Section P.2 Exponents and Radicals

Objective: In this lesson you learned how to use properties of exponents and radicals to simplify and evaluate expressions.

### Important Vocabulary
Define each term or concept.

- Exponential form
- Scientific notation
- Principal \( n \)th root
- Rational exponent

### I. Exponents (Pages 12–13)

In general, if \( b \) is a real number and \( r \) is a positive integer, then

\[
b^r = b \cdot b \cdot b \cdots b, \quad \text{where } r \text{ is the } \underline{\text{number of factors}} \text{ and } b \text{ is the } \underline{\text{base}}.
\]

Complete the following properties of exponents.

- \((ab)^m = \underline{\text{product of powers}}\)
- \(a^{m+n} = \underline{\text{power of a power}}\)
- \(\frac{1}{a^n} = \underline{\text{reciprocal of a power}}\)
- \(|a^2| = \underline{\text{absolute value of a power}}\)
- \(a^m \cdot a^n = \underline{\text{product of powers}}\)
- \(a^{mn} = \underline{\text{power of a power}}\)
- \(a^0 = \underline{\text{any number to the power of 0}}\)
- \(\left(\frac{a}{b}\right)^m = \underline{\text{quotient of powers}}\)

### II. Scientific Notation (Page 14)

When a number is written in scientific notation, a \underline{\text{exponent}} indicates that the number is between 0 and 1.

A \underline{\text{exponent}} indicates that the number is 10 or more.
Example 1:  (a) Write 970,000 in scientific notation.
(b) Write $8.3 \times 10^{-4}$ in decimal form.

III. Radicals and Their Properties  (Pages 15–16)

Let $a$ and $b$ be real numbers. If $a = b^2$, then $b$ is the
________________ of $a$. If $a = b^3$, then $b$ is the
________________ of $a$.

In $\sqrt[n]{a}$, the positive integer $n$ is the __________ of the radical,
and the number $a$ is the ______________.

The radical expression $\sqrt[3]{-36}$ is not a real number because . . .

Example 2:  Simplify each radical expression.
(a) $\sqrt{\frac{81}{16}}$  (b) $\frac{3\sqrt{3} \cdot \sqrt{9}}{16}$

IV. Simplifying Radicals  (Pages 17–18)

An expression involving radicals is in simplest form when the
following conditions are satisfied:
1) 
2) 
3) 

Radical expressions are like radicals if . . .

Example 3:  Explain how to simplify a radical.
V. Rationalizing Denominators and Numerators
(Pages 18–19)

To change a radical expression so that it is free of radicals in the denominator is called ________.

The conjugate of the radical expression \( a + b\sqrt{m} \) is ________.

What type of rationalizing factor should be used if a denominator is of the form:
(a) \( \sqrt{m} \) ?
(b) \( \sqrt[3]{m} \) ?

Example 4: Explain how to rationalize the denominator of the expression \( \frac{4 + \sqrt{13}}{5 - \sqrt{8}} \).

VI. Rational Exponents  (Pages 19–20)

The numerator of a rational exponent denotes the ________ to which the base is raised, and the denominator denotes the ________ or the ________ to be taken.

Example 5: Write the radical expression \( \sqrt[4]{w^9} \) in exponential form.

Example 6: Explain how to simplify the expression \( \frac{x^{3/4}}{x^{2/3}} \).
**Homework Assignment**

Page(s)  
Exercises