

7

Piloting--Plotting a Course

Navigation is the science of directing the movements of a boat from one place to another in a safe and efficient manner. Basic navigational skills are desirable for operators of boats of all sizes; power and sail. You will become aware of the need for these skills the first time you encounter darkness, fog, haze, rain, sleet, or unfamiliar waters.

In this course we will deal only with that part of navigation known as piloting. Piloting is operating a boat using landmarks, navigational aids, and soundings (the depth of the water) as primary tools. Most advanced forms of navigation, including electronic and celestial methods, are based on the principles of piloting.

Operating a boat in shallow, rock-strewn, near-shore waters requires constant attention to a boat's position and course. A knowledge of piloting will be of great value in the safe operation of your vessel. It will provide you with two valuable safety skills:

- 1) the ability to determine your position at any time
- 2) the ability to select the safest and most efficient route from one place to another

In this course we will divide the basic principles of piloting into four sections: Plotting a Course, in this section; The Mariner's Compass, in Section 9; Distance, Speed, and Time, in Section 11; and Determining Position, in Section 13. Learn this material and use it on the water. Practice is the key to successful piloting.

Plotting a Course

In this section we will describe how to plot and label a course on a chart. This is an important step in determining your position and selecting your route from one place to another.

Tools for Plotting

Plotting is drawing a boat's course on a chart. The tools to do this vary with the size of the boat and the amount of charting space available. We will use the following tools in this course:

- **charts**—you will find a Course Measurement practice chart (Fig 56I) and a Bowditch Bay chart for the homework (inside the back cover of this manual)
- **dividers** for measuring distances
- **sharp pencil** (preferably a #2) for drawing course lines and labeling the chart
- an **eraser** to correct mistakes or remove previous work
- a course measuring and **plotting tool** – this course and all USPS courses will use the USPS Rectangular Course Plotter (Fig 56A)

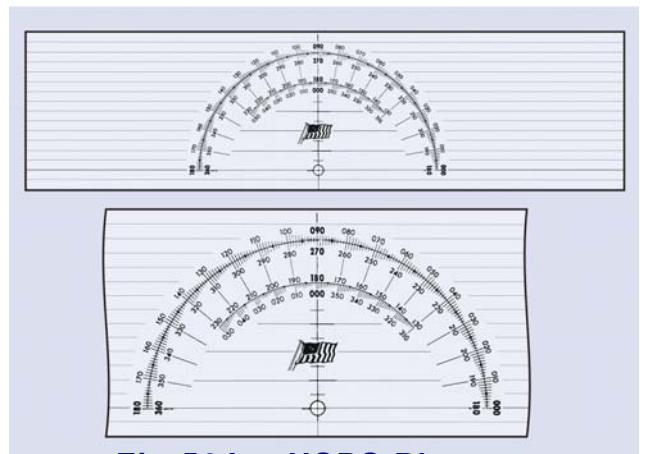


Fig 56A – USPS Plotter

USPS Rectangular Course Plotter is a clear plastic device approximately 4 inches wide and 15 inches long. It is imprinted with a number of lines parallel to the long edges, and two half circle segments similar to protractor scales used for measuring and plotting courses. You will use this plotter to draw course lines and measure course direction. The outer circle segment has two scales reading counterclockwise from 0° to 180°, and 180° to 360°. These scales are used to measure or construct courses using meridians of longitude an alignment reference. The inner circle segment has two scales: one reading counterclockwise from 120° to 240°, and one clockwise from 060° to 300°. These scales are used to measure or construct course lines using parallels of latitude to align the plotter.

Other plotting tools are available, including parallel rules, rolling parallel rules, and protractors with movable arms. These are shown and explained in the USPS Piloting Course.

True Direction

Direction on a chart is measured from 000° to 360° in a clockwise direction from true north. (*True north* is the direction to the geographic north pole.)

Observe the compass rose shown on your Bowditch Bay chart. The outer circle shows 0° (zero degrees) as true north. East is 90°, south is 180°, and west is 270°, all measured from 0°, which is true north. Note that 0° and 360° are the same. (The inner circle refers to magnetic north which we will discuss later.)

