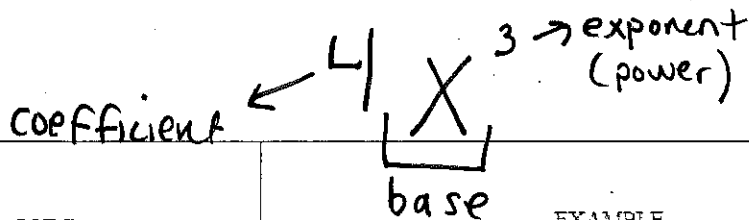


7.1, 7.3, 7.4

Properties of Exponents:



#	RULE	EXAMPLE
1	Addition	$x^2 + x^2 = 2x^2$ * Base and exponent must match
2	Subtraction	$2x^3 - x^3 = x^3$ * Base and exponent must match
3	Multiplication	$x^2 \cdot x^3 = x^5$ $3^2 \cdot 3^3 = 3^5$ * Bases match - add exponents
4	Division	$\frac{x^5}{x^3} = x^2$ $\frac{3^5}{3^3} = 3^2$ * Bases match - subtract exponents
5	Powers	$(x^3)^4 = x^{12}$ $(9^3)^4 = 9^{12}$ * Multiply exponents

} 2 Bases
2 exp.

} 1 base
2 exp

Additional Rules (for all exponents):

Rule #6 (for a zero exponent):

$$x^0 = 1$$

$$\frac{x^3}{x^3} = x^0 = 1$$

Rule #7 (for a negative exponent):

$$\frac{1}{x^{-3}} = x^3 \quad \left(\frac{y^4}{x^3}\right)^{-1} = \frac{x^3}{y^4}$$

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

Note: Simplifying an expression using the properties of exponents means rewriting it WITHOUT

negative exponents or any repeat variables

$$x^{-3}$$

$$x \cdot x$$

Examples: Simplify each expression fully.

1.) $c^9 \cdot c^{-4} \cdot c^{-7}$

$$c^{9 + (-4) + (-7)}$$

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

2.) $\frac{b^6}{b^{-2}}$

$$b^{6 - (-2)}$$

$$\left(b^8 \right)$$

3.) $(h^4)^{-3}$

$$h^{-12}$$

$$\left(\frac{1}{h^{12}} \right)$$

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

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

$$= \frac{x^8 y^4}{x^4 y^{12}} = x^4 y^{-8}$$

$$\left(\frac{x^4}{y^8} \right)$$

5.) $(6a^3 b^{-1})(5ab^{-7})$

$$30a^4 b^{-8}$$

$$\left(\frac{30a^4}{b^8} \right)$$

6.) $\frac{8m^2 n^2}{4m n^3}$

$$2m^2 n^{-1}$$

$$\left(\frac{2m^2}{n} \right)$$

7.) $(5m^3 n)^2 (3m^{-4} n^2)^4$

$$5^2 m^{3 \cdot 2} n^2 \cdot 3^4 m^{-4 \cdot 4} n^{2 \cdot 4}$$

$$25 m^6 n^2 \cdot 81 m^{-16} n^8$$

$$2025 m^{-10} n^{10}$$

$$\left(\frac{2025 n^{10}}{m^{10}} \right)$$

8.) $\frac{2mn^2(3m^2n)^2}{12m^3n^4}$

$$\frac{2mn^2 \cdot 3^2 m^{2 \cdot 2} n^2}{12m^3 n^4}$$

$$\frac{18m^5 n^4}{12m^3 n^4}$$

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

Extra Practice:

Directions: Simplify each expression fully using the rules of exponents.

1. $c^{12} \cdot c^{-4} \cdot c^6$

c^{14}

2. $\frac{b^8}{b^2}$

b^6

3. $\frac{x^{-2}y}{x^4y^{-1}}$

$x^{-6}y^2$

$\frac{y^2}{x^6}$

4. $\left(\frac{a^7b}{a^{-3}b^2}\right)^{-1}$

$\frac{a^{-3}b^2}{a^7b}$

$a^{-5}b$

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

5. $\frac{1}{2}(-5a^2b^3)^2(abc)^2$

$\frac{1}{2}25a^4b^6a^2b^2c^2$

$\frac{25}{2}a^6b^8c^2$

6. $m^7 \cdot m^8$

m^{15}

7. $\frac{2^3c^4t^2}{2^2c^4t^2}$

2

8. $4j(-j^{-2}k^2)(3j^3k^{-7})$

$-12j^{-2+1+3}k^2k^{-7}$

$-12j^2k^{-5}$

$\frac{-12j^2}{k^5}$

9. $\frac{2mn^2(3m^2n)^3}{12m^3n^4}$

$\frac{2mn^2 \cdot 9m^6n^3}{12m^3n^4} = \frac{18m^7n^5}{12m^3n^4}$

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

10. $(a^4)^5$

a^{20}

Extra Practice: Exponent Rules

Directions: Simplify each expression fully using the rules of exponents.

1.) $a^{-3} \cdot a^{-5}$

$$\frac{1}{a^8}$$

2.) $\frac{h^{-1}k^7}{h^2k^{-3}}$

$$\frac{h^{-3}k^{10}}{h^3}$$

3.) $(5m^{-7}n^2)^3$

$$5^3 m^{-21} n^6$$

$$\frac{125n^6}{m^{21}}$$

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

$$\frac{x^{15}y^5}{x^{10}y^{20}} \quad x^5y^{-15}$$

$$\frac{x^5}{y^{15}}$$

5.) $(4a^{-6}b^{-5})(3a^2b^{-9})$

$$12a^{-4}b^{-14}$$

$$\frac{12}{a^4b^{14}}$$

6.) $\frac{24m^{-3}n^2}{8mn^5}$

$$3m^{-4}n^{-3}$$

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

7.) $(2p^{-1}r^2)^4(3p^5r^{-3})^2$

$$2^4 p^{-4} r^8 \cdot 3^2 p^{10} r^{-6}$$

$$144p^6r^2$$

8.) $\frac{(4m^5n)^8}{2m^7n^{10}}$

$$4^8 m^{40} n^8$$

$$\frac{4^8 m^{40} n^8}{2m^7 n^{10}}$$

$$32m^8n^{-7}$$

$$\frac{32m^8}{n^7}$$

Directions: Simplify each expression fully using the rules of exponents.

1. $y^5 \cdot y^7$

y^{12}

2. $\frac{12x^9}{4x^4}$

$3x^5$

3. $8^6 \cdot 8^2$

$8^8 = 16777216$

4. $(y^5)^2$

y^{10}

5. $\frac{(y^4)^2}{(y^3)^2}$

$\frac{y^8}{y^6} = y^2$

6. $(4xy^2)(2y)^3$

$4 \cdot 8 x y^5$

$32xy^5$

7. $\left(\frac{x^3y}{y^4}\right)^4$

$\frac{x^{12}y^4}{y^4} = x^{12}$

8. $(x^3y^2)^3$

x^9y^6

9. $\frac{(2x^5y^3)^3(4xy^4)^2}{8x^7y^{12}}$

$\frac{2^3 x^{15} y^9 \cdot 16 x^2 y^8}{8 x^7 y^{12}}$

$x^8 y^5$

$16x^8y^5$

10. $\frac{15x^2y^7}{3x^4y^5}$

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

