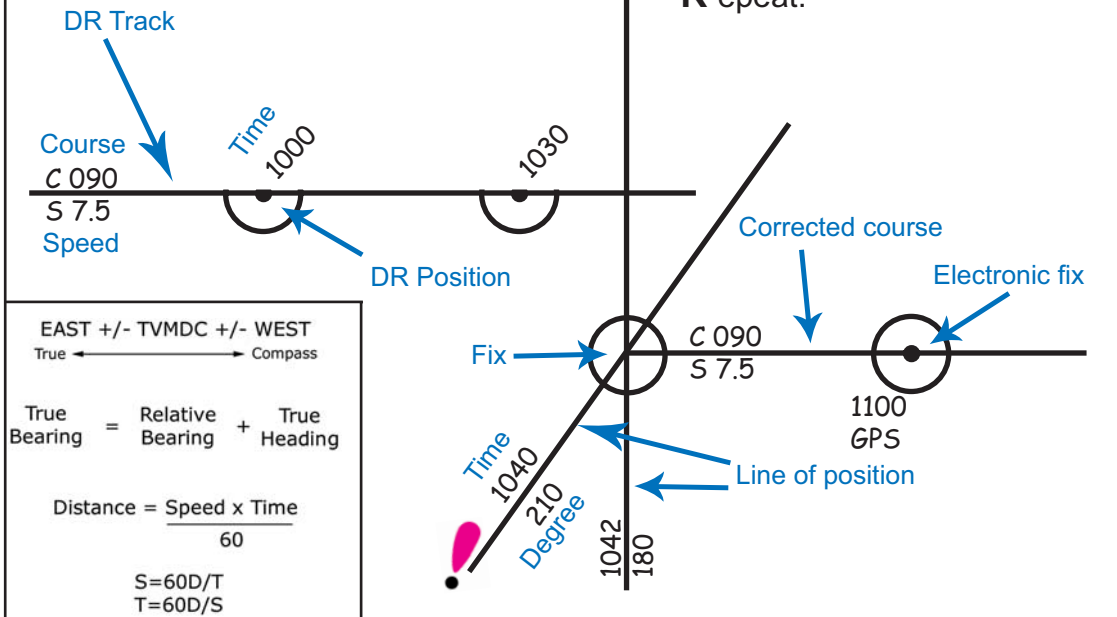


Voyage Planning

- A** ssemble reference materials.
- P** lot voyage alternatives.
- E** valuate voyage alternatives.
- C** hoose a voyage plan.

Voyage Navigation

- O** btain a fix on vessel position.
- C** ompare with DR position.
- C** ompute current and drift.
- U** pdate DR Plot.
- R** epeat.

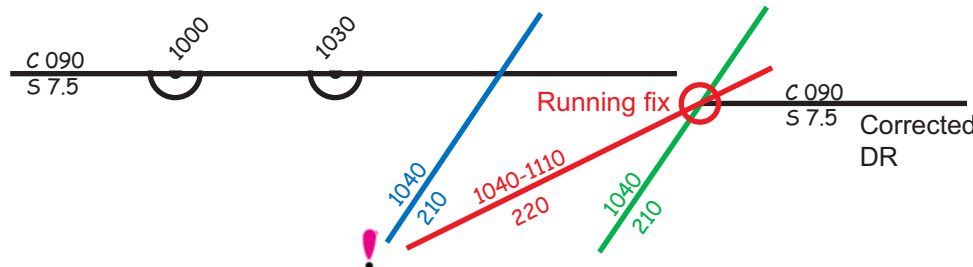


Obtain a fix on vessel position.