In Chapter 5, Charts, you learned about the latitude and longitude grid system found on charts. Meridians of longitude run true north-south through the geographic north and south poles. Parallels of latitude run true east-west, parallel to the equator. On your Bowditch Bay chart, note that the longitude lines are

vertical and parallel to a line through the 0° and 180° graduation marks on the compass rose. The latitude lines are horizontal and parallel to a line through the 90° and 270° graduation marks.

North may not be at the top of some small-craft charts due to the orientation of the charts. However, the compass rose and meridians of longitude will indicate true North and provide North-South direction on all charts.

Determining a Course

For the exercises in this book, you will label courses drawn on charts with reference to true north. That way the angle of a course line with any longitudinal meridian will be the same angle with true north; the direction of the earth's geographic North Pole.

We frequently plot courses from one known location to another. For practice, using one edge of your plotter, draw a course line on your Course Measurement practice chart (Fig 56I) from Point A to Point B.

Measuring Course Direction

Using a Meridian Grid Line

Before doing the exercise, let's look at an example shown in Figures 56B through 56E. You can determine the true direction of your planned course line from Starting Waypoint to Destination Waypoint by comparing it to the meridians of longitude and the true north geographic pole:

- Place the edge of your plotter (or one of the parallel lines on your plotter) on the course line. See Fig 56B.
- Slide the plotter along the course until the bulls-eye lies directly on a grid line (in this case on a meridian, a line of longitude). See Fig 56C.
- Read the course on the outer scales when using a meridian. There are two

scales with different numbers. In this case we will select 040°. See Fig 56D. To select the proper number, be aware of your “sense of direction” - in this case you are moving toward the Northeast, going from Start to Destination. (the Northeast Quadrant runs from 0° to 90° - see Fig 56E). Otherwise, you might read the adjacent scale and get the heading from Destination to Start (220°) - this is called the reciprocal and heads in the Southwest direction.

- Now, try the exercise on Fig 56I going from Point A to Point B.

Using a Parallel Grid Line

Next, let’s look at the example in Figures 56F through 56H.

- Then, repeat this plotting technique by drawing a course line from point A to Point C.
- In this case it is more advantages to slide your plotter along the course line until the bulls-eye lies directly over a grid line (a parallel of latitude). See Fig 56G.
- Now read the course on the inner scale (005°). Again be aware of your “sense of direction” to avoid reading the reciprocal course direction from Point C to Point A.

Determining a Course Line

The following describes the technique that allows you to depart from a specific point (Point A) and navigate a true course of 085°.

- Anchor the edge of your plotter with your dividers to the departure point (Point A).
- Align the edge of your plotter in the approximate direction of your true course (085°). See Fig 56H.
- Slide your plotter along the approximate true course line until the bulls-eye intersects a grid line (in this case a meridian of longitude).

- Slowly rotate the plotter to read the desired true course of 085° while maintaining the bulls-eye on the meridian of longitude.
- This may require several readjustments.

Now let’s try the exercise - See Fig 56I. Draw your true course.

Always state a course direction to the nearest whole degree. Suppose your true course is 067°. If your plotter reads a degree more or less, do not be concerned. This is within an acceptable level of accuracy.

Labeling a Course Direction

A course plotted on a chart is of little value when navigating unless you label its direction on the course line. Then the skipper need only refer to the chart for the course directions previously plotted.

It is important to follow closely a standard method of labeling course lines. Do so, and anyone with basic skills can pick up your chart and understand and continue the work you’ve begun.

The basic rule is: Label a course line for direction *on and above the line*, as near as practicable to the start of the course.

A course label always starts with the letter “C” for “Course.” Always use three digits to the nearest whole degree, for example 005, 015, or 150. Note that you use preceding zeros if necessary. The label for a course of 5° is C 005. Do not use the degree symbol (°) when labeling a chart. See Fig 57. It is also acceptable to label a course line relative to Magnetic North, but you must follow the three digits with the letter “M” to avoid confusion.

