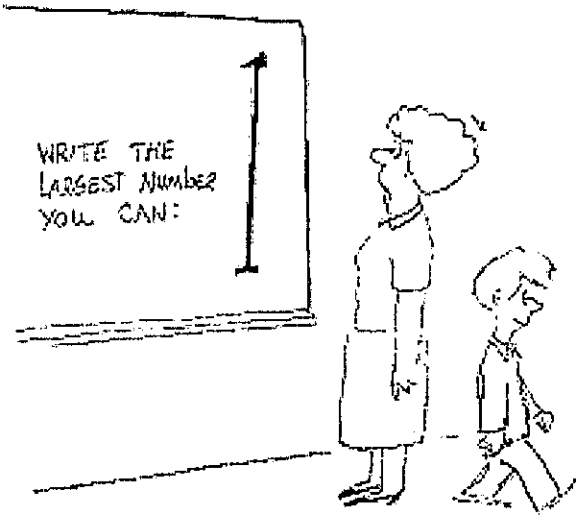
Name: KEY!

Hour: _____

Chapter 7A

Powers & Exponents



Lesson 7-1: Integer Exponents

Zero Exponent	Positive Exponent	Negative Exponent
any # or letter raised to the power 0 is equal to 1.	Positive powers tell you how many times to mult. the base by itself	Neg. powers tell you to switch places in fraction then mult the base by itself
$8^0 = 1$, $5^0 = 1$ $a^0 = 1$, $x^0 = 1$	$5^3 = 5 \cdot 5 \cdot 5$ or $x^6 = x \cdot x \cdot x \cdot x \cdot x \cdot x$	$5^{-3} = \frac{1}{5^3} = \frac{1}{5 \cdot 5 \cdot 5}$ or $x^{-4} = \frac{1}{x^4} = \frac{1}{x \cdot x \cdot x \cdot x}$

Practice

1. 5^3

$5 \cdot 5 \cdot 5 = \boxed{125}$

2. $(-8)^5$

$(-8)(-8)(-8)(-8)(-8) = \boxed{-32,768}$

3. 6^{-4} $\frac{1}{6^4} = \frac{1}{6 \cdot 6 \cdot 6 \cdot 6}$

$= \boxed{\frac{1}{1296}}$

4. 3^0

$\boxed{1}$

5. -6^{-4}

$-\frac{1}{6^4} = -\frac{1}{6 \cdot 6 \cdot 6 \cdot 6}$

$= \boxed{-\frac{1}{1296}}$

6. 103^0

$\boxed{1}$

Evaluate each expression for the give values of the variables.

7. x^{-1} for $x = 2$

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

8. $a^0 b^{-3}$ for $a = 8$ and $b = -2$

$8^0 \cdot (-2)^{-3}$

$\downarrow$

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

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

Simplify the expression.

9. $3y^{-2}$

$3 \cdot \frac{1}{y^2}$

$\boxed{\frac{3}{y^2}}$

10. $\frac{-4}{k^{-4}}$

$-4 \cdot \frac{1}{k^{-4}}$

$\boxed{-4 \cdot k^4}$

11. $\frac{x^{-3}}{a^0 y^5}$

$\frac{1}{a^0 y^5 x^3}$

$\frac{1}{1 \cdot y^5 x^3}$

$\boxed{\frac{1}{y^5 x^3}}$

Lesson 7-3: Multiplication Properties of Exponents

Simplifying Exponentional Expressions
An exponential expression is completely simplified if...

- There are no negative exponents
- The same base does not appear more than once in a product or quotient
- No powers are raised to powers
- No products are raised to powers
- No quotients are raised to powers
- Coefficients do not have any common factor other than 1

Property Name	Words	Numbers	Algebra
Product of Powers Property	When mult. w/ same base, add the exponents	$6^7 \cdot 6^4 = \boxed{6^{11}}$	$a^m \cdot a^n = \boxed{a^{m+n}}$
Power of a Power Property	When power is raised to another power, mult. exponents	$(6^7)^4 = \boxed{6^{28}}$	$(a^m)^n = \boxed{a^{m \cdot n}}$
Power of a Product Property	When multiplying raised to a power, distribute the exponent	$(2 \cdot 4)^3 = \boxed{2^3 \cdot 4^3}$	$(a \cdot b)^n = \boxed{a^n \cdot b^n}$

