Name_____ Date _____

4.4 Congruence and Transformations

For use with Exploration 4.4

Essential Question What conjectures can you make about a figure reflected in two lines?

1 EXPLORATION: Reflections in Parallel Lines

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software to draw any scalene triangle and label it $\triangle ABC$.

a. Draw any line $\overleftrightarrow{DE}$. Reflect $\triangle ABC$ in $\overleftrightarrow{DE}$ to form $\triangle A'B'C'$.

b. Draw a line parallel to $\overleftrightarrow{DE}$. Reflect $\triangle A'B'C'$ in the new line to form $\triangle A''B''C''$.

c. Draw the line through point A that is perpendicular to $\overleftrightarrow{DE}$. What do you notice?

d. Find the distance between points A and A''. Find the distance between the two parallel lines. What do you notice?

e. Hide $\triangle A'B'C'$. Is there a single transformation that maps $\triangle ABC$ to $\triangle A''B''C''$. Explain.

f. Make conjectures based on your answers in parts (c)–(e). Test your conjectures by changing $\triangle ABC$ and the parallel lines.

2 EXPLORATION: Reflections in Intersecting Lines

Go to *BigIdeasMath.com* for an interactive tool to investigate this exploration.

Work with a partner. Use dynamic geometry software to draw any scalene triangle and label it $\triangle ABC$.

a. Draw any line $\overleftrightarrow{DE}$. Reflect $\triangle ABC$ in $\overleftrightarrow{DE}$ to form $\triangle A'B'C'$.

b. Draw any line $\overleftrightarrow{DF}$ so that $\angle EDF$ is less than or equal to 90°. Reflect $\triangle A'B'C'$ in $\overleftrightarrow{DF}$ to form $\triangle A''B''C''$.

c. Find the measure of $\angle EDF$. Rotate $\triangle ABC$ counterclockwise about point D twice using the measure of $\angle EDF$.

d. Make a conjecture about a figure reflected in two intersecting lines. Test your conjecture by changing $\triangle ABC$ and the lines.

Communicate Your Answer

3. What conjectures can you make about a figure reflected in two lines?

4. Point Q is reflected in two parallel lines, $\overleftrightarrow{GH}$ and $\overleftrightarrow{JK}$, to form Q' and Q''. The distance from $\overleftrightarrow{GH}$ to $\overleftrightarrow{JK}$ is 3.2 inches. What is the distance QQ''?

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4.4 Notetaking with Vocabulary

For use after Lesson 4.4

In your own words, write the meaning of each vocabulary term.

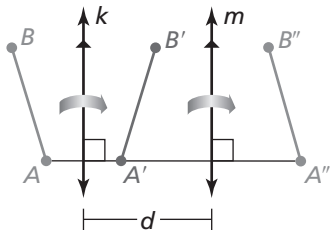
congruent figures

congruence transformation

Theorems

Theorem 4.2 Reflections in Parallel Lines Theorem

If lines k and m are parallel, then a reflection in line k followed by a reflection in line m is the same as a translation.



If A'' is the image of A, then

1. AA'' is perpendicular to k and m, and
2. $AA'' = 2d$, where d is the distance between k and m.

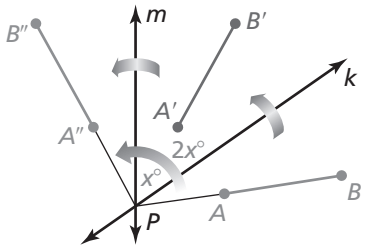
Proof Ex. 31. p. 206

Notes:

Theorem 4.3 Reflections in Intersecting Lines Theorem

If lines k and m intersect at point P, then a reflection in line k followed by a reflection in line m is the same as a rotation about point P.

The angle of rotation is $2x°$, where $x°$ is the measure of the acute or right angle formed by lines k and m.



