PROBLEM SOLVING

EXAMPLES 4 and 5 on pp. 497–498 for Exs. 49–51

49. **MULTIPLE REPRESENTATIONS** Draw a square with side lengths that are 1 unit long. Divide it into four new squares with side lengths that are one half the side length of the original square, as shown in Step 1. Keep dividing the squares into new squares, as shown in Steps 2 and 3.

Step 0 Step 1 Step 2 Step 3

a. Making a Table Make a table showing the number of new squares and the side length of a new square at each step for Steps 1–4. Write the number of new squares as a power of 4. Write the side length of a new square as a power of $\frac{1}{2}$.

b. Writing an Expression Write and simplify an expression to find by how many times the number of new squares increased from Step 2 to Step 4.

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50. **GROSS DOMESTIC PRODUCT** In 2003 the gross domestic product (GDP) for the United States was about 11 trillion dollars, and the order of magnitude of the population of the U.S. was 10^8. Use order of magnitude to find the approximate per capita (per person) GDP?

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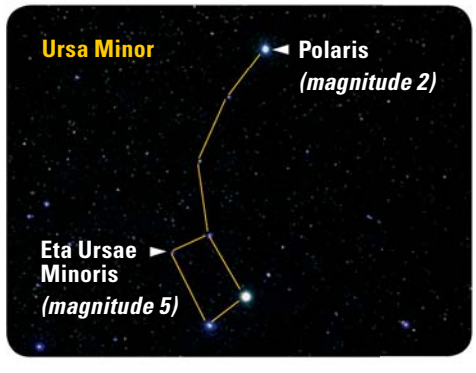
51. **SPACE TRAVEL** Alpha Centauri is the closest star system to Earth. Alpha Centauri is about 10^{13} kilometers away from Earth. A spacecraft leaves Earth and travels at an average speed of 10^4 meters per second. About how many years would it take the spacecraft to reach Alpha Centauri?

52. **ASTRONOMY** The brightness of one star relative to another star can be measured by comparing the magnitudes of the stars. For every increase in magnitude of 1, the relative brightness is diminished by a factor of 2.512. For instance, a star of magnitude 8 is 2.512 times less bright than a star of magnitude 7.

The constellation Ursa Minor (the Little Dipper) is shown. How many times less bright is Eta Ursae Minoris than Polaris?



53. **EARTHQUAKES** The energy released by one earthquake relative to another earthquake can be measured by comparing the magnitudes (as determined by the Richter scale) of the earthquakes. For every increase of 1 in magnitude, the energy released is multiplied by a factor of about 31. How many times greater is the energy released by an earthquake of magnitude 7 than the energy released by an earthquake of magnitude 4?

= WORKED-OUT SOLUTIONS on p. WS1 = TAKS PRACTICE AND REASONING = MULTIPLE REPRESENTATIONS