# Geometry Lesson 45

Objective: TSW be introduced to coordinate proofs.

A coordinate proof is a style of proof that uses coordinate geometry and algebra. In a coordinate proof, a diagram is used that is placed on the coordinate plane. Figures can be placed anywhere on the plane, but it is usually easiest to place one side on an axis or to place one vertex at the origin.

Example 1 Positioning a Figure on the Coordinate Plane
Triangle *ABC* has a base of 4 units and a height of 3 units. Angle *A* is a right angle. Position ΔABC on the coordinate plane.

 SOLUTION
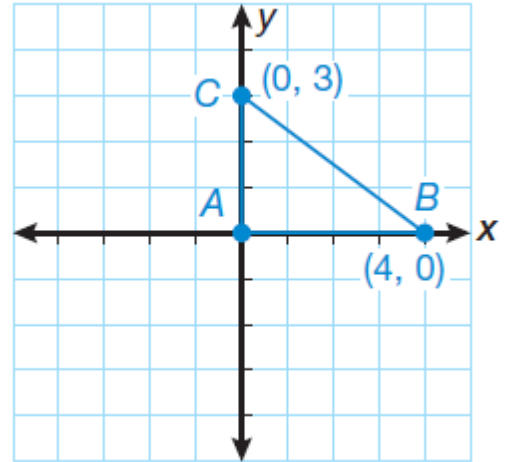
When a figure is placed in a convenient position on the coordinate plane, the equations and values used in a proof will be easier to work with. Below are examples of convenient placement for common figures.
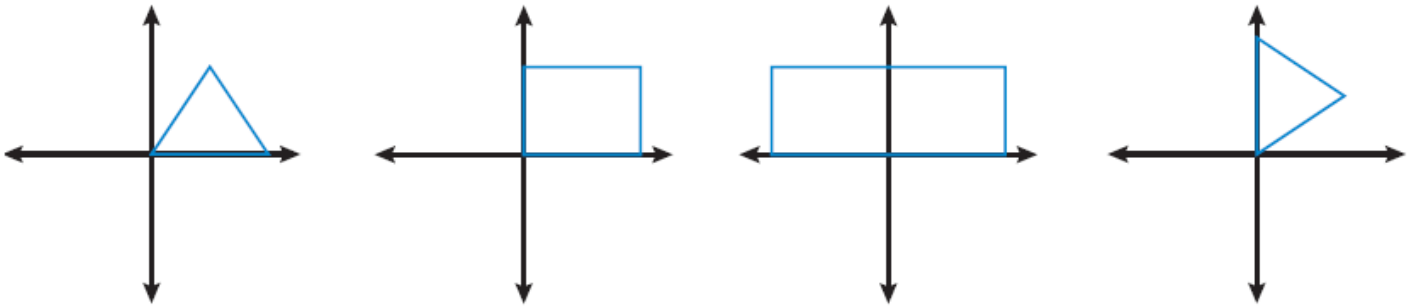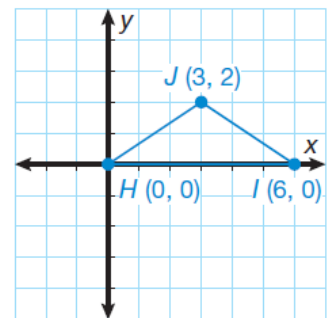
Example 2 Writing a Proof Using Coordinate Geometry
Use a coordinate proof to show that ΔHIJ is an isosceles triangle.

 SOLUTION

 If ΔHIJ is isosceles then, by definition, two of its sides must have equal length. Calculate each of the side lengths to verify that ΔHIJ is an isosceles triangle.

Sometimes a figure's dimensions might be unknown. When placing a figure with unknown dimensions on the coordinate plane, pick a convenient position and label the vertices of the figure using information that is given in the problem.

