

Advanced Coastal Navigation Review with Answers

Revised 6/27/07

1. What is the difference between Great Circle and Rhumb line and what are they both used for in navigation? **Great Circle** is the circle formed on the earth's surface when a plane is passed through the earth's center. **Rhumb Line** a line that is formed that spirals around the globe toward the nearest pole. This happens when a direction is specified other than north, south, east and west. Also called a loxodrome. It appears as a straight line on a Mercator chart and is typically used for coastal navigation. In navigation, a **rhumb line** (or **loxodrome**) is a line crossing all meridians at the same angle, i.e. a path of constant bearing.
2. Define: **Prime meridian** – the meridian from which longitude is measured both east and west. It passes through Greenwich, England, and divides the earth into Eastern and Western Hemispheres. **Longitude** – the distance east or west of the prime meridian expressed in degrees from 0 to 180 (east or west). **Latitude** – the distance north or south of the equator expressed in degrees from 0 to 90 (north or south).
3. Define variation and deviation and what causes them. **Magnetism** is a force produced between electric currents. Electric currents within the core of the Earth create a magnetic field which surrounds the Earth. **Variation** is the angular difference between the magnetic meridian and the geographic meridian at a particular location. The earth's magnetic poles are some distance from the geographic or "true" poles. The magnetic lines of force do not pass over the surface in a neat geometric pattern because they are influenced by the varying mineral content of the earth's crust. For these reasons, there is usually an angular difference, or **variation**, between true north and magnetic north from a given geographic location. **Deviation** is the effect of the vessel's magnetic fields upon a compass. It's the difference between where a compass actually points and where it would point if there was no magnetic interference within the boat.
4. Define and know how to determine relative bearings. **Relative bearing** is a direction relative to the fore-and-aft line of a boat. It is expressed in degrees and labeled "R". **Formula:** ships heading + relative bearing = bearing of object.
5. One nautical mile = one minute of what? **Latitude**
6. One minute of latitude = what? 1 nautical mile
7. Given variation and deviation, how do you find True, Magnetic and Compass? **Formula: TVMDC +W**
8. Define **lubber's line**. A permanent line on a compass which is used to read the compass heading of a boat. Should be parallel to the vessel's keel.
9. (Nothing there).
10. What does a compass adjuster do and what does he give you when finished? Consults on compass placement and where to stow gear to minimize deviation. They also will "swing ship" and provide a deviation table specific to the boat. He gives you a "corrected compass"

11. What chart projections are used by mariners and where are they used? **Mercator projections** are the most commonly used by mariners except in the extreme polar areas because shapes and distances are increasingly distorted. **Polyconic projections** in which the earth is projected on a series of cones concentric with the earth's axis and tangent to the sphere of the earth. – used in the Great Lake area. They are not conformal (whatever that means).
12. What are the general properties of these projections? See above.
13. The vertical reference datum clearances for bridges is MHHW. It used to be MHW.
14. What are chart scales based on and what scales are used on what charts. Chart scales are based on the details shown. Large scale charts show more detail and used for coastal navigation and harbors. Small scale charts are used for blue water sailing.
 - Sailing charts – 1:600,000 and smaller
 - General charts – 1:150,000 and 1:600,000
 - Coast charts – 1:40,000 and 1:150,000
 - Small craft charts – 1:60,000 and larger
 - Harbor charts – scales larger than 1: 40,000
15. Where would you find detailed descriptions of stuff shown on charts? **Chart # 1**
16. What is the significance of bottom contour lines? They represent a constant depth, and profile the bottom shape.
17. What is the first thing you should do when you first look at a new chart? Note that the chart is for the appropriate waters and check to see if it's current.
18. What will you learn about that chart when you look? Scale and a whole bunch of useful information.
19. What would a flashing light depth sounder tell you about the bottom (if you could buy one)? Depth and bottom characteristics.
20. What properties would you choose in a marine binocular and why? **7 x 50mm**. A higher power would be too difficult to identify objects from a moving boat.
21. Can you convert civil time to military time? Yes, midnight is 0000, 3am is 0300, 5:30am is 0530 and 7:48pm is 1948. How's that?
22. Do you know how to determine time differences using military time? Yes, the difference between 0339 and 0951 is 0612 hours. Careful with the 60 minute part.
23. What do many boaters use to determine the speed through the water of their vessels? Speed curve or speed table for that particular vessel. You can also use a log and count the seconds from bow to stern. If you don't have a log, take a shit.
24. How do you label dead reckoning position, fix, estimated position, electronic position, dead reckoning track, Line of Position, LOP using a range? Study the inside back cover of our book.

