The University of the State of New York

230TH HIGH SCHOOL EXAMINATION

SPHERIC TRIGONOMETRY

Wednesday, January 23, 1924—1.15 to 4.15 p. m., only

Write at top of first page of answer paper (*a*) name of school where you have studied, (*b*) number of weeks and recitations a week in spheric trigonometry.

The minimum time requirement for spheric trigonometry is two recitations a week for half a school year, or the equivalent.

Answer six questions, including three from group I, one from group II and two from group III.

A, B and C represent the angles of a triangle ABC; a, b and c represent the respective opposite sides. In a right triangle, C represents the right angle.

Give special attention to neatness and arrangement of work.

In the examination in spheric trigonometry the use of the slide rule will be allowed for checking, provided all computations with tables are shown on the answer paper.

Group I

Answer three questions from this group.

1 Prove geometrically that in any right spheric triangle in which all parts except the right angle are less than 90°

$$\sin a = \sin c \sin A \qquad [15]$$

2 From the formula $\cos A = \cos a \sin B$, show that in a right spheric triangle an oblique angle and the opposite side are either both greater than 90° or both less than 90°. [15]

3 State Napier's rules of circular parts concerning a right spheric triangle [7]. Using these rules, give *two* values for $\cos c$ [8].

4 Starting with the formula

$\cos a = \cos b \cos c + \sin b \sin c \cos A$, derive the formula

$$\sin \tfrac{1}{2} A = \sqrt{\frac{\sin (s-b) \sin (s-c)}{\sin b \quad \sin c}} \qquad [15]$$

Group II

Answer one question from this group.

5 In the right spheric triangle ABC, given $a = 26° 25' 15''$, $b = 48° 10' 25''$; solve the triangle [12]. Check the result [3].

6 In the isosceles spheric triangle ABC, given $a = 54° 20'$, $b = 54° 20'$, $c = 65° 42'$; solve the triangle. [15]

Group III

Answer two questions from this group.

7 Find angle A in the spheric triangle in which $a = 50° 12'$, $b = 116° 45'$, $c = 129° 25'$ [20]

8 Find the area of a triangle on the surface of the earth, regarded as a sphere of radius 3958 miles, in which $A = 75° 10' 20''$, $B = 68° 18' 32''$, $a = 62° 42' 50''$. [20]

9 Find the shortest distance in nautical miles from New York (lat. 40° 43′ N., long. 74° W.) to Liverpool (lat. 53° 24′ N., long. 3° 4′ W.). [20] [A nautical mile is the length of 1′ of the arc of a great circle on the earth's surface.]