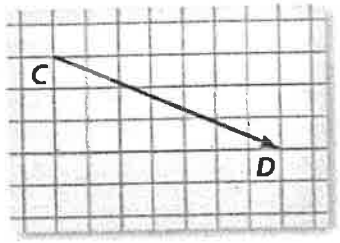
Name _____ Date _____

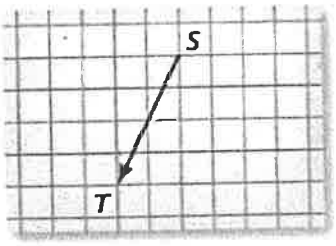
In Exercises 3 and 4, name the vector and write its component form. *(See Example 1.)*

3.



$\overrightarrow{CD}$ $\langle 7, -3 \rangle$

4.



$\overrightarrow{ST}$ $\langle -2, -4 \rangle$

In Exercises 5–8, the vertices of $\triangle DEF$ are $D(2, 5)$, $E(6, 3)$, and $F(4, 0)$. Translate $\triangle DEF$ using the given vector. Graph $\triangle DEF$ and its image. *(See Example 2.)*

5. $\langle 6, 0 \rangle$

(5) $D'(8, 5)$
$E'(12, 3)$
$F'(10, 0)$

6. $\langle 5, -1 \rangle$

(6) $D'(7, 4)$
$E'(11, 2)$
$F'(9, -1)$

7. $\langle -3, -7 \rangle$

(7) $D'(-1, -2)$
$E'(3, -4)$
$F'(1, -7)$

8. $\langle -2, -4 \rangle$

(8) $D'(0, 1)$
$E'(4, -1)$
$F'(2, -4)$

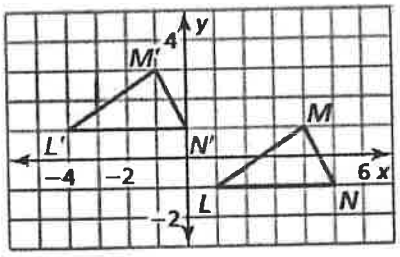
In Exercises 9 and 10, find the component form of the vector that translates $P(-3, 6)$ to P'.

9. $P'(0, 1)$ $\langle 3, -5 \rangle$

10. $P'(-4, 8)$ $\langle -1, 2 \rangle$

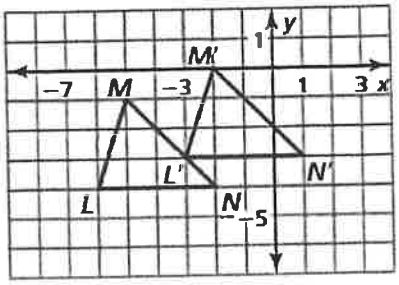
In Exercises 11 and 12, write a rule for the translation of $\triangle LMN$ to $\triangle L'M'N'$. *(See Example 3.)*

11.



$(x, y) \rightarrow (x - 5, y + 2)$

12.



$(x, y) \rightarrow (x + 3, y + 1)$

In Exercises 13–16, use the translation.

$(x, y) \rightarrow (x - 8, y + 4)$

13. What is the image of $A(2, 6)$? $A'(-6, 10)$

14. What is the image of $B(-1, 5)$? $B'(-9, 9)$

15. What is the preimage of $C'(-3, -10)$? $C(5, -14)$

16. What is the preimage of $D'(4, -3)$? $D(12, -7)$

In Exercises 17–20, graph $\triangle PQR$ with vertices $P(-2, 3)$, $Q(1, 2)$, and $R(3, -1)$ and its image after the translation. *(See Example 4.)*

17. $(x, y) \rightarrow (x + 4, y + 6)$ $P'(2, 9)$ $Q'(5, 8)$ $R'(7, 5)$

18. $(x, y) \rightarrow (x + 9, y - 2)$ $P'(7, 1)$ $Q'(10, 0)$ $R'(12, -3)$

19. $(x, y) \rightarrow (x - 2, y - 5)$ $P'(-4, -2)$ $Q'(-1, -3)$ $R'(1, -6)$

20. $(x, y) \rightarrow (x - 1, y + 3)$ $P'(-3, 6)$ $Q'(0, 5)$ $R'(2, 2)$

In Exercises 21 and 22, graph $\triangle XYZ$ with vertices $X(2, 4)$, $Y(6, 0)$, and $Z(7, 2)$ and its image after the composition. *(See Example 5.)*

21. **Translation:** $(x, y) \rightarrow (x + 12, y + 4)$
Translation: $(x, y) \rightarrow (x - 5, y - 9)$

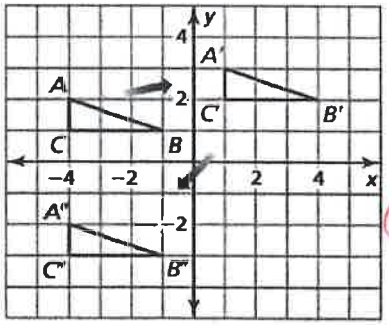
$X'(14, 8)$ $Y'(18, 4)$ $Z'(19, 6)$ $X''(9, -1)$ $Y''(13, -5)$ $Z''(14, -3)$

22. **Translation:** $(x, y) \rightarrow (x - 6, y)$
Translation: $(x, y) \rightarrow (x + 2, y + 7)$

$X'(-4, 4)$ $Y'(0, 0)$ $Z'(1, 2)$ $X''(-2, 11)$ $Y''(2, 7)$ $Z''(3, 9)$

In Exercises 23 and 24, describe the composition of translations.

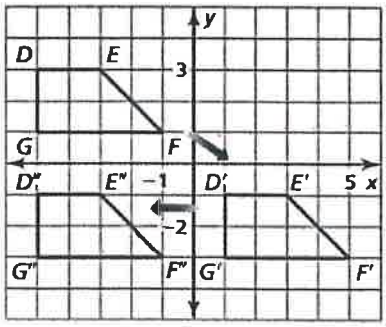
23.



$(x, y) \rightarrow (x + 5, y + 1)$

$(x, y) \rightarrow (x - 5, y - 5)$

24.



$(x, y) \rightarrow (x + 6, y - 4)$

$(x, y) \rightarrow (x - 6, y)$

~~$(x, y) \rightarrow (x + 6)$~~