

# Congruent Figures

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

## Quick Review

Two figures are **congruent** when one can be moved onto the other using only *rigid motions* — translations, reflections, and rotations. Congruent figures have exactly the same **size and shape**: matching (*corresponding*) sides are equal in length and matching angles are equal in measure. We write  $\triangle ABC \cong \triangle DEF$ , and the *order of the letters* tells you which parts match:  $A$  with  $D$ ,  $B$  with  $E$ ,  $C$  with  $F$ . If you know a pair is congruent, you can find missing sides and angles by matching them up.

◇ **Example:**  $\triangle ABC \cong \triangle DEF$ . If  $AB = 7$  cm,  $BC = 9$  cm, and  $\angle A = 50^\circ$ , find  $DE$  and  $\angle D$ .  
 ⇒ The congruence statement lines up the parts for us. Since  $A$  matches  $D$  and  $B$  matches  $E$ , side  $AB$  matches side  $DE$  — so  $DE = AB = 7$  cm. And angle  $\angle A$  matches angle  $\angle D$ , so  $\angle D = \angle A = 50^\circ$ . Congruent figures simply copy each other part for part.

**Answer:**  $DE = 7$  cm,  $\angle D = 50^\circ$

## PRACTICE

Use the congruence statement to find each missing measure.

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|---|--|
| 1. $\triangle ABC \cong \triangle DEF$ , $AB = 5 \Rightarrow DE = ?$ _____                    | 13. $\triangle ABC \cong \triangle DEF$ , $\angle D = 30^\circ$ , $\angle E = 80^\circ \Rightarrow \angle C = ?$ _____ |
| 2. $\triangle ABC \cong \triangle DEF$ , $BC = 11 \Rightarrow EF = ?$ _____                   | 14. If $\triangle ABC \cong \triangle DEF$ , then $AB + BC$ equals _____   |
| 3. $\triangle ABC \cong \triangle DEF$ , $AC = 8 \Rightarrow DF = ?$ _____                    | 15. $\triangle GHI \cong \triangle JKL$ , $GH = 2x$ , $JK = 14 \Rightarrow x = ?$ _____                                |
| 4. $\triangle ABC \cong \triangle DEF$ , $\angle A = 40^\circ \Rightarrow \angle D = ?$ _____ | 16. $\triangle GHI \cong \triangle JKL$ , $HI = x + 3$ , $KL = 10 \Rightarrow x = ?$ _____                             |
| 5. $\triangle ABC \cong \triangle DEF$ , $\angle B = 75^\circ \Rightarrow \angle E = ?$ _____ | 17. $\triangle GHI \cong \triangle JKL$ , $\angle G = 3x$ , $\angle J = 60^\circ \Rightarrow x = ?$ _____              |
| 6. $\triangle ABC \cong \triangle DEF$ , $\angle C = 65^\circ \Rightarrow \angle F = ?$ _____ | 18. Are two figures with equal sides but different angles congruent? _____   |
| 7. $\triangle PQR \cong \triangle STU$ , $PQ = 13 \Rightarrow ST = ?$ _____                   | 19. Perimeter of $\triangle ABC = 24$ . $\triangle ABC \cong \triangle DEF$ . Perimeter of $\triangle DEF = ?$ _____   |
| 8. $\triangle PQR \cong \triangle STU$ , $QR = 6 \Rightarrow TU = ?$ _____                    | 20. $\triangle ABC \cong \triangle DEF$ , $DE = 9$ , $EF = 12$ , $DF = 15$ . Perimeter of $\triangle ABC = ?$ _____    |
| 9. $\triangle PQR \cong \triangle STU$ , $\angle Q = 90^\circ \Rightarrow \angle T = ?$ _____ |  |
| 10. $\triangle PQR \cong \triangle STU$ , $PR = 10$ , $SU = ?$ _____                          |  |
| 11. Square $WXYZ \cong$ Square $ABCD$ , $WX = 4 \Rightarrow AB = ?$ _____                     |  |

### Word Problems

21. Two triangular sails are congruent,  $\triangle ABC \cong \triangle DEF$ . On the first sail,  $AB = 6$  ft,  $BC = 8$  ft, and  $AC = 10$  ft. How much trim is needed to edge the second sail? \_\_\_\_\_
22. A factory stamps out congruent metal brackets. One bracket is  $\triangle PQR$  with  $\angle P = 90^\circ$  and  $\angle Q = 35^\circ$ . In the congruent bracket  $\triangle STU$ , what is  $\angle U$ ? \_\_\_\_\_
23. A quilt uses congruent square patches.  $WXYZ \cong ABCD$ , and side  $WX$  measures 5 inches. A quilter sews 40 inches of border around patch  $ABCD$ . Is that exactly enough? \_\_\_\_\_
24. A logo is made of two congruent triangles. In  $\triangle GHI \cong \triangle JKL$ , side  $GH = 2x + 1$  and its matching side  $JK = 13$ . Solve for  $x$ , then state the length of  $GH$ . \_\_\_\_\_



