

Math 2

U1.1 Laws of Exponents (Review)

Zero Exponent Property:

$$a^0 = 1$$

Ex 1: a) $5^0 = 1$

b) $(-\frac{1}{3})^0 = 1$

c) $ab^0 = a$

d) $2x^0y^3 = 2y^3$

Negative Exponent Property:

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

or $\frac{1}{a^{-n}} = a^n$

Ex 2: a) $2^{-4} = \frac{1}{16}$

b) $\frac{1}{(-5)^{-2}} = 25$

c) $\frac{x^2y^{-3}}{z^{-1}} = x^2y^3z$

• An algebraic expression is in SIMPLEST form when its written with only Positive Exponents

• A "fractional" algebraic expression is in SIMPLEST form when there are no Common Factors.
(It cannot be reduced any more)

Ex 3: Simplify. (Hint: no negative exponents in final expression)

<p>a.) $3^2x^0y^4$</p> <p>$9y^4$</p>	<p>b.) $4m^{-3}n^5$</p> <p>$\frac{4n^5}{m^3}$</p>	<p>c.) $\frac{8}{4c^{-3}}$</p> <p>$\frac{8c^3}{4} = 2c^3$</p>
<p>d.) $\frac{6^{-2}7^4}{(-4)^{-3}}$</p> <p>$\frac{(-4)^3r}{6^2s^4} \rightarrow \frac{-64r}{36s^4}$</p> <p>$\frac{-16r}{9s^4}$</p>	<p>e.) $\frac{5^{-2}a^8b^{-1}}{c^0d^{-2}}$</p> <p>$\frac{a^8d^2}{25b}$</p> <p>$\frac{a^8d^2}{5^2(1)b}$</p>	<p>f.) $\frac{7s^0t^{-5}}{2^{-1}v^2}$</p> <p>$\frac{7(2)(1)}{t^5v^2} = \frac{14}{t^5v^2}$</p>

Ex 4: a.) Write each expression with only positive exponents.
b.) Evaluate each expression where $m = 2$ and $t = -3$.

<p>a.) $2m^{-3}t^4$</p> <p>$\frac{2t^4}{m^3}$</p> <p>$\frac{2(-3)^4}{(2)^3} \rightarrow \frac{2(81)}{8}$</p> <p>$\frac{81}{4}$</p>	<p>b.) $\frac{4^{-1}}{m^t}$</p> <p>$\frac{1}{4m^t}$</p> <p>$\frac{1}{4(2)^{-3}} \rightarrow \frac{2^3}{4} \rightarrow \frac{8}{4} = 2$</p>	<p>c.) $5t^{-m}$</p> <p>$\frac{5}{t^m}$</p> <p>$\frac{5}{(-3)^{(2)}} \rightarrow \frac{5}{9}$</p>
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U1.1 Laws of Exponents (Review)

Multiplying Powers with Same Base Property: $a^m \cdot a^n = a^{m+n}$ (Add exponents)

Ex 5: a) $3^2 \cdot 3^3 = 3^5 \rightarrow 243$ b) $3x^4 \cdot 4x^7 = 12x^{11}$ c) $2a^2 \cdot b^3 \cdot 5a \cdot 8b^7 = 80a^3b^{10}$

Handwritten notes: $3^{2+3} \rightarrow$, $3 \cdot 4 \cdot x^{4+7} \rightarrow$, $2 \cdot 1 \cdot 5 \cdot 8 \cdot a^{2+1} \cdot b^{3+7} \rightarrow$

Raising a Power to a Power Property: $(a^m)^n = a^{mn}$

Ex 6: a) $(5^2)^3 = 5^6 \rightarrow 15,625$ b) $(x^3)^5 = x^{15}$ c) $(a^3 \cdot a^4 \cdot a^{-2})^2 = a^{10}$

Handwritten notes: $\rightarrow 5^6 \rightarrow$, $\rightarrow x^{3 \cdot 5} \rightarrow$, $* \text{Simplify inside 1st, if you can} *$, $(a^{3+4+(-2)})^2 \rightarrow (a^5)^2$

Raising a Product to a Power Property: $(ab)^n = a^n b^n$

Ex 7: a) $(3x)^4 = 81x^4$ b) $(2z^4)^3 = 8z^{12}$

Handwritten notes: $\rightarrow 3^4 x^4 \rightarrow$, $\rightarrow 2^3 z^{4 \cdot 3} \rightarrow$

Dividing Powers with the Same Base Property: $\frac{a^m}{a^n} = a^{m-n}$ (Top exp. - bottom exp.)

