The University of the State of New York

236th High School Examination

PLANE TRIGONOMETRY

Wednesday, June 16, 1926 — 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 five recitations a week for half a school year, or the equivalent.

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

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 plane 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 In a right triangle ABC, $a = 65.7$ feet, $b = 113.8$ feet. Find the length of the perpendicular from C to the hypotenuse AB. [16]

2 A watch tower is situated on the summit of a hill. The hill inclines 26° 42′ 17″ to the horizontal. At a distance of 39.42 feet from the base of the tower, measured down the incline, the angle subtended by the tower is 18° 40′. Find the height of the tower. [16]

3 Point A is known to be 4.3 miles from one end B of a lake and 6.75 miles from the other end C; at point A the lake subtends an angle of 37° 17′. How long is the lake? [16]

4 The following method may be used to find the slope of a railroad embankment: A pole 12 feet long is held in a plane that is perpendicular to the base edge of the embankment so that one end touches the level ground 6 feet from the foot of the embankment and the other end touches the face of the embankment $7\frac{1}{2}$ feet up from the base. What angle does the embankment make with the level ground? [16]

Group II

Answer four questions from this group.

5 If $\tan x = \frac{3}{4}$, x being in the first quadrant, and if $y = 2x$, find $\cos(x + y)$. [13]

6 *a* Prove that in any oblique triangle $\frac{b-c}{b+c} = \frac{\tan\frac{1}{2}(B-C)}{\tan\frac{1}{2}(B+C)}$ [8]

b If x and y are angles in the first quadrant and if $\sin x = \cos y$, prove that $\sin(x + y) = 1$. [5]

7 *a* If $75° - \sin^{-1}\frac{1}{2}\sqrt{3} = 3\sin^{-1}x$, find x expressed as a decimal. [7]

b Without the use of tables find the value of *each* of the following: $\tan 210°$, $\sec 225°$, $\cot(-300°)$ [6]

8 *a* Solve the equation $\cos x + \sec x = \frac{5}{2}$ for all positive values of x less than 360°. [9]

b Through how many radians does a place on the earth's surface move in $4\frac{1}{2}$ hours as a result of the rotation of the earth? [4]

9 Prove the following identities:

$$\frac{\cos 4x - \cos 2x}{\sin 4x + \sin 2x} = -\tan x \qquad [7]$$

$$\tan x + \cot x = \sec x \csc x \qquad [6]$$

10 State whether *each* of the following statements is true or false: [Label each answer with the corresponding letter.]

a Sec x is always greater in absolute value than $\cos x$. [2]

b The sine of one half of an angle is sometimes greater than the sine of the whole angle. [3]

c The logarithm of $\frac{1}{2}$ is twice the cologarithm of 1. [2]

d In any right triangle ABC, $\frac{\tan A}{\tan B}$ is never equal to $\frac{a}{b}$. [3]

e If two angles of a triangle are unequal, the sines of these angles are unequal in the same order. [3]