Name _____ Class _____ Date _____

# Practice 8-1

## Zero and Negative Exponents

**Simplify each expression.**

1. $16^0$
2. $4^{-2}$
3. $3^{-3}$
4. $8^{-4}$
5. $\frac{1}{2^{-5}}$
6. $\frac{4}{4^{-3}}$
7. $\frac{3}{6^{-1}}$
8. $\frac{2^{-1}}{2^{-5}}$
9. $3 \cdot 8^0$
10. $16 \cdot 2^{-2}$
11. $12^{-1}$
12. $-7^{-2}$
13. $16 \cdot 4^0$
14. $9^0$
15. $\frac{32^{-1}}{8^{-1}}$
16. $\frac{9}{2^{-1}}$
17. $\frac{8^{-2}}{4^0}$
18. $\frac{9^{-1}}{3^{-2}}$
19. $5(-6)^0$
20. $(3.7)^0$
21. $(-9)^{-2}$
22. $(-4.9)^0$
23. $-6 \cdot 3^{-4}$
24. $\frac{7^{-2}}{4^{-1}}$

**Evaluate each expression for $a = -2$ and $b = 6$.**

25. $b^{-2}$
26. $a^{-3}$
27. $(-a)^{-4}$
28. $-b^{-3}$
29. $4a^{-3}$
30. $2b^{-2}$
31. $(3a)^{-2}$
32. $(-b)^{-2}$
33. $2a^{-1}b^{-2}$
34. $-4a^{-2}b^{-3}$
35. $3^{-2}a^{-2}b^{-1}$
36. $(3ab)^{-2}$

**Simplify each expression.**

37. $x^{-8}$
38. $xy^{-3}$
39. $a^{-5}b$
40. $m^2n^{-9}$
41. $\frac{1}{x^{-7}}$
42. $\frac{3}{a^{-4}}$
43. $\frac{5}{d^{-3}}$
44. $\frac{6}{r^{-5}s^{-1}}$
45. $3x^{-6}y^{-5}$
46. $8a^{-3}b^2c^{-2}$
47. $15s^{-9}t^{-1}$
48. $-7p^{-5}q^{-3}r^2$
49. $\frac{d^{-4}}{e^{-7}}$
50. $\frac{3m^{-4}}{n^{-8}}$
51. $\frac{6m^{-8}n}{p^{-1}}$
52. $\frac{a^{-2}b^{-1}}{cd^{-3}}$

**Write each number as a power of 10 using a negative exponent.**

53. $\frac{1}{10{,}000}$
54. $\frac{1}{1{,}000{,}000}$
55. $\frac{1}{10{,}000{,}000}$
56. $\frac{1}{1{,}000{,}000{,}000}$

**Write each expression as a decimal.**

57. $10^{-5}$
58. $10^{-8}$
59. $4 \cdot 10^{-1}$
60. $6 \cdot 10^{-4}$

**Evaluate each expression for $m = 4$, $n = 5$, and $p = -2$.**

61. $m^p$
62. $n^m$
63. $p^p$
64. $n^p$
65. $m^pn$
66. $m^{-n}$
67. $p^{-n}$
68. $mn^p$
69. $p^{-m}$
70. $\frac{m}{n^p}$
71. $\frac{1}{n^{-m}}$
72. $-n^{-m}$

Name _____ Class _____ Date _____

# Practice 8-3

## Multiplication Properties of Exponents

**Simplify each expression.**

1. $(3d^{-4})(5d^8)$
2. $(-8m^4)(4m^8)$
3. $n^{-6} \cdot n^{-9}$
4. $a^3 \cdot a$
5. $3^8 \cdot 3^5$
6. $(3p^{-15})(6p^{11})$
7. $p^7 \cdot q^5 \cdot p^6$
8. $(-1.5a^5b^2)(6a)$
9. $(-2d^3e^3)(6d^4e^6)$
10. $\frac{1}{b^{-7} \cdot b^5}$
11. $p^5 \cdot q^2 \cdot p^4$
12. $\frac{1}{n^7 \cdot n^{-5}}$
13. $(8d^4)(4d^7)$
14. $x^{-9} \cdot x^3 \cdot x^2$
15. $2^3 \cdot 2^2$
16. $r^7 \cdot s^4 \cdot s \cdot r^3$
17. $b^7 \cdot b^{13}$
18. $(7p^4)(5p^9)$
19. $2^8 \cdot 2^{-9} \cdot 2^3$
20. $(6r^4s^3)(9rs^2)$
21. $4^3 \cdot 4^2$
22. $m^{12} \cdot m^{-14}$
23. $s^7 \cdot t^4 \cdot t^8$
24. $(-3xy^6)(3.2x^5y)$
25. $5^{-7} \cdot 5^9$
26. $\frac{1}{h^7 \cdot h^3}$
27. $\frac{1}{t^{-5} \cdot t^{-3}}$
28. $f^5 \cdot f^2 \cdot f^0$
29. $r^6 \cdot r^{-13}$
30. $5^{-6} \cdot 5^4$