Ex 8: a) $\frac{3^7}{3^5} = 3^2 \rightarrow 9$ b) $\frac{a^{14}b^5}{a^6b} = a^8b^4$ c) $\frac{24d^{-3}e^7f}{15d^6e^2f^3} = \frac{8e^5}{5d^9f^2}$

Handwritten notes: $\rightarrow 3^{7-5} \rightarrow 3^2$, $a^{14-6} b^{5-1} \rightarrow$, $\frac{24}{15} d^{-3-6} e^{7-2} f^{1-3} \rightarrow \frac{8}{5} d^{-9} e^5 f^{-2}$

Raising a Quotient to a Power Property: $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$ or $\left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \frac{b^n}{a^n}$

Ex 9: a) $\left(\frac{1}{5}\right)^3 = \frac{1}{125}$ b) $\left(\frac{x^2}{y^5}\right)^6 = \frac{x^{12}}{y^{30}}$ c) $\left(\frac{4}{m^7}\right)^{-2} = \frac{m^{14}}{16}$

Handwritten notes: $\frac{1^3}{5^3} \rightarrow \left(\frac{1}{5}\right)\left(\frac{1}{5}\right)\left(\frac{1}{5}\right)$, $\frac{x^{2 \cdot 6}}{y^{5 \cdot 6}} \rightarrow$, $\rightarrow \left(\frac{m^7}{4}\right)^2 \rightarrow \frac{m^{14}}{4^2}$

Examples: Simplify each expression on a separate sheet and place your answers in the boxes.

1.) $c^4 \cdot d^{-3} \cdot c^2$	2.) $\frac{c^{-1}d^3}{c^5d^{-4}}$	3.) $\frac{(2a^7)(4a^2)}{6a^3}$	4.) $\left(\frac{6m^{-4}}{2m^6}\right)^2$
5.) $(-4x^5yz^2)(x^{-5}y^{-3}z)$	6.) $\left(\frac{2d^5}{d^2}\right)^{-4}$	7.) $\frac{27m^3t^6}{3m^7t^{-5}}$	8.) $\frac{6}{24 \cdot a^{-4} \cdot a^2 \cdot b^{-1}}$
9.) $(3f^4g^{-3}f^2)^3(g^5f^2g)^{-1}$	10.) $\left(\frac{-12k^{-3}}{3k^6}\right)^{-2}$	11.) $(m^{2x})^{x+5}$	12.) $\left(\frac{x^m}{x^{m-2}}\right)^{-3}$

$$\textcircled{1} \frac{c^4 \cdot d^{-3} \cdot c^2}{c^{4+2} d^{-3}}$$

$$\frac{c^6}{d^3}$$

$$\frac{c^6}{d^3}$$

$$\textcircled{2} \frac{c^{-1} d^3}{c^5 d^{-4}}$$

$$\frac{c^{-1-5} d^{3-(-4)}}{6a^3}$$

$$\frac{c^{-6} d^{7}}{6a^3}$$

$$\frac{d^7}{c^6}$$

$$\frac{8a^{9-3}}{6} \rightarrow \frac{4a^6}{3}$$

$$\frac{8a^6}{6}$$

$$\textcircled{4} \left(\frac{6m^{-4}}{2m^6} \right)^2$$

$$\left(\frac{3m^{-4-6}}{1} \right)^2$$

$$\left(3m^{-10} \right)^2$$

$$3^2 m^{-10 \cdot 2}$$

$$9m^{-20}$$

$$\frac{9}{m^{20}}$$

$$\textcircled{5} (-4x^5 y z^2)(x^{-5} y^3 z)$$

$$-4x^{5+(-5)} y^{1+3} z^{2+1}$$

$$-4x^0 y^4 z^3$$

$$-\frac{4z^3}{y^4}$$

$$\textcircled{6} \left(\frac{2d^5}{d^2} \right)^{-4}$$

$$\left(2d^{5-2} \right)^{-4}$$

$$\left(2d^3 \right)^{-4}$$

$$2^{-4} d^{3 \cdot (-4)}$$

$$\frac{1}{2^4 d^{12}} \rightarrow \frac{1}{16d^{12}}$$

$$\textcircled{7} \frac{27m^3 t^6}{3m^7 t^{-5}}$$

$$\frac{27m^{3-7} t^{6-(-5)}}{3}$$

$$9m^{-4} t^{11}$$

$$\frac{9t^{11}}{m^4}$$

$$\textcircled{8} \frac{6}{24a^{-4} \cdot a^2 \cdot b^{-1}}$$

$$\frac{6}{24a^{-4+2} b^{-1}}$$

$$\frac{6}{24a^{-2} b^{-1}} \rightarrow \frac{6a^2 b}{24}$$

⑨ $(3F^4 g^3 F^2)^3 (g^5 F^2 g)^{-1}$ ⑩ $\left(\frac{-12k^3}{3k^6}\right)^{-2}$

$(3F^{4+2} g^3)^3 (g^{5+1} F^2)^{-1}$
 $(3F^6 g^3)^3 (g^6 F^2)^{-1}$
 $(3^3 F^{6 \cdot 3} g^{3 \cdot 3}) (g^{6 \cdot (-1)} F^{2 \cdot (-1)})^{-1}$

$\left(\frac{3k^6}{-12k^3}\right)^2$

$(27F^{18} g^{-9}) (g^{-7} F^{-2})$

$\left(\frac{1k^{6-(-3)}}{-4}\right)^2$

$27F^{18+(-2)} g^{-9+(-7)}$

$\left(\frac{k^9}{-4}\right)^2$

⑪ $27F^{16} g^{-16}$

$\frac{27F^{16}}{g^{16}}$

$\frac{k^{18}}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

⑫ $\frac{1}{16}$

⑬ $\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$

$\frac{1}{16}$