**Activity 3.6.3 Quadrilaterals in Standard Position**



Do this part of the activity with Geogebra.

1. Pick any four points *P*, *Q*, *R*, and *S* that are the vertices of a convex quadrilateral. Try to make it so that no pairs of sides are parallel or congruent.

1. Use the Polygon tool to form quadrilateral *PQRS*.
2. Label the origin, (0,0), as point *O*.
3. Label a point on the positive *x*-axis as point *N*.



1. Translate *PQRS* by the vector from *P* to *O*.
2. Measure the angle $∠$*QON*.
3. Rotate *P’Q’R’S’* by m $∠$ *QON* so that Q” lies on the positive *x­*-axis. (Your rotation may be either clockwise or counter-clockwise, so think carefully which one you want.)
4. Write the coordinates of P’’Q’’R’’S’’ in the space below.

*P’’*(\_\_\_,\_\_\_), *Q’’*(\_\_\_,\_\_\_), *R’’*(\_\_\_,\_\_\_),and *S’’*(\_\_\_,\_\_\_).

Through translation and rotation, any quadrilateral may be represented with these coordinates: *P*(0,0), *Q*(*a*, 0), *R*(*d*,*e*), and *S*(*b*,*c*).

1. For your quadrilateral *P’’Q’’R’’S’’* find the values of these five variables:

 *a* = \_\_\_\_\_\_\_\_\_ *b* = \_\_\_\_\_\_\_\_\_\_ *c* = \_\_\_\_\_\_\_\_\_ *d* = \_\_\_\_\_\_\_\_\_\_\_ *e* = \_\_\_\_\_\_\_\_\_\_

1. Hide quadrilaterals *PQRS* and *P’Q’R’S’* so that only *P’’Q’’R’’S’’* is visible.

**Special Quadrilaterals**

As we have seen, every quadrilateral may be represented with five variables: *a, b, c, d,* and *e.* These variables appear in the coordinates of the vertices: *P*(0,0), *Q*(*a*, 0), *R*(*d*,*e*), and *S*(*b*,*c*).

Special quadrilaterals require fewer variables as the following exercises demonstrate:



2. Suppose ***e* = *c*.**
Then the quadrilateral is *P*(0,0), *Q*(*a*, 0), *R*(*d*,*c*), and *S*(*b*,*c*).
Show that this quadrilateral must be a trapezoid.



3. Suppose *e* = *c* and ***d* = *a* + *b****.*
Then the trapezoid is *P*(0,0), *Q*(*a*, 0), *R*(*a + b*, *c*), and *S*(*b*,*c*).
Show that this trapezoid must be a parallelogram.

4. Suppose *e* = *c*, *d* = *a* + *b,* and ***b* = 0**.
Then the parallelogram is *P*(0,0), *Q*(*a*, 0), *R*(*a*, *c*), and *S*(0,*c*).
Show that this parallelogram must be a rectangle.



5. Suppose *e* = *c*, *d* = *a* + *b, b* = 0, and ***c* = *a***.
Then the rectangle is *P*(0,0), *Q*(*a*, 0), *R*(*a*, *a*), and *S*(0,*a*).
Show that this rectangle must be a square.