Exercise 7-1 drawing a Course Line. Take the Bowditch Bay chart from inside the back cover of this manual. Draw a course line from GC “1” off Chapman Point to RG “D” GONG on the upper right side of the chart. (When drawing a course line to

or from a navigational aid, always draw the course line to or through the circles or dots at the bottom of the symbols.) Measure and label the true course from GC “1” to RG “D” GONG. Label the reciprocal, RG “D” GONG to GC “1”. Retain this chart for use in homework in future chapters.

You must remember that one of the reasons that you plot the course on a chart is to ensure that the selected path is safe to navigate. The GPS does not know what lies upon a selected course, so it is your responsibility to check.

Finding your way digitally

Many boaters use GPS (Global Positioning System) to aid with their navigation tasks. GPS provides your current position and can be used to steer courses to waypoints along the way.

When using a GPS receiver, you still will need to plot a course line on the chart, but you provide the GPS with the coordinates of your destination and each intervening waypoint rather than course angles and distances between waypoints. Once a waypoint is activated in the GPS, it will provide you with the course direction and distance to that waypoint.

To provide the coordinates to the GPS, you must read them from your chart. The chart is your reference for safe paths, so you will need to plot straight line course segments (called *legs*) that safely avoid obstacles. Each end point of these straight line course segments is marked by a waypoint. Each waypoint is represented by its coordinates (latitude and longitude) and a name.

While physically located at the starting point for your course line, you select the first waypoint for navigation of the first leg, and the GPS computes the course direction and distance to that point for you. It is wise to compare the GPS reported course direction (bearing to the waypoint) with those you measure on your chart using the techniques described in this book. This ensures that you have not made a mistake in entering the waypoint.

