RLP-GEOA · RLP Geometry A — Transformations, Congruence, Similarity and Trigonometry

Unit 2: Congruence and Proof

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 2.1 — Congruence Defined by Rigid Motions

FLUENCY

1. Find the distance between (4, −7) and (−8, 5), and the midpoint of the segment.

2. Find the distance between (−1, 2) and (−8, 5), and the midpoint of the segment.

3. Find the distance between (1, 2) and (0, −9), and the midpoint of the segment.

4. Triangle P has vertices (0, 0), (4, 0), (0, 3). Triangle Q has vertices (1, 1), (1, 5), (−2, 1). Are they congruent? If so, give a sequence of rigid motions.

5. Triangle R has vertices (0, 0), (4, 0), (0, 4). Is it congruent to triangle P above? Justify.

6. $\triangle ABC \cong \triangle KLM$. Name the side congruent to CA and the angle congruent to $\angle B$.

7. $\triangle DEF \cong \triangle XYZ$ with $DE = 7$, $EF = 9$, $\angle F = 48°$. Find YZ and $\angle Z$.

8. A student writes $\triangle ABC \cong \triangle EDF$ after mapping A to D, B to E, C to F. What is wrong?

APPLICATION

9. Two metal brackets are cut from sheet metal. One has corners at (0, 0), (6, 0), (6, 2) and (0, 2) cm on a template; the other at (10, 1), (10, 7), (8, 7), (8, 1). Show they are congruent with a single rigid motion or a sequence, and state it.

10. Explain, using the definition of congruence, why two congruent triangles must have the same perimeter and the same area.

11. A tile pattern repeats a triangle with vertices (0, 0), (2, 0), (0, 1). A second copy has vertices (5, 5), (5, 3), (6, 5). Find a sequence of rigid motions from the first to the second.

CHALLENGE

12. Prove that if all three pairs of corresponding sides and angles of two triangles are congruent, a rigid motion carries one onto the other. Describe each step and which given fact it uses.

REVIEW

13. Find the image of (0, 2) under a rotation of 270° counterclockwise about the origin.

14. Find the image of (8, 8) under a rotation of 180° about the origin.

15. How many lines of symmetry does a regular octagon have?

Lesson 2.2 — Triangle Congruence Criteria in Three Proof Formats

FLUENCY

1. Given $AB = DE$, $BC = EF$ and $CA = FD$. Which criterion, if any, proves $\triangle ABC \cong \triangle DEF$?

2. Given $AB = DE$, $\angle B = \angle E$ and $BC = EF$. Which criterion, if any?

3. Given $\angle A = \angle D$, $AB = DE$ and $\angle B = \angle E$. Which criterion, if any?

4. Given $AB = DE$, $BC = EF$ and $\angle A = \angle D$. Which criterion, if any?

5. Given $\angle A = \angle D$, $\angle B = \angle E$ and $\angle C = \angle F$. Which criterion, if any?

6. Given $\angle A = \angle D$, $\angle B = \angle E$ and $BC = EF$. Which criterion, if any?

7. M is the midpoint of both AB and CD. Which criterion proves $\triangle AMC \cong \triangle BMD$, and what are the three pairs?

8. In kite $ABCD$, $AB = AD$ and $CB = CD$. Which criterion proves $\triangle ABC \cong \triangle ADC$?

APPLICATION

9. **Complete the proof.** Given: $AB \cong CB$ and D is the midpoint of AC. Prove: $\triangle ABD \cong \triangle CBD$. Write a two-column proof.

10. **Identify the flaw.** "Given $AB = DE$, $AC = DF$ and $\angle B = \angle E$. So $\triangle ABC \cong \triangle DEF$ by SAS."

11. **Complete the proof.** Given: M is the midpoint of AB and of CD. Prove: $AC \cong BD$. Write it as a paragraph proof.

CHALLENGE

12. Show that SSA fails with numbers: $AB = 8$, $\angle A = 40°$ and $BC = 6$. Find both possible lengths of AC to the nearest hundredth. (Use your calculator for sin and cos; they are formally introduced in Unit 4.)

REVIEW

13. Find the image of $(-8, 7)$ under a rotation of 180° about the origin.

14. Find the image of $(7, 1)$ under a reflection over the line $y = x$.

15. Construct (describe) the perpendicular bisector of a segment and say why every point on it is equidistant from the endpoints.

Lesson 2.3 — Proving Theorems about Lines, Angles and Triangles

FLUENCY

1. Two lines cross. One angle is 118°. Find the other three.

2. Vertical angles measure $(4x + 12)°$ and $(6x - 20)°$. Find x and the angle.

3. Parallel lines are cut by a transversal. Alternate interior angles are $(3x + 10)°$ and $(5x - 30)°$. Find x and the angle.

