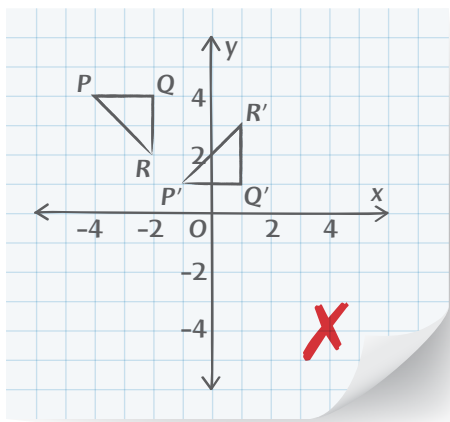


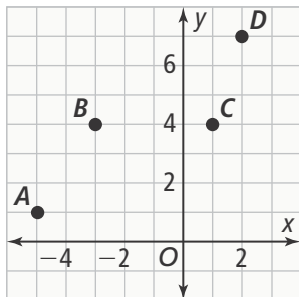


UNDERSTAND

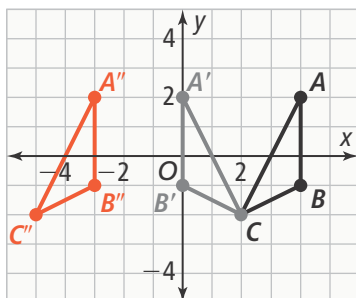
11. **Error Analysis** Hugo graphed $\triangle PQR$ and $(R_t \circ T_{\langle 3, 1 \rangle})(\triangle PQR)$ where the equation of line t is $y = 2$. His translation and reflection were both correct. What mistake did Hugo make?



12. **Mathematical Connections** Suppose line k has equation $x = 3$. Compare the areas of $ABCD$ and $A''B''C''D'' = (T_{\langle 1, 2 \rangle} \circ R_k)(ABCD)$. Justify your answer.
13. **Make Sense and Persevere** A robot travels from position A to B to C to D . What composition of rigid motions represents those moves?



14. **Higher Order Thinking** How can you describe the complete transformation to a person who cannot see the transformations below?

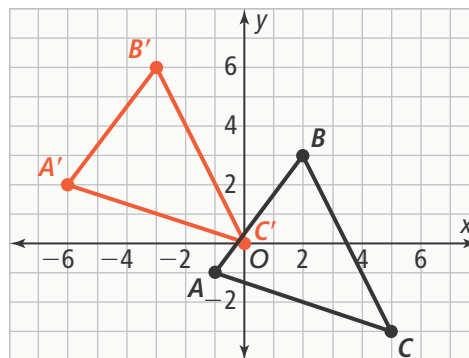


PRACTICE

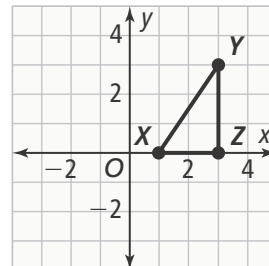
For Exercises 15–17, give the coordinates of the image. **SEE EXAMPLE 1**

15. $T_{\langle 3, -1 \rangle}(\triangle ABC)$ for $A(5, 0)$, $B(-1, 2)$, $C(6, -3)$
16. $T_{\langle -4, 0 \rangle}(\triangle DEF)$ for $D(3, 3)$, $E(-2, 3)$, $F(0, 2)$
17. $T_{\langle -10, -5 \rangle}(\triangle GHJ)$ for $G(0, 0)$, $H(3, 6)$, $J(12, -1)$
18. What is the rule for the rigid motion?

SEE EXAMPLE 2



19. Write a composition of translations that is equivalent to $T_{\langle 8, -5 \rangle}(x, y)$. **SEE EXAMPLE 3**
20. Given $\triangle XYZ$, line n with equation $x = -2$, and line p with equation $x = 2$, write a translation that is equivalent to $R_n \circ R_p$. **SEE EXAMPLE 4**



For Exercises 21–24, write each composition of translations as one translation. **SEE EXAMPLE 3**

21. $T_{\langle -3, 3 \rangle} \circ T_{\langle -2, 4 \rangle}$ 22. $T_{\langle -4, -3 \rangle} \circ T_{\langle 3, 1 \rangle}$
23. $T_{\langle 5, -6 \rangle} \circ T_{\langle -7, 5 \rangle}$ 24. $T_{\langle 8, -2 \rangle} \circ T_{\langle -4, 9 \rangle}$

For Exercises 25–28, write each composition of reflections as one translation. Suppose k is the line with equation $x = -3$, ℓ is the line with equation $x = -2$, m is the line with equation $x = 1$, n is the line with equation $x = -1$, p is the line with equation $y = 1$, q is the line with equation $y = 3$, s is the line with equation $y = 2$, and t is the line with equation $y = -4$. **SEE EXAMPLE 4**