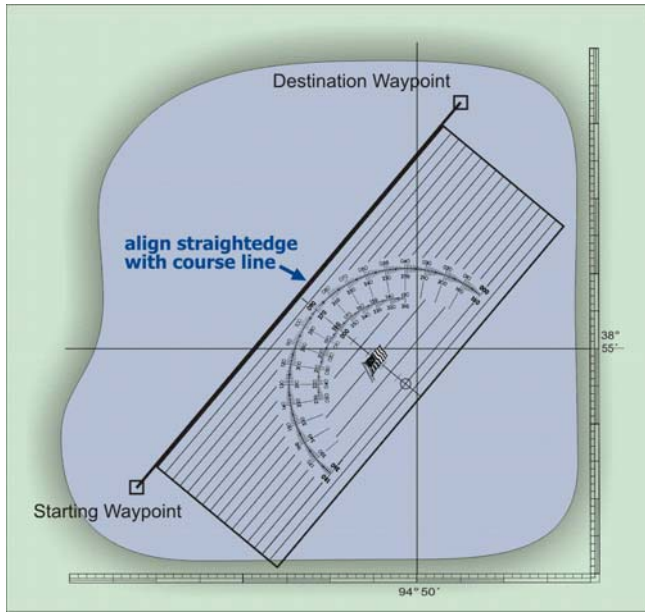


Fig 56B – Align Plotter with Course Line

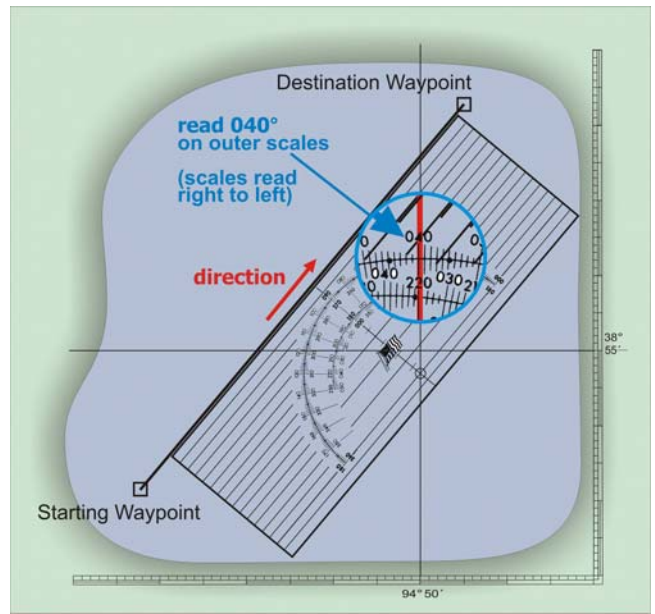


Fig 56D – Read Course Direction on Outer Scale

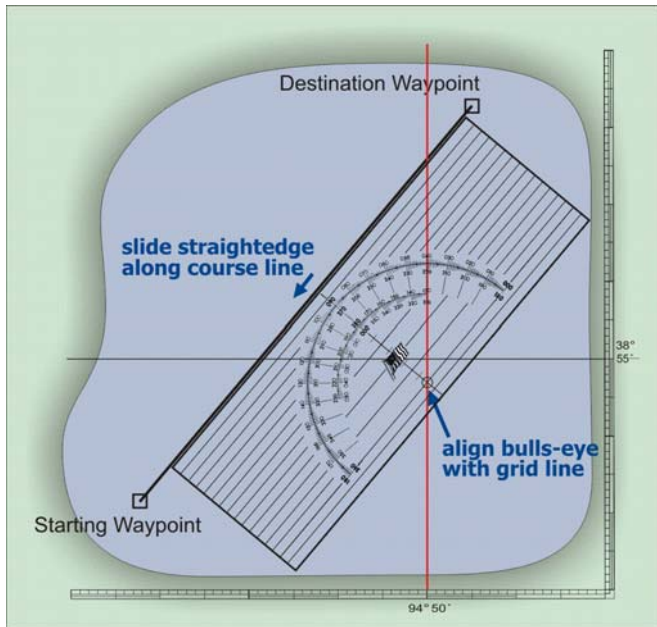


Fig 56C – Align Bulls-eye with Meridian

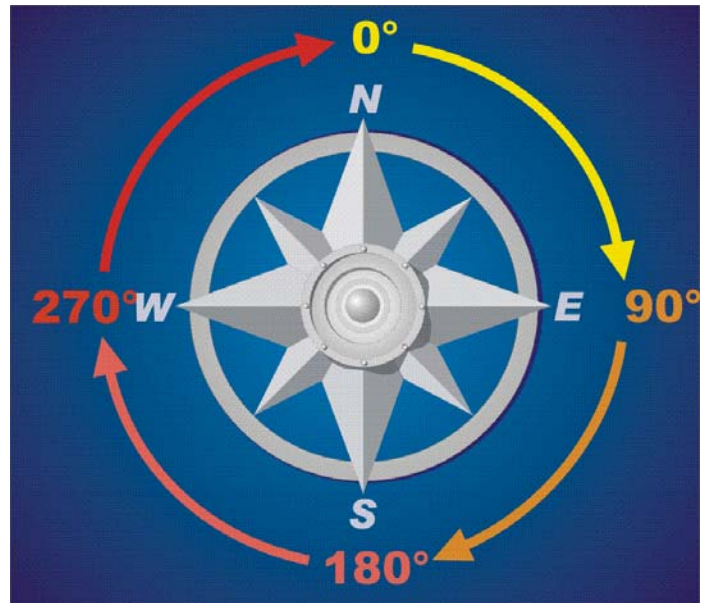


Fig 56E – Sense of Direction

