7-4: DIVISION PROPERTIES OF EXPONENTS

Lesson Objectives:

- *Divide powers with the same base*
- *Raise a quotient to a power*

1 Dividing Powers With the Same Base

PROPERTY: DIVIDING POWERS WITH THE SAME BASE

For every nonzero number *a* and integers *m* and *n*,

a) $\frac{3^7}{3^4}$ b) $\frac{x^2}{x^5}$

EXAMPLE 1: SIMPLIFYING A POWER RAISED TO A POWER
Simplify each expression.

1. $\frac{a^6}{a^{14}}$ 2. $\frac{n^{-8}}{n^4}$ 3. $\frac{c^{15}}{c^9}$ 4. $\frac{7^{-3}}{7^{-5}}$

5. $\frac{m^6}{m^{10}}$ 6. $\frac{4^6}{4^8}$ 7. $\frac{4^{-1}}{4^2}$ 8. $\frac{z^7}{z^{-3}}$

9. $\frac{c^{-1}d^3}{c^5d^{-4}}$ 10. $\frac{x^7y^9z^3}{x^4y^7z^8}$ 11. $\frac{a^6b^{-5}}{a^{-2}b^7}$

12. $\frac{a^7b^5}{a^6b}$ 13. $\frac{m^8n^3}{m^{10}n^5}$ 14. $\frac{x^4y^{-8}z^{-2}}{x^{-1}y^6z^{-10}}$

EXAMPLE 2: DIVIDING NUMBERS IN SCIENTIFIC NOTATION

Simplify each quotient. Write each answer in scientific notation.

15. $\frac{8\times10^{9}}{4\times10^{5}}$ 16. $\frac{9.5\times10^{9}}{5\times10^{4}}$ 17. $\frac{6.4\times10^{9}}{8\times10^{7}}$ 18. $\frac{1.8\times10^{-8}}{0.9\times10^{3}}$

PROPERTY: RAISING A QUOTIENT TO A POWER

For every nonzero numbers *a* and *b* and integer *n*,

a) $\left(\frac{4}{5}\right)^{3}$

EXAMPLE 3: RAISING A QUOTIENT TO A POWER

Simplify each expression.

19. $\left(\frac{a^{2}}{b^{3}}\right)^{5}$ 20. $\left(\frac{5a^{0}b^{4}}{c^{-3}}\right)^{2}$ 21. $\left(\frac{a^{8}b^{6}}{a^{11}}\right)^{5}$ 22. $\left(\frac{a^{2}b^{-4}}{b^{2}}\right)^{5}$

23. $\left(\frac{a^{3}}{b^{2}}\right)^{4}$ 24. $\left(\frac{2a^{3}b^{-2}}{c^{3}}\right)^{5}$ 25. $\left(\frac{m^{-3}n^{4}}{n^{-2}}\right)^{4}$ 26. $\left(\frac{p^{-3}q^{-2}}{p^{-3}q^{-3}r^{5}}\right)^{4}$

EXAMPLE 4: SIMPLIFYING AN EXPONENTIAL EXPRESSION
Simplify each expression.

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

28. $\left(-\frac{2x}{y}\right)^{-4}$

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

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

31. $\left(\frac{r^3s^{-1}}{r^2s^6}\right)^{-1}$

32. $\left(\frac{2^{13}m^{14}n^{22}}{m^{-2}n^{-4}p^{33}r1^9}\right)^{0}$

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

34. $\left(\frac{s^{-4}}{t^{-1}}\right)^{-2}$

35. $\left(\frac{x^{-3}y}{xz^{-4}}\right)^{-2}$

36. $\left(\frac{x^2y^4z^5}{x^{-1}y^2z^7}\right)^{-3}\left(\frac{x^{-2}y^2z^{-3}}{xy^{-5}z^{-5}}\right)^{4}$

Name _____ ***7-4 Practice Worksheet*** Period _____

Simplify each expression.

1. $\frac{5^2 5^3}{5^3 5^2}$

2. $\frac{m^{-2}}{m^{-5}}$

3. $\frac{3^2 m^3 t^6}{3^5 m^7 t^{-5}}$

4. $\frac{4.2\times10^8}{7\times10^5}$

5. $\frac{3.5\times10^6}{5\times10^8}$

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

7. $\left(\frac{2p}{5}\right)^3$

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

9. $\left(\frac{3b^2}{5}\right)^2$

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

11. $\frac{(2a^7)(3a^2)}{6a^3}$

12. $\left(\frac{n^4 n}{n^{-2}}\right)^{-4}$

13. $\frac{7^9(1^0)^2}{7^7}$

14. $\left(\frac{(3x)^2 y}{x^2 y^4}\right)^{-2}$

15. $\frac{(5a^2)(6b^3)}{(2a^3)(25b^{-2})}$

16. $\left(\frac{2ab^6}{a^3 b}\right)^{-2}\left(\frac{3a^2b^2}{a^5b^4}\right)^4$

Explain why each expression is *not* in simplest form.

17. $5^3 m^3$

18. $x^5 y^{-2}$

19. $(2c)^4$

20. $\frac{d^7}{d}$

21. $x^0 y$