

4.2: Negative Exponents (Cont'd)

Note Title

2/26/2015

Ex: $2^{-3} = \frac{2^{-3}}{1} = \frac{1}{2^3} = \boxed{\frac{1}{8}}$

$(-3)^{-4} = \frac{(-3)^{-4}}{1} = \frac{1}{(-3)^4} = \boxed{\frac{1}{81}}$

$5^{-2} = \frac{5^{-2}}{1} = \frac{1}{5^2} = \boxed{\frac{1}{25}}$

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

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

$-3^{-4} = -\frac{3^{-4}}{1} = -\frac{1}{3^4} = \boxed{-\frac{1}{81}}$

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

$\frac{3}{4^{-2}} = \frac{3 \cdot 4^2}{1} = \frac{3 \cdot 16}{1} = \frac{48}{1} = \boxed{48}$

Ex: $2^{-3} + 2^{-4} = \frac{2^{-3}}{1} + \frac{2^{-4}}{1} = \frac{1}{2^3} + \frac{1}{2^4} = \frac{1}{8} + \frac{1}{16}$
 $= \frac{1}{8} \cdot \frac{2}{2} + \frac{1}{16}$
 $= \frac{2}{16} + \frac{1}{16} = \boxed{\frac{3}{16}}$

Ex: $x^{-3} x^{-4} = x^{-7} = \frac{x^{-7}}{1} = \boxed{\frac{1}{x^7}}$

Ex: $2x^{-5} = \frac{2x^{-5}}{1} = \boxed{\frac{2}{x^5}}$

Ex: $(2x)^{-5} = \frac{(2x)^{-5}}{1} = \frac{1}{(2x)^5} = \frac{1}{2^5 x^5} = \boxed{\frac{1}{32x^5}}$

Recall: Definition of a Negative Exponent

$$x^{-n} = \frac{1}{x^n}$$

Ex: $\frac{2x^{-3}}{x^2y^{-4}} = \frac{2}{x^3x^2} \frac{y^4}{1} = \boxed{\frac{2y^4}{x^5}}$

Ex: $\frac{x^3y^{-2}z^{-1}}{x^{-2}y^{-4}z^5} = \frac{x^3}{y^2z^4} \frac{x^2y^4}{z^5} = \frac{x^5y^4}{y^2z^9} = \boxed{\frac{x^5y^2}{z^9}}$

Ex: $\left(\frac{2x^2}{y^4}\right)^{-3} = \frac{2^{-3}x^{-6}}{y^{-12}} = \frac{y^{12}}{2^3x^6} = \boxed{\frac{y^{12}}{8x^6}}$

Ex: $\frac{(-x^{-2}y^1)^{-4}}{(-3x^2y^{-2})^3} = \frac{(-1)^{-4}x^8y^{-4}}{(-3)^3x^6y^{-6}} = \frac{x^8}{(-1)^4y^{16}(-27)x^6}y^6$
 $= \frac{x^8y^6}{1(-27)y^{16}x^6} = \frac{x^2}{-27y^{10}} = \boxed{-\frac{x^2}{27y^{10}}}$

Example: $\frac{-3x^{-5}(x^{-1}y^3z^{-2})^{-4}}{(3x^2y^1)^{-2}(2xy^{-3}z)^1} = \frac{-3x^{-5}x^4y^{-12}z^8}{3^{-2}x^{-4}y^{-8} \cdot 2^1x^1y^{-3}z^1}$

$= \frac{-3}{x^5} \frac{x^4}{y^{12}} \frac{z^8 \cdot 3^2x^4y^8}{2^1x^1y^{-3}z^1} \frac{y^{12}}{z^4}$

$= \frac{-3(9)x^4z^8x^4y^8y^{12}}{16x^5y^{12}x^1z^4} = \frac{-27x^8y^{20}z^8}{16x^9y^{12}z^4}$

$= \boxed{\frac{-27y^8z^4}{16x}} = \boxed{-\frac{27y^8z^4}{16x}}$

Note:

$\frac{1}{-4} = -\frac{1}{4} \quad \frac{-1}{4} = -\frac{1}{4}$

All these are equal
 So we can pull all minus
 sign from numerator or denom.
 & write it outside
 the fraction.

What if the exponent is 0?

Important Fact:

$$x^0 = 1, \text{ as long as } x \neq 0.$$

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Here's the reason:

$$\frac{2^3}{2^3} = \frac{8}{8} = 1$$

Property of Exponents:

$$\frac{2^3}{2^3} = 2^{3-3} = 2^0$$

using $\frac{x^a}{x^b} = x^{a-b}$
must be the same!
So $2^0 = 1$

Same approach works for other bases, except for a base of 0 (cannot divide by 0)

Ex: $(-5)^0 = 1$

$$(25x^2y^3z)^0 = 1 \quad (\text{as long as } x \neq 0, y \neq 0, z \neq 0)$$

Note: 0^0 is not defined.

Scientific Notation (In sections 4.1 and 4.2)

We write numbers with one digit to the left of the decimal point and a power of 10.
(used for very large and very small numbers)

Example: $3254 = 3.254 \times 10^3$ in scientific notation

Ex: write 278163 in scientific notation.
 2.78163×10^5

Ex: Write 0.0001732 in scientific notation.

$$1.732 \times 10^{-4}$$

Check: 0 0 0 0 0 0 1.732

Ex: Write the number without scientific notation.
 $2.5731 \times 10^{-3} = 0.0025731$

0 0 0 0 2.5731

Prereading Assignment

Read 4.3 (pp 335-338)

Read 4.4 (pp 343-345)

Rework Example 2 from 4.3 (pp 336)

work similar problem: Matched Problem #2

Rework Example 4 from 4.4 (p 344)

work similar problem: Matched problem #4