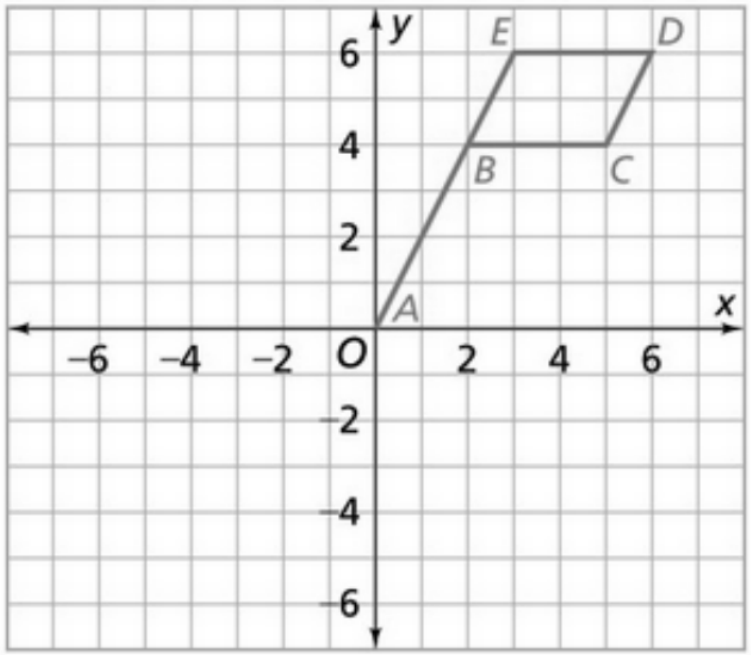
3.3 Spinning on a Grid

Coordinate Rules for Rotations

Look again at the flag in the first quadrant.



What coordinate rules for rotations would rotate the flag 90° or 180° counterclockwise about point *A*?

A Rotate points A–E 90° counterclockwise about the origin. Copy and complete the table showing the coordinates of points A'–E', which are the images of points A–E.

Point	A	B	C	D	E
Original Coordinates	(0, 0)	(2, 4)	■	■	■
Coordinates After a 90° Rotation	■	■	■	■	■

1. Write a rule for the pattern relating the coordinates of key points to the coordinates of their images after a rotation of 90°: $(x, y) \rightarrow$ (■, ■).
2. Would your rule give the correct coordinates if the flag started in the second, third, or fourth quadrant? Justify your answer with sketches and examples of coordinates that match.
3. **a.** Do any points remain unchanged under this rotation? Explain.

   b. Do the flag and its image make a symmetric design?

B Rotate points A–E another 90° counterclockwise about the origin so that they rotate a total of 180°. Copy and complete the table showing the coordinates of points A''–E'', which are the images of points A'–E'.

Point	A	B	C	D	E
Original Coordinates	(0, 0)	(2, 4)	■	■	■
Coordinates After a 180° Rotation	■	■	■	■	■

1. Write a rule for the pattern relating the coordinates of key points to the coordinates of their images after a rotation of 180°: $(x, y) \rightarrow$ (■, ■).
2. Would your rule give the correct coordinates if the flag started in the second, third, or fourth quadrant? Justify your answer with sketches and examples of coordinates that match.

A.

Point	A	B	C	D	E
Original Coordinates	(0, 0)	(2, 4)	(5, 4)	(6, 6)	(3, 6)
Coordinates After a 90° Rotation	(0, 0)	(–4, 2)	(–4, 5)	(–6, 6)	(–6, 3)

1. $(x, y) \rightarrow (-y, x)$
2. The same rule applies regardless of where the flag starts.
3. **a.** A; the center of the rotation does not "move."

   b. We would need two more images to make a complete design with rotational symmetry.

B.

Point	A	B	C	D	E
Original Coordinates	(0, 0)	(2, 4)	(5, 4)	(6, 6)	(3, 6)
Coordinates After a 180° Rotation	(0, 0)	(–2, –4)	(–5, –4)	(–6, –6)	(–3, –6)

1. $(x, y) \rightarrow (-x, -y)$
2. The same rule applies regardless of where the flag starts.

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