9. How are the eclipses of the sun and moon produced ?   Illustrate your answer by diagrams.

10. Account for the formation of a large number of images by two parallel mirrors.   Illustrate your answer by a carefully drawn diagram.

11. Draw a diagram which will show the paths of rays of light through a telescope.   How may the magnifying power by obtained ?

12. Explain why the note of a siren seems different in pitch when a steamer is approaching and when it is receding from you.

NAVIGATION.

Paper 3 (3 hours).

1. What are the general principles underlying the construction of Special Tables for finding Position Lines ?   Explain how these principles are applied in particular to any such tables that you are familiar with.

2. Explain, with sketches if necessary, how you would know whether the failure of three bearings to intersect at a common point is due to an error common to all three bearings or to errors in the individual bearings, and say also what position you would consider to be the position of the ship on the chart, having proved the failure to be due to the second reason.

3. Explain the construction and use of a vernier, taking as an example the sextant, the arc of which is divided to 10', the vernier affording a degree of accuracy of 10".

4. Describe in detail the principle of a Rotating Wireless Beacon, and explain in detail how such a beacon can be used to facilitate coastal navigation.

5. Calculate the height of the tide off Dover at 04 hrs. G.M.T. on 10th December, 1929, by means of the Harmonic Tidal Constants.

6. Explain the course and speed errors of the Gyro compass.   Find the error on such a compass in Lat. 50° N., ship steaming 12 knots, course 320°.

CHART WORK.

Paper 4 (2 hours).

1. Discuss in detail the advantages and disadvantages of the position line by horizontal angle when used with another such line to determine the ship's position.

2. Draw sketches and describe in detail the use which may be made of one or more fixed objects on shore to ensure the safety of the ship when in the vicinity of hidden dangers.

3. How would you proceed to find the distance off a known object by vertical angle when the height of the object is known but its base is beyond the horizon ?

4. Describe briefly, the usual method employed in reproducing and printing Admiralty Charts.

CHART CONSTRUCTION AND MARINE SURVEYING.

Paper 5 (3 hours).

1. Construct a plan to Natural Scale $\frac{1}{20800}$ between the limits 52° 02' 30" and 52° 06' North Lat. and 7° 31' and 7° 37' West Long., and give a scale of Lat. and Dist. but no compass.

2. On the plan so constructed insert the following positions :—
    Wyse Pt. F.S. Lat. 52° 05' N., Long. 7° 34' 12" W.
    Ballinacourty Pt. F.S. Lat. 52° 4' 40" N., Long. 7° 33' 10" W.
    Helvich Harbour Lt. Ho. Lat. 52° 3' 18" N., Long. 7° 32' 42" W.
    Two sounding boats A and B are in such positions that from A the observed angles were Wyse 50° 30', Ballinacourty 84° 40', Helvich, and from B the observed angles were Wyse 33° 15', Ballinacourty 117° 40', Helvich.
    Find the distances of each boat from Ballinacourty and Helvich respectively.

3. Write a brief description of the use of the Tide Pole to reduce tidal sounding to Chart Datum.