The University of the State of New York

250TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Thursday, January 22, 1931 — 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 What function of A is the reciprocal of csc A? *Ans*.....

2 Express in equation form sin A in terms of cos A. *Ans*.....

3 Does cos A equal sec $(90° - A)$? [Answer *yes* or *no*.] *Ans*.....

4 As A increases from 90° to 180°, does sin A increase or decrease? *Ans*.....

5 Express sin $(-220°)$ as the sine of a positive angle less than 90°. *Ans*.....

6 Find the value of sin 23° 48′ 20″. *Ans*.....

7 If log cos $A = 9.90429 - 10$, find A in degrees, minutes and seconds. *Ans*.....

8 Write the formula for the area K of a triangle ABC in terms of A, b and c. *Ans*.....

9 If $A = \sin^{-1}\frac{5}{13}$ and A is acute, what is the value of tan A? *Ans*.....

10 Is it possible to find an angle A such that $\sin A = \frac{30}{21}$? [Answer *yes* or *no*.] *Ans*.....

11 How many degrees in 2 radians? [Express your answer to the *nearest degree*.] *Ans*.....

12 In a right triangle ABC, $\tan A = \frac{3}{8}$ and $a = 15$; find b. *Ans*.....

13 If $4 \sin^2 x = 1$, find *two* values of x between 180° and 360°. *Ans*.....

14 Express in degrees and minutes the angle of elevation of the sun if the shadow of a small tree is three times as long as the tree is high. *Ans*.....

15 Express in radical form the value of tan 120°. *Ans*.....

16 Using the tables, find the value of sin 213°. *Ans*.....

17 How many angles of a triangle can have a negative cosine? *Ans*.....

18 How many solutions are there for triangle ABC if A, a and b are given and A is acute and a is larger than b? *Ans*.....

19 Derive a formula for the apothem a of a regular n-gon inscribed in a circle of radius r. *Ans*.....

20 A pupil copied $y = \sin^2 A$ as $y = \sin 2A$; determine the amount of error in y when A is 30°. *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 From a point A at an elevation of 400 feet above a river, the angle of depression of point B is 20° and of point C is 16°. B is on the nearer bank and C on the farther bank of the river. A, B and C lie in a vertical plane that is perpendicular to the banks of the river. What is the width of the river? [12½]

22 A road goes from A to C by way of B, B being outside line AC. A new road will cut directly from A to C. Calculate the length of the new road if angle $ABC = 38°$, $AB = 1357$ yards and $BC = 987$ yards. [12½]

23 Find to the *nearest minute* the angle opposite the longest side of the triangle whose sides are 224 feet, 180 feet and 210 feet. [12½]

Group II

Answer two questions from this group.

24 *a* Starting with the formula for $\cos 2A$, derive the formula for $\cos \frac{1}{2}x$. [7]

b Without the use of tables find the value of $\sin 75°$. Show all work. [Answer may be left in radical form.] [5½]

25 *a* Prove the following identity:

$$\tan x - \tan y = \frac{\sin (x - y)}{\cos x \cos y} \quad [4\frac{1}{2}]$$

b Solve the equation $\sin 2x = \cos x$ for all values of x between 0° and 360°. [8]

26 An acute angle AOC has its vertex O at the center of a circle whose radius is 1, with the points A and C on the circle. A tangent is drawn to the circle at C, the line OA extended cutting this tangent at D; the perpendicular AE is drawn from A to the radius OC. Letting x represent the angle AOC, answer the following:

a What function of x is represented by the line segment AE? [2]

b What line segment represents (1) $\cos x$, (2) $\tan x$, (3) $\sec x$? [2, 2, 2]

c As x increases, what change takes place in $\cos x$? [2]

d As CD increases, what change takes place in OE? [2½]