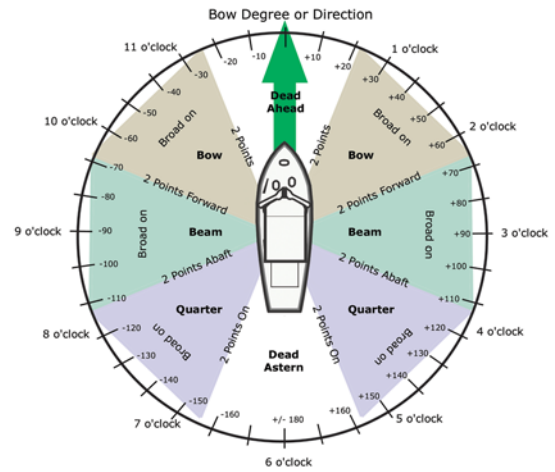
- Note your vessel's current compass heading.
- Locate two candidate objects for lines of position (LOP) - any nearby stationary object appearing on the chart.
- Take a bearing on the first object using a compass or this sheet. The LOP is a straight line drawn from the object along the compass heading.
- Mark the first LOP on a chart or the M-board (on the back of this sheet).
- Take a bearing on the second object. (If only one object is available, follow the steps for a running fix below).
- Mark the second LOP on a chart or the M-board.
- The intersection of the two LOPs is the vessel's approximate position.

Take a running fix.

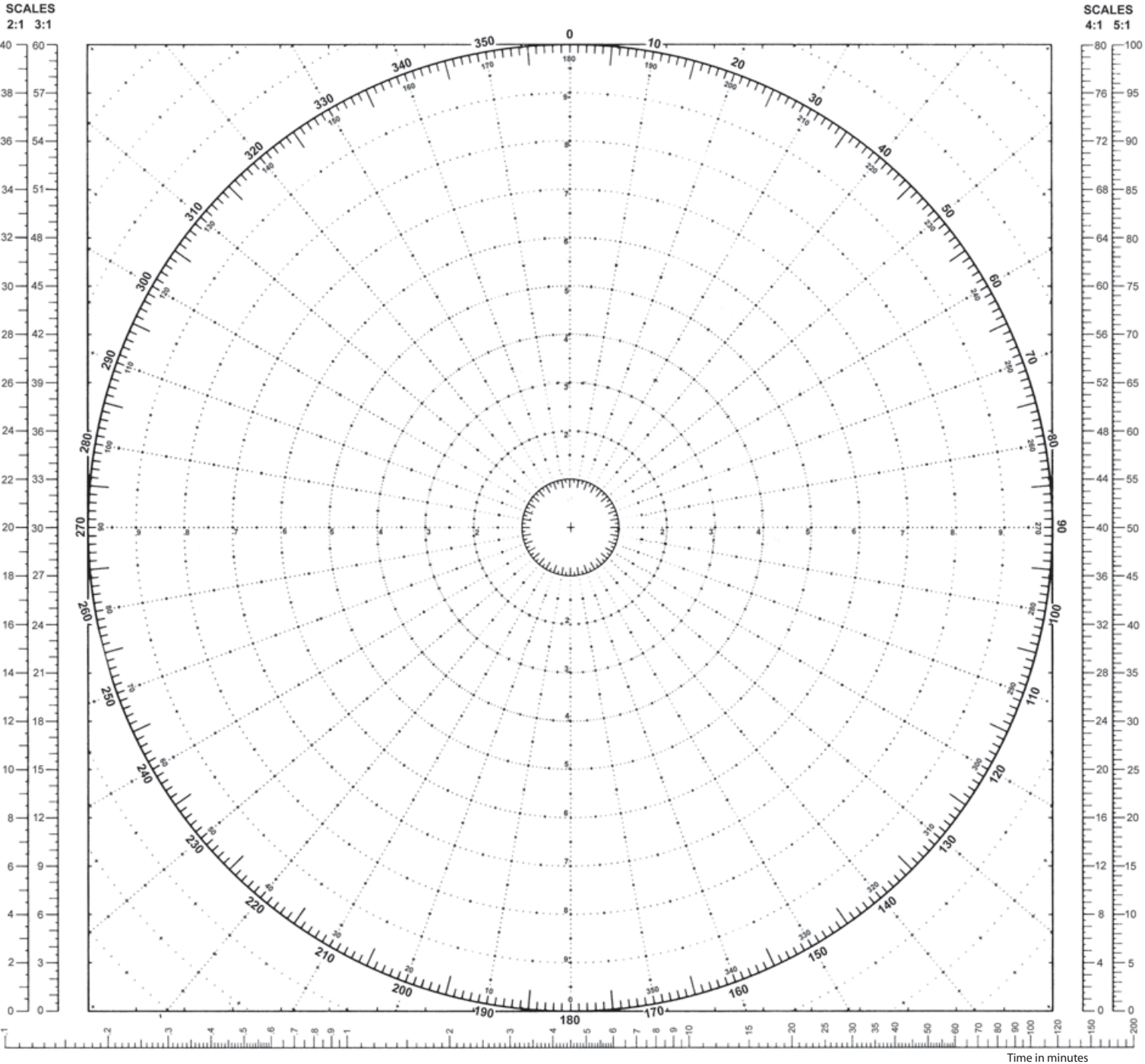
- Locate a candidate object.
- Take a bearing on the object (below-blue).
- Mark the LOP on the chart or M-board.
- Draw a line parallel to the LOP through the DR track at a point equal to the amount of distance that will be covered between this fix and the next one (below-green).
- After the elapsed time, take another bearing on the object (use time/distance equation to calculate location on DR track) (red-below).
- Plot the estimated position on the chart or M-board.



