

18. If $T:(x, y) \rightarrow (x + 2, y)$, then $T^2:(x, y) \rightarrow (\underline{\quad}, \underline{\quad})$.

19. If $T:(x, y) \rightarrow (x + 3, y - 4)$, then $T^2:(x, y) \rightarrow (\underline{\quad}, \underline{\quad})$.

20. If R_x is reflection in the x -axis, then $(R_x)^2:P \rightarrow \underline{\quad}$.

In each exercise, a rule is given for a mapping S . Write the rule for S^{-1} .

B 21. $S:(x, y) \rightarrow (x + 5, y + 2)$ 22. $S:(x, y) \rightarrow (x - 3, y - 1)$

23. $S:(x, y) \rightarrow (3x, -\frac{1}{2}y)$ 24. $S:(x, y) \rightarrow (\frac{1}{4}x, \frac{1}{4}y)$

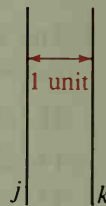
25. $S:(x, y) \rightarrow (x - 4, 4y)$ 26. $S:(x, y) \rightarrow (y, x)$

27. If $S:(x, y) \rightarrow (x + 12, y - 3)$, find a translation T such that $T^6 = S$.

28. Find a transformation S (other than the identity) for which $S^5 = I$.

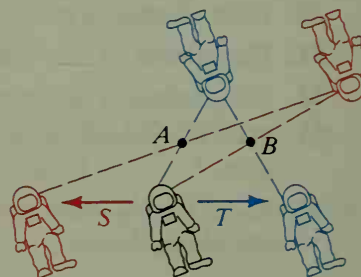
C 29. a. j and k are vertical lines 1 unit apart. According to Theorem 14-7, $R_k \circ R_j$ and $R_j \circ R_k$ are both translations. Describe in words the distance and direction of each translation.

b. Show that $R_k \circ R_j$ and $R_j \circ R_k$ are inverses by showing that their composite is I . Note: Forming composites of transformations is an associative operation, so $(R_k \circ R_j) \circ (R_j \circ R_k) = R_k \circ (R_j \circ R_j) \circ R_k$.



30. The blue lines in the diagram illustrate the statement $H_B \circ H_A = \text{translation } T$. The red lines show that $H_A \circ H_B = \text{translation } S$.

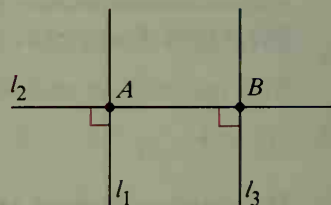
a. How is translation S related to translation T ?
b. Prove your answer correct by showing that $(H_A \circ H_B) \circ (H_B \circ H_A) = I$. (Hint: See Exercise 29, part (b).)



31. Complete the proof by giving a reason for each step.

Given: $l_1 \perp l_2$; $l_3 \perp l_2$; R_1, R_2 , and R_3 denote reflections in l_1, l_2 , and l_3 .

Prove: $H_B \circ H_A$ is a translation.



Proof:

Statements

Reasons

1. $H_A = R_2 \circ R_1$

1. $\underline{\quad?}$

2. $H_B = R_3 \circ R_2$

2. $\underline{\quad?}$

3. $H_B \circ H_A = (R_3 \circ R_2) \circ (R_2 \circ R_1)$

3. $\underline{\quad?}$

4. $H_B \circ H_A = (R_3 \circ (R_2 \circ R_2)) \circ R_1$

4. Composition is associative.

5. $H_B \circ H_A = (R_3 \circ I) \circ R_1$

5. $\underline{\quad?}$

6. $H_B \circ H_A = R_3 \circ R_1$

6. $\underline{\quad?}$

7. $H_B \circ H_A$ is a translation.

7. $\underline{\quad?}$