50. ◆ **TAKS REASONING** Write three expressions involving products of powers, powers of powers, or powers of products that are equivalent to $12x^8$.

51. **CHALLENGE** Show that when a and b are real numbers and n is a positive integer, $(ab)^n = a^n b^n$.

PROBLEM SOLVING

52. **ICE CREAM COMPOSITION** There are about 954,930 air bubbles in 1 cubic centimeter of ice cream. There are about 946 cubic centimeters in 1 quart. Use order of magnitude to find the approximate number of air bubbles in 1 quart of ice cream.

TEXAS @HomeTutor for problem solving help at classzone.com

53. **ASTRONOMY** The order of magnitude of the radius of our solar system is 10^{13} meters. The order of magnitude of the radius of the visible universe is 10^{13} times as great. Find the approximate radius of the visible universe.

TEXAS @HomeTutor for problem solving help at classzone.com

54. **COASTAL LANDSLIDE** There are about 1 billion grains of sand in 1 cubic foot of sand. In 1995 a stretch of beach at Sleeping Bear Dunes National Lakeshore in Michigan slid into Lake Michigan. Scientists believe that around 35 million cubic feet of sand fell into the lake. Use order of magnitude to find about how many grains of sand slid into the lake.

55. ◆ **MULTIPLE REPRESENTATIONS** There are about 10^{23} atoms of gold in 1 ounce of gold.

a. Making a Table Copy and complete the table by finding the number of atoms of gold for the given amounts of gold (in ounces).

Gold (ounces)	10	100	1000	10,000	100,000
Number of atoms	?	?	?	?	?

b. Writing an Expression A particular mine in California extracted about 96,000 ounces of gold in 1 year. Use order of magnitude to write an expression you can use to find the approximate number of atoms of gold extracted in the mine that year. Simplify the expression. Verify your answer using the table.

56. **MULTI-STEP PROBLEM** A microscope has two lenses, the objective lens and the eyepiece, that work together to magnify an object. The total magnification of the microscope is the product of the magnification of the objective lens and the magnification of the eyepiece.

Eyepiece

Objective lens

a. Your microscope's objective lens magnifies an object 10^2 times, and the eyepiece magnifies an object 10 times. What is the total magnification of your microscope?

b. You magnify an object that is 10^2 nanometers long. How long is the magnified image?