

4.2: Division with Exponents and Negative Exponents (cont'd)

Note Title

2/26/2015

Homework Q's

$$\underline{4.1 \#49} \quad (0.5ab)^2 = (0.5)^2 a^2 b^2 \\ = \boxed{0.25a^2b^2}$$

$$\begin{array}{r} 0.5 \\ \times 0.5 \\ \hline .25 \end{array}$$

$$\begin{array}{r} \text{Note: } 5 \\ \times 0.5 \\ \hline 2.5 \end{array}$$

Section 4.2 (cont'd)

Recall: Definition of a negative exponent:

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

In this class, we will write all our answers with positive exponents only.

Ex: Simplify x^{-2} .

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

Examples:

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

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

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

$$-3^{-5} = -\frac{3^{-5}}{1} = -\frac{1}{3^5} = \boxed{-\frac{1}{243}}$$

$$\begin{array}{r} 81 \\ \underline{3} \\ 243 \end{array}$$

More examples:

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

$$\frac{4}{3^{-2}} = \frac{4 \cdot 3^2}{1} = \frac{4 \cdot 9}{1} = \frac{36}{1} = \boxed{36}$$

Ex:

$$\left(\frac{2}{3}\right)^{-4} = \frac{2^{-4}}{3^{-4}} = \frac{3^4}{2^4} = \boxed{\frac{81}{16}}$$

OR

$$\left(\frac{2}{3}\right)^{-4} = \left(\frac{3}{2}\right)^4 = \frac{3^4}{2^4} = \boxed{\frac{81}{16}}$$

Ex:

$$\left(-\frac{3}{5}\right)^{-4} = \left(-\frac{5}{3}\right)^4 = + \frac{5^4}{3^4} = \boxed{\frac{625}{81}}$$

Ex:

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

Ex:

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

OR

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

Ex:

$$4^{-1} + 4^{-2} = \frac{4^{-1}}{1} + \frac{4^{-2}}{1}$$

$$= \frac{1}{4^1} + \frac{1}{4^2} = \frac{1}{4} + \frac{1}{16}$$

$$= \frac{1}{4} \cdot \frac{4}{4} + \frac{1}{16}$$

$$= \frac{4}{16} + \frac{1}{16} = \boxed{\frac{5}{16}}$$

$$\text{Ex: } \frac{2x^4 y^{-3}}{x^{-2} y^{-5}} = \frac{2x^4 x^2 y^5}{y^3} = \frac{2x^6 y^5}{y^3} = \frac{2x^6 y^2}{1} = \boxed{2x^6 y^2}$$

$$\begin{aligned} \text{Ex: } \frac{-3x^{-4} y^2 z^{-6}}{2x^{-1} y^{-8} z^{-2}} &= \frac{-3 y^2 x^1 y^8 z^2}{x^1 z^6 \cdot 2} \\ &= \frac{-3 x y^{10} z^2}{2 x^1 z^6} = \boxed{\frac{-3 y^{10}}{2 x^3 z^4}} = \boxed{-\frac{3 y^{10}}{2 x^3 z^4}} \end{aligned}$$

$$\text{Note: } \frac{-1}{4} = -\frac{1}{4} \quad \text{also} \quad \frac{1}{-4} = -\frac{1}{4}$$

$$\text{So, } \frac{-1}{4} = \frac{1}{-4} = -\frac{1}{4}$$

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

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

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

$$= \frac{-3 \cdot 9 x^8 y^{20} z^8}{16 x^9 y^{12} z^4} = \boxed{\frac{-27 y^8 z^4}{16 x}} = \boxed{-\frac{27 y^8 z^4}{16 x}}$$

Important Fact:

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

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Here's why:

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

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

These must be equal!

$$\text{so } 2^0 = 1$$

Using the same logic, $5^0 = 1$

$$(-3)^0 = 1$$

Note: 0^0 is undefined

(we could not duplicate this logic for a base of 0, because division by 0 is undefined)

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

$$(4x^3 y^3 z^{123})^0 = 1 \quad (\text{as long as } x \neq 0, y \neq 0, z \neq 0)$$

Scientific Notation (Sections 4.1 and 4.2)

In scientific notation, we write numbers with 1 digit to the left of the decimal point, multiplied by a power of 10.

Big numbers: 10 to a positive power

Small numbers: 10 to a negative power

Ex: Write 32541 in scientific notation.

$$\boxed{3.2541 \times 10^4}$$

32541
↑
4 slots

Ex: write 0.00012345 in scientific notation

$$0.00012345 = 1.2345 \times 10^{-4}$$

4 slots

Ex: write 2.317×10^5 without scientific notation

$$2317000000 = 231,700$$

Ex: write 5.29734×10^{-3} without scientific notation

$$000.00529734 = 0.00529734$$

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