Gen. Measurement	Specific Measurement	Definition
Position (degrees & minutes)	Latitude	Distance north or south of the equator.
Direction (3 digit degrees)	Longitude	Distance east or west of the prime meridian
	Course/Heading	Average direction steered
Speed (knots)	Bearing	Horizontal direction of a line of site between to objects
	Variation	Effect of a ship's magnetic fields on a compass
Distance (nautical miles)	Speed	Difference between the magnetic and geographic meridian
	Drift	Rate at which a vessel advances relative to the water and over a horizontal distance
Time (4 digits)	Speed through water	Apparent speed based on observations and log
	ETA	Overall speed actually accomplished
	Distance	Speed at which the current is moving
	Cross track error	Measurement of an area along a horizontal line between two points
	Time to go	Distance between the vessel's actual and intended course
		Calculated time until the next waypoint
		Estimated time of arrival

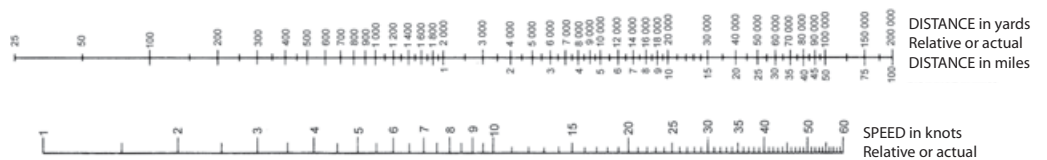


- Take a bearing using this sheet:
- Align the green arrow with your vessel's course.
 - Site the object using first the color regions and then the degree measurements.
 - Add or subtract the degrees as indicated on the diagram from your vessel's course. The result is the object's bearing. [Note: If a compass is not available, use the clock settings as an approximation.]



Scale: Speed :1;
Distance :1 thousands of yards.

Actual distance and speed can be used in the same way as relative units.