4. Parallel lines are cut by a transversal. Corresponding angles are $(2x + 15)°$ and $(4x - 25)°$. Find the angle.

5. A triangle's angles are x, $2x$ and $3x$. Find them.

6. Two angles of a triangle are 40° and 65°. Find the exterior angle at the third vertex.

7. P is on the perpendicular bisector of AB. $PA = 3x + 2$ and $PB = 5x - 6$. Find PA.

APPLICATION

8. **Complete the proof.** Lines AB and CD meet at E. Prove $\angle AEC \cong \angle BED$. Supply the reason for each step: (1) $\angle AEC + \angle CEB = 180°$; (2) $\angle CEB + \angle BED = 180°$; (3) $\angle AEC + \angle CEB = \angle CEB + \angle BED$; (4) $\angle AEC = \angle BED$.

9. **Identify the flaw.** "Lines l and m are parallel. The angles of triangle PQR sum to 180°, so the alternate interior angles at P and Q are congruent."

10. **Write a flow proof** that the angles of $\triangle ABC$ sum to 180°, using the line through C parallel to AB.

CHALLENGE

11. Prove that when parallel lines are cut by a transversal, the two interior angles on the same side of the transversal are supplementary.

REVIEW

12. Find the image of $(-2, 7)$ under a rotation of $90°$ counterclockwise about the origin.

13. Find the image of $(-2, 3)$ under a reflection over the line $y = x$.

14. Which criterion proves two triangles congruent when two angles and the included side match?

Lesson 2.4 — Triangle and Parallelogram Theorems at Work

FLUENCY

1. Two sides of a triangle are 7 and 12. What lengths are possible for the third side?

2. Which set can be the side lengths of a triangle: 4, 9, 13 or 6, 8, 13?

3. A triangle has sides 5, 8 and 11. Name the largest and smallest angles by the sides they face.

4. One angle of a parallelogram is 65°. Find the other three.

5. The diagonals of parallelogram $ABCD$ meet at E. $AE = 2x + 3$ and $EC = 5x - 9$. Find AC.

6. The vertex angle of an isosceles triangle is 40°. Find each base angle.

7. In $\triangle ABC$, $BC = 14$. Find the midsegment joining the midpoints of AB and AC.

8. A median of a triangle is 18 cm long. How far is the centroid from the vertex and from the midpoint?

APPLICATION

9. A scissor lift's arms form parallelograms. Explain why the platform stays parallel to the base as the lift rises, naming the property you use.

10. *(Illustrative.)* A triangular garden bed must have sides of 3 m and 5 m. Which of 1.5 m, 2.5 m, 7.5 m and 8.5 m could the third side be, and which of those makes the largest angle face the 5 m side?

11. **Complete the proof.** Given parallelogram $ABCD$ with diagonal AC. Prove $AB \cong CD$.

CHALLENGE

12. Prove that the diagonals of a rectangle are congruent.

REVIEW

13. Find the image of (−3, −2) under a rotation of 270° counterclockwise about the origin.

14. Find the distance between (−8, 4) and (−9, −3), and the midpoint of the segment.

15. A regular hexagon is inscribed in a circle of radius 9. Find its perimeter.

Unit 2 checkpoint

1. Which information does NOT guarantee two triangles are congruent?
   A. SSS
   B. SAS
   C. ASA
   D. SSA
2. True or false: If △ABC ≅ △PQR, then AC = PR.
3. M is the midpoint of AB and CD. Which criterion proves △AMC ≅ △BMD?
   A. SSS
   B. SAS with vertical angles
   C. ASA
   D. None
4. Vertical angles measure (3x + 5)° and (5x − 15)°. The angle measures _____°.
5. Alternate interior angles formed by parallel lines are (2x + 30)° and (4x − 10)°. Then x = _____.
6. The angles of a triangle are x, x + 20 and 2x. What is the largest angle?
   A. 40°
   B. 60°
   C. 80°
   D. 100°

7. True or false: Using the triangle angle sum to prove the alternate interior angle theorem is valid in this course's order of proofs.
8. P is on the perpendicular bisector of AB and PA = 12. Then PB = _____.
9. Which set of lengths can form a triangle?
   A. 2, 3, 6
   B. 5, 5, 10
   C. 6, 7, 12
   D. 1, 2, 3
10. One angle of a parallelogram is 72°. Its consecutive angle is _____°.
11. The base angles of an isosceles triangle with a 50° vertex angle each measure _____°.
12. A median is 21 cm. How far is the centroid from the vertex?
   A. 7 cm
   B. 10.5 cm
   C. 14 cm
   D. 15 cm
13. True or false: Every parallelogram has congruent diagonals.

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