Chapter 12 Polynomials and Exponents
12.5 Integer Exponents and the Quotient Rule

Negative Integers as Exponents ~ The Quotient Rule ~ Other Rules for Exponents ~ Scientific Notation

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STUDY PLAN

Read: Read Section 12.5 on pages 770-778 in your textbook or eText.

Practice: Do your assigned exercises in your ☐ Book ☐ MyMathLab ☐ Worksheets
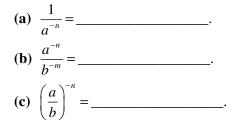
Review: Keep your corrected assignments in an organized notebook and use them to review for the test.

Key Terms
Exercise 1-4: Use the vocabulary terms listed below to complete each statement.
Note that some terms or expressions may not be used.

$a^m - a^n$	$\left(\dfrac{b}{a}\right)^n$	a^{m-n}	$\dfrac{b^m}{a^n}$
$\dfrac{1}{a^n}$	$\dfrac{a^n}{b^m}$	$\left(\dfrac{a}{b}\right)^n$	a^n
reciprocal		**scientific notation**	

1. Let a be a nonzero real number and n be a positive integer. Then $a^{-n} = $ _____.
   That is, a^{-n} is the _____ of a^n.

2. For any nonzero number a and integers m and n, $\dfrac{a^m}{a^n} = $ _____.

3. The following three rules hold for any nonzero numbers a and b and positive integers m and n.

   (a) $\dfrac{1}{a^{-n}} = $ _____.

   (b) $\dfrac{a^{-n}}{b^{-m}} = $ _____.

   (c) $\left(\dfrac{a}{b}\right)^{-n} = $ _____.

4. A real number a is in _____ when a is written in the form $b \times 10^n$, where $1 \le |b| < 10$ and n is an integer.

Negative Integers as Exponents

Exercises 1-10: Refer to Examples 1-3 on pages 771-772 in your text and the Section 12.5 lecture video.

Simplify each expression.

1. 4^{-2} 1. _____

2. 5^{-1} 2. _____

3. x^{-3} 3. _____

4. $(a+b)^{-4}$ 4. _____

Evaluate each expression.

5. $3^2 \cdot 3^{-5}$ 5. _____

6. $5^{-3} \cdot 5^{-1}$ 6. _____

Simplify the expression. Write the answer using positive exponents.

7. $x^3 \cdot x^{-5}$ 7. _____

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

9. $(ab)^{-4}$ 9. _____

10. $(xy)^{-5}\left(xy^{-3}\right)^2$ 10. _____

The Quotient Rule

Exercises 11-13: Refer to Example 4 on page 773 in your text and the Section 12.5 lecture video.

Simplify each expression. Write the answer using positive exponents.

11. $\dfrac{3^4}{3^6}$ **11.** _____

12. $\dfrac{15a^2}{5a^6}$ **12.** _____

13. $\dfrac{x^6 y^2}{x^5 y^7}$ **13.** _____

Other Rules for Exponents

Exercises 14-17: Refer to Example 5 on page 774 in your text and the Section 12.5 lecture video.

Simplify each expression. Write the answer using positive exponents.

14. $\dfrac{1}{3^{-4}}$ **14.** _____

15. $\dfrac{4^{-2}}{3^{-3}}$ **15.** _____

16. $\dfrac{4x^2 y^{-3}}{12x^{-3} y^4}$ **16.** _____

17. $\left(\dfrac{b^3}{5}\right)^{-2}$ **17.** _____

Scientific Notation

Exercises 18-23: Refer to Examples 6-8 on pages 776-777 in your text and the Section 12.5 lecture video.

Write each number in standard form.

18. 4.17×10^5 **18.** _____

19. 2.3×10^{-4} **19.** _____

20. 5.82×10^{-2} **20.** _____

Write each number in scientific notation.

21. $32,000,000$ **21.** _____

22. 0.00002 **22.** _____

23. There are approximately 5.859×10^{12} miles in one light year.   **23.** _____
The distance from Earth to the moon and back is 4.8×10^5 miles.
How many round trips to the moon does one light-year represent?
Write your answer in scientific notation.