The University of the State of New York

EXAMINATION FOR QUALIFYING CERTIFICATES

PLANE TRIGONOMETRY

Wednesday, September 14, 1921—9.15 a. m. to 12.15 p. m., only

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

Group I

Answer two questions from this group.

1 Assuming the formulas for $\sin(x+y)$ and $\cos(x+y)$ (*a*) derive the formula for $\tan(x+y)$, (*b*) from the formula found in *a* derive the formula for $\tan 2x$.

2 Prove that in any triangle the difference of any two sides is to their sum as the tan of half the difference of the opposite angles is to the tan of half their sum.

3 Prove that in any triangle $\tan \frac{1}{2} A = \sqrt{\frac{(s-b)(s-c)}{s(s-a)}}$ where a, b and c are the sides of the triangle, s is one half the perimeter and A is the angle opposite side a.

Group II

Answer two questions from this group.

4 *a* Prove that $\frac{\sqrt{1+\sin 2A}-\cos A}{\sqrt{1+\sin 2A}-\sin A} = \tan A$

b Prove that $\cos 2x = \frac{1-\tan^2 x}{1+\tan^2 x}$

5 Solve for values of x between 0° and 360° the equation $3\tan^2 x + 8\cos^2 x = 7$

6 *a* If $\tan x = -\frac{12}{5}$ find $\sin 2x$. In what quadrant is $2x$?

b Express in radians 67° 30′; express in degrees $\frac{3}{4}\pi$ radians.

Group III

Answer three questions from this group.

7 From the roof of a house 40 feet high the angle of elevation of the top of a chimney across a level street is found to be 40° 25′, and the angle of depression of the base of the chimney is 35° 20′. Find the height of the chimney.

8 Solve and check the triangle ABC, given $b = 41.553$, $A = 118° 55'$, $C = 45° 41' 35''$.

9 By the use of logarithms find the value of

$$\left(\frac{-85.14 \times \sqrt{.1479}}{7.1163 \times .09532}\right)^{\frac{2}{3}}$$

10 The sides AB, BC and CD of a quadrilateral $ABCD$ are 38, 55 and 42 respectively, and the angles B and C are 132° 56′ and 98° 29′ respectively. Find side AD and the angles A and D. [Outline in detail the work necessary for the solution and the order for doing the work, but *do not do any of the logarithmic computation*.]