

## Exponents and Roots

## Properties of Exponents, Part I

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4.1.1 Product and Power Properties of Exponents

Simplify.

1.  $3^3$

2.  $(-4)^2$

3.  $-4^2$

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

5.  $6 \cdot 6^2 \cdot 6^3 \cdot 6^2$

6.  $(2^3)^3$

7.  $(b^4)^6 \cdot b$

8.  $(3x)^3$

9.  $(5w^8)^2$

10.  $(-4x^3)^4$

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

12.  $(p^4q^2)^7$

4.1.2 Integer Exponents

13. **Biology** One of the smallest bats is the northern blossom bat, which is found from Southeast Asia to Australia. This bat weighs about  $2^{-1}$  ounce. Simplify this expression.

Simplify.

14.  $8^0$

15.  $-9^{-2}$

16.  $\left(\frac{2}{5}\right)^0$

17.  $13^{-2}$

18.  $(-3)^{-1}$

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19.  $(-4)^2$

20.  $\left(\frac{1}{2}\right)^{-2}$

21.  $-7^{-1}$

22.  $a^5 \cdot a^0 \cdot a^{-5}$

23.  $b \cdot (a^3)^4 \cdot (b^{-2})^3$

24.  $x^7 \cdot x^{-6} \cdot y^{-3}$

25.  $(x^2)^{-1}$

26.  $(x^4)^2 \cdot (x^{-1})^{-4}$

27.  $(3^6)^0$

28.  $(x^3y^4)^3 \cdot (xy^3)^{-2}$

Evaluate each expression for the given value(s) of the variable(s).

29.  $\left(\frac{2}{3}v\right)^{-3}$  for  $v = 9$

30.  $(10 - d)^0$  for  $d = 11$

31.  $10m^{-1}n^{-5}$   
for  $m = 10$   
and  $n = -2$

32.  $(3ab)^{-2}$   
for  $a = \frac{1}{2}$  and  $b = 8$

33.  $4w^v x^v$  for  $w = 3$ ,  $v = 0$ , and  $x = -5$

Simplify.

34.  $k^{-4}$

35.  $2z^{-8}$

36.  $\frac{1}{2b^{-3}}$

37.  $c^{-2}d$

38.  $-5x^{-3}$

39.  $4x^{-6}y^{-2}$

40.  $\frac{r^{-5}}{s^{-1}}$

41.  $\frac{2f^0}{7g^{-10}}$

42.  $\frac{s^5}{t^{-12}}$

43.  $\frac{3w^{-5}}{x^{-6}}$

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44.  $b^0c^0$

45.  $\frac{2}{3}m^{-1}n^5$

46.  $\frac{q^{-2}r^0}{s^0}$

47.  $\frac{a^{-7}b^2}{c^3d^{-4}}$

48.  $\frac{h^3k^{-1}}{6m^2}$

4.1.3 Quotient Properties of Exponents

Simplify.

49.  $\frac{x^8y^3}{x^3y^3}$

50.  $\frac{x^8y^4}{x^9yz}$

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

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

53.  $\left(\frac{1}{7}\right)^{-3}$

54.  $\left(\frac{x^2}{y^5}\right)^{-5}$

55.  $\left(\frac{8w^7}{16}\right)^{-1}$

56.  $\left(\frac{1}{4}\right)^{-2}\left(\frac{6x}{7}\right)^{-2}$