The University of the State of New York

241st High School Examination

PLANE TRIGONOMETRY

Wednesday, January 18, 1928 — 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 all the questions in group I, three questions from group II and two 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.

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 all questions in this group. Each correct answer will receive 3 credits.

1 In a triangle whose sides are 30, 40 and 50, find the sine of the largest angle.

2 In a right triangle, $a = 24$, $b = 36$; find angle A correct to the *nearest minute*.

3 Solve for the positive acute value of x:

$$\tan^2 x - 2 + \cot^2 x = 0$$

4 If $\sin x = -\frac{1}{2}\sqrt{2}$ and $\cos x$ is negative, find $\tan x$.

5 Given $\tan \frac{1}{2}x = 1$, x being a positive angle less than 180°; find $\cos x$.

6 Given $A = \sin^{-1} \frac{1}{3}$, A being a positive obtuse angle; find $\cos A$.

7 Change 40° to radians. [The result may be left in terms of π.]

8 A farmer has a triangular plot of ground. Two adjacent sides are 12 rods and 18 rods and the included angle is 30°. Find the area.

9 Two boy scouts wish to find the approximate distance across a ravine extending east and west. Along the edge of the ravine they take two points, M and R, 100 feet apart. A point O on the opposite side due north of M is sighted and the angle MRO found to be 64°. How wide is the ravine?

10 Express tan 140° in terms of a positive angle less than 90°.

Group II

Answer three questions from this group.

11 A flagstaff 40 feet high stands on top of a cliff that is perpendicular to the surface of a lake. From a boat the angles of elevation to the top and bottom of the flagstaff are 38° and 30° respectively. Find the height of the cliff. [15]

12 Find the perimeter of a regular polygon of 12 sides inscribed in a circle whose radius is 6 inches. [15]

13 A and B are two points on opposite sides of a river. A straight line 160 yards long is measured from A to C, a point on the same side of the river as A. The angles BAC and BCA are 62° 16′ and 54° 28′ 15″ respectively. Find the distance from A to B. [15]

14 The sides of a triangle are 100, 124.6 and 168.4; using the formula for the tangent of a half angle, find the angle opposite the shortest side. [15]

Group III

Answer two questions from this group.

15 Using a unit circle, indicate by lines the six trigonometric functions of any angle in the second quadrant. [Label each line and indicate whether it is positive or negative.] [12½]

16 Prove the following identities:

a $\cos^4 x - \sin^4 x = \cos 2x$ [6½]

b $\tan x + \tan y = \dfrac{\sin (x+y)}{\cos x \cos y}$ [6]

17 Derive formulas for $\tan (x + y)$ and $\cot (x + y)$, starting with the formulas for the sine and cosine of the sum of two angles. [12½]

18 *a* Construct a table of values for $\sin x$ at intervals of 30°, as x varies from 0° to 360°. [4½]

b Plot the graph of $y = 2 \sin x$ [8]