

Lesson 8 Ratio and Proportion

You come in contact with ratios every day. Whenever you see the words “nine out of ten” or “miles to the gallon,” or “1 inch = 5 miles,” you are reading a ratio.

A ratio is a comparison of two numbers, and it can be written as a fraction. For example, if the scale on a map represents 1 inch for every 5 miles, you can say that the ratio of inches to miles is 1 inch = 5 miles, or $\frac{1}{5}$.

Example Angie has a planter that measures 4 feet long, 2 feet wide and 3 feet high. She makes another planter that is proportional to it but has a length of 12 inches. What is the width and height of the new planter?

Step 1. Determine the scale Angie used to create the second planter. Because the new planter will be in inches, convert all measurements of the old planter to inches. There are 12 inches in a foot, so multiply the number of feet by 12 to get the number of inches.

Step 2. Set up a ratio of the old length and the new one as a fraction: $\frac{48}{12}$

length is 4 feet \times 12 = 48 inches
width is 2 feet \times 12 = 24 inches
height is 3 feet \times 12 = 36 inches

Step 3. Reduce the fraction to its lowest terms. Divide the top and bottom numbers by 12.

$$\frac{48}{12} \div \frac{12}{12} = \frac{4}{1}$$

The ratio of the old planter length to the new planter length is 4 inches (old planter) = 1 inch (new planter), $\frac{4}{1}$.

Step 4. Set up a proportion to find the width of the new planter. Let w stand for the width of the new planter. We know that the old planter is 24 inches wide.

$$\frac{4 \text{ inches (length of old planter)}}{1 \text{ inch (length of new planter)}} = \frac{24 \text{ inches (width of old planter)}}{w \text{ inches (width of new planter)}}$$

Now find out what number multiplied by 4 equals 24. $24 \div 4 = 6$. That number is 6. Multiply the top and the bottom by 6. $4 \times 6 = 24$. Multiply 1 inch \times 6 to get the width of the new planter.

$$\frac{4}{1} \times \frac{6}{6} = \frac{24 \text{ inches}}{6 \text{ inches (width of new planter)}}$$

Step 5. Set up a proportion to find the height of the new planter. Let h stand for the height of the new planter. We know that the old planter is 36 inches high.

$$\frac{4 \text{ inches (length of old planter)}}{1 \text{ inch (length of new planter)}} = \frac{36 \text{ inches (height of old planter)}}{h \text{ inches (height of new planter)}}$$

Now find out what number multiplied by 4 equals 36. $36 \div 4 = 9$. That number is 9. $9 \times 4 = 36$. Multiply the top and bottom numbers by 9 to get the height of the new planter.

$$\frac{4}{1} \times \frac{9}{9} = \frac{36 \text{ inches}}{9 \text{ inches (height of new planter)}}$$

The width of the new planter is 6 inches and the height is 9 inches.

Test Example

Read the question. Circle the answer.

- 1 Carmen is building a shed. The blueprints show that a 3-inch line represents a 12-foot side. What scale was used to draw the blueprint?

- A 3 inches = 10 feet C 1 inch = 4 feet
B 3 inches = $\frac{1}{2}$ foot D 1 inch = 3 feet

- 1 C The ratio 3 inches = 12 feet can be written as $\frac{3}{12}$. It can be reduced by dividing each number by 3.

$$\frac{3 \text{ inches}}{12 \text{ feet}} \div \frac{3}{3} = \frac{1 \text{ inch}}{4 \text{ feet}}$$

Hint

For a proportion, the terms in both ratios have to be kept in the same order. Be sure that you are comparing inches to inches and feet to feet.

Practice

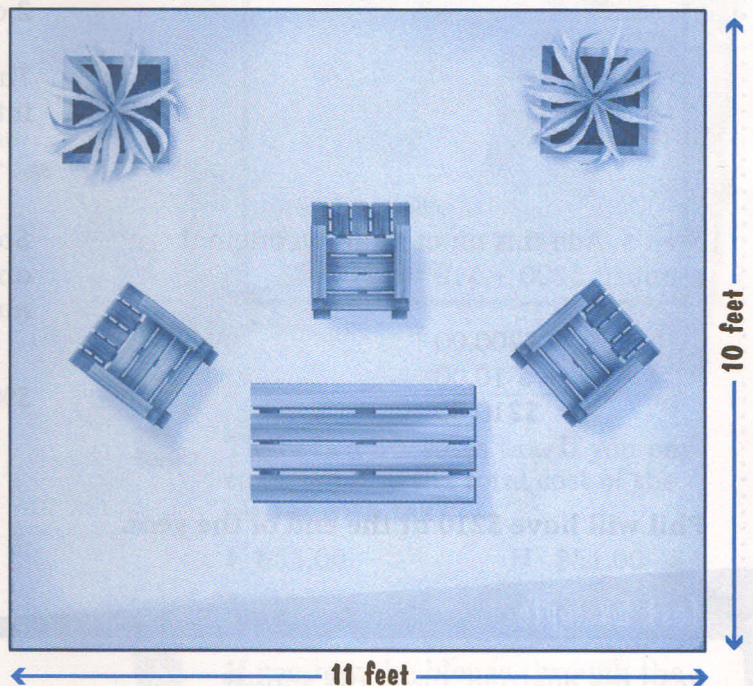
Sarah wants to build a new back patio. This diagram shows the dimensions of the patio. Study the diagram. Then answer numbers 1 and 2.

- 1 A 2-inch line in the diagram represents 6 feet of the patio. What scale is used to draw the diagram?

- A 1 inch = 6 feet
B 1 inch = 3 feet
C 1 inch = 2 feet
D 1 inch = 8 feet

- 2 Sarah's neighbor Stan wants a new patio for his yard like Sarah's. His patio will have a length of 22 feet. What will be the width of the larger patio?

- F 6 feet
G 4 feet
H 15 feet
J 20 feet



Check your answers on page 117.