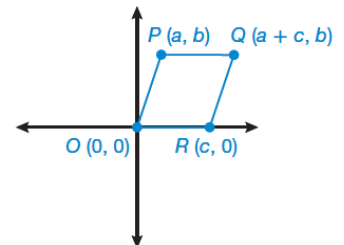Example 3 Assigning Variable Coordinates to Vertices

a. A square has a side length, a. Place the square on the coordinate plane and label each vertex with an ordered pair.

    SOLUTION
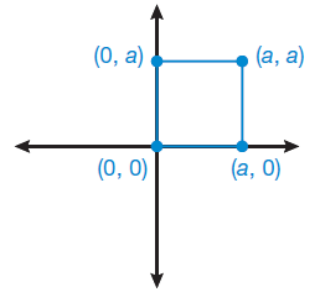
b. Given the parallelogram $OPQR$, with one side length labeled c, assign possible coordinates to the vertices.
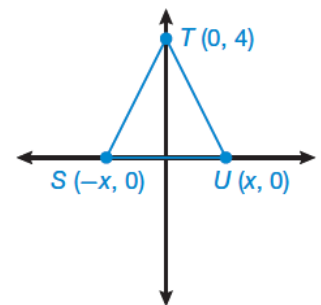
    SOLUTION

Hint

By placing a vertex of the parallelogram on the origin, one fewer variable can be used to diagram the parallelogram.

c. Assign coordinates to the vertices of isosceles ΔSTU with a height of 4 from the vertex.

    SOLUTION

When you assign variable coordinates to a figure used in a proof, remember that the values you choose must apply to all cases. When the dimensions of a figure are not given, variables must be used to ensure the proof is valid for a figure of any size.

Example 4 Writing a Coordinate Proof

Prove that the diagonals of a square are perpendicular to one another.

    SOLUTION
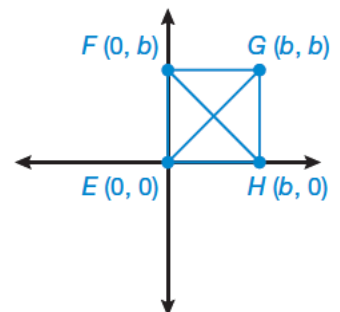
Example 5 Application: Constructing a Swimming Pool

A contractor has been hired to build a swimming pool with a smaller wading pool beside it. The contractor draws a diagram of what he plans to build and overlays a coordinate grid on it, as shown. Show that the wading pool has a surface area that is one eighth the size of the larger pool's surface area.
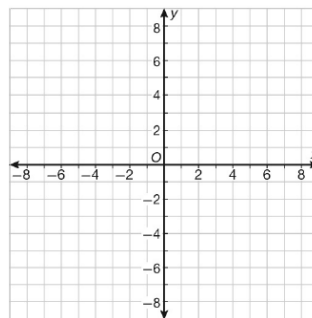
   SOLUTION
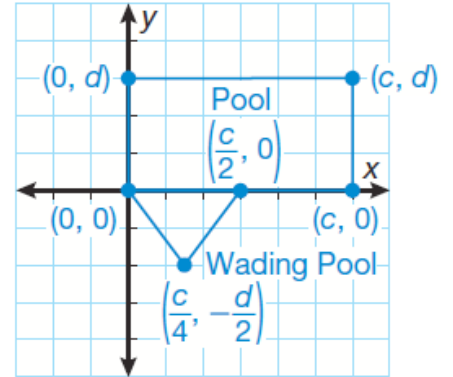
You Try!!!!

b. Prove that ΔJKL is an isosceles triangle.
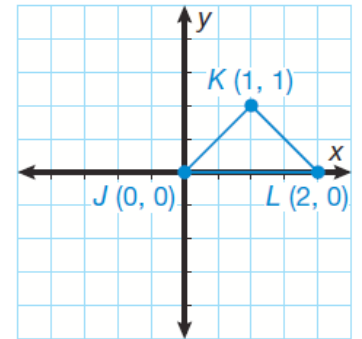
c. Place a right triangle with leg lengths of a and b units on the coordinate plane. Label the vertices with their coordinates.

d. Prove that figure $TUVW$ is a parallelogram.