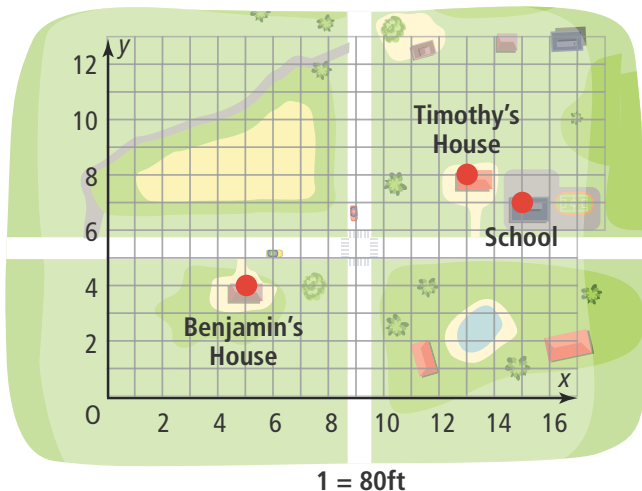
25. $R_k \circ R_\ell$ 26. $R_m \circ R_n$
27. $R_p \circ R_q$ 28. $R_s \circ R_t$

29. The distance between vertical lines a and b is 6 units and a is left of b . If $T_{\langle x, 0 \rangle}(\triangle JKL) = (R_b \circ R_a)(\triangle JKL)$, what is the value of x ?

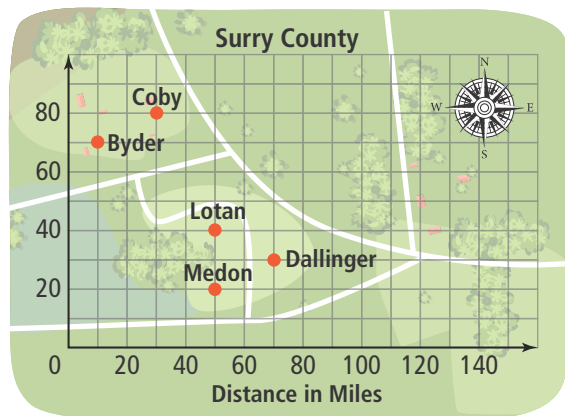
SEE EXAMPLE 5

APPLY

- 30. Communicate Precisely** Benjamin walks from his house to Timothy's house and then to school. Describe Benjamin's walk as a composition of translations. If Benjamin walks from his house directly to school, what translation describes his walk?



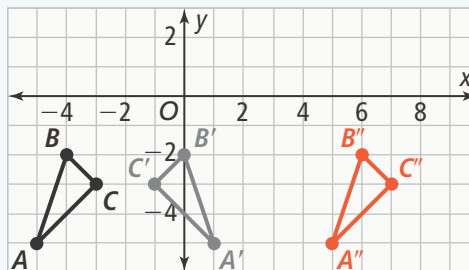
Use the map for Exercises 31 and 32.



- 31. Model With Mathematics** The Surry County sheriff's patrol route starts in Coby. The composition of rigid motions $T_{\langle -20, 10 \rangle} \circ T_{\langle 40, -50 \rangle}$ describes her route. How would you describe the sheriff's route in words?
- 32. Reason** What composition of rigid motions describes a car trip starting in Medon, stopping in Dallinger, and then going on to Byder?

ASSESSMENT PRACTICE

- 33.** Does each of the rigid motions below result in $\triangle A''B''C''$? Select Yes or No.



Suppose a is the line with equation $x = 6$, b is the line with equation $x = 3$, and c is the line with equation $x = -2$.

	Yes	No
$T_{\langle 0, 10 \rangle}(\triangle ABC)$	☐	☐
$T_{\langle 10, 0 \rangle}(\triangle ABC)$	☐	☐
$(R_{y\text{-axis}} \circ R_a)(\triangle ABC)$	☐	☐
$(R_b \circ R_c)(\triangle ABC)$	☐	☐

- 34. SAT/ACT** Suppose the equation of line m is $x = -7$ and the equation of line n is $x = 7$. Which is the equivalent to the composition $T_{\langle -1, 3 \rangle} \circ T_{\langle -6, 4 \rangle}$?
- (A) R_m (C) R_n
(B) $T_{\langle -7, 7 \rangle}$ (D) $T_{\langle -6, 4 \rangle} \circ T_{\langle -1, 3 \rangle}$
- 35. Performance Task** Rectangle $WXYZ$ has a perimeter of 16 units and an area of 15 square units.

Part A Graph $WXYZ$ on a sheet of graph paper. Write a composition of rigid motions describing two reflections of $WXYZ$ across parallel lines of your choosing. Graph and label the parallel lines, $W'X'Y'Z'$, and $W''X''Y''Z''$.

Part B Write a single rigid motion that is equivalent to the composition of rigid motions in Part B. Justify your answer.

Part C Compare the perimeter and area of $WXYZ$ and $W''X''Y''Z''$. What can you conclude about the effect of translation on the properties of figures?