

# HOW TO LEARN EXPONENT RULES?

## Product Rule

$$a^x \times a^y = a^{x+y}$$

$$a^2 \times a^3 = a^5$$

## Quotient Rule

$$a^x \div a^y = a^{x-y}$$

$$a^7 \div a^3 = a^4$$

## Power Rule

$$(a^x)^y = a^{xy}$$

$$(a^7)^2 = a^{14}$$

## Negative Rule

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

$$a^{-4} = \frac{1}{a^4}$$

## Zero Rule

$$a^0 = 1$$

## Practice

Simplify each expression (you may leave answers in exponential form.)

a)  $2^3 \cdot 2^8$

b)  $\left(\frac{2}{5}\right)^4 \cdot 5$

c)  $\frac{5^6}{5^4}$

d)  $2^3 \cdot 3^2$

e)  $\frac{x^{20}}{x^{20}}$

f)  $7^{-2} \cdot 7^{-4}$

g)  $(2^4)^7$

h)  $3^0$

i)  $(x^2y)^4$

Challenge:

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

## Exponent Rules Review Worksheet

Product Rule: When multiplying monomials that have the same base, add the exponents.

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

Example 1:  $x \cdot x^3 \cdot x^4 = x^{1+3+4} = x^8$

Example 2:  $(2x^2y)(-3x^3y^4) = 2 \cdot (-3) \cdot x^2 \cdot x^3 \cdot y \cdot y^4 = -6x^5y^5$

Power Rule: When raising monomials to powers, multiply the exponents.

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

Example 3:  $(x^2y^3)^4 = x^{2 \cdot 4} y^{3 \cdot 4} = x^8y^{12}$

Example 4:  $(2x^3yz^2)^3 = 2^3 x^{3 \cdot 3} y^3 z^{2 \cdot 3} = 8x^9y^3z^6$

Quotient Rule: When dividing monomials that have the same base, subtract the exponents.

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

Example 5:  $\frac{x^3}{x^{-2}} = x^{3-(-2)} = x^5$

Example 6:  $\frac{5^6}{5^2} = 5^{6-2} = 5^4$

Example 7:  $\frac{36m^3n^5}{-9mn^4} = \frac{36}{-9} \cdot \frac{m^3}{m} \cdot \frac{n^5}{n^4} = -4m^2n$

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**Simplify each of the following.**

1)  $a \cdot a^2 \cdot a^3$       2)  $(2a^2b)(4ab^2)$       3)  $(6x^2)(-3x^5)$       4)  $b^3 \cdot b^4 \cdot b^7 \cdot b$       5)  $(3x^3)(3x^4)(-3x^2)$

6)  $(2x^2y^3)^2$       7)  $(5x^2y^4)^3$       8)  $(6x^4y^6)^3$       9)  $(4x^3y^3)^3$       10)  $(7xy)^2$

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11)  $\frac{x^3}{x}$

12)  $\frac{18c^3}{-3c^2}$

13)  $\frac{9a^3b^5}{-3ab^2}$

14)  $\frac{-48c^2d^4}{-8cd}$

15)  $\frac{22y^6z^8}{2yz^{-7}}$

16)  $x^2 \cdot x^7$

17)  $(x^2)^7$

18)  $(-2x^4)^5$

19)  $7^0$

20)  $8x^0$

21)  $\frac{2x^3}{-8x^4}$

22)  $\frac{xy^7}{x^3y^4}$

23)  $6x^5 \cdot 3x^5 \cdot x^0$

24)  $(3st^{12})^3$

25)  $\left(\frac{3m^2n^7}{m}\right)^5$

Use the quotient rule and answer in a single exponent.

$$10^{10} \div 10^2 =$$

$$9^7 \div 9^3 =$$

$$14^{12} \div 14^4 =$$

$$3^3 \div 3^1 =$$

$$4^{15} \div 4^{12} =$$

$$7^{11} \div 7^3 =$$

$$8^{11} \div 8^9 =$$

$$2^{11} \div 2^2 =$$

$$16^8 \div 16^2 =$$

$$20^7 \div 20^2 =$$

$$13^{17} \div 13^{12} =$$

$$1^{99} \div 1^{90} =$$

## Exponent Rules Review

Name \_\_\_\_\_

Per \_\_\_\_\_

### Multiplication

**Part 1: Simplify each expression.**

1.)  $2^3 \cdot 2^4$

2.)  $8^1 \cdot 8^3$

3.)  $t^4 \cdot t^4$

4.)  $x^5 \cdot x^9$

5.)  $3^4 \cdot x^3 \cdot x^5$

**Part 2: Find the product of the expressions.**

6.)  $(6x^2)(4x^2)$

7.)  $(3x^3y^2)(-6y^5)$

8.)  $(5p^3)(-m^8p^2)$

9.)  $(10g^3h^8v^6)(11gh^8)$

10.)  $(4f^9h^3)(-5f^6)(-3h^2)$

11.)  $(-2^2x^3y^4)((-3)^2x^4y^4)$

12.) \*Challenge:  $(3x^a y^b z^c)(-y^f z^g)$

### Power to a Power

**Part 1: Find the product. Expand if it helps you.**

13.)  $(p^2)^5 =$

14.)  $(x^m)^2 =$

15.)  $(2^3x)^2 =$

16.)  $2(3a^2)^3$

17.)  $(2x)^2$

18.)  $(10^2)^3$

19.)  $(-3^2x^6)^5$

20.)  $(7j^2)^3$

21.)  $\left(\frac{8x^2}{2x^2}\right)^2$

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

## Division

Part 1: Simplify to find the quotients.

$$23.) \frac{a^8}{a^3}$$

$$24.) \frac{7^{11}}{7^8}$$

$$25.) \frac{7 \cdot b^5}{b^4}$$

$$26.) \frac{x^{10}}{x^4}$$

$$27.) \frac{12 \cdot g^8 \cdot h^4}{g^3 \cdot h^5}$$

$$28.) \frac{4 \cdot p^{11}}{8 \cdot p^6}$$

$$29.) \frac{c^9}{6c^4}$$

$$30.) \frac{2 \cdot x^3 y^8}{4 \cdot y^2}$$

$$31.) \frac{3x^{14} y^{11}}{18x^2}$$

## Negative Exponents

Rewrite **without negative exponents** and simplify.

$$32.) 6 \cdot c^3 \cdot d^{-2}$$

$$33.) 6x^4 x^{-10}$$

$$34.) (2^0 \cdot x^{-3})^4$$

$$36.) \frac{a^{12} b^{-3}}{a^5 b^5}$$

$$37.) \left( \frac{5x^{13} y^5 z^2}{3 \cdot 5^2} \right)^0$$

$$38.) (g^3 \cdot g^{-2})^4$$

$$39.) \left( \frac{4c^{-5}}{8d^0} \right)^3$$

$$40.) \left( \frac{x^{-8}}{y^{11}} \right)^{-2}$$

$$41.) \frac{(2x^3) \cdot (x^4)^2}{8x^{11}}$$