

## MULTIPLICATION

$$x^m \times x^n = x^{m+n}$$

## DIVISION

$$x^m \div x^n = x^{m-n}$$

## POWER OF A POWER

$$(x^m)^n = x^{m \times n}$$

## PRODUCT RULE

$$(x^m x^n)^a = x^{a \times m} x^{a \times n}$$

**Handling Coefficients:** Simplify the following using exponent rules:

Example 1:

$$(2x^2)^3 = (2x^2)(2x^2)(2x^2)$$

$$= 8x^6$$

OR

$$= 2^{1 \times 3} \cdot x^{2 \times 3}$$

$$= 2^3 \cdot x^6$$

$$= 8x^6$$

Example 2:

$$(-3x^2y^3)^2 = (-3)^2 \cdot x^{2 \times 2} \cdot y^{3 \times 2}$$

$$= 9x^4y^6$$

Example 3:

$$(4y^2)(y^3) = 4y^{2+3}$$

$$= 4y^5$$

Example 4:

$$\frac{(3a^2b)^2}{(ab)^2} = \frac{9a^{2 \times 2} \cdot b^{1 \times 2}}{a^{1 \times 2} \cdot b^{1 \times 2}}$$

$$= \frac{9a^4b^2}{a^2b^2}$$

$$= 9a^{4-2} b^{2-2}$$

$$= 9a^2 (b^0) 1$$

$$= 9a^2$$

Example 5:

$$\frac{8a^2b}{-2ab} = -4a^{2-1} b^{1-1}$$

$$= -4a (b^0) 1$$

$$= -4a$$

Example 6:

$$\frac{(2a^2b^3)(8ab^2)}{(4ab^3)} = \frac{16a^{2+1} \cdot b^{3+2}}{4ab^3}$$

$$= \frac{16a^3b^5}{4ab^3}$$

$$= 4a^{3-1} b^{5-3}$$

$$= 4a^2b^2$$

**Exponent Rules Practice**

Simplify each using the exponent rules. Leave your answers in exponential form.

a. $6^2 \times 6^8 = 6^{2+8} = 6^{10}$	b. $9^7 \div 9^5 = 9^{7-5} = 9^2$	c. $(5^2)^6 = 5^{2 \times 6} = 5^{12}$
d. $3^{10} \times 3^3 = 3^{10+3} = 3^{13}$	e. $4^9 \div 4^6 = 4^{9-6} = 4^3$	f. $(10^5)^3 = 10^{5 \times 3} = 10^{15}$
g. $(-5)^2(-5)^2 = (-5)^{2+2} = (-5)^4$	h. $\frac{(-11)^5}{(-11)^2} = (-11)^{5-2} = (-11)^3$	i. $(p^6)^{11} = p^{6 \times 11} = p^{66}$
j. $(-2)^2(-2)^5(-2)^4 = (-2)^{2+5+4} = (-2)^{11}$	k. $\frac{(-1)^5}{(-1)} = (-1)^{5-1} = (-1)^4 = 1$	l. $\frac{7^2 \times 7^4}{7^3} = \frac{7^{2+4}}{7^3} = \frac{7^6}{7^3} = 7^{6-3} = 7^3$
m. $(2^4)^3 \times 2^8 = 2^{4 \times 3} \cdot 2^8 = 2^{12} \cdot 2^8 = 2^{12+8} = 2^{20} = -6a^{2+1} \cdot b^{1+3}$	n. $\frac{(8^7)^2}{8 \times 8^9} = \frac{8^{7 \times 2}}{8^{1+9}} = \frac{8^{14}}{8^{10}} = 8^{14-10} = 8^4 = 5x^{4-1} \cdot y^{1-1}$	o. $(5^3)(5^4)^{-2} \div (5^{-7}) = 5^3 \cdot 5^{-8} \div 5^{-7} = 5^{3-8} \div 5^{-7} = 5^{-5} \div 5^{-7} = 5^{-5-(-7)} = 5^{-5+7} = 5^2$
p. $(2a^2b)(-3ab^3) = -6a^3b^4$	q. $\frac{10x^4y}{2xy} = 5x^3y^0 = 5x^3$	r. $\frac{(4ab^7)(-3a^2)}{12ab^5} = \frac{-12a^{1+2} \cdot b^7}{12ab^5} = \frac{-12a^3b^7}{12ab^5} = -1a^{3-1}b^{7-5} = -1a^2b^2$

ANSWERS: a.  $6^{10}$ , b.  $9^2$ , c.  $5^{12}$ , d.  $3^{13}$ , e.  $4^3$ , f.  $10^{15}$ , g.  $(-5)^4$ , h.  $(-11)^3$ , i.  $p^{66}$ , j.  $(-2)^{11}$ , k.  $(-1)^4$ , l.  $7^3$ , m.  $2^{20}$ , n.  $8^4$ , o.  $5^2$ , p.  $-6a^3b^4$ , q.  $5x^3$ , r.  $-1a^2b^2$