

# Similarity and Ratios

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Quick Review and Helpful Hints

*Similar* figures have the same shape but different sizes. Their corresponding (matching) sides are in proportion – they share one common ratio called the *scale factor*. To find a missing side, set up a proportion of corresponding sides and cross-multiply.

▷ **Example:** Two triangles are similar. The small one has a side of 3 matching a side of 9 in the large one. If the small one also has a side of 4, find the matching side. **Work:** Set up a proportion of corresponding sides:  $\frac{3}{9} = \frac{4}{x}$ . Cross-multiply:  $3x = 9 \cdot 4 = 36$ , so  $x = 12$ .



Corresponding sides share the ratio  $\frac{3}{9} = \frac{4}{12}$ .

★ **Answer:**  $x = 12$

### Practice Problems

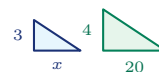
Use the similar figures shown. Set up a proportion and solve for the missing side.

1. Find  $x$ :  $\frac{2}{6} = \frac{5}{x}$ .



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7. Find  $x$ :  $\frac{x}{20} = \frac{3}{4}$ .



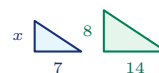
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2. Find  $x$ :  $\frac{3}{12} = \frac{4}{x}$ .



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8. Find  $x$ :  $\frac{7}{14} = \frac{x}{8}$ .



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3. Find  $x$ :  $\frac{4}{10} = \frac{6}{x}$ .



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9. Find  $x$ :  $\frac{10}{25} = \frac{6}{x}$ .



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4. Find  $x$ :  $\frac{5}{15} = \frac{x}{9}$ .



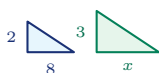
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10. Find  $x$ :  $\frac{9}{12} = \frac{x}{20}$ .



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5. Find  $x$ :  $\frac{8}{x} = \frac{2}{3}$ .



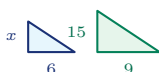
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11. Find  $x$ :  $\frac{4}{x} = \frac{6}{9}$ .



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6. Find  $x$ :  $\frac{6}{9} = \frac{x}{15}$ .



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12. Find  $x$ :  $\frac{5}{8} = \frac{15}{x}$ .



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13. Find  $x$ :  $\frac{12}{8} = \frac{x}{6}$ .



14. Find  $x$ :  $\frac{2}{5} = \frac{x}{20}$ .



◆ Word Problems

15. Similar triangles: 4 cm matches 12 cm. If another small side is 5 cm, find the matching large side.



16. A 6-ft man casts a 4-ft shadow. A tree casts a 20-ft shadow. How tall is the tree?

17. A scale drawing has 3 in for 18 ft. What real length does 5 in represent?

18. Similar rectangles: the smaller is 8 cm by 5 cm. The larger matching long side is 24 cm. Find the larger short side.



19. On a map, 2 inches represent 50 miles. How many miles are represented by 7 inches?

20. A 4 in by 6 in photo is enlarged so the 4-in side becomes 10 in. Find the new length of the 6-in side.



21. A model truck uses a scale where 1 inch on the model represents 24 inches on the real truck. If the model is 7 inches long, how long is the real truck?

22. A 4-ft mailbox casts a 3-ft shadow. At the same time, a flagpole casts an 18-ft shadow. How tall is the flagpole?

23. A floor plan shows a 12-ft wall as 3 inches. On the same plan, how long should a 16-ft wall be?

24. Two similar signs have matching widths 5 ft and 15 ft. If the smaller sign's perimeter is 26 ft, find the larger sign's perimeter.



## Answer Keys

- |             |              |             |               |
|-------------|--------------|-------------|---------------|
| 1. $x = 15$ | 7. $x = 15$  | 13. $x = 9$ | 19. 175 miles |
| 2. $x = 16$ | 8. $x = 4$   | 14. $x = 8$ | 20. 15 in     |
| 3. $x = 15$ | 9. $x = 15$  | 15. 15 cm   | 21. 168 in    |
| 4. $x = 3$  | 10. $x = 15$ | 16. 30 ft   | 22. 24 ft     |
| 5. $x = 12$ | 11. $x = 6$  | 17. 30 ft   | 23. 4 in      |
| 6. $x = 10$ | 12. $x = 24$ | 18. 15 cm   | 24. 78 ft     |

### Step-by-Step Explanations

**1.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use the matching sides in the diagrams:  $\frac{2}{6} = \frac{5}{x}$ . Cross-multiply:  $2x = 30$ , so  $x = 15$ . So the final answer is  $x = 15$ .

**2.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The matching sides give  $\frac{3}{12} = \frac{4}{x}$ . Cross-multiply:  $3x = 48$ , so  $x = 16$ . So the final answer is  $x = 16$ .

**3.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Set corresponding sides equal:  $\frac{4}{10} = \frac{6}{x}$ . Then  $4x = 60$ , so  $x = 15$ . So the final answer is  $x = 15$ .

