University of the State of New York

77TH EXAMINATION

SPHERIC TRIGONOMETRY

FRIDAY, June 12, 1891—1:15 to 4:15 P. M., only

40 *credits, necessary to pass,* 30

NOTE.—Draw carefully and neatly each figure in construction or proof, using letters instead of numbers. Arrange work clearly and logically.

Let c represent the hypotenuse of a right triangle, b and a the other two sides, C, B and A the opposite angles respectively.

1. How many triangles on the surface of a sphere have for their sides the same three arcs of great circles? Are the three angles the same? Give the reason for your answer. Which of these triangles is considered in spheric trigonometry? 4

2. Explain the method of finding the length of the sides of a triangle when the length of the radius of the sphere is known. 2

3. Prove that in a right triangle,

(a) $\cos c = \cos b \cos a$; (b) $\sin b = \tan a \operatorname{ctn} A$. 6

4. State Napier's rules and apply them to obtain equations (a) and (b) of question 3. 5

5. Prove that (a) $\sin a \sin B = \sin b \sin A$; ($b$) $\cos a = \cos b \cos c + \sin b \sin c \cos A$, where a, b and c represent the sides of an oblique triangle, A, B and C the opposite angles respectively. 7

6. Given A and b of a right triangle; deduce the formulae for finding B, a and c; also a formula called a *check*, including only the required parts, and the formulae involving the logarithmic functions of each part. 6

7. Given in a quadrantal triangle A, B and c ($c = 90°$); deduce the formulae for finding a, b and C; also the *check*. 4

8. Deduce the formula for finding the distance between two places on the earth's surface, the latitude and longitude of each being given. Let d represent the distance, L the difference of longitude, l the latitude of one place and l' the latitude of the other. 6