

Negative Exponents

$x^{-1} \rightarrow$ an unhappy exponent  move it to bottom $\frac{1}{x^1}$ 

$$\frac{x^{-2}}{y^{-3}} \rightarrow \frac{y^3}{x^2} \img alt="happy sun emoji" data-bbox="218 142 276 181"/>$$

We need to make sure that our answers DO NOT contain negative exponents
This can be done as the last step as all exponent laws still apply

1) Simplify the following

a) $(7x^{-4})(10x^{17})$
 $= 70x^{13}$ (the negative expo took care of itself)

b) $(-12x^{-19})(5x^{10})$
 $= -60x^{-9}$ make x happy $= \frac{-60}{x^9}$ (only negative expo move – not coefficients)

c) $\frac{28x^{12}}{4x^{-4}}$
 $= 7x^{16}$ (the negative expo took care of itself $12 - (-4) = 16$)

d) $\left(\frac{2x^{-5}}{y^6}\right)^{-3}$
 flip it first: $\left(\frac{y^6}{2x^{-5}}\right)^3$ apply the power $\frac{y^{18}}{8x^{-15}}$ move x $= \frac{y^{18}x^{15}}{8}$

e) $\left(\frac{-5x^{-4}}{4y^{-2}}\right)^{-2}$
 flip it first: $\left(\frac{4y^{-2}}{-5x^{-4}}\right)^2$ apply the power $\frac{16y^{-4}}{25x^{-8}}$ move x,y $= \frac{16x^8}{25y^4}$

f) $\frac{-48x^{-5}y^{-6}}{56x^{11}y^{-10}}$
 move x down, y up $\frac{-48y^{-6+10}}{56x^{11+5}} \rightarrow = \frac{-6y^4}{7x^{16}}$

g) $(2x^3)^4(-x^{-4})^5$
 simplify: $(16x^{12})(-1x^{-20})$ combine $-16x^{-8}$ move x $= \frac{-16}{x^8}$

h) $(6x^2)^{-2}(4x^3)$
 rewrite: $\frac{4x^3}{(6x^2)^2} \rightarrow \frac{4x^3}{36x^4}$ reduce: $= \frac{1}{9x}$

Working with numbers (assume no calculator)

If you don't remove the negative exponents ...

Nasty decimals may appear 😞

Negative Exponents



2) Simplify the following

a) 7^3

$$= \frac{1}{7^3} \rightarrow \frac{1}{343}$$

b) $(-9)^3$

$$= \frac{1}{(-9)^3} \rightarrow \frac{1}{-729} \text{ (notice negative did not cancel)}$$

c) $(-12)^2$

$$= \frac{1}{(-12)^2} \rightarrow \frac{1}{144} \text{ (notice negative did cancel due to even power)}$$

3) Write using exponents other than -1

a) $\frac{1}{81}$

$$81 = 9 \times 9 \text{ or } 3 \times 3 \times 3 \times 3 \quad \text{Answer(s): } 9^{-2} \text{ or } 3^{-4}$$

b) $-\frac{1}{64}$

$$64 = 4 \times 4 \times 4 \text{ or } 2 \times 2 \times 2 \times 2 \times 2 \times 2$$

but need a negative so only answer is $(-4)^{-3}$

c) $\frac{-125}{49}$

$$125 = 5 \times 5 \times 5 \quad 49 = 7 \times 7 \quad \text{Answer: } (-5)^3(7)^{-2}$$

Assignment = worksheet

Negative Exponents (worksheet)

1) Simplify the following (write answer with no negative exponents)

a) $(x^{-9})(x^{-4})$

b) $\frac{p^{-7}}{p^2}$

c) $(x^{-13})(x^8)$

d) $(y^5)(y^{-9})$

e) $\frac{x^{-5}}{x^{13}}$

f) $\frac{a^7}{a^{-4}}$

g) $\frac{m^{-14}}{m^{-17}}$

h) $(x^{-5})(x^{17})$

i) $\frac{t^{-9}}{t^{-17}}$

j) $(5n^{-4})(2n^{17})$

k) $\frac{12x^4}{3x^{-4}}$

k) $\frac{60x^5}{12p^{-5}}$

l) $\frac{16w^{-8}}{4w^{-2}}$

m) $(7a^{-4})(-4a^{-2})$

n) $(-12y^{-9})(6y^{17})$

o) $\frac{15x^{-15}}{3x^5}$

p) $-4m^{-7}(3m^{-2})$

q) $\frac{18x^5}{-3x^{-8}}$

2) Simplify the following (write answer with no negative exponents)

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

b) $\left(\frac{x}{y^2}\right)^{-2}$

c) $\left(\frac{x^4}{y^2}\right)^{-3}$

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

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

f) $\left(\frac{x^{-5}}{y^6}\right)^{-3}$

g) $\left(\frac{3x^7}{2y^{-2}}\right)^{-3}$

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

2) **Simplify**

a) $\frac{(x^{-2})^3}{(x^3)^4}$

b) $(y^4)^2(y^{-2})^6$

c) $\frac{(m^{-3})^4}{(x^5)^{-2}}$

d) $(x^2)^{-7}(x^{-3})^{-4}$

e) $(x^2)^4(x^{-4})^5$

f) $(7x^2)^{-2}(x^3)$

g) $\frac{-3x^{-4}y^8}{x^9y^{-4}}$

h) $\frac{-6x^{-5}y^{-6}}{3x^{11}y^{10}}$

i) $\frac{-18x^6y^{-30}}{9x^{-4}y^{-12}}$

j) $\frac{50x^{-7}y^{40}}{4x^{-4}y^{-12}}$

3) **Write the following using an exponent other than -1**

a) $\frac{1}{169}$

b) $\frac{1}{64}$

c) $\frac{1}{81}$

d) $\frac{1}{10000}$

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6a)

b)

c)

7a)

b)

c)

8a)

b)

c)

d)

e)

f)

10a)

b)

c)

d)