

5.1 Use Properties of Exponents- Day 1

	Expanded Form	Simplified
1. $a^5 \cdot a^2$	aaaaaaaa	a^7
2. $(a^5)^2$	$(a^5)(a^5) = aaaaaaaaaa$	a^{10}
3. $(4a^2)^3$	$(4a^2)(4a^2)(4a^2) = 4 \cdot 4 \cdot 4 aaaaaaaaa$	$64a^6$
4. $(3a^2b^3)^4$	$(3a^2b^3)(3a^2b^3)(3a^2b^3)(3a^2b^3)$	$81a^8b^{12}$

Remember: An exponent affects what is to its immediate left!!!

$3 \cdot 4^2 = 3 \cdot 16 = 48$ $(3 \cdot 4)^2 = (12)^2 = (12)(12) = 144$

$(-3 \cdot 4)^2 = (-12)^2 \rightarrow (-12)(-12) = 144$ $-(3 \cdot 4)^2 = -1(12)^2 = -1(144) = -144$

Rules for Multiplying Monomials

Product of Powers	$a^m \cdot a^n$	a^{m+n}
Power of a Power	$(a^m)^n$	a^{mn}
Power of Products	$(ab)^m$	$a^m b^m$
Power of a Monomial	$(a^m b^n)^p$	$a^{mp} b^{np}$

Examples- Simplify the following:

5. $(\frac{1}{2}a^2b)^3 \rightarrow (\frac{1}{2})(\frac{1}{2})(\frac{1}{2}) a^6 b^3$ $\frac{1}{8} a^6 b^3$ or $\frac{a^6 b^3}{8}$	6. $(2a^4)(3a^3b)(-4a^2b^3)^2$ $(2a^4)(3a^3b)(16a^4b^6)$ $96a^{11}b^7$
7. $9(\frac{1}{3}a^2b^4)^2 \cdot 9(\frac{1}{9}a^6b^8)$ a^6b^8	8. $(-4x^5)^3 (-4)(-4)(-4)x^{15}$ $-64x^{15}$
9. $(-5a^3)^2 + (3a)^3$ $25a^6 + 27a^3$	10. $(5a^3)^2 + (2a^2)^3$ $25a^6 + 8a^6$ $33a^6$

	Expanded Form	Simplified
11. $\frac{a^5}{a^3}$	$\frac{a \cdot a \cdot a \cdot a \cdot a}{a \cdot a \cdot a} = 1 \cdot 1 \cdot 1 \cdot a \cdot a \rightarrow a^2$	a^2
12. $\frac{a^3}{a^5} a^{-2}$	$\frac{a \cdot a \cdot a}{a \cdot a \cdot a \cdot a \cdot a} \cdot \frac{1 \cdot 1 \cdot 1}{a \cdot a} \rightarrow \frac{1}{a^2}$	$\frac{1}{a^2}$
13. $\frac{4a^2b^3}{8ab^3} \frac{10b^2}{2}$	$\frac{2 \cdot 2 \cdot a \cdot a \cdot b \cdot b \cdot b}{2 \cdot 2 \cdot 2 \cdot a \cdot b \cdot b \cdot b \cdot b} \rightarrow \frac{a}{2b^2}$	$\frac{a}{2b^2}$
14. $\frac{a^4}{a^4} a^0$	$\frac{a \cdot a \cdot a \cdot a}{a \cdot a \cdot a \cdot a} = 1$	

Rules for Dividing Monomials

Quotient of Powers	$\frac{a^m}{a^n}$	a^{m-n}
Zero Exponent	a^0	1
Negative Exponent	a^{-1}	$\frac{1}{a}$

Examples- Simplify the following:

15. $\frac{144x^5y^3z^4}{12x^6y^2z^4} 12x^{-1}y^{-5}z^0$	16. $\frac{(3x^5)^2}{(-2x^3)^{-3}} \rightarrow (9x^{10})(-2x^3)^3$ $\rightarrow (9x^{10})(-8x^9)$ $\rightarrow -72x^{19}$
17. $\frac{x^5y^2}{xy^3} x^4y^{-1}$	18. $\left(\frac{2a^3}{b^4}\right)^{-2} \left(\frac{b^{-4}}{2a^3}\right)^2 \rightarrow \frac{b^{-8}}{4a^6}$
19. $\frac{(x^4y^{-7})^0}{(-3)^2} = \frac{1}{9}$	20. $\frac{1}{x^0 + y^0} = \frac{1}{1+1}$ $\frac{1}{2}$

Name _____

5.1 Use Properties of Exponents- Homework Day 1

Simplify each expression.

