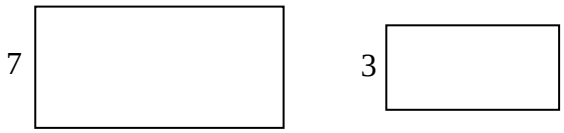
Area Ratios of Similar Figures

1. a. On a piece of graph paper draw a rectangle and determine its area.

   b. Draw another rectangle by doubling the length of each side of the first rectangle. Determine the area of this rectangle.

   c. Explain the relationship between the areas.

2. The rectangles drawn are similar. The lengths of a pair of corresponding sides are given.



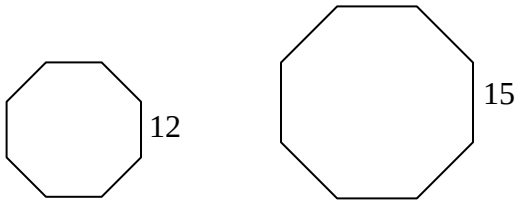
   a. What is the similarity ratio of the rectangle on the left to the rectangle on the right?

   b. What is the ratio of the perimeter of the rectangle on the right to the perimeter of the rectangle on the left?

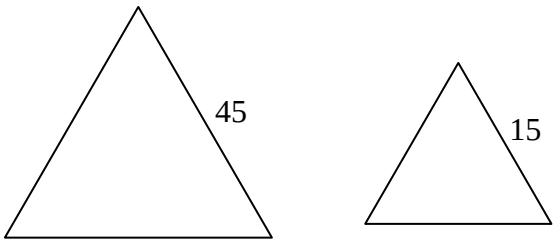
   c. What is the ratio of the area of the figure on the right to the area of the figure on the left?

3. Find the ratio of the perimeter of the figure on the left to the figure on the right. Then find the ratio of the area of the figure on the left to the figure on the right. Use mathematics to justify your answers.

   a. Regular Octagons

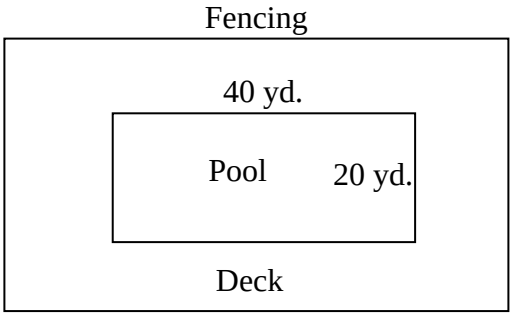


   b. Equilateral Triangles



Area Ratios of Similar Figures (Continued)

4. The dimensions of the rectangular pool shown below are 40 yards by 20 yards. Fencing is to be ordered to enclose the deck. The ratio of the dimensions of the region that is fenced in to the dimensions of the pool is $\frac{3}{2}$.

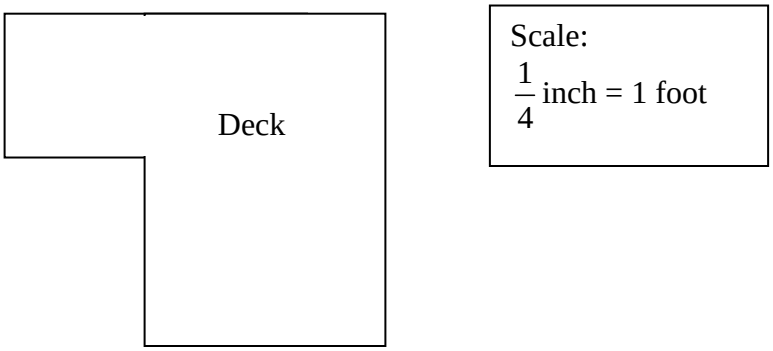


a. What are the dimensions, in yards, of the region that is fenced in? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

b. How many yards of fence were purchased to enclose the deck?

c. Fencing costs $7.50 per yard. How much did it cost to purchase fencing to enclose the deck?

5. A scale drawing of a deck is shown below.



a. What is the perimeter of the actual deck? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

b. What is the area of the actual deck? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

c. If the deck dimensions are doubled, what is the ratio of the perimeters of the new deck to the actual deck? Use mathematics to justify your answer.

d. If the deck dimensions are doubled, what is the ratio of the areas of the new deck to the actual deck? Use mathematics to justify your answer.

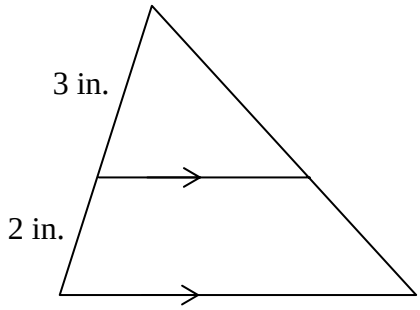
Area Ratios of Similar Figures (Continued)

6. It costs $440 to carpet a room that measures 16 feet by 24 feet. How much would it cost to carpet a similar room that measures 12 feet by 18 feet? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.

