The University of the State of New York

269TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Thursday, June 17, 1937 — 9.15 a. m. to 12.15 p. m., only

Instructions

Do not open this sheet until the signal is given.

Group I

This group is to be done first and the maximum time allowed for it is one and one half hours.

If you finish group I before the signal to stop is given you may begin group II. However, it is advisable to look your work over carefully before proceeding, since *no credit will be given any answer in group I which is not correct and in its simplest form.*

When the signal to stop is given at the close of the one and one half hour period, work on group I must cease and this sheet of the question paper must be detached. The sheets will then be collected and you should continue with the remainder of the examination.

Groups II and III

Write at top of first page of answer paper to groups II and III (*a*) name of school where you have studied, (*b*) number of weeks and recitations a week in plane trigonometry.

The minimum time requirement is five recitations a week for half a school year, or the equivalent.

In this examination the customary lettering is used. 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.

The use of the slide rule will be allowed for checking but all computations with tables must be shown on the answer paper.

Answer *five* questions from these two groups, including at least *two* questions from each group.

Fill in the following lines:

Name of school.....Name of pupil.....

Detach this sheet and hand it in at the close of the one and one half hour period.

Group I

Answer all questions in this group. Each correct answer will receive 2½ credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

1 Find log 62.54 *Ans*.....

2 Find, correct to the *nearest minute*, the acute angle A when $\log \sin A = 9.8737 - 10$ *Ans*.....

3 A regular pentagon is inscribed in a circle whose radius is 10; find, correct to the *nearest integer*, the length of the apothem. *Ans*.....

4 Find the numerical value of cot 33° 24′ *Ans*.....

5 Write the numerical value of $2 \sin \frac{\pi}{6}$ *Ans*.....

6 Express cos (—40°) as a function of a positive angle less than 45°. *Ans*.....

7 Complete the formula cos $(A + B) =$ .... *Ans*.....

8 In which quadrant does an angle lie if its tangent is negative and its cosecant is positive? *Ans*.....

9 In terms of the sides of triangle ABC, complete the formula $\tan \frac{1}{2} A =$ .... *Ans*.....

10 In triangle ABC, express b as a function of a, sin A and sin B. *Ans*.....

11 In triangle ABC, $a = 4$, $b = 5$ and $c = 8$; write the cosine of the smallest angle. *Ans*.....

12 Write the positive value of cos $(\tan^{-1} \frac{3}{4})$. *Ans*.....

13 If tan $x = d$, express tan $(45° + x)$ as a function of d. *Ans*.....

14 Express the tangent of a positive acute angle A in terms of cosine A. *Ans*.....

15 In a circle of radius 10 inches, find the number of inches in an arc intercepted by a central angle of 2 radians. *Ans*.....

16 If A, B and C are the angles of any triangle, is the expression $\sin \frac{1}{2} A = \cos \frac{1}{2} (B + C)$ true? [Answer *yes* or *no*.] *Ans*.....

17 If $\cos x = \frac{4}{5}$, find the positive numerical value of $\tan \frac{1}{2} x$. *Ans*.....

18 In triangle ABC, $a = 9$, $b = 4$, angle $C = 60°$; find the numerical value of $\tan \frac{1}{2} (A - B)$. [Answer may be left in radical form.] *Ans*.....

19 Find the positive value of sin x from the equation $\cos 2x = 2 \sin^2 x$ *Ans*.....

20 What function of an angle, other than the sine and the cotangent, decreases as the angle increases from 90° to 180°? *Ans*.....

See instructions for groups II and III on page 1.

Answer five questions from groups II and III, including at least two questions from each group.

Group II

Answer at least two questions from this group.

21 *a* Derive the law of sines for an acute triangle. [6]

b Starting with the formulas for $\sin(x - y)$ and $\cos(x - y)$, derive the formula for $\tan(x - y)$. [4]

22 *a* Find, correct to the *nearest degree*, the acute angle x that satisfies the equation $3\sin^2 x + 4\sin x - 4 = 0$ [6]

b Prove the identity: $\dfrac{\sin 2x}{\sin x} - \dfrac{\cos 2x}{\cos x} = \sec x$ [4]

23 *a* Using the same set of axes, plot the graph of $y = \tan x$ and the graph of $y = \cos x$, as x varies from 0° to 180° in intervals of 30°. [8]

b From the graphs made in answer to *a* estimate the value of the acute angle for which $\tan x$ is equal to $\cos x$. [2]

*24 Using polar coordinates, plot the graph of $r = 10\sin\theta$, as θ varies from 0° to 180° in intervals of 30°. [10]

Group III

Answer at least two questions from this group.

25 In triangle ABC, $A = 44° 12'$, $C = 57° 28'$ and $AC = 62.5$ feet. Find BC correct to the *nearest tenth of a foot*. [3, 7]

26 Two forces of 170 pounds and 242 pounds act on a body at an angle of 86° 40′. Find, correct to the *nearest minute*, the angle made by the resultant and the greater force. [3, 7]

27 The building regulations in a city specify that a dwelling may not be placed on a lot whose area is less than 7500 square feet. A triangular corner lot lies between two streets that intersect at an angle of 75° 32′. If the frontage of the lot on one of the streets is 115.8 feet, find, correct to the *nearest foot*, the frontage on the other street if the area of the lot is to be 7500 square feet. [3, 7]

28 From a window on a level with the base of a steeple, the angle of elevation of the top of the steeple is 37° 20′. At another window 18 feet vertically above the first, the angle of elevation is 28° 10′. Find, correct to the *nearest foot*, the height of the steeple. [5, 5]

* This question is based on one of the optional topics in the syllabus.