1. $(4^0 w^2)^{-5}$	2. $\frac{y^4}{y^{-7}}$	3. $\frac{x^8}{x^4}$	4. $(3^2 s^3)^6$
5. $(y^4 z^2) \cdot (y^{-3} z^{-5})$	6. $(2m^3 n^{-1})(8m^4 n^{-2})$	7. $(7c^7 d^2)^{-2}$	8. $(5g^4 h^{-3})^{-3}$
9. $\frac{x^5 y^{-8}}{x^3 y^{-6}}$	10. $\frac{16p^0 r^{-6}}{4p^{-3} r^{-7}}$	11. $\frac{12a^{-3} b^9}{21a^2 b^{-5}}$	12. $\frac{8e^{-4} f^{-2}}{18ef^{-5}}$

13. $\frac{x^2y^3}{2} \cdot \frac{2x^4}{y^3}$	14. $\frac{4m^4}{-6m^{-1}n^5} \cdot \frac{3n^{-1}}{m^{-2}}$	15. $\frac{(c^4)^3}{4} \cdot \frac{12d^{-6}}{(15cd)^{-1}}$	16. $\frac{w^{-3}}{v^{-5}} \cdot \frac{v^{-5}}{w^{-3}}$
17. $\left(\frac{x^7y^{-2}}{3y^{-3}}\right)^{-2}$	18. $\left(\frac{qr^2s}{3r^4}\right)^{-3}$	19. $\left[\left(z^{-2}\right)^2\right]^3$	20. $\left[\left(b^0\right)^{-1}\right]^{-2}$

Write an expression that makes each statement true.

21. $(2m^3n^2)^6 = \underline{\quad ? \quad} \cdot 4m^{12}n^{-5}$	22. $\frac{?}{9x^2y^6z} = \frac{2x}{3y^2}$
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5.1 Use Properties of Exponents- *Scientific Notation*Scientific Notation:

A number is written in scientific notation if it is in the form of $c \times 10^n$, where $1 \leq c < 10$ and n is an integer. Remember each time you move a decimal point you are multiplying or dividing by a power of 10.

Scientific Notation	Decimal Form
1. 4.58×10^6	
2. 4.58×10^{-3}	
	3. 381,000
	4. .000102

Examples- Simplify Using Scientific Notation

5. 234.6×10^9	6. $(4.5 \times 10^{-5})(1.6 \times 10^{-2})$
7. $(8.5 \times 10^7)(1.2 \times 10^3)$	8. $\frac{8.1 \times 10^{12}}{5.4 \times 10^{-2}}$
9. $\frac{3.2 \times 10^{-6}}{6.4 \times 10^2}$	10. $\frac{.000000441}{.0098}$

5.1 Review Worksheet

Simplify the following. Don't leave any negative exponents in your final answer.

1. $-4x^3 \cdot -2x^4$

2. $(-5a^2b^2)(3a^{-4}b^7)$

3. $(-2mn^7)^5$

4. $(5x)^3 \cdot (-3x)^2$

5. $\frac{b^{13}c^4}{b^3c}$

6. $\frac{12x^2y^5}{4x^6y}$

7. $\frac{2(x^3y^{-8}z^{10})^0}{(2)^{-3}}$

8. $\frac{15a^5b^2c^4}{25a^3b^3c^4}$

9. $(3a^2b^{-5})(2a^{-3}b^4)^{-3}$

10. $\frac{(2x^{-3}y)^2}{4x^{-9}y^8}$

Write the following expressions in Scientific Notation:

<p>11. .00075 cm (diameter of a red blood cell)</p>	<p>12. 326,000,000 cubic miles (volume of water on Earth)</p>
<p>13. $.00176 \times 10^{-7}$</p>	<p>14. $(5.2 \times 10^6)(1.7 \times 10^{-9})$</p>
<p>15. $\frac{2.7 \times 10^6}{9 \times 10^{10}}$</p>	<p>16. $\frac{(7.5 \times 10^8)(4.5 \times 10^{-4})}{1.5 \times 10^7}$</p>

Challenge: Simplify the following expression.

$$\frac{1}{x^0 + \frac{1}{x^0 + \frac{1}{x^0 + \frac{1}{x^0}}}}$$