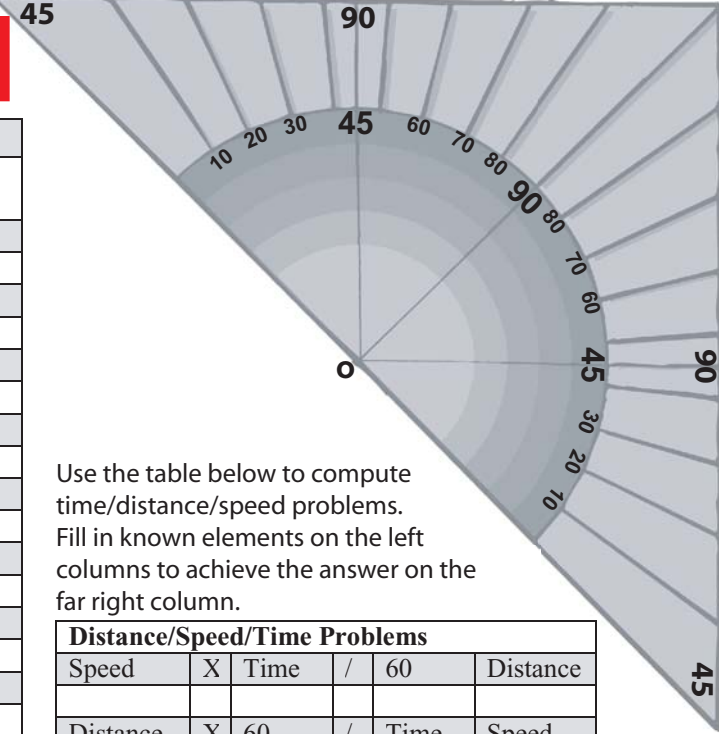
LOGARITHMIC TIME, SPEED, DISTANCE SCALE

Use of miles with logarithmic time, speed and distance scale:

To find speed: place one point of dividers on elapsed time and second point on distance in miles. Without changing the spread of the dividers or the right-left relationship of the points, place the first point on 40. The second point will then indicate the speed in knots.

Use of 3 Scale Nomogram:
Given any two corresponding quantities, solve for the third by laying rule points on proper scales and read intersection on the third scale.

To find the Distance or Time: Place one point of the dividers on 60 and the second point on the speed in knots. Without changing the spread of the dividers or the right-left relationship of the points, place the first point on time. The second point will indicate the distance in miles. Or, place the second point on the distance in miles. The second point now indicates time.



Measuring Latitude and Longitude:

Place the start the distance scale below at the first waypoint, starting point or current position. Align the sheet so the scale follows the craft's intended course or distance to be measured, using the chart's compass rose if necessary. The scale intervals now show minutes of latitude or longitude on 1:40,000 scale charts (.5 minutes on 1:80,000).

Distance:

You can calculate your distance by boatspeed and the Whole Interval Minutes Per Mile Chart. Maintain one of the constant speeds listed on the left side, then use the number to the right to determine the amount of time per mile. Divide the actual minutes on your maintained speed by the number of minutes per mile to determine distance.

Distance off:

Your distance away from an object is equal to the distance the boat covers in the time between the objects is 45 and 90 degrees off the bow. Use the protractor to determine the angle off and the Whole Interval chart to determine the distance covered based on the time and boat speed.

Distance from objects above the horizon (height known):

Hold the three bars up against the object and apply the corresponding multiple to the known height to calculate the distance from the object.

Distance from objects below the horizon:

Hold the sheet 45 degrees and with the object centered on the protractor, with the protractors centerline parallel to the horizon. Take an approximate reading of the angle between the object and the horizon. Use the Distance by Degrees/Minutes chart for the distance. Use the 12' column if you are navigating from a flybridge.

Whole Interval Minutes Per Mile Chart

Speed	Number of minutes to go a mile
3	20
4	15
4.3	14
4.6	13
5	12
5.5	11
6	10
6.7	9
7.5	8
8.6	7
10	6
12	5
15	4
20	3
30	2

Buy maintaining one of the constant speeds on the left you'll know exactly how long it takes to make a mile. Once that length of time passes you know the boat is a mile further along its plotted course.

Use the table below to compute time/distance/speed problems. Fill in known elements on the left columns to achieve the answer on the far right column.

Distance/Speed/Time Problems					
Speed	X	Time	/	60	Distance
Distance	X	60	/	Time	Speed
Distance	X	60	/	Speed	Time

Distance by Degrees/Minutes Beneath the Horizon

6 foot eye height	12 foot eye height	Distance away in yards
2.3°	4.5°	50
1.1°	2.2°	100
44'	1.5°	150
32'	1.1°	200
25'	52'	250
21'	43'	300
17'	36'	350
15'	31'	400
13'	27'	450
12'	24'	500
9.2'	20'	600
7.6'	16'	700
6.4'	14'	800
5.4'	12'	900
4.7'	11'	1000

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3" = 9° angle = 15x height

2" = 6° angle = 10x height

1" = 3° angle = 5x height

