Slopes of Parallel and Perpendicular Line Segments

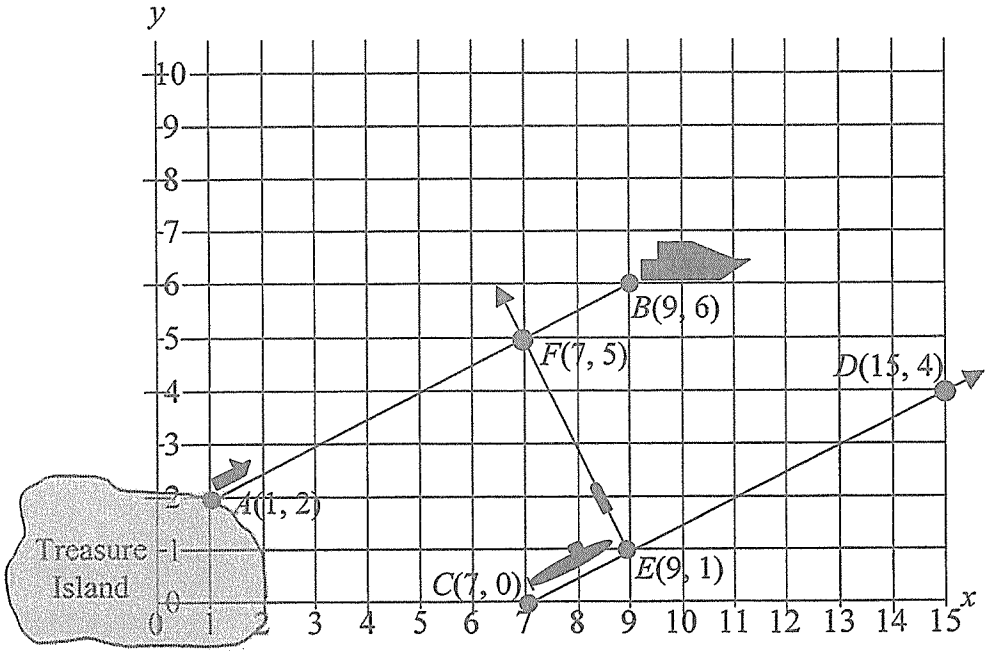
4.4 Solve problems using slopes of parallel lines and perpendicular lines. [CN, PS, V]

Investigation

To complete this investigation you will need to recall two definitions from plane geometry.

- *Parallel lines* are lines that do not intersect.
- *Perpendicular lines* are lines that intersect at right angles.

The pirate Bartholomew Robert was rumored to have hid a treasure of gold coins on a small island. You are part of a Discovery Channel expedition that found the treasure and is transporting it from the island to an awaiting ship. A grid of the area around the island is shown below. The scales on the axes are in kilometres.



Your motor boat is leaving the island at point $A(1, 2)$ and traveling to point $B(9, 6)$ to rendezvous with the ship. Unbeknownst to you, a submerged submarine has approached your boat and is now traveling at the same speed as you. The path of the submarine follows a line from point $C(7, 0)$ to $D(15, 4)$.

1. a) How is the path of the submarine related to the path of your boat?

   b) Calculate the slope of your boat's path.

   c) Calculate the slope of the submarine's path.

   d) How are the slopes of the paths of the two vessels related?

2. The submarine fires a torpedo from point $E(9, 1)$ and it hits your boat when your boat is at point $F(7, 5)$.
   a) How is the path of the torpedo related to the path of your boat?

   b) Calculate the slope of the torpedo's path.

   c) How is the slope of the torpedo's path related to the slope of your boat's path?

   d) This is the final chapter in the story of the treasure hunt. From a literary perspective, how should the story end?

Tutorial

Complete the following statements by filling in the blanks.

1. Parallel lines do not _____ and perpendicular lines meet at _____ angles.
2. The slopes of parallel lines are _____.
3. If two lines are perpendicular than their slopes are *negative reciprocals* of each other. That is, the slopes of two lines have _____ signs and are _____ of each other.

Examples

Example 1: *Slopes of Parallel and Perpendicular Lines*

Determine the slope of a line segment parallel and perpendicular to a segment with each given slope.

Given Slope	Slope of Parallel Lines	Slope of Perpendicular Lines
$\frac{3}{5}$		
7		
$-\frac{4}{3}$		
–0.5		
undefined		