4-7 Negative Exponents *(Pages 181–185)*

What does a negative exponent mean? Look at some examples:

$$2^{-2} = \frac{1}{2^2} \text{ or } \frac{1}{4} \qquad\qquad 3^{-4} = \frac{1}{3^4} \text{ or } \frac{1}{81}$$

Negative Exponents	For any nonzero number a and integer n, $a^{-n} = \frac{1}{a^n}$.

Examples

a. Write 2^{-3} using a positive exponent.

$$2^{-3} = \frac{1}{2^3}$$

b. Write $\frac{1}{3^2}$ as an expression using negative exponents.

$$\frac{1}{3^2} = 3^{-2}$$

Try These Together

1. Write 7^{-4} using a positive exponent.
   HINT: This is $\frac{1}{7^?}$.

2. Write $\frac{1}{5^2}$ as an expression using negative exponents.
   HINT: The exponent will be −2.

Practice

Write each expression using positive exponents.

3. $x^{-5}y^{-8}$

4. n^{-7}

5. pq^{-2}

6. $s^3 t^{-2}$

7. $a^{-4}b^{-3}c$

8. $\dfrac{-2x^8}{y^{-9}}$

9. $\dfrac{(-3)^4}{p^{-10}}$

10. $(-1)^{-3}m^2n^{-1}$

11. $\dfrac{1}{t^{-7}}$

Write each fraction as an expression using negative exponents.

12. $\dfrac{1}{2^5}$

13. $\dfrac{1}{y^6}$

14. $\dfrac{1}{27}$

15. $\dfrac{-4}{m^{10}}$

16. $\dfrac{16}{s^3 t^2}$

17. $\dfrac{a^4}{b^3}$

Evaluate each expression for $n = -2$.

18. n^{-4}

19. 3^n

20. n^{-2}

21. **Physics** The average density of the Earth is about 5.52 grams per cubic centimeter, or $5.52 \text{ g} \cdot \text{cm}^{-3}$. Write this measurement as a fraction using positive exponents.

22. **Standardized Test Practice** Express $a^3 b^{-4} c^2 d^{-1}$ using positive exponents.

    A $\dfrac{a^3 b^4}{c^2 d}$ B $a^3 b^4 c^2 d$ C $\dfrac{b^4 d}{a^3 c^2}$ D $\dfrac{a^3 c^2}{b^4 d}$

Answers: 1. $\frac{1}{7^4}$ 2. 5^{-2} 3. $\frac{1}{x^5 y^8}$ 4. $\frac{1}{n^7}$ 5. $\frac{p}{q^2}$ 6. $\frac{s^3}{t^2}$ 7. $\frac{ac}{a^4 b^3}$ 8. $-2x^8 y^9$ 9. $(-3)^4 p^{10}$ 10. $\frac{m^2}{(-1)^3 n}$ 11. t^7 12. 2^{-5} 13. y^{-6} 14. 3^{-3} 15. $-4m^{-10}$ 16. $16s^{-3}t^{-2}$ 17. $\frac{a^4}{b^{-3}}$ 18. $\frac{1}{16}$ 19. $\frac{1}{9}$ 20. $\frac{1}{4}$ 21. $\frac{5.52 \text{ g}}{\text{cm}^3}$ 22. D

Operations with Exponents

Simplify the exponents.

1) $\left(\dfrac{3^3}{3^6} \right)^2$

2) $\left(4h^2 \cdot h \right)^2$

3) $\left(3g^2 \cdot g \cdot 2 \right)^2$

4) $r^{-3} \cdot r^6$

5) $\left(s \cdot 3s^2 \right)^3$

6) $\dfrac{9b^{-4}w^{-6}}{8bw^{-2}}$

7) $\left(\dfrac{nz}{6n^2z^3} \right)^2$

8) $\dfrac{ny}{3n^{-4}y^{-3}}$

9) $\left(\dfrac{g^2}{g^4} \right)^3$

10) $\dfrac{6kz^{-3}}{8k^{-5}z^2}$

11) $5s^2 \cdot 2s^{-4}c^3$

12) $7z \cdot 6z^{-4}$