

Module 1: Reasoning with Shapes

TOPIC 1: USING A RECTANGULAR COORDINATE SYSTEM

Students begin this topic by investigating a geometry puzzle which stimulates the need to measure and then prove that three angles in squares sum to 90° . Students then review the properties of squares and rigid motions and use constructions to build a rectangular coordinate system by creating and transforming squares. Students then study parallel and perpendicular line relationships on the coordinate plane, classify polygons on the coordinate plane, and determine the area and perimeter of shapes on the coordinate plane.

Where have we been?

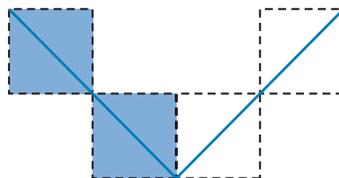
Students have performed rigid motion transformations of geometric objects in middle school and have explored the properties of triangles, quadrilaterals, and regular polygons. They have studied informal demonstrations of geometric congruence using parallel lines and have a wealth of experience with the coordinate plane from elementary school through middle school.

Where are we going?

In this topic, students are introduced to making conjectures—a theme that will continue into the early parts of the next topic. Students use what they have learned in previous courses to ask formal questions about shapes and lines. These questions will be addressed formally with proofs as students move into later topics in this course.

Using Squares to Show the Slopes of Perpendicular Lines

The diagram shows a diagonal drawn in a 1 unit \times 1 unit square. The square is then translated up 1 and right 1. The figure composed of these unshaded squares is then rotated 90° counterclockwise to produce the shaded squares.



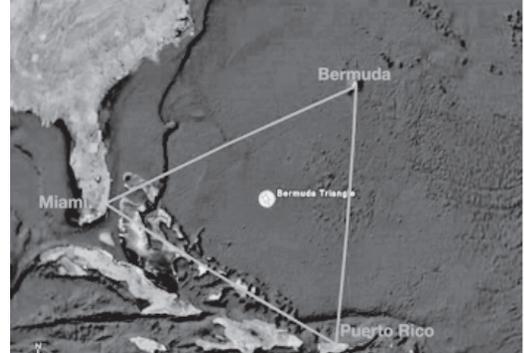
The squares constructed can be those of a coordinate plane. You can use the squares to show that the slopes of perpendicular lines are negative reciprocals of each other.

The Bermuda Triangle

One of the most famous stretches of ocean in the Atlantic is an area between the United States, Puerto Rico, and Bermuda known as the Bermuda Triangle.

A heavily traveled area by planes and ships, it has become famous because of the many stories about ships and planes lost or destroyed as they moved through the Triangle.

For years, the Bermuda Triangle was suspected of having mysterious, supernatural powers that fatally affected all who traveled through it. Others believed natural phenomena, such as human error and dangerous weather, are to blame for the incidents.



Talking Points

Coordinate geometry can be an important topic to know about for college admissions tests.

Here is an example of a sample question:

In the xy -plane, a triangle has vertices at $(5, 0)$, $(\sqrt{2}, 0)$, and $(2, \sqrt{10})$. What is the approximate area of the triangle?

You can think of the base as the horizontal line segment. Its length is $5 - \sqrt{2}$, and the height is $\sqrt{10}$. So, the area is

$$\frac{1}{2}(\sqrt{10})(5 - \sqrt{2}) \approx 5.67$$

So, the area of the triangle is approximately 5.67 square units.

Key Terms

conjecture

A conjecture is a mathematical statement that appears to be true, but has not been formally proved.

transformation

A transformation is the mapping, or movement, of the points of a figure on a plane according to a common action or operation.

Distance Formula

The Distance Formula states that if (x_1, y_1) and (x_2, y_2) are two points on the coordinate plane, then the distance d between them is given by $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.