Practice

1. $2^5 \cdot 2^6$ (+)

2^{11}

2. $4^2 \cdot 3^{-2} \cdot 4^5 \cdot 3^6$

$4^7 \cdot 3^4$

3. $a^4 \cdot b^5 \cdot a^2$

$a^6 \cdot b^5$

4. $y^2 \cdot y^1 \cdot y^{-4}$

$y^{-1} = \frac{1}{y^1} = \boxed{\frac{1}{y}}$

5. $(7^4)^3$

7^{12}

6. $(x^2)^{-4}$

x^{-8}

7. $(-3x)^2$

$(-3)^2 x^2$

8. $(x^{-2} \cdot y^0)^3$

$x^{-2 \cdot 3} \quad y^{0 \cdot 3}$

$x^{-6} \quad y^0$

1

$x^{-6} \cdot 1$

x^{-6}

$\boxed{\frac{1}{x^6}}$

Lesson 7-4: Division Properties of Exponents

Property Name	Words	Numbers	Algebra
Quotient of Powers Property	when dividing w/ same base, subtract exponents	$\frac{6^7}{6^4} = 6^{7-4} = \boxed{6^3}$	$\frac{a^m}{a^n} = \boxed{a^{m-n}}$
Positive Power of a Quotient Property	fraction raised to pos. exponent, distribute exp.	$\left(\frac{3}{5}\right)^4 = \frac{3^4}{5^4}$	$\left(\frac{c}{d}\right)^9 = \frac{c^9}{d^9}$
Negative Power of a Quotient Property	fraction raised to neg. exponent, flip first then distribute	$\left(\frac{2}{3}\right)^{-6} = \left(\frac{3}{2}\right)^6 = \boxed{\frac{3^6}{2^6}}$	$\left(\frac{x}{y}\right)^{-3} = \left(\frac{y}{x}\right)^3 = \boxed{\frac{y^3}{x^3}}$

Practice

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

$3^{8-2} = \boxed{3^6}$

2. $\frac{x^5}{x^5}$

$x^{5-5} = x^0 = \boxed{1}$

3. $\frac{a^5b^9}{(ab)^4}$

$\frac{a^5 b^9}{a^4 b^4}$

$a^{5-4} b^{9-4}$

$a^1 b^5$

$\boxed{a b^5}$

4. $\frac{2^3 \cdot 3^2 \cdot 5^7}{2^1 3^4 \cdot 5^5}$

$2^{3-1} \cdot 3^{2-4} \cdot 5^{7-5}$

$2^2 \cdot 3^{-2} \cdot 5^2$

$\boxed{2^2 \cdot \frac{1}{3^2} \cdot 5^2}$

5. $\left(\frac{3}{4}\right)^3$

$\frac{3^3}{4^3}$

6. $\left(\frac{2x^3}{yz}\right)^3$

$\frac{(2x^3)^3}{(yz)^3} = \frac{2^3 x^{3\cdot 3}}{y^3 z^3} = \boxed{\frac{2^3 x^9}{y^3 z^3}}$

7. $\left(\frac{2}{5}\right)^{-3}$ flip! $= \left(\frac{5}{2}\right)^3$

$\boxed{\frac{5^3}{2^3}}$

8. $\left(\frac{3x}{y^2}\right)^{-3}$ flip! $= \left(\frac{y^2}{3x}\right)^3$

$\frac{y^{2\cdot 3}}{(3x)^3} = \boxed{\frac{y^6}{3^3 x^3}}$

9. $\left(\frac{3}{4}\right)^{-1}\left(\frac{2x}{3y}\right)^{-2}$ flip flip

$\left(\frac{4}{3}\right)^1 \left(\frac{3y}{2x}\right)^2$

$\frac{4^1}{3^1} \cdot \frac{(3y)^2}{(2x)^2}$

$\boxed{\frac{4}{3} \cdot \frac{3^2 y^2}{2^2 x^2}}$