Lesson 2: Simplifying Expressions with Integer Exponents

Recall:

Rule	Numeric Example	Algebraic Example
Product	$2^3 \times 2^4 = 2^7$	$a^m \times a^n = a^{m+n}$
Quotient	$5^6 \div 5^2 = 5^4$	$a^m \div a^n = a^{m-n}$
Power of a power	$(3^3)^2 = 3^6$	$(a^m)^n = a^{mn}$
Power of a product	$(2 \times 3)^4 = 2^4 \times 3^4$	$(xy)^m = x^m y^m$
Power of a quotient	$\left(\frac{3}{5}\right)^2 = \frac{3^2}{5^2}$	$\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}, y \neq 0$

Test yourself: True or False? Circle the correct choice. (Pull tab for answers)

$x^9 \div x^{-9} = x^0$	true	**false**	$(3a^2)^2 = 9a^4$	**true**	false	$-6^2 = -36$	**true**	false
$(2y^3)^4 = 2y^{12}$	true	**false**	$(x^5)(x^4) = x^{20}$	true	**false**	$(x^7)(x^5) = x^{12}$	**true**	false
$(5^2)(5^2) = 25^4$	true	**false**	$(4a^2)^0 = 1$	**true**	false	$(a^4b^{-3})^{-3} = a^{-12}b^0$	**true**	false
$(-1)^6 = 1$	**true**	false	$(-6)^2 = -36$	true	**false**			

Pull

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Zero Exponent Rule $a^0 = 1, a \neq 0$

Test yourself: Is the answer equal to one, or not equal to one? Circle the correct choice. (Pull tab for answers)

$-(-x)^0$	$=1$	**$\neq 1$**	-3^0	$=1$	**$\neq 1$**	$(-1)^{100}$	**$=1$**	$\neq 1$
$2000x^0$	$=1$	**$\neq 1$**	$(-1)^{101}$	$=1$	**$\neq 1$**	$\frac{(2^3)}{(2^{-3})}$	$=1$	**$\neq 1$**
$5x^0$	$=1$	**$\neq 1$**	$(-120x)^0$	**$=1$**	$\neq 1$			
-1^{50}	$=1$	**$\neq 1$**	$4^{-2} \div 4^{-2}$	**$=1$**	$\neq 1$			

Pull

Negative Exponents

Any base raised to a **negative exponent** equals the **reciprocal of the base** to the **positive exponent**!

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

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

Ex: $\left(\frac{3}{4}\right)^{-2} = \left(\frac{4}{3}\right)^2$

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Ex 1) Rewrite as a positive power then evaluate and express in rational (fractional) form.

a) -2^3 b) 2^{-3} c) -2^{-3} d) $(-2)^{-3}$ e) $-(-2)^{-3}$

already is a positive power

$= -8$

$= \frac{1}{2^3}$ or $\left(\frac{1}{2}\right)^3$

$= \frac{1}{8}$

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

$= -\frac{1}{8}$

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

$(-2)(-2)(-2)$

$= \frac{-1}{8}$

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

$= \frac{1}{8}$

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Ex 2) Simplify, then evaluate each expression. Express answers in rational form.

a) $\left(5^{-2}\right)^3\left(5^3\right)$

$= (5^{-6})(5^3)$

$= 5^{-3}$

$= \frac{1}{5^3}$

$= \frac{1}{125}$

b) $\frac{\left(6^{-2}\right)^5\left(6^7\right)}{6^5}$

$= \frac{(6^{-10})(6^7)}{6^5}$

$= \frac{6^{-3}}{6^5}$

$= \frac{1}{6^{5--3}}$

$= \frac{1}{6^8}$

$= \frac{1}{1679616}$

or: $6^{-3-5} = 6^{-8}$

$= \frac{1}{6^8}$

$= \frac{1}{1679616}$

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c) $3^{-5} \div \left(\frac{3^1}{3^5}\right)$

$= 3^{-5} \div 3^{-4}$

$= 3^{-5-(-4)}$

$= 3^{-1}$

$= \frac{1}{3}$

d) $\frac{\left(16^{-2}\right)^3 (2)^3}{(-8)^{-6}}$

$= \frac{(16^{-6})(2^3)}{(-8)^{-6}}$

$= \frac{(2^4)^{-6}(2^3)}{(2^3)^{-6}}$

$= \frac{(2^{-24})(2^3)}{(2^{-18})}$

$= 2^{-21-(-18)}$

$= 2^{-3}$

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

$= \frac{1}{8}$

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Ex 3) Simplify $\frac{(12)^{-5}\left(3^{-2}\right)^{-3}}{\left(2^4\right)^{-2}}$ using the power of a product rule. Then evaluate.

$4 \times 3 = 2^2 \times 3$

$= \frac{(2^2 \cdot 3^1)^{-5}(3^6)}{2^{-8}}$

$= \frac{2^{-10} \times 3^{-5} \times 3^6}{2^{-8}}$

$= \frac{3^1}{2^{-8+10}}$

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

$= \frac{3}{4}$

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Ex 4) Evaluate $(x^n - y^n)^n$ where $x = -1$, $y = -2$, and $n = -3$

$= \left((-1)^{-3} - (-2)^{-3}\right)^{-3}$

$= \left(-1 - \left(\frac{1}{(-2)^3}\right)\right)^{-3}$

$= \left(-1 - \left(-\frac{1}{8}\right)\right)^{-3}$

$= \left(-1 + \frac{1}{8}\right)^{-3}$

$= \left(-\frac{8}{8} + \frac{1}{8}\right)^{-3}$

$= \left(-\frac{7}{8}\right)^{-3}$

$= \left(-\frac{8}{7}\right)^{3}$

$= -\frac{512}{343}$

Do ALL homework questions without a calculator, unless specified otherwise.

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HW U2L2:

1. p. 221 #4-7ace, 8,9ace,11acd, 13-14ace,15 (calculator permitted for 7,11)

2. Correct and sign unit 1 test

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