The University of the State of New York

259TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Thursday, January 25, 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.

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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 the top of a hill a man observes that the angles of depression of two successive markers one mile apart in the horizontal plain below, in a straight line before him, are 14° 20' and 5° 31'. Find to the *nearest foot* the height of the hill. [$12\frac{1}{2}$]

22 In the roof of a clubhouse three steel girders, 27.4 feet, 39.7 feet and 50.5 feet in length, are riveted into a triangle. Using the formula for cosine or tangent of a half angle in terms of its sides, find to the *nearest minute* the angle at which the longest and shortest girders meet. [$12\frac{1}{2}$]

23 From a point 256 feet from one end of a pond and 178 feet from the other, the angle subtended by the pond is 57° 50'. Find to the *nearest foot* the length of the pond. [$12\frac{1}{2}$]

Group II
Answer two questions from this group.

24 *a* Starting with the formulas for sin $(x + y)$ and sin $(x - y)$, derive the formula for the sum of two sines expressed as a product. [$6\frac{1}{2}$]

b Prove the identity:
$$\frac{\cos 2x}{\sin x} + \frac{\sin 2x}{\cos x} = \csc x \quad [6]$$

25 Find to the *nearest minute* the positive angle in the second quadrant that satisfies the equation:
$$\tan 2x \, (\tan^2 x - 1) = 2 \tan^2 x - 4 \quad [12\frac{1}{2}]$$

26 *a* Starting with the expression for the law of sines, derive the law of tangents. [$6\frac{1}{2}$]

b Solve for all values of x between 0° and 360° inclusive:
$$2 \sin \frac{x}{2} + \tan \frac{x}{2} = 0 \quad [6]$$

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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 $2\frac{1}{2}$ credits assigned to it. Each answer must be reduced to its simplest form.

1 The angle y is in the first quadrant; express cot y in terms of cos y.   *Ans*...........

2 Express cos $(90° + A)$ as a trigonometric function of angle A.   *Ans*...........

3 Express sin 234° as the sine of a positive acute angle.   *Ans*...........

4 If sin x = .9184 and x is a positive acute angle, find the value of x correct to the *nearest minute.*   *Ans*...........

5 Find the value of tan $(\cos^{-1} \frac{5}{13})$ if the angle is in the first quadrant.   *Ans*...........

6 As a positive angle in the second quadrant increases, what function other than the secant and cosecant increases?   *Ans*...........

7 Find the logarithm of 354.4   *Ans*...........

8 If sin A = $\frac{3}{5}$ and A is in the second quadrant, what is the value of cos $2A$?   *Ans*...........

9 If 4 sin² x = 3, find a value of x in the third quadrant.   *Ans*...........

10 Find the numerical value of sin 150° — sin 210°   *Ans*...........

11 Express tan² $\frac{1}{2}x$ in terms of a function of x.   *Ans*...........

12 If A is a positive acute angle and x = sin A and y = sin $2A$, express y as a function of x.   *Ans*...........

13 Using the law of cosines, express cos A in terms of a, b and c.   *Ans*...........

14 Find the area of the triangle ABC, which has b = 5, c = 4 and A = 56° 20'   *Ans*...........

15 In a circle of radius 50 inches, a chord subtends an angle of 37° 40' at the center. Find the distance of the chord from the center of the circle. [Express answer to the *nearest inch.*]   *Ans*...........

16 How many different triangles may be formed in which a = 14, b = 12, A = 30°?   *Ans*...........

17 Find to the *nearest degree* the number of degrees in an angle of 2.2 radians.   *Ans*...........

18 What is the value in radians of 1° 48'? [Answer may be left in terms of π.]   *Ans*...........

19 Find log tan 57° 18'   *Ans*...........

20 If A is a positive acute angle and log cos A = 9.9605 — 10, find the value of A correct to the *nearest minute.*   *Ans*...........

[3]