**4.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Match the first pair and second pair:  $\frac{5}{15} = \frac{x}{9}$ . Cross-multiply:  $15x = 45$ , so  $x = 3$ . So the final answer is  $x = 3$ .

**5.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use the same side order across both triangles:  $\frac{x}{8} = \frac{2}{3}$ . Then  $2x = 24$ , so  $x = 12$ . So the final answer is  $x = 12$ .

**6.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The diagrams show  $\frac{6}{9} = \frac{x}{15}$ . Cross-multiply:  $9x = 90$ , so  $x = 10$ . So the final answer is  $x = 10$ .

**7.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Corresponding sides give  $\frac{x}{20} = \frac{3}{4}$ . Cross-multiply:  $4x = 60$ , so  $x = 15$ . So the final answer is  $x = 15$ .

**8.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use  $\frac{7}{14} = \frac{x}{8}$ . Cross-multiply:  $14x = 56$ , so  $x = 4$ . So the final answer is  $x = 4$ .

**9.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Matching sides form  $\frac{10}{25} = \frac{6}{x}$ . Then  $10x = 150$ , so  $x = 15$ . So the final answer is  $x = 15$ .

**10.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The proportion is  $\frac{9}{12} = \frac{x}{20}$ . Cross-multiply:  $12x = 180$ , so  $x = 15$ . So the final answer is  $x = 15$ .

**11.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use  $\frac{4}{x} = \frac{6}{9}$ . Cross-multiply:  $6x = 36$ , so  $x = 6$ . So the final answer is  $x = 6$ .

**12.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Corresponding sides give  $\frac{5}{8} = \frac{15}{x}$ . Then  $5x = 120$ , so  $x = 24$ . So the final answer is  $x = 24$ .

**13.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use  $\frac{12}{8} = \frac{x}{6}$ . Cross-multiply:  $8x = 72$ , so  $x = 9$ . So the final answer is  $x = 9$ .

**14.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use  $\frac{2}{5} = \frac{x}{20}$ . Cross-multiply:  $5x = 40$ , so  $x = 8$ . So the final answer is  $x = 8$ .

**15.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Pair up the matching sides in the similar triangles:  $\frac{4}{12} = \frac{5}{x}$ . Cross-multiply ( $4x = 60$ ) to get  $x = 15$  cm. So the final answer is 15 cm.

**16.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The person and tree make similar right triangles:  $\frac{6}{4} = \frac{h}{20}$ . Cross-multiply ( $4h = 120$ ), so the tree is 30 ft tall. So the final answer is 30 ft.

**17.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The scale drawing keeps the same ratio:  $\frac{3}{18} = \frac{5}{x}$ . Cross-multiply ( $3x = 90$ ) to get  $x = 30$  ft. So the final answer is 30 ft.

**18.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Match long side to long side and short side to short side:  $\frac{8}{24} = \frac{5}{x}$ . Cross-multiply ( $8x = 120$ ), so  $x = 15$  cm. So the final answer is 15 cm.

**19.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is Use the map scale as a proportion:  $\frac{2}{50} = \frac{7}{x}$ . Cross-multiply to get  $2x = 350$ , so  $x = 175$  miles. So the final answer is 175 miles.

**20.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The photo scale factor is  $10 \div 4 = 2.5$ . The matching side becomes  $6 \times 2.5 = 15$  inches. So the final answer is 15 in.

**21.** Start by naming the process: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The model scale is 1 : 24, so multiply the model length by 24:  $7 \times 24 = 168$  inches. So the final answer is 168 in.

**22.** A good way to think about this is: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The mailbox and flagpole make similar triangles with their shadows:  $\frac{4}{3} = \frac{h}{18}$ . Thus  $3h = 72$ , so  $h = 24$  ft. So the final answer is 24 ft.

**23.** Step by step: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The scale is 3 inches for 12 feet, so 1 inch represents 4 feet. A 16-ft wall is  $16 \div 4 = 4$  inches. So the final answer is 4 in.

**24.** Take it one move at a time: Read what the problem is asking, choose the matching rule, write the setup, and then simplify one step at a time. The setup/work is The matching widths change by a factor of  $15 \div 5 = 3$ . Perimeter scales by the same factor, so  $26 \times 3 = 78$  ft. So the final answer is 78 ft.



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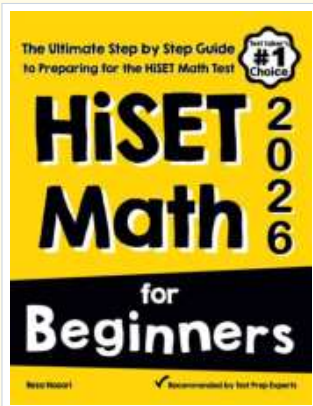
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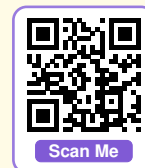
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