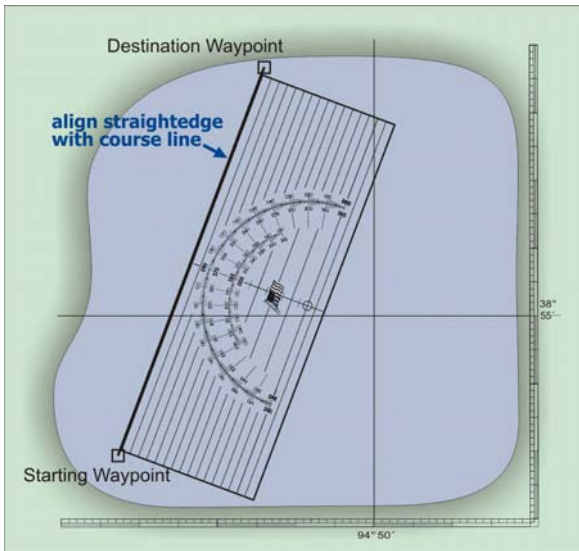


Fig 56F – Align Plotter with Course Line

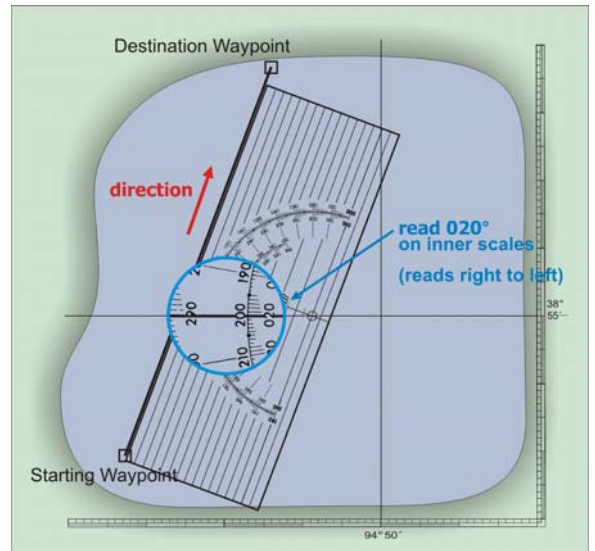


Fig 56H – Read Course Direction on Inner Scale

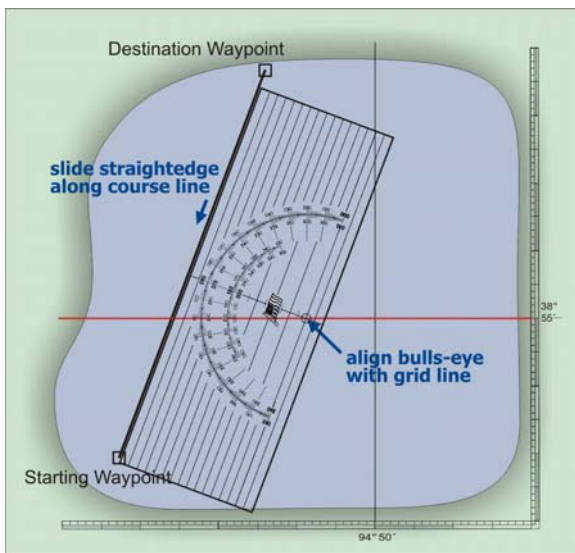


Fig 56G – Align Bulls-eye with Parallel of Latitude

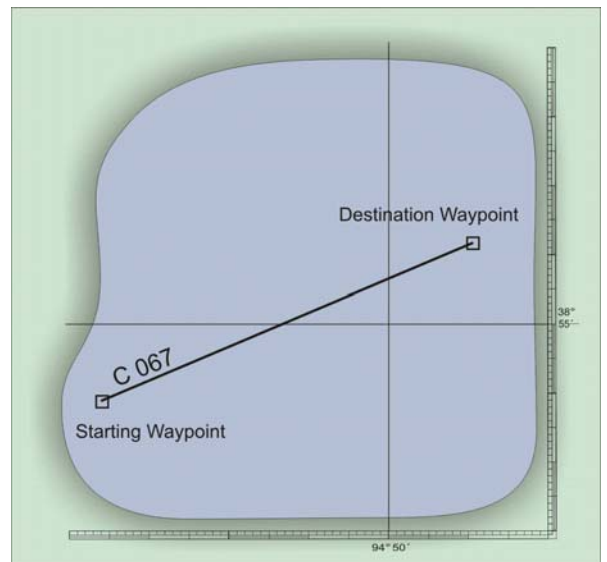


Fig 57 Labeling a Course Line (Course 067° True)

