

SCIENTIFIC NOTATION A number is expressed in **scientific notation** if it is in the form $c \times 10^n$ where $1 \leq c < 10$ and n is an integer. When you work with numbers in scientific notation, the properties of exponents can make calculations easier.

EXAMPLE 2 Use scientific notation in real life

LOCUSTS A swarm of locusts may contain as many as 85 million locusts per square kilometer and cover an area of 1200 square kilometers. About how many locusts are in such a swarm?



Solution

Number of locusts	=	Locusts per square kilometer	×	Number of square kilometers
				Substitute values.
				Write in scientific notation.
				Use multiplication properties.
				Product of powers property
				Write 10.2 in scientific notation.
				Product of powers property

▶ The number of locusts is about 1.02×10^{11} , or about 102,000,000,000.

REVIEW SCIENTIFIC NOTATION

For help with scientific notation, see p. 982.

GUIDED PRACTICE for Examples 1 and 2

Evaluate the expression. Tell which properties of exponents you used.

1. $(4^2)^3$

2. $(-8)(-8)^3$

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

4. $\frac{6 \cdot 10^{-4}}{9 \cdot 10^7}$

SIMPLIFYING EXPRESSIONS You can use the properties of exponents to simplify algebraic expressions. A simplified expression contains only positive exponents.

EXAMPLE 3 Simplify expressions

a. $b^{-4}b^6b^7 = b^{-4+6+7} = b^9$ **Product of powers property**

b. $\left(\frac{r^{-2}}{s^3}\right)^{-3} = \frac{(r^{-2})^{-3}}{(s^3)^{-3}}$ **Power of a quotient property**

$= \frac{r^6}{s^{-9}}$ **Power of a power property**

$= r^6s^9$ **Negative exponent property**

c. $\frac{16m^4n^{-5}}{2n^{-5}} = 8m^4n^{-5-(-5)}$ **Quotient of powers property**

$= 8m^4n^0 = 8m^4$ **Zero exponent property**

INTERPRET BASES

In this book, it is assumed that any base with a zero or negative exponent is nonzero.