Problem of the Week
Problem B and Solution
A Directional Challenge

Problem

The magnetic compass was first used for navigation during the Song dynasty in China, about a thousand years ago. It provided a way to determine direction even on foggy days and at night.

a) On the compass represented on the grid below, the range of possible directions is divided into sixteen segments, each consisting of $360° \div 16 = 22.5°$. Each direction is named, e.g., N, NE, SSW, etcetera. Calculate the (smaller) angle between each pair of directions given in the table. Verify your answers by measuring the angles with a protractor.

Angle	Number of Degrees
N and E	90°
N and NE	45°
N and S	180°
N and SE	135°
SW and WSW	22.5°

b) Suppose that a schooner starts from the location at the centre of the compass. Using a protractor with 0° along North, measure the angle (clockwise) of the direction the schooner should travel to each of the four destinations indicated by the solid dots. If the direction is one of the labelled directions, state the name of that direction.

c) Use a ruler to measure the distances from the centre of the compass to each of the four destinations. What is the ratio of the distance to Destination 1 to the distance to Destination 3? What is the ratio of the distance to Destination 4 to the distance to Destination 2?

Solution

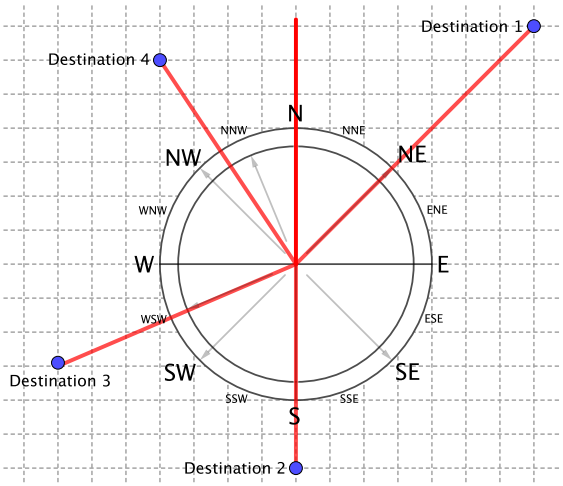
a) The solution to part a) is shown in the chart above.

b) For Destination 1, the schooner should travel at an angle of 45°, i.e., in the NE direction.

For Destination 2, the schooner should travel at an angle of 180°, i.e., in the S direction.

For Destination 3, the schooner should travel at an angle of $180° + 45° + 22.5° = 247.5°$, i.e., in the WSW direction.

For Destination 4, the schooner should travel at an angle of $270° + 45° + \frac{1}{2} \times 22.5° = 326.25°$, i.e., in a direction that is halfway between NW and NNW.



c) The ratio of the distance to Destination 1 to that for Destination 3 is about 1.3. The ratio of the distance to Destination 4 to that for Destination 2 is about 1.2.

Answers to b) and c) may vary, depending on the accuracy of the measurements.