Land Ho!

Purpose:
Participants will identify geometric terms in a problem situation and represent them symbolically, graphically, numerically, and/or verbally. They will use properties of angles and triangles to solve the problem.

Overview:
Participants will identify geometric terms including point, line, ray, segment, plane, angle, triangle, linear pair, congruent, vertex, and exterior angle using the drawing in the problem situation. They will use a variety of representations to describe geometric terms. Participants will also explore different strategies to solve the problem using geometric concepts.

TExES Mathematics 4-8 Competencies. The beginning teacher:

III.009.A Understands concepts and properties of points, lines, planes, angles, lengths, and distances.

III.010.C Uses a variety of representations (e.g., numeric, verbal, graphic, symbolic) to analyze and solve problems involving two-and three-dimensional figures such as circles, triangles, polygons, cylinders, prisms, and spheres.

TEKS Mathematics Objectives. The student is expected to:

4.8A Identify right, acute, and obtuse angles.

5.7A Identify critical attributes including parallel, perpendicular, and congruent parts of geometric shapes and solids.

5.7B Use critical attributes to define geometric shapes or solids.

5.9 Locate and name points on a coordinate grid using ordered pairs of whole numbers.

6.6A Use angle measurements to classify angles as acute, obtuse, or right.

6.6B Identify relationships involving angles in triangles and quadrilaterals.

7.6B Use properties to classify shapes including triangles, quadrilaterals, pentagons, and circles.

8.7B Use geometric concepts and properties to solve problems in fields such as art and architecture.

Terms.
Point, collinear, line, plane, undefined terms, line segment, ray, angle, acute angle, obtuse angle, exterior angle, triangle, isosceles triangle, congruent, linear pair, supplementary angles, base angle, vertex angle, coordinate plane, ordered pair, axes, quadrant, property of equality

Materials.
- Grid paper
- Protractor
- Straight edge
- Patty paper

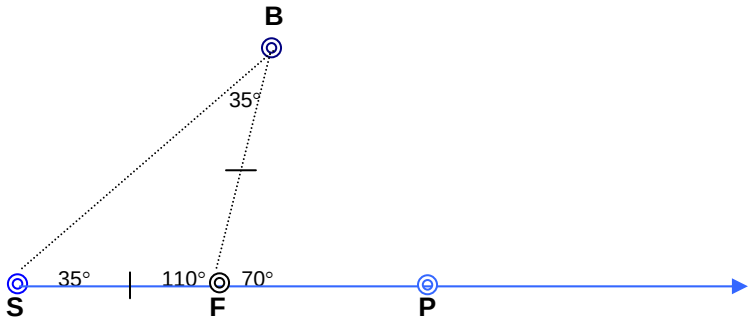
Transparencies.
- *Land Ho!*

Activity Sheet(s).
- *Land Ho!*

Procedure:

Steps	Questions/Math Notes
1. Have participants read the problem and use a protractor and straight edge to make a drawing for the problem labeling positions as follows: Original position of sailboat: S New position of sailboat: F Position of beacon: B Position of sailboat as it sails away from position F: P	Ask questions that require participants to reflect upon their understanding of the mathematical concepts embedded in the drawing. *What does the position of the sailboat and beacon represent in the drawing?* *How do you name these positions?* *Identify a set of collinear points in the drawing; a set of non-collinear points. Justify your answers.* *What forms a plane in the drawing? How can you name the plane?* *Is there another way to form a plane? Explain.* *Identify and name angles in the drawing with supporting evidence.* *Identify and name lines, segments, and rays in the drawing.* *What are the points S, F, and B called in triangle SFB?* *How would you describe the sides of triangle SFB?* *What are different ways to classify a triangle?* *How would you classify the triangle with vertices S, F, and B? Justify your answer.* *What seems to be the relationship between the size of the angles and the opposite sides of the triangle?* *Which angles form a linear pair in the drawing? Explain.* *What do you know about angles that form a linear pair?* *What do you know about the sum of the interior angles of a triangle? How could you justify this with a model?*
2. Have participants work in pairs to solve the problem. Ask several groups with different strategies to put their solution on an overhead transparency and discuss with the whole group.	*How did you use geometric concepts to help you solve the problem?* *How could you have solved this problem another way? Please share your strategy.*

Solution: 100 yards
The distance of the sailboat at point F to the beacon at point B is the same as the distance of the sailboat from point S to point F. A sailor can determine the distance traveled from point S to point F. This distance is equal to the distance from point F to the beacon at point B. Symbolically, this can be expressed as SF= BF.



m∠ BFS = 110 *(∠BFS and ∠BFP form a linear pair and linear pairs form supplementary angles.)*

m∠ BSF + m∠ BFS + m∠ SBF = 180° *(The sum of the interior angles of a triangle is 180°.)*

35° + 110° + m∠ SBF = 180° *(substitution)*
m∠ SBF = 35° *(subtraction property of equality)*

Since two angles of triangle SFB have the same measure and are congruent, the sides opposite are congruent. Triangle SFB is isosceles with segments SF and BF congruent.

Extension:
Locate the points S, F, B, and P on a coordinate grid in the first quadrant with point S at the origin. Point F is 100 yards from point S.

a. What are the coordinates of point F on your graph? Point B? How did you determine these?
b. How can you describe segment SF numerically?
c. How can you describe ray SP numerically? How could you determine the shortest distance from point B to line SP?
d. How does this distance compare to the length of segment BF?

Solution:

a. *Answers will vary according to the scale used on the x-axis. The coordinates of point F are (100,0) and the coordinates of point B are (134,94) rounded to the nearest degree.*
b. *$0 \leq x \leq 100$, where x represents a real number*
c. *$x \geq 0$, where x represents a real number ; The shortest distance from a point to a line is the perpendicular distance from the point to the x-axis.*
d. *Use the edge of a piece of patty paper to compare the lengths of the segments. Segment BF is longer than the segment drawn perpendicular to the x-axis from point B. The distance formula (introduced later) can also be used to compute the distances and compare.*

Reference:
Serra, Michael (1997). Discovering Geometry, An Inductive Approach *(p. 241). Berkeley, CA: Key Curriculum Press.*