

## Math by Design Hint Pages

### Using Proportional Reasoning for Scale Drawings

Flossville Park, Ahoy, Matey! Subtask 1: Place and size the pond.

Windjammer Center, 3 R's Subtask 1: Place and size the gazebo.

Windjammer Center, Pentagonal Plot Subtask 1: Place and size the garden.

A **ratio** is a comparison between two numbers, often written as a fraction.

For example, the *ratio* of stars to stripes on the flag of the United States is  $\frac{50}{13}$ .

A **proportion** is a statement of equality between two ratios.

The statement  $\frac{2}{3} = \frac{10}{15}$  is an example of a *proportion*.

When a proportion is true, the cross products of the two ratios will always be equal.

For example, using the proportion above:

$$\begin{aligned}\frac{2}{3} &= \frac{10}{15} \\ 2(15) &= 3(10) \\ 30 &= 30\end{aligned}$$

The fact that the cross products are equal provides a method for determining the value of a missing number in a proportion.

#### Example 1:

Find the value of  $n$  that makes this proportion true.  $\frac{12}{8} = \frac{21}{n}$

**Answer:** The value of  $n$  that makes the proportion true is 14.

$$\begin{aligned}\frac{12}{8} &= \frac{21}{n} \\ 12n &= 8(21) \\ 12n &= 168 \\ \frac{12n}{12} &= \frac{168}{12} \\ n &= 14\end{aligned}$$

Proportions are often used to find missing measurements in scale drawings.

**Example 2:** The scale of a map is 1 cm represents 5 km. If the distance between two cities is actually 58 km, how far apart should these cities be placed on the map?

**Answer:** The cities should be 11.6 cm apart on the map.

$$\begin{aligned}\frac{1 \text{ cm}}{5 \text{ km}} &= \frac{n \text{ cm}}{58 \text{ km}} \\ 58 &= 5n \\ 11.6 &= n\end{aligned}$$