8.3 Define and Use Zero and Negative Exponents

Before	You used properties of exponents to simplify expressions.
Now	You will use zero and negative exponents.
Why?	So you can compare masses, as in Ex. 52.

Key Vocabulary
• reciprocal, *p. 915*

In the activity, you saw what happens when you raise a number to a zero or negative exponent. The activity suggests the following definitions.

KEY CONCEPT   *For Your Notebook*

Definition of Zero and Negative Exponents

Words	Algebra	Example
a to the zero power is 1.	$a^0 = 1, a \neq 0$	$5^0 = 1$
a^{-n} is the reciprocal of a^n.	$a^{-n} = \dfrac{1}{a^n}, a \neq 0$	$2^{-1} = \dfrac{1}{2}$
a^n is the reciprocal of a^{-n}.	$a^n = \dfrac{1}{a^{-n}}, a \neq 0$	$2 = \dfrac{1}{2^{-1}}$

EXAMPLE 1   Use definition of zero and negative exponents

SIMPLIFY EXPRESSIONS
In this lesson, when simplifying powers with numerical bases, evaluate the numerical power.

a. $3^{-2} = \dfrac{1}{3^2}$ Definition of negative exponents

$\qquad = \dfrac{1}{9}$ Evaluate exponent.

b. $(-7)^0 = 1$ Definition of zero exponent

c. $\left(\dfrac{1}{5}\right)^{-2} = \dfrac{1}{\left(\dfrac{1}{5}\right)^2}$ Definition of negative exponents

$\qquad = \dfrac{1}{\dfrac{1}{25}}$ Evaluate exponent.

$\qquad = 25$ Simplify by multiplying numerator and denominator by 25.

d. $0^{-5} = \dfrac{1}{0^5}$ (Undefined) a^{-n} is defined only for a *nonzero* number a.

✓ **GUIDED PRACTICE**   for Example 1

Evaluate the expression.

1. $\left(\dfrac{2}{3}\right)^0$ **2.** $(-8)^{-2}$ **3.** $\dfrac{1}{2^{-3}}$ **4.** $(-1)^0$