**Simplify each expression. Write each answer in scientific notation.**

31. $(7 \times 10^7)(5 \times 10^{-5})$
32. $(3 \times 10^8)(3 \times 10^4)$
33. $(9.5 \times 10^{-4})(2 \times 10^{-5})$
34. $(4 \times 10^9)(4.1 \times 10^8)$
35. $(7.2 \times 10^{-7})(2 \times 10^{-5})$
36. $(5 \times 10^7)(4 \times 10^3)$
37. $(6 \times 10^{-6})(5.2 \times 10^4)$
38. $(4 \times 10^6)(9 \times 10^8)$
39. $(6.1 \times 10^9)(8 \times 10^{14})$
40. $(2.1 \times 10^{-4})(4 \times 10^{-7})$
41. $(1.6 \times 10^5)(3 \times 10^{11})$
42. $(9 \times 10^{12})(0.3 \times 10^{-18})$
43. $(4 \times 10^9)(11 \times 10^3)$
44. $(5 \times 10^{13})(9 \times 10^{-9})$
45. $(7 \times 10^6)(4 \times 10^9)$
46. $(6 \times 10^{-8})(12 \times 10^{-7})$
47. $(6 \times 10^{15})(3.2 \times 10^2)$
48. $(5 \times 10^8)(2.6 \times 10^{-16})$

49. In 1990, the St. Louis metropolitan area had an average of $82 \times 10^{-6}$ g/m$^3$ of pollutants in the air. How many grams of pollutants were there in $2 \times 10^3$ m$^3$ of air?

50. Light travels approximately $5.87 \times 10^{12}$ mi in one year. This distance is called a light-year. Suppose a star is $2 \times 10^4$ light-years away. How many miles away is that star?

51. The weight of 1 m$^3$ of air is approximately $1.3 \times 10^3$ g. Suppose that the volume of air inside of a building is $3 \times 10^6$ m$^3$. How much does the air inside the building weigh?

52. Light travels $1.18 \times 10^{10}$ in. in 1 second. How far will light travel in 1 nanosecond or $1 \times 10^{-9}$ s?

# What Happens to a Dog Who Eats Table Scraps ?

Simplify each expression below. Find your answer in the corresponding answer column and notice the letter next to it. Write this letter in the box that contains the number of that exercise.

| | | | |
|---|---|---|---|
| (1) $(x^3)^2$ | (L) $81x^2$ | (14) $(4a^2b^3)^2$ | (H) $-a^6b^6$ |
| (2) $(x^4)^3$ | (T) $125x^{11}$ | (15) $(2a^4b)^3$ | (E) $-a^{10}b^8$ |
| (3) $(2x^2)^3$ | (S) $-32x^{15}$ | (16) $(-5a^3b^3)^2$ | (R) $16a^4b^6$ |
| (4) $(-4x^3)^2$ | (G) $8x^6$ | (17) $(ab^5)^3$ | (N) $a^8b^9$ |
| (5) $(-3x^4)^3$ | (E) $-64x^4$ | (18) $(-a^2b^2)^3$ | (I) $25a^6b^6$ |
| (6) $(8x^5)^2$ | (H) $x^6$ | (19) $(-8ab^4)^2$ | (S) $18a^5b^2$ |
| (7) $(-2x^3)^5$ | (N) $-12x^3$ | (20) $2a(3a^2b)^2$ | (U) $27a^3b^4$ |
| (8) $(4x)^3$ | (S) $64x^{10}$ | (21) $-b(5a^3b)^3$ | (N) $a^3b^{15}$ |
| (9) $(-9x)^2$ | (E) $x^{12}$ | (22) $3ab(2ab^2)^4$ | (I) $64a^2b^8$ |
| (10) $x(2x^2)^3$ | (P) $64x^3$ | (23) $(ab^3)^2(a^2b)^3$ | (O) $48a^5b^9$ |
| (11) $-3x(2x)^2$ | (E) $16x^6$ | (24) $(-2ab^2)^2(-ab)^3$ | (S) $8a^{12}b^3$ |
| (12) $x^2(5x^3)^3$ | (I) $8x^7$ | (25) $(3ab^2)(3ab)^2$ | (G) $-4a^5b^7$ |
| (13) $-4x^2(-4x)^2$ | (T) $-27x^{12}$ | (26) $(-a^2b)^4(-a^2b^4)$ | (T) $-125a^9b^4$ |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | | | | |

