The University of the State of New York

EXAMINATION FOR QUALIFYING CERTIFICATES

PLANE TRIGONOMETRY

Wednesday, September 16, 1925—9.15 a. m. to 12.15 p. m., only

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Answer seven questions, including three from group I and four from group II. Papers entitled to less than 75 credits will not be accepted. 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.

Group I
Answer three questions from this group.

1 Given $c = 54.38$, $A = 103°\ 18'$, $B = 40°\ 48'$; find a and b. [16]

2 Given $a = 32.46$, $b = 41.72$, $c = 53.98$; find A, B and C. [16]

3 From a point on a horizontal plane the angle of elevation to the top of a mountain is A and k feet farther away in the same vertical plane the angle of elevation is B. Find in terms of A, B and k the height of the mountain above the horizontal plane. [16]

4 A ship B is 12 miles S. 45° W. of a lighthouse A and sails S. 50° E. to C, a distance of 15 miles. Find the distance from C to A. [16]

Group II
Answer four questions from this group.

5 a Prove that $\tan (x + y) = \dfrac{\tan x + \tan y}{1 - \tan x \tan y}$ [6]

b Prove that $\tan \frac{1}{2}x = \dfrac{1 - \cos x}{\sin x}$ [7]

6 a If $A = \sin^{-1} \frac{1}{2} = \cot^{-1} \sqrt{3}$, find, without the use of tables, $\sin \frac{1}{2}A$; $\cos A$; $\tan 2A$. [6]

b An angle of 30° at the center of a circle subtends an arc AB of length $\frac{\pi}{3}$ feet. Find the length of the perpendicular dropped from A on the radius BC. [7]

7 a Find the numerical value of

$$\tan^2 \frac{2\pi}{3} + \cos^2 \frac{7\pi}{6} + \sin^2 \frac{7\pi}{4} \qquad [6]$$

b Plot the graph of $y = \sin x$, as x varies continuously from 0° to 360°. [7]

8 a In a right triangle show that

$$\tan \tfrac{1}{2}A = \sqrt{\frac{c-b}{c+b}} \qquad [6]$$

b Prove the following identity:

$$\frac{\sin x + \sin 2x}{1 + \cos x + \cos 2x} = \tan x \qquad [7]$$

9 Solve the following equation for values of x between 0° and 360°:

$$\tan^2 x \tan 2x + 2 \tan x = \sqrt{3} \qquad [13]$$