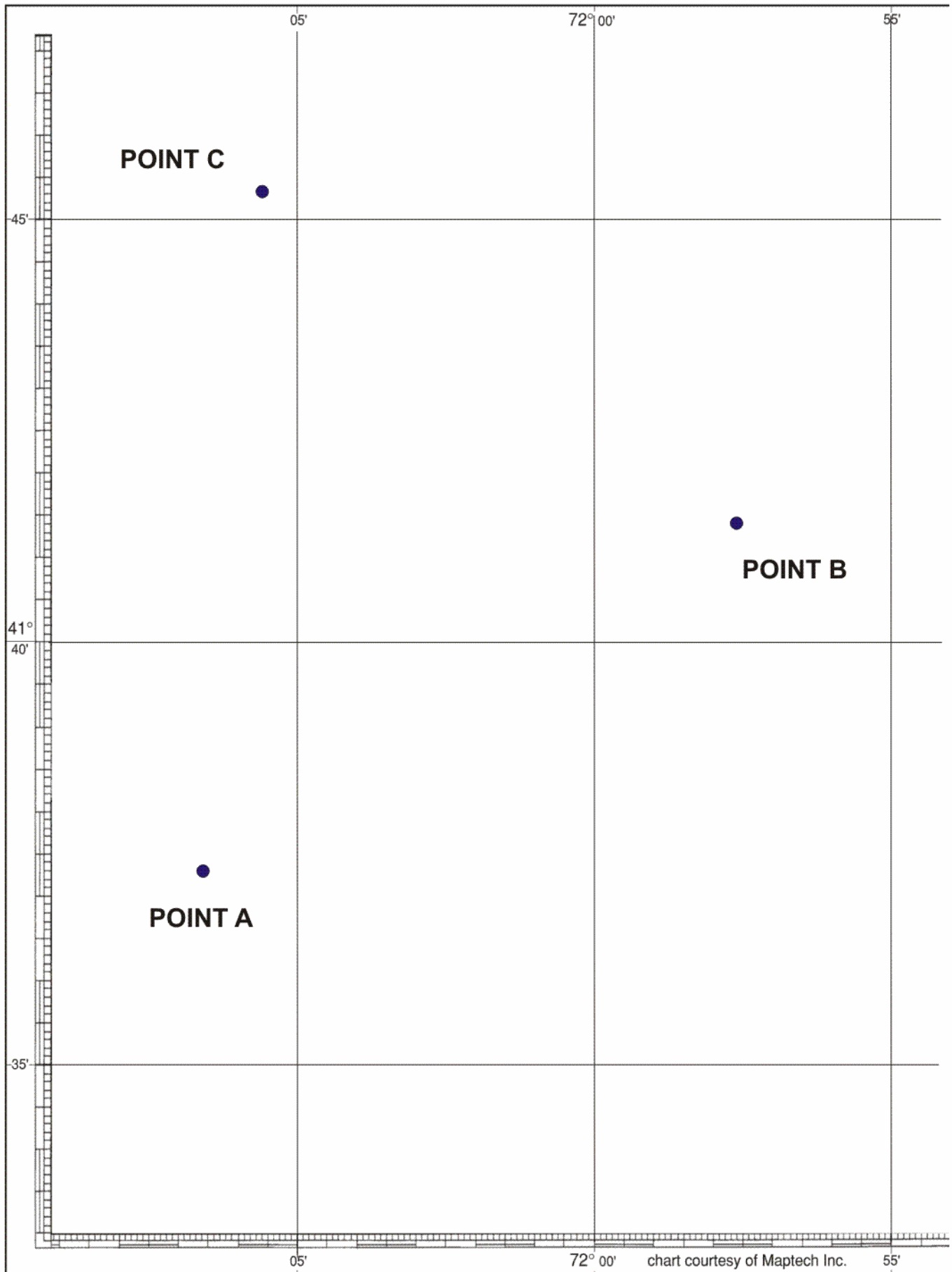


Figure 56 I
Course Measurement Practice Chart

COURSE MEASUREMENT - answers

