

Name: \_\_\_\_\_

### 3.2 Worksheet

1. Write each expression as a single power

a)  $3^4 \times 3^9 \div 3^{11}$

b)  $(-4)^3 \div (-4)^2 \times (-4)^{10}$

c)  $6^0 \times 6^3 \div 6^2$

d)  $\frac{4^3 \times 4^5}{4^2 \times 4^6}$

e)  $\frac{(-3)^4 \times (-3)^4}{(-3)^3}$

2. Simplify each expression, then evaluate.

a)  $(5^3 \times 5^3)^1 - (4^2)^2$

b)  $10^2 \times 10^2 + 10^4$

c)  $2^3 \times 2^2 - 2^5 \times 2$

d)  $(3^3 \div 3^2)^3 + (8^4 \times 8^3)^0$

e)  $\frac{10^4 \times 10^3}{10^2}$

f)  $\frac{10^5}{10^3} + 10^2$

g)  $4^2 - 3^0 \times 3 + 2^3$

h)  $3^2 \times 3 + 2^2 \times 2^4$

**Practice** Do the circled Questions

Express as a power of 2.

- ①  $2^4 \times 2^3$     ②  $2^6 \div 2^2$     ③  $(2^4)^3$   
 4.  $2 \times 2^7$     5.  $2^3 \times 2^m$     6.  $2^7 \div 2^7$   
 7.  $2^x \div 2^4$     8.  $(2^7)^y$     9.  $2^{-3} \times 2^4$   
 10.  $2^{-2} \div 2^{-5}$     11.  $(2^3)^{-1}$     12.  $2^{-4} \times 2^0$

Evaluate.

13.  $3^{-2}$     14.  $5^0$     15.  $2^{-3}$   
 16.  $(-2)^{-4}$     17.  $(2^{-1})^2$     18.  $-(-3)^0$   
 19.  $\frac{1}{5^{-2}}$     20.  $\frac{1}{(-4)^{-1}}$     21.  $-(2^3)^{-2}$

Simplify.

- ②②  $a^4 \times a^3$     ②③  $(m^6)(m^2)$   
 24.  $b^5 \times b^6 \times b$     ②⑤  $a \times b^2 \times a^4$   
 26.  $(x^3)(y)(y^4)(x^5)$     27.  $(x^3)(x^{-5})$   
 28.  $m^{-4} \times m^{-5}$     29.  $y^{-1} \times y^{-3} \times y^2$   
 ③①  $a^5 \times a^0$     31.  $(a^{-3})(b^{-2})(a^2)$

Simplify.

- ③②  $x^6 \div x^3$     33.  $m^7 \div m$     34.  $t^4 \div t^{-2}$   
 35.  $y^{-5} \div y^{-3}$     ③⑥  $m^4 \div m^0$     37.  $t^0 \div t^{-5}$

Simplify.

- ③⑧  $(x^3)^2$     39.  $(a^2b^3)^4$     40.  $(x^2)^{-1}$   
 41.  $(t^4)^0$     42.  $(a^{-1}b^2)^{-2}$     43.  $(x^2y^3)^{-3}$

Simplify.

44.  $\left(\frac{x}{2}\right)^3$     ④⑤  $\left(\frac{a}{b}\right)^4$     ④⑥  $\left(\frac{x^2}{y^3}\right)^5$   
 47.  $\left(\frac{x}{3}\right)^{-1}$     48.  $\left(\frac{m^{-3}}{n}\right)^0$     49.  $\left(\frac{a^{-2}}{b^{-3}}\right)^{-2}$

Simplify.

- ⑤①  $5m^4 \times 3m^2$     ⑤②  $(4ab^4)(-5a^3b^2)$   
 ⑤②  $5a(-2ab^2)(-3b^3)$     ⑤③  $(-6m^3n^2)(-4mn^5)$   
 54.  $(7x^2)(6x^{-2})$     55.  $(3x^{-2}y^2)(-2x^2y^{-3})$   
 56.  $(-6a^{-1}b^2)(-a^{-3}b^{-4})$     ⑤⑦  $(-10x^4) \div (-2x)$   
 ⑤⑧  $\frac{45a^2b^4}{9ab^2}$     ⑤⑨  $\frac{(4m^2n^4)(7m^3n)}{14mn^5}$   
 ⑥①  $\frac{3ab^3 \times 10a^4b^2}{15a^2b^6}$     61.  $\frac{4a^4b^3}{a^5b^6} \times \frac{-a^3}{-(b^2)}$   
 62.  $(35x^5) \div (5x^{-3})$     63.  $(-6m^{-4}n^2) \div (2m^{-1}n^{-6})$   
 64.  $\frac{-54a^5b^{-7}}{-6a^{-2}b^{-3}}$     65.  $\frac{(-2x^{-3}y)(-12x^{-4}y^{-2})}{6xy^{-3}}$

Simplify.

66.  $(2m^3)^2$     ⑥⑦  $(-4x^2)^3$     ⑥⑧  $(-3m^2n^3)^2$   
 69.  $(5c^{-3}d^3)^{-2}$     70.  $(2a^{-3}b^{-2})^{-3}$     71.  $(-3x^3y^{-2})^{-4}$   
 72.  $\left(\frac{4x}{3y}\right)^2$     ⑦③  $\left(\frac{-2a^2}{3y^3}\right)^3$     ⑦④  $\left(\frac{3a}{-b^4}\right)^4$   
 75.  $\left(\frac{2m^2}{n^3}\right)^{-2}$     ⑦⑥  $\left(\frac{6ab^3}{2ab}\right)^3$     77.  $\left(\frac{4x^{-3}y^4}{8x^2y^{-2}}\right)^{-2}$

Evaluate.

- ⑦⑧  $\frac{6}{x^0 + y^0}$     79.  $4^{-1} + 2^{-3}$   
 80.  $\frac{3^{-3} + 3^{-4}}{3^{-5}}$     81.  $\frac{(6^4 + 4^6)^0}{3^{-1}}$

**Applications and Problem Solving**

**82. History** The Burgess Shale in British Columbia's Yoho National Park contains one of the world's best fossil collections. The fossils are about  $5.4 \times 10^8$  years old. This is about  $4.5 \times 10^4$  times older than the first known human settlement in British Columbia. About how many years ago did humans first settle in British Columbia?

**83. Chemistry** A piece of wood burns completely in one second at  $600^\circ\text{C}$ . The time the wood takes to burn is doubled for every  $10^\circ\text{C}$  drop in temperature and halved for every  $10^\circ\text{C}$  increase in temperature. In how many seconds would the wood burn at  
 a)  $500^\circ\text{C}$ ?    b)  $650^\circ\text{C}$ ?

**84.** Without evaluating the expressions, determine which is bigger,  $20^{100}$  or  $400^{40}$ .

**85.** Evaluate.

- a)  $\frac{6^1 + 6^{-1}}{6^1 - 6^{-1}}$     b)  $\frac{5^{-4} - 5^{-6}}{5^{-3} + 5^{-5}}$   
 c)  $2^{-n}(2^n - 2^{1+n})$     d)  $3\left(3^{2x} - \frac{1}{3^{-2x}}\right)$

**86. Equations** Determine the value of  $x$ .

- a)  $x^2 \times x^3 = 32$     b)  $x^5 \div x^2 = 64$   
 c)  $x^{-1} \times x^{-3} = \frac{1}{81}$     d)  $x^2 \div x^5 = \frac{1}{125}$

**87. Equation** For which values of  $x$  is the following equation true? Explain.  
 $x^{-4} + x^{-4} = 1$