## Answer Keys

- |                |   |
|----------------|---|
| 1. 5           | 13. $70^\circ$  |
| 2. 11          | 14. $DE + EF$   |
| 3. 8           | 15. 7   |
| 4. $40^\circ$  | 16. 7   |
| 5. $75^\circ$  | 17. 20  |
| 6. $65^\circ$  | 18. no  |
| 7. 13          | 19. 24  |
| 8. 6           | 20. 36  |
| 9. $90^\circ$  | 21. 24 ft   |
| 10. 10         | 22. $\angle U = 55^\circ$   |
| 11. 4          | 23. Yes; the perimeter of $ABCD$ is 20 in, so 40 in is more than enough |
| 12. $60^\circ$ | 24. $x = 6$ ; $GH = 13$   |

### Step-by-Step Explanations

- |  |   |
|--|---|
| <p>1. <math>AB</math> corresponds to <math>DE</math>, so they are equal: <math>DE = 5</math>.</p> <p>2. <math>BC</math> corresponds to <math>EF</math>, so <math>EF = 11</math>.</p> <p>3. <math>AC</math> corresponds to <math>DF</math>, so <math>DF = 8</math>.</p> <p>4. <math>\angle A</math> corresponds to <math>\angle D</math>, so <math>\angle D = 40^\circ</math>.</p> <p>5. <math>\angle B</math> corresponds to <math>\angle E</math>, so <math>\angle E = 75^\circ</math>.</p> <p>6. <math>\angle C</math> corresponds to <math>\angle F</math>, so <math>\angle F = 65^\circ</math>.</p> <p>7. <math>PQ</math> corresponds to <math>ST</math>, so <math>ST = 13</math>.</p> <p>8. <math>QR</math> corresponds to <math>TU</math>, so <math>TU = 6</math>.</p> <p>9. <math>\angle Q</math> corresponds to <math>\angle T</math>, so <math>\angle T = 90^\circ</math>.</p> <p>10. <math>PR</math> corresponds to <math>SU</math>, so <math>SU = 10</math>.</p> <p>11. <math>WX</math> corresponds to <math>AB</math>, so <math>AB = 4</math>.</p> <p>12. <math>\angle C = 180 - 55 - 65 = 60^\circ</math>, and <math>\angle F</math> matches <math>\angle C</math>, so <math>\angle F = 60^\circ</math>.</p> <p>13. <math>\angle F = 180 - 30 - 80 = 70^\circ</math>, and <math>\angle C</math> matches <math>\angle F</math>, so <math>\angle C = 70^\circ</math>.</p> <p>14. Each side copies its match, so <math>AB + BC = DE + EF</math>.</p> | <p>15. <math>GH = JK</math>, so <math>2x = 14</math> and <math>x = 7</math>.</p> <p>16. <math>HI = KL</math>, so <math>x + 3 = 10</math> and <math>x = 7</math>.</p> <p>17. <math>\angle G = \angle J</math>, so <math>3x = 60</math> and <math>x = 20</math>.</p> <p>18. Congruent figures need <i>both</i> matching sides and matching angles equal.</p> <p>19. All sides copy over, so the perimeter is also 24.</p> <p>20. The sides of <math>\triangle ABC</math> match <math>\triangle DEF</math>: <math>9 + 12 + 15 = 36</math>.</p> <p>21. The second sail copies every side of the first, so its perimeter is <math>6 + 8 + 10 = 24</math> ft of trim.</p> <p>22. In <math>\triangle PQR</math>, <math>\angle R = 180 - 90 - 35 = 55^\circ</math>. Since <math>R</math> corresponds to <math>U</math>, <math>\angle U = 55^\circ</math>.</p> <p>23. Side <math>AB</math> matches <math>WX = 5</math> in, so <math>ABCD</math> has perimeter <math>4 \times 5 = 20</math> in. 40 in of border is more than enough.</p> <p>24. Corresponding sides are equal, so <math>2x + 1 = 13</math>, giving <math>2x = 12</math> and <math>x = 6</math>. Then <math>GH = 2(6) + 1 = 13</math>.</p> |
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