y)^3}{(x)^3(y^{-1})^3} = \frac{-8x^9y^3}{x^3y^{-3}} = \frac{-8x^6y^6}{x^3y^{-3}} = \boxed{-8x^6y^6}$

Still need help with:

$\frac{16x^{13}}{x^7} = \boxed{16x^6}$