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

Unit 3: Similarity

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

Name _____ Period _____

Lesson 3.1 — Dilations and Their Properties

FLUENCY

1. Dilate (3, −2) from the origin with scale factor 2.

2. Dilate (−4, 6) from the origin with scale factor 1/2.

3. Dilate (5, 1) from the origin with scale factor 3.

4. Dilate (−6, −9) from the origin with scale factor 1/3.

5. Dilate (4, 5) from (1, 2) with scale factor 2.

6. Dilate (0, 3) from (−2, 1) with scale factor 3.

7. Dilate (6, 5) from (2, −1) with scale factor 1/2.

8. A segment of length 5 is dilated with scale factor 2.5 from a center not on the segment's line. Find the image's length and describe its direction.

APPLICATION

9. A projector lens acts as a dilation. A 3.5 cm tall figure on a slide appears 1.4 m tall on the screen. What is the scale factor, and how wide is the image of a 5 cm wide figure?

10. Segment AB has $A(1, 2)$ and $B(3, 1)$. Dilate it from the origin by 3. Show the image is parallel to AB and three times as long.

11. A line passes through the center of a dilation with scale factor 4. What is its image? Explain.

CHALLENGE

12. A dilation sends $A(1, 1)$ to $(3, 5)$ and $B(2, 1)$ to $(5, 5)$. Find the scale factor and the center.

REVIEW

13. Find the image of $(0, -1)$ under a reflection over the x-axis.

14. Which criterion proves two triangles congruent from three pairs of equal sides?

15. Parallel lines are cut by a transversal. One angle is $48°$. Find its alternate interior angle and its same-side interior angle.

Lesson 3.2 — Similarity Transformations and the AA Criterion

FLUENCY

1. Triangle ABC is similar to triangle DEF. $AB = 8$ and the corresponding side $DE = 16$. If $BC = 7$, find EF, and the ratio of the triangles' areas.

2. Triangle ABC is similar to triangle DEF. $AB = 16$ and the corresponding side $DE = 8$. If $BC = 24$, find EF, and the ratio of the triangles' areas.

3. Triangle ABC is similar to triangle DEF. $AB = 8$ and the corresponding side $DE = 24$. If $BC = 5$, find EF, and the ratio of the triangles' areas.

4. Triangle ABC is similar to triangle DEF. $AB = 12$ and the corresponding side $DE = 6$. If $BC = 4$, find EF, and the ratio of the triangles' areas.

5. Triangle ABC is similar to triangle DEF. $AB = 12$ and the corresponding side $DE = 6$. If $BC = 10$, find EF, and the ratio of the triangles' areas.

6. Triangle ABC is similar to triangle DEF. $AB = 15$ and the corresponding side $DE = 20$. If $BC = 36$, find EF, and the ratio of the triangles' areas.

7. Are triangles with sides 5, 12, 13 and 7.5, 18, 19.5 similar? If so, give the scale factor.

8. Are triangles with sides 4, 6, 8 and 6, 9, 13 similar?

9. One triangle has angles 52° and 71°. Another has angles 71° and 57°. Are they similar?

APPLICATION

10. Is a 5-by-7 inch photo similar to a 4-by-6 inch photo? Is an 8-by-12 inch print similar to the 4-by-6?

11. $\triangle PQR \sim \triangle STU$ with $PQ = 6$, $QR = 10$, $RP = 8$ and $ST = 9$. Find TU, US and the perimeter of $\triangle STU$.

12. **Complete the proof.** In $\triangle ABC$, $DE \parallel BC$ with D on AB and E on AC. Prove $\triangle ADE \sim \triangle ABC$.

CHALLENGE

13. In trapezoid $ABCD$ with $AB \parallel DC$, the diagonals meet at E. Prove $\triangle AEB \sim \triangle CED$, then find CE if $AB = 12$, $DC = 8$ and $AE = 9$.

REVIEW

14. Find the image of $(-4, 7)$ under a rotation of $90°$ counterclockwise about the origin.

15. Given $AB = DE$, $\angle A = \angle D$ and $AC = DF$, which criterion proves congruence?

16. A triangle's angles are in the ratio $2 : 3 : 4$. Find them.

Lesson 3.3 — Proportional Segments and the Pythagorean Theorem by Similarity

FLUENCY

1. A right triangle has legs 2 and 3. Find the hypotenuse exactly.

2. A right triangle has legs 7 and 13. Find the hypotenuse exactly.

3. A right triangle has legs 13 and 13. Find the hypotenuse exactly.

4. A right triangle has hypotenuse 14 and one leg 4. Find the other leg exactly.

5. A right triangle has hypotenuse 21 and one leg 7. Find the other leg exactly.

6. In $\triangle ABC$, $DE \parallel BC$ with $AD = 6$, $DB = 4$ and $AE = 9$. Find EC.

7. In $\triangle ABC$, $DE \parallel BC$ with $AD = 5$, $DB = 10$ and $EC = 14$. Find AE.

8. D is on AB and E is on AC with $AD = 4$, $DB = 6$, $AE = 6$ and $EC = 9$. Is $DE \parallel BC$?

9. The altitude to the hypotenuse of a right triangle divides it into segments 4 and 9. Find the altitude.

10. The altitude to the hypotenuse divides it into segments 2 and 8. Find the altitude.

11. A right triangle's hypotenuse is 25, and the altitude to it cuts off a segment of 9 next to leg a. Find a.

APPLICATION

12. *(Illustrative.)* A loading ramp rises along a 4.8 m slope. A support strut parallel to the ground meets the slope 1.8 m from the bottom and the vertical post 0.9 m from the ground. How tall is the post?

