The University of the State of New York

225TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Wednesday, June 15, 1921—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 plane trigonometry.

The minimum time requirement for plane trigonometry is two recitations a week for a school year.

Answer seven questions, including two from group I, two from group II and three 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.

Group I

Answer two questions from this group.

1 Prove $\sin(x+y)=\sin x \cos y+\cos x \sin y$, when x and y are each less than 90° and $x+y$ is greater than 90°. [13]

2 Prove that in any triangle the sides are proportional to the sines of the opposite angles. [Two cases] [13]

3 Prove that $\cos\frac{1}{2}A=\sqrt{\frac{s(s-a)}{bc}}$ when a, b and c are the sides of a triangle and s is one half the perimeter. [13]

Group II

Answer two questions from this group.

4 *a* Prove that $\frac{1+\tan^2 A}{1+\cot^2 A}=\frac{\sin^2 A}{\cos^2 A}$ [3]

b Prove that $\sin(30°+x)+\sin(30°-x)=\cos x$ [4]

c If $\cos x=-\frac{3}{5}$, x being in the second quadrant, find $\sec 2x$. In what quadrant does $2x$ lie? [5], [1]

5 Solve for values of x between 0° and 360°:

a $2\cos x+\sec x=3$ [6]

b $2+\tan 2x=\tan\left(\frac{\pi}{4}+x\right)$ [7]

6 *a* Express in radians 120°, 270°, 4° 30′ [5]

b An angle of 30° at the center C of a circle subtends an arc AB of length $\frac{\pi}{3}$ feet; find the length of the perpendicular dropped from A on CB. [8]

Group III

Answer three questions from this group.

7 Solve and check the triangle ABC, given $a=2.15$, $c=1.59$, $A=19°\ 12'$ [13], [3]

8 A tree standing on ground that slopes at an angle of 20°, casts a shadow 70 feet long extending directly down the hill; if the tree subtends an angle of 28° 32′ at the end of the shadow, find the height of the tree. [16]

9 The bases of a trapezoid are 48.25 feet and 94.75 feet; the angles at the end of the longer base are 63° 52′ and 70° 55′. Find the lengths of the other two sides. [16]

10 A man owns a triangular lot on the corner of two streets which intersect at an angle of 62°; the frontage on one street is 200 feet, on the other 150 feet. He adds to his lot a triangle of 1200 square feet by extending the 150 foot frontage but leaving the 200 foot frontage unchanged, the entire lot still being a triangle. By how much is the 150 foot frontage increased? [16]