Lesson 6: Segments That Meet at Right Angles

Classwork

Opening Exercise

Carlos thinks that the segment having endpoints and is perpendicular to the segment with endpoints and Do you agree? Why or why not?

Working with a partner, given and, find the coordinates of a point so that .

**Example 1**

Given points ,,, and, are segments and perpendicular? Are the lines containing the segments perpendicular? Explain.

Exercises 1–4

1. Given ,,, and , find a general formula in terms of , , , , , , , and that will let us determine whether segments and are perpendicular.
2. Recall the Opening Exercise of Lesson 4 in which a robot is traveling along a linear path given by the equation . The robot hears a ping from a homing beacon when it reaches the point and turns to travel along a linear path given by the equation. If the homing beacon lies on the -axis, what is its exact location? (Use your own graph paper to visualize the scenario.)
   1. If point is the -intercept of the original equation, what are the coordinates of point ?
   2. What are the endpoints of the original segment of motion?
   3. If the beacon lies on the -axis, what is the -value of this point, ?
   4. Translate point to the origin. What are the coordinates of , , and ?

* 1. Use the formula derived in this lesson to determine the coordinates of point .

1. A triangle in the coordinate plane has vertices ,, and . Is it a right triangle? If so, at which vertex is the right angle? (Hint: Plot the points and draw the triangle on a coordinate plane to help you determine which vertex is the best candidate for the right angle.)
2. ,,, and are vertices of a quadrilateral. If bisects , but does not bisect , determine whether is a kite.

Problem Set

1. Are the segments through the origin and the points listed perpendicular? Explain.
   1. ,
   2. ,
2. Given ,, and listed below, are segments andperpendicular? Translate to the origin, write the coordinates of the images of the points, then explain without using slope.
3. Is triangle , where ,, and , a right triangle? If so, which angle is the right angle? Justify your answer.
4. A quadrilateral has vertices ,,,and. Prove that the quadrilateral is a rectangle.
5. Given points ,, and , find the -coordinate of point with -coordinate so that the lines and are perpendicular.
6. A robot begins at position and moves on a path to . It turns counterclockwise.
   1. What point with -coordinate is on this path?
   2. Write an equation of the line after the turn.
   3. If it stops to charge on the -axis, what is the location of the charger?
7. Determine the missing vertex of a right triangle with vertices and if the third vertex is on the -axis. Verify your answer by graphing.
8. Determine the missing vertex for a rectangle with vertices ,, and , and verify by graphing. Then, answer the questions that follow.
   1. What is the length of the diagonal?
   2. What is a point on both diagonals in the interior of the figure?
9. A right triangle has vertices and and a third vertex located in Quadrant IV.
   1. Determine the coordinates of the missing vertex.
   2. Reflect the triangle across the -axis. What are the new vertices?
   3. If the original triangle is rotated counterclockwise about the vertex , what are the coordinates of the other vertices?
   4. Now rotate the original triangle clockwise about . What are the coordinates of the other vertices?
   5. What do you notice about both sets of vertices? Explain what you observe.