13. For a right triangle with legs 6 and 8, find the hypotenuse, the two segments the altitude cuts it into, and the altitude.

14. **Identify the flaw.** "In right $\triangle ABC$ with altitude CD, $\triangle ADC \sim \triangle ABC$, so $AD/AB = DC/BC$."

CHALLENGE

15. A right triangle has legs 5 and 12. Find, exactly, the two segments of the hypotenuse and the altitude to it.

REVIEW

16. Find the image of $(-1, 0)$ under a rotation of $270°$ counterclockwise about the origin.

17. The diagonals of a rectangle are $3x + 1$ and $5x - 7$. Find their length.

Lesson 3.4 — Measuring the Unreachable with Similar Triangles

FLUENCY

1. Triangle ABC is similar to triangle DEF. $AB = 11$ and the corresponding side $DE = 33$. If $BC = 9$, find EF, and the ratio of the triangles' areas.

2. Triangle ABC is similar to triangle DEF. $AB = 6$ and the corresponding side $DE = 8$. If $BC = 6$, find EF, and the ratio of the triangles' areas.

3. Triangle ABC is similar to triangle DEF. $AB = 10$ and the corresponding side $DE = 25$. If $BC = 14$, find EF, and the ratio of the triangles' areas.

4. Triangle ABC is similar to triangle DEF. $AB = 20$ and the corresponding side $DE = 30$. If $BC = 12$, find EF, and the ratio of the triangles' areas.

5. A 1.7 m person casts a 2.5 m shadow while a light pole casts an 11 m shadow. How tall is the pole?

6. Eyes 1.6 m high, 1.2 m from a mirror on the ground; the mirror is 15 m from a wall. How high is the point of the wall seen in the mirror?

7. A map uses a scale of 1 cm : 250 m. Two stops are 6.4 cm apart on the map. How far apart are they?

APPLICATION

8. *(Illustrative.)* A student 1.5 m tall stands so the tip of her shadow meets the tip of a flagpole's shadow. She is 12 m from the pole and her shadow is 3 m long. How tall is the flagpole?

9. A tree's shadow measures 15 m and a 1.6 m student's shadow measures 2.0 m, each to within ±0.1 m. Taking the tree's shadow as exact, give the range of possible heights.

10. State two assumptions of the mirror method and describe how each could make the answer wrong.

CHALLENGE

11. To measure the width of a river, a surveyor marks points so that $\triangle ABE \sim \triangle DCE$ with $AB \parallel CD$, where AB is the unknown width across the river. $DC = 18$ m, $CE = 12$ m and $BE = 40$ m. Find AB and explain which angles make the triangles similar.

REVIEW

12. Find the image of (8, 6) under a rotation of 180° about the origin.

13. Two sides of a triangle are 9 and 14. Give the range of the third side.

Unit 3 checkpoint

1. Dilate (6, −3) from the origin with scale factor 1/3.
   A. (2, −1)
   B. (18, −9)
   C. (3, −6)
   D. (2, 1)
2. Dilate (5, 4) from center (1, 2) with scale factor 2.
   A. (10, 8)
   B. (9, 6)
   C. (11, 10)
   D. (6, 4)
3. True or false: A dilation takes a line not through its center to a parallel line.
4. A segment of length 8 is dilated by scale factor 0.75. Its image has length _____.

5. Which pair of triangles is similar?
   A. 3, 4, 5 and 6, 8, 11
   B. 3, 4, 5 and 7.5, 10, 12.5
   C. 2, 3, 4 and 4, 6, 9
   D. 5, 5, 6 and 6, 6, 5
6. True or false: Two triangles with two pairs of congruent angles are similar.
7. DE ∥ BC in △ABC with AD = 3, DB = 6 and AE = 4. Then EC = _____.
8. The altitude to the hypotenuse cuts it into segments 3 and 12. The altitude is _____.
9. In the Pythagorean proof by similarity, △ACD ~ △ABC gives which relation?
   A. $b^2 = c \cdot AD$
   B. $a^2 = c \cdot AD$
   C. $b = c \cdot AD$
   D. $b^2 = AD \cdot DB$
10. A 1.8 m person casts a 1.2 m shadow when a building casts a 20 m shadow. How tall is the building?
    A. 13.3 m
    B. 30 m
    C. 24 m
    D. 36 m
11. True or false: If △ABC ~ △DEF with scale factor 3, the area of △DEF is 3 times the area of △ABC.
12. △PQR ~ △XYZ with PQ = 4 and XY = 10. If QR = 6, then YZ = _____.

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