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8-2 Study Guide and Intervention *(continued)*

Dividing Monomials

Negative Exponents Any nonzero number raised to the zero power is 1; for example, $(-0.5)^0 = 1$. Any nonzero number raised to a negative power is equal to the reciprocal of the number raised to the opposite power; for example, $6^{-3} = \frac{1}{6^3}$. These definitions can be used to simplify expressions that have negative exponents.

Zero Exponent	For any nonzero number a, $a^0 = 1$.
Negative Exponent Property	For any nonzero number a and any integer n, $a^{-n} = \frac{1}{a^n}$ and $\frac{1}{a^{-n}} = a^n$.

The simplified form of an expression containing negative exponents must contain only positive exponents.

Example **Simplify $\frac{4a^{-3}b^6}{16a^2b^6c^{-5}}$. Assume that the denominator is not equal to zero.**

$\frac{4a^{-3}b^6}{16a^2b^6c^{-5}} = \left(\frac{4}{16}\right)\left(\frac{a^{-3}}{a^2}\right)\left(\frac{b^6}{b^6}\right)\left(\frac{1}{c^{-5}}\right)$ Group powers with the same base.

$= \frac{1}{4}(a^{-3-2})(b^{6-6})(c^5)$ Quotient of Powers and Negative Exponent Properties

$= \frac{1}{4}a^{-5}b^0c^5$ Simplify.

$= \frac{1}{4}\left(\frac{1}{a^5}\right)(1)c^5$ Negative Exponent and Zero Exponent Properties

$= \frac{c^5}{4a^5}$ Simplify.

The solution is $\frac{c^5}{4a^5}$.

Exercises

Simplify. Assume that no denominator is equal to zero.

1. $\frac{2^2}{2^{-3}}$ 2^5 or 32
2. $\frac{m}{m^{-4}}$ m^5
3. $\frac{p^{-8}}{p^3}$ $\frac{1}{p^{11}}$
4. $\frac{b^{-4}}{b^{-5}}$ b
5. $\frac{(-x^{-1}y)^0}{4w^{-1}y^2}$ $\frac{w}{4y^2}$
6. $\frac{(a^2b^3)^2}{(ab)^{-2}}$ a^6b^8
7. $\frac{x^4y^0}{x^{-2}}$ x^6
8. $\frac{(6a^{-1}b)^2}{(b^2)^4}$ $\frac{36}{a^2b^6}$
9. $\frac{(3st)^2u^{-4}}{s^{-1}t^2u^7}$ $\frac{9s^3}{u^{11}}$
10. $\frac{s^{-3}t^{-5}}{(s^2t^3)^{-1}}$ $\frac{1}{st^2}$
11. $\left(\frac{4m^2n^2}{8m^{-1}\ell}\right)^0$ 1
12. $\frac{(-2mn^2)^{-3}}{4m^{-6}n^4}$ $-\frac{m^3}{32n^{10}}$

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8-2 Practice (Average)

Dividing Monomials

Simplify. Assume that no denominator is equal to zero.

1. $\frac{8^8}{8^4}$ 8^4 or 4096

2. $\frac{a^4b^6}{ab^3}$ a^3b^3

3. $\frac{xy^2}{xy}$ y

4. $\frac{m^5np}{m^4p}$ mn

5. $\frac{5c^2d^3}{-4c^2d}$ $-\frac{5d^2}{4}$

6. $\frac{8y^7z^6}{4y^6z^5}$ $2yz$

7. $\left(\frac{4f^3g}{3h^6}\right)^3$ $\frac{64f^9g^3}{27h^{18}}$

8. $\left(\frac{6w^5}{7p^6s^3}\right)^2$ $\frac{36w^{10}}{49p^{12}s^6}$

9. $\frac{-4c^2}{24c^5}$ $-\frac{1}{6c^3}$

10. $x^3(y^{-5})(x^{-8})$ $\frac{1}{x^5y^5}$

11. $p(q^{-2})(r^{-3})$ $\frac{p}{q^2r^3}$

12. 12^{-2} $\frac{1}{144}$

13. $\left(\frac{3}{7}\right)^{-2}$ $\frac{49}{9}$

14. $\left(\frac{4}{3}\right)^{-4}$ $\frac{81}{256}$

15. $\frac{22r^3s^2}{11r^2s^{-3}}$ $2rs^5$

16. $\frac{-15w^0u^{-1}}{5u^3}$ $-\frac{3}{u^4}$

17. $\frac{8c^3d^2f^4}{4c^{-1}d^2f^{-3}}$ $2c^4f^7$

18. $\left(\frac{x^{-3}y^5}{4^{-3}}\right)^0$ 1

19. $\frac{6f^{-2}g^3h^5}{54f^{-2}g^{-5}h^3}$ $\frac{g^8h^2}{9}$

20. $\frac{-12t^{-1}u^5v^{-4}}{2t^{-3}uv^5}$ $-\frac{6t^2u^4}{v^9}$

21. $\frac{r^4}{(3r)^3}$ $\frac{r}{27}$

22. $\frac{m^{-2}n^{-5}}{(m^4n^3)^{-1}}$ $\frac{m^2}{n^2}$

23. $\frac{(j^{-1}k^3)^{-4}}{j^3k^3}$ $\frac{j}{k^{15}}$

24. $\frac{(2a^{-2}b)^{-3}}{5a^2b^4}$ $\frac{a^4}{40b^7}$

25. $\left(\frac{q^{-1}r^3}{qr^{-2}}\right)^{-5}$ $\frac{q^{10}}{r^{25}}$

26. $\left(\frac{7c^{-3}d^3}{c^5de^{-4}}\right)^{-1}$ $\frac{c^8}{7d^2e^4}$

27. $\left(\frac{2x^3y^2z}{3x^4yz^{-2}}\right)^{-2}$ $\frac{9x^2}{4y^2z^6}$

28. **BIOLOGY** A lab technician draws a sample of blood. A cubic millimeter of the blood contains 22^3 white blood cells and 22^5 red blood cells. What is the ratio of white blood cells to red blood cells? $\frac{1}{484}$

29. **COUNTING** The number of three-letter "words" that can be formed with the English alphabet is 26^3. The number of five-letter "words" that can be formed is 26^5. How many times more five-letter "words" can be formed than three-letter "words"? 676