Proof Ex. 31. p. 206

Notes:

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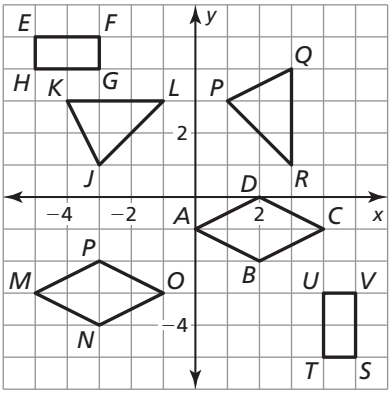
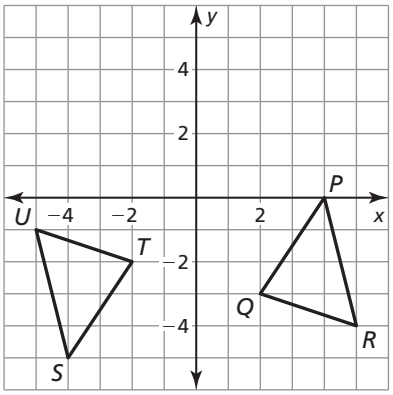
4.4 Notetaking with Vocabulary (continued)

Extra Practice

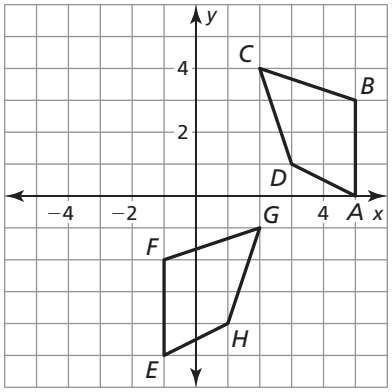
1. Identify any congruent figures in the coordinate plane. Explain.



2. Describe a congruence transformation that maps $\triangle PQR$ to $\triangle STU$.



3. Describe a congruence transformation that maps polygon $ABCD$ to polygon $EFGH$.



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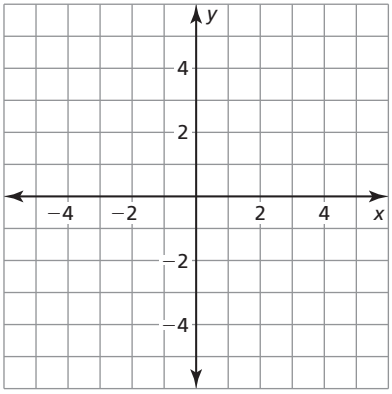
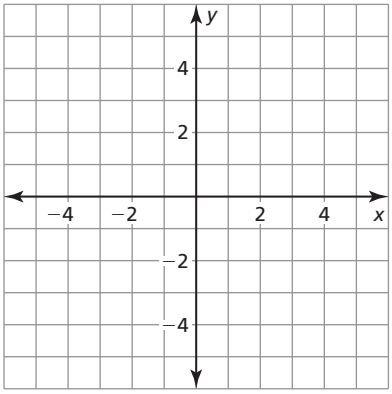
4.4 Notetaking with Vocabulary (continued)

In Exercises 4 and 5, determine whether the polygons with the given vertices are congruent. Use transformations to explain your reasoning.

4. $A(2, 2), B(3, 1), C(1, 1)$ and $D(2, -2), E(3, -1), F(1, -1)$

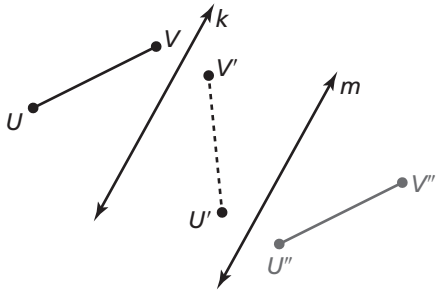


5. $G(3, 3), H(2, 1), I(6, 2), J(6, 3)$ and $K(2, -1), L(-3, -3), M(2, -2), N(2, -1)$



In Exercises 6–9, $k \parallel m$, $\overline{UV}$ is reflected in line k, and $\overline{U'V'}$ is reflected in line m.

6. A translation maps $\overline{UV}$ onto which segment?



7. Which lines are perpendicular to $\overline{UU''}$?

8. Why is V'' the image of V? Explain your reasoning.

9. If the distance between k and m is 5 inches, what is the length of $\overline{VV''}$?

10. What is the angle of rotation that maps A onto A''?