The University of the State of New York

260TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Thursday, June 21, 1934 — 9.15 a. m. to 12.15 p. m., only

Instructions

Do not open this sheet until the signal is given.

Answer all questions in part I and four questions from part II.

Part I is to be done first and the maximum time to be allowed for this part is one and one half hours. Merely write the answer to each question in the space at the right; no work need be shown.

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

When the signal to stop is given at the close of the one and one half hour period, work on part 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.

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.

In both parts of this examination the use of the slide rule will be allowed for checking; in part II all computations with tables must be shown on the answer paper.

PLANE TRIGONOMETRY

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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.

Part I

Answer all questions in this part. Each question has 2½ credits assigned to it. Each answer must be reduced to its simplest form.

1 Express tan 75° as a function of 15°. *Ans*.....

2 Express cos 245° in terms of the sine of a positive acute angle. *Ans*.....

3 What is the value in radians of 3° 36′? [Answer may be left in terms of π.] *Ans*.....

4 Express $\sin^2 \frac{1}{2} x$ in terms of cos x. *Ans*.....

5 What does $\frac{c-b}{c+b}$ equal in the formula called the law of tangents? *Ans*.....

6 Express the area K of triangle ABC as a function of the three sides a, b and c, and of s, the semiperimeter. *Ans*.....

7 Given cos $A = .2864$; find, correct to the *nearest minute*, the value of the positive acute angle A. *Ans*.....

8 Find log tan 72° 17′ *Ans*.....

9 Find the value of sin 161° 26′ *Ans*.....

10 The lengths of two sides of a parallelogram are 6 inches and 10 inches and the angle between them is 41° 50′; what is the length of the altitude on the longer side? [Express answer correct to the *nearest inch*.] *Ans*.....

11 In triangle ABC, given $a = 7$, $c = 9$, $B = 60°$; find the value of b. [Answer may be left in radical form.] *Ans*.....

12 Find the numerical value of tan 225° — sin 150° *Ans*.....

13 As a positive angle in the fourth quadrant increases, what function other than the sine and the tangent increases? *Ans*.....

14 Express cot x in terms of sin x when x is a positive acute angle. *Ans*.....

15 If tan $A = x$ and tan $2A = y$, express y as a function of x. *Ans*.....

16 Find A, an angle between 90° and 180°, if $A = \cos^{-1}(-\frac{1}{2}\sqrt{2})$ *Ans*.....

17 What value of x between 0° and 90° satisfies the equation $4 \sin^2 x - 3 = 0$? *Ans*.....

18 What is the maximum value of sin $3x$? *Ans*.....

19 In how many points does the graph of $y = \sin x$ cross the graph of $y = \cos x$, as x varies from 0° to 360°? *Ans*.....

20 How many different triangles may be formed in which $a = 8$, $b = 12$ and $A = 34°$? *Ans*.....

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Write at top of first page of answer paper to part II (*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.

Part II

Answer four questions from this part, selecting two questions from each group.

Group I

Answer two questions from this group.

21 A vertical tower stands at the bottom of an inclined road which makes an angle of 39° 50′ with the horizontal. From a point 256 feet up the road from the foot of the tower the angle subtended by the tower is 22° 43′. Find, correct to the *nearest foot*, the height of the tower. [12½]

22 A four-sided field $ABCD$ has angle $BAD = 67° 40'$, side $AB = 268$ feet and side $AD = 150$ feet; find, correct to the *nearest foot*, the length of diagonal BD. [12½]

23 In the triangle ABC, $a = 4.92$, $b = 3.57$, $c = 7.41$; find angle C correct to the *nearest minute*. [12½]

Group II

Answer two questions from this group.

24 *a* Derive the law of cosines for an acute triangle. [7]

b Prove the identity: $\sin 2x = \dfrac{2 \tan x}{1 + \tan^2 x}$ [5½]

25 Using the formula for $\sin (x + y)$, derive the formula expressing $\sin 3A$ in terms of $\sin A$. [12½]

26 *a* Find, correct to the *nearest minute*, the values of x between 0° and 360° that satisfy the equation $3 \sin^2 x - 7 \sin x + 2 = 0$ [7]

b Prove the identity: $\tan \left(\dfrac{\pi}{4} + x\right) = \dfrac{\cos x + \sin x}{\cos x - \sin x}$ [5½]