25. Do you know how to make a running fix? Take a bearing on an ATON and draw the LOP. Allow some time to pass and take another bearing on the same ATON, and draw a new LOP. Determine how far you should have traveled during the time between two bearings (based on speed, time, distance). Advance the original LOP along the original DR plot that same distance and draw a line. Where that line intersects the second LOP is your running fix position. Start a new DR plot from this new position. See page 6-20.
26. Do you know how to make an estimated position? Take a LOP on an ATON. Place a point on the DR plot where you should be at that exact time. Draw a perpendicular line from the LOP to the new point you place on the DR plot. Where the perpendicular line intersects the LOP is your estimated position. See page 6-13.
27. Why are buoys not necessarily the best thing to use to make a fix? Because they are not fixed.
28. What do you desire in the objects from which you will make a fix? Objects that are permanently fixed and visible, and the object needs to be charted.
29. What are set and drift? **Set** is the direction the current is flowing, expressed in degrees. **Drift** is the speed in knots the current is flowing. It is also the speed at which the vessel deviates from course due to wind and current.
30. How can you figure out what actual set and drift are? See pages 7-7 and 7-9.
31. What are the various kinds of tide patterns and where can they be found? Tide refers to the vertical motion of water. Three daily patterns are **diurnal** – one period per lunar day (one high and one low), **semidiurnal** – one-half of tidal day (two highs and two lows) and **mixed** – two highs and two lows per day with large inequalities in high and/low tides.
32. Do you know how to find the tide and its characteristics for a particular location? Yes, the **Tide Tables** are the most important source. Sometimes you can find information in local newspapers..
33. Do you know how to find the tide and current for any other location? Using Tide Tables, reference stations and sub-station information.
34. Do you know how to calculate tide and current for times not given in the tables? Yes, need to use the Tide Tables and worksheets, using sub-station and reference station info along with time differences.
35. On what basic principle is GPS based? Calculates position based on 3 or more satellites using triangulation and distance.
36. How good was GPS before selective availability (SA) was turned off? +/- 300' (check notes – not in book)
37. How good is GPS since May 1, 2000 after SA was turned off? +/- 10'
38. Why is DGPS better than even GPS without SA? DGPS uses land based reference stations which removes all errors within standard GPS system.
39. Why is DGPS not better than regular GPS? Since DGPS uses land based reference stations, it is good only in coastal areas where GPS is used worldwide.
40. Do the NavRules discuss any electronic system aboard a vessel? Only **RADAR**.

41. What good is a relative motion plot and what can it tell you? Very important in collision avoidance. It tells you the direction of relative motion (comparing your vessel with another object). It tells you the speed of relative motion, closest point of approach and the time to closest point of approach.
42. Know the difference between luminous, geographic and nominal range of lights and why you need to know them. The **nominal range** of a light is the maximum distance a light can be seen in clear weather (meteorological visibility of 10 nautical miles). The **luminous range** of a light is the greatest distance a light can be expected to see given its **nominal range** and the prevailing meteorological visibility. The **geographic range** is the greatest distance the curvature of the earth permits an object at a given height to be seen from a particular height of eye without regard to luminous intensity or visibility conditions. You need to know them because some lights (ATON's) may or may not be visible, depending on different factors.
43. What are the Local Notice to Mariners and the Notice to Mariners good for? Keeps you up to date on local ATON's, dredging, marine construction, special marine activities (all within a certain district).
44. Be generally familiar with the use of alarms available to the various kinds of electronic equipment found aboard a vessel. Anchor, shallow water, cross track error alarms, etc...
45. What use is the **Coast Pilot**? Supplements the charts with details of harbors and waterways, anchorages, drawbridge schedules, currents, tide and water levels, misc. dangers, etc....
46. What use is the **Light List**? Contains detailed, specific information that cannot be shown on nautical charts. Details like buoyage, bridge markings and electronic ATONs (including radar, loran, RDF).
47. Can you figure out how not to run out of fuel? Yes, do some fuel planning which includes a fuel plan worksheet, allow for a reserve, do a DR plot, consider for foul currents, know how many gallons/hour your boat uses, efficiency, use your speed chart and the formula below.

$$D = ST/60$$

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