

5.1: Multiplying & Dividing Expressions w/commas

Note Title

Buses

6/19/2017

(Exponents Part I)

$$\underline{\text{Ex:}} \quad -4^2 = \boxed{-16}$$

$$\underline{\text{Ex:}} \quad x^2 x^5 = \boxed{x^7}$$

$$\underline{\text{Ex:}} \quad (-4)^2 = \boxed{16}$$

$$\underline{\text{Ex:}} \quad \frac{x^{10}}{x^4} = \boxed{x^6}$$

$$\underline{\text{Ex:}} \quad \left(\frac{3}{4}\right)^3 = \frac{3}{4} \left(\frac{3}{4}\right) \left(\frac{3}{4}\right) = \frac{3^3}{4^3} = \boxed{\frac{27}{64}}$$

$$\underline{\text{Ex:}} \quad 22^1 = \boxed{22} \quad \underline{\text{Ex:}} \quad (-1)^{50} = \boxed{1}$$

$$\underline{\text{Ex:}} \quad (-1)^{63} = \boxed{-1}$$

$$\underline{\text{Ex:}} \quad -3(-2)^5 \\ -3(-32) \\ = \boxed{96}$$

$$\underline{\text{Ex:}} \quad 3^2 + 4^3 \\ = 9 + 64 = \boxed{73}$$

$$\underline{\text{Ex:}} \quad \left(-\frac{1}{2}\right)^4 = +\frac{1^4}{2^4} = \frac{1}{16}$$

$$\underline{\text{Ex:}} \quad \left(-\frac{2}{5}\right)^3 = -\frac{2^3}{5^3} = \boxed{-\frac{8}{125}}$$

Ex. Evaluate for $x = -3, y = 4$

$$-3x^3 + (-5y)^2$$

$$-3(-3)^3 + (-5(4))^2$$

$$= -3(-27) + (-20)^2$$

$$= 81 + 400$$

$$= \boxed{481}$$

Ex. $a^3 \cdot a \cdot a^5$

$$= a^{3+1+5} = \boxed{a^9}$$

Ex. $\frac{4^{12}}{4^{10}} = 4^{12-10}$

$$= 4^2 = \boxed{16}$$

Ex. $\frac{y^3 y^6}{y^4} = \frac{y^9}{y^4} = \boxed{y^5}$

Ex. $(-2c^2d^3)(6c^3d)$

$$= -2(6)c^2c^3d^3d$$

$$= \boxed{-12c^5d^4}$$

Ex. $(3r^5)(-4r^2)(r)$

$$= \boxed{-12r^8}$$

Ex. $\frac{15a^3a^{11}}{20a^4a^5}$

$$= \frac{15a^{14}}{20a^9}$$

$$= \frac{3a^5}{4} = \boxed{\frac{3}{4}a^5}$$

5.2: More Properties of Exponents (Exponents Part II)

Recall: Properties of Exponents

$$1) x^a x^b = x^{a+b}$$

$$2) \frac{x^a}{x^b} = x^{a-b}$$

$$3) (x^a)^b = x^{ab}$$

$$4) (xy)^a = x^a y^a$$

$$5) \left(\frac{x}{y}\right)^a = \frac{x^a}{y^a}$$

Ex: $(2^2)^3 = 2^6 = \boxed{64}$ ← equal

OR $(2^2)^3 = (4)^3 = \boxed{64}$ ←

Ex: $(-2a)^4$

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

Ex: $(3xy)^3$

$$3^3 x^3 y^3$$
$$= \boxed{27x^3y^3}$$

Simplify

Ex.: $\left(-\frac{c}{d}\right)^5$

$$\frac{(-1)^5 c^5}{d^5} = -\frac{c^5}{d^5} = \boxed{-\frac{c^5}{d^5}}$$

Ex.: $(c^2 d^3 h)^4$

$$= (c^2)^4 (d^3)^4 (h)^4$$

$$= \boxed{c^8 d^{12} h^4}$$

Ex.: $(-6 x^4 y^3)^2$

$$(-6)^2 x^8 y^6$$

$$= \boxed{36 x^8 y^6}$$

Ex.: $(-3x^4 y^2)^2 (-2x^5 yz)^3$

$$(-3)^2 x^8 y^4 (-2)^3 x^{15} y^3 z^3$$

$$9 x^8 y^4 \cdot (-8) x^{15} y^3 z^3$$

$$= \boxed{-72 x^{23} y^7 z^3}$$

Ex.: $\left(\frac{-5x^4}{y^5 z^2}\right)^3$

$$\frac{(-5)^3 x^{12}}{y^{15} z^6}$$

$$= \boxed{\frac{-125 x^{12}}{y^{15} z^6}}$$

$$= \boxed{-\frac{125 x^{12}}{y^{15} z^6}}$$

5.3: Definitions of b^0 and b^{-n}

(Exponents Part III - Negative Exponents)

Definition of a negative exponent

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

(x^{-n} is the reciprocal of x^n)

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

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

By the way: $x^{-1} = \frac{x^{-1}}{1} = \frac{1}{x^1} = \frac{1}{x}$

because

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

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

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

Simplify.

Ex: 3^{-2}

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

$$\underline{\text{Ex:}} \quad -2^{-4} = -\frac{2^{-4}}{1} = -\frac{1}{2^4} = \boxed{-\frac{1}{16}}$$

$$\underline{\text{Ex:}} \quad (-3)^{-4} = \frac{(-3)^{-4}}{1} = \frac{1}{(-3)^4} = \boxed{\frac{1}{81}}$$

$$\underline{\text{Ex:}} \quad \left(\frac{2}{3}\right)^{-2} = \frac{2^{-2}}{3^{-2}} = \frac{3^2}{2^2} = \boxed{\frac{9}{4}}$$

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

$$\underline{\text{Ex:}} \quad \frac{1}{5^{-2}} = \frac{5^2}{1} = \frac{25}{1} = \boxed{25}$$

Simplify. Write variables with positive exponents only.

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

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

Ex. $\frac{x^{-4} y^{-3}}{x^5 y^{-6}} = \frac{y^6}{x^4 y^3 x^5} = \frac{y^6}{x^9 y^3} = \boxed{\frac{y^3}{x^9}}$

Ex. $x^{-12} y^5 x^8 y^{-7} = \frac{x^{-12} y^5 x^8 y^{-7}}{1} = \frac{y^5 x^8}{x^{12} y^7}$

Note: $\frac{y^5 x^8}{x^{12} y^7} = y^{5-7} x^{8-12}$

$= y^{-2} x^{-4}$

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

Recall: $\frac{x^a}{x^b} = x^{a-b}$

same as $\boxed{\frac{1}{x^4 y^2}}$

both OK

Definition of an Exponent of 0

Ex. $\frac{2^3}{2^3} = \frac{8}{8} = 1$ must be equal

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

Ex: $2^5 = 32$

$$2^4 = 2^5 \div 2 = 32 \div 2 = 16$$

$$2^3 = 16 \div 2 = 8$$

$$2^2 = 8 \div 2 = 4$$

$$2^1 = 4 \div 2 = 2$$

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

★

Important Fact: $x^0 = 1$ as long as $x \neq 0$

Note: 0^0 is undefined

Ex: $(-5)^0 = \boxed{1}$

Ex: $(4x^2y^3z)^0 = \boxed{1}$ as long as $x \neq 0, y \neq 0, z \neq 0$