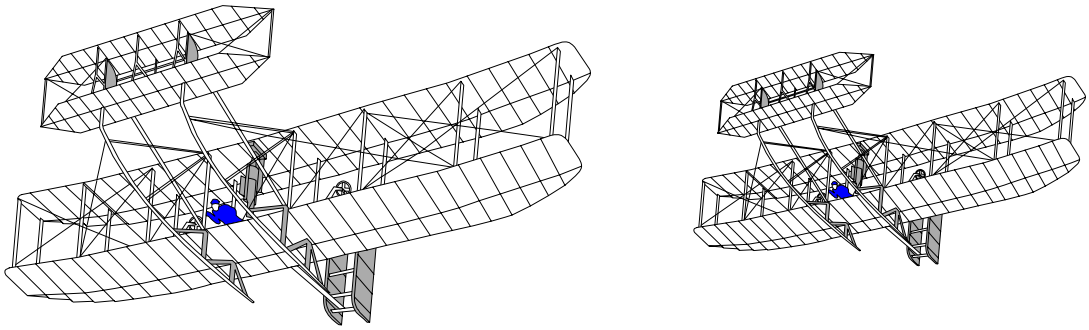
7. The lengths of corresponding altitudes in two similar triangles are in the ratio of $\frac{1}{5}$. What is the ratio of their areas?

8. The areas in two similar parallelograms are in the ratio of $\frac{4}{25}$. What is the ratio of the lengths of corresponding altitudes?

9. Given the figure at the right, what is the ratio of the areas of the small triangle to the large triangle? Use mathematics to explain how you determined your answer. Use words, symbols, or both in your explanation.



10. Two scale models of the Wright brothers plane the Kittyhawk are shown below. The two models are similar to each other because they are both similar to the original plane. The larger model is 25 cm long, and the smaller model is 15 cm long.



a. What is the ratio of the wingspan of the larger model to the wingspan of the smaller model? Use mathematics to justify your answer.

b. What is the ratio of the area of the top wing of the larger model to the area of the top wing of the smaller model? Use mathematics to justify your answer.

Answers:

1. b. Answers will vary
   c. The new area is four times the original area.

2. a. $\frac{7}{3}$ b. $\frac{7}{3}$ c. $\frac{49}{9}$

3. a. perimeter ratio: $\frac{12}{15}$ or $\frac{4}{5}$ area ratio: $\frac{144}{225}$ or $\frac{16}{25}$

   If two similar polygons or circles have lengths of corresponding sides (or radii) in the ratio of $\frac{a}{b}$, then their areas are in the ratio of $\frac{a^2}{b^2}$ or $\left(\frac{a}{b}\right)^2$.

   b. perimeter ratio: $\frac{45}{15}$ or $\frac{3}{1}$ area ratio: $\frac{2025}{225}$ or $\frac{9}{1}$

   If two similar polygons or circles have lengths of corresponding sides (or radii) in the ratio of $\frac{a}{b}$, then their areas are in the ratio of $\frac{a^2}{b^2}$ or $\left(\frac{a}{b}\right)^2$.

4. a. Dimensions: $\frac{x}{40} = \frac{3}{2}$ $\frac{x}{20} = \frac{3}{2}$

   $2x = 120$ $2x = 60$

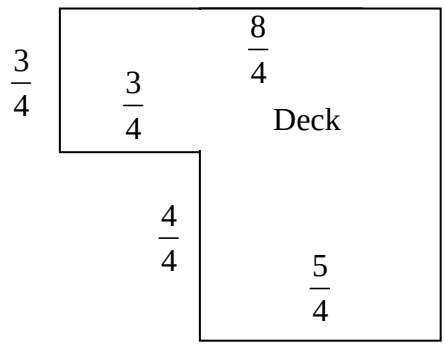
   $x = 60$ $x = 30$

   60 yards by 30 yards for fence

   b. Total fence needed: 120 + 60 = 180 yards

   c. Cost: (180 yards)($7.50 per yard) = $1,350.00

5. a.



Scale:
$\frac{1}{4}$ inch = 1 foot

$$P: \frac{8}{4}+\frac{7}{4}+\frac{5}{4}+\frac{4}{4}+\frac{3}{4}+\frac{3}{4}=\frac{30}{4}$$

Perimeter of the deck is 30 ft.

b. $8(7) - 3(4) = 44$ ft.^{2}

c. 2:1 The ratio of the perimeters is equal to the ratio of the corresponding sides.

d. 4:1 The ratio of the areas is equal to the square of the ratio of the corresponding sides.

6. The ratio of the areas is $\left(\frac{16}{12}\right)^2=\left(\frac{4}{3}\right)^2=\frac{16}{9}$

$\frac{16}{9}=\frac{440}{x}$ so x, the cost, is \$247.50.

7. $\frac{1}{25}$

8. $\frac{2}{5}$

9. The ratio of sides is 3:5 so ratio of areas is $3^2:5^2 = 9:25$.

10. a. $\frac{25}{15}$ or $\frac{5}{3}$. If the figures are similar then the ratios of corresponding dimensions will be the same.

b. $\frac{25}{9}$ If two similar polygons or circles have lengths of corresponding sides (or radii) in the ratio of $\frac{a}{b}$, then their areas are in the ratio of $\frac{a^2}{b^2}$ or $\left(\frac{a}{b}\right)^2$.