Name _____ Class _____ Date _____

# Practice 8-4

## More Multiplication Properties of Exponents

**Simplify each expression.**

1. $(4a^5)^3$
2. $(2^{-3})^4$
3. $(m^{-3}n^4)^{-4}$
4. $(x^5)^2$
5. $2^5 \cdot (2^4)^2$
6. $(4x^4)^3(2xy^3)^2$
7. $x^4 \cdot (x^4)^3$
8. $(x^5y^3)^3(xy^5)^2$
9. $(5^2)^2$
10. $(a^4)^{-5} \cdot a^{13}$
11. $(3f^4g^{-3})^3(f^2g^{-2})^{-1}$
12. $x^3 \cdot (x^3)^5$
13. $(d^2)^{-4}$
14. $(a^3b^4)^{-2}(a^{-3}b^{-5})^{-4}$
15. $(x^2y)^4$
16. $(12b^{-2})^2$
17. $(m^{-5})^{-3}$
18. $(x^{-4})^5(x^3y^2)^5$
19. $(y^6)^{-3} \cdot y^{21}$
20. $n^6 \cdot (n^{-2})^5$
21. $(m^5)^{-3}(m^4n^5)^4$
22. $(a^3)^6$
23. $b^{-9} \cdot (b^2)^4$
24. $(4^{-1}s^3)^{-2}$
25. $(5a^3b^5)^4$
26. $(b^{-3})^6$
27. $(y^6)^3$
28. $a^{-4} \cdot (a^4b^3)^2$
29. $(x^4y)^3$
30. $d^3 \cdot (d^2)^5$

**Simplify. Write each answer in scientific notation.**

31. $10^{-9} \cdot (2 \times 10^2)^2$
32. $(3 \times 10^{-6})^3$
33. $10^4 \cdot (4 \times 10^6)^3$
34. $(9 \times 10^7)^2$
35. $10^{-3} \cdot (2 \times 10^3)^5$
36. $(7 \times 10^5)^3$
37. $(5 \times 10^5)^4$
38. $(2 \times 10^{-3})^3$
39. $(5 \times 10^2)^{-3}$
40. $(3 \times 10^5)^4$
41. $(4 \times 10^8)^{-3}$
42. $(1 \times 10^{-5})^{-5}$
43. $10^5 \cdot (8 \times 10^7)^3$
44. $(10^2)^3(6 \times 10^{-3})^3$
45. $10^7 \cdot (2 \times 10^2)^4$

46. The kinetic energy, in joules, of a moving object is found by using the formula $E = \frac{1}{2}mv^2$, where $m$ is the mass and $v$ is the speed of the object. The mass of a car is $1.59 \times 10^3$ kg. The car is traveling at $2.7 \times 10^1$ m/s. What is the kinetic energy of the car?

47. The moon is shaped somewhat like a sphere. The surface area of the moon is found by using the formula $S = 12.56r^2$. What is the surface area of the moon if the radius is $1.08 \times 10^3$ mi?

48. Because of a record corn harvest, excess corn is stored on the ground in a pile. The pile is shaped like a cone. The height of the pile is 25 ft, and the radius of the pile is $1.2 \times 10^2$ ft. Use the formula $V = \frac{1}{3}\pi r^2 h$ to find the volume.

49. Suppose the distance in feet that an object travels in $t$ seconds is given by the formula $d = 64t^2$. How far would the object travel after $1.5 \times 10^3$ seconds?