

The University of the State of New York

295TH HIGH SCHOOL EXAMINATION

TRIGONOMETRY

Thursday, August 23, 1945 — 3.30 to 6.30 p. m., only

Instructions

Part I is to be done first and the maximum time allowed for it is one and one half hours. At the end of that time, this part of the examination must be detached and will be collected by the teacher. If you finish part I before the signal to stop is given, you may begin part II.

Write at top of first page of answer paper to parts II, III and IV (a) names of schools where you have studied, (b) number of weeks and recitations a week in trigonometry previous to entering summer high school, (c) number of recitations in this subject attended in summer high school of 1945 or number and length in minutes of lessons taken in summer of 1945 under a tutor licensed in the subject and supervised by the principal of the school you last attended.

The minimum time requirement is five recitations a week for half a school year. The summer school session will be considered the equivalent of one semester's work during the regular session or five recitations a week for half a school year.

For those who have met the time requirement, the minimum passing mark is 65 credits; for all others 75 credits.

For admission to this examination attendance on at least 30 recitations in this subject in a registered summer high school in 1945 or an equivalent program of tutoring approved in advance by the Department is required.

Answer five questions from parts II, III and IV, including at least one question from each part.

Part II

Answer at least one question from part II.

21 Derive the formula for $\sin(x + y)$ for the case in which x , y and $x + y$ are positive acute angles. [10]

22 Solve the equation $25 \sin^2 x - 10 \sin x - 3 = 0$ for all values of x between 0° and 360° , expressing each result correct to the nearest degree. [10]

23 Prove that the area of any quadrilateral is equal to one half the product of its diagonals and the sine of one of the angles formed at the intersection of the diagonals. [10]

24 a Draw on one set of axes the graphs of $y = \sin x$ and $y = \sin \frac{x}{2}$ as x varies from 0 to

2π radians inclusive at intervals of $\frac{\pi}{2}$. [7]

b From the graphs made in answer to a, find all values of x from 0 to 2π inclusive for which $\sin x = \sin \frac{x}{2}$. [3]

Part III

Answer at least one question from part III.

25 The pilot of an airplane desires to fly from A directly north to B , a distance of 150 miles, then from B to C and from C back to A . If C is east of line AB and the distances BC and CA are 200 miles and 174 miles, respectively, find, correct to the nearest degree, the direction in which he must fly in going from B to C . [10]

TRIGONOMETRY

26 A navigator observes a lighthouse bearing N 48° W. He sails 500 yards due west and then observes that the lighthouse bears N 30° W. How far is he from the lighthouse at the time of the second observation? [10]

27 Two sides of a parallelogram are 4 inches and 5 inches long and the angle included by them is 70° . Find the angles that the longer diagonal makes with the sides of the parallelogram and find the length of that diagonal correct to the *nearest inch*. [10]

Part IV

Answer at least one question from part IV.

28 In right spherical triangle ABC , $A = 40^\circ 31'$ and $a = 32^\circ 22'$. Find B . [10]

29 After "shooting the sun" with a transit, an observer found side b of spherical triangle ABC to be $49^\circ 40'$. By subtracting the latitude of his position, from 90° , he found a to be $48^\circ 10'$. After consulting the Nautical Almanac, he found c to be $79^\circ 30'$.

a Find B (the hour angle) correct to the *nearest tenth of a degree*. [9]

b Using the formula $H = \frac{B}{15}$ and the result obtained in answer to *a*, find the number of hours (H) between noon and the time when the observation of the sun was made. [1]

TRIGONOMETRY

Fill in the following lines:

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

Part I

Answer all questions in part I. Each correct answer will receive $2\frac{1}{2}$ credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

- | | |
|--|---------|
| 1 In which quadrant does an angle lie if its tangent and its cosecant are both negative? | 1..... |
| 2 What is the value of $\cot 315^\circ$? | 2..... |
| 3 What is the value of $\sin \frac{2\pi}{3}$? | 3..... |
| 4 If A is a positive acute angle, express $\cot A$ in terms of $\cos A$. | 4..... |
| 5 Find the positive acute angle that satisfies the equation
$3 \tan x - \frac{1}{\tan x} = 0$ | 5..... |
| 6 Express the altitude CD of triangle ABC in terms of a and a function of B . | 6..... |
| 7 Find the area of triangle ABC in which $a = 20$, $b = 4$ and $C = 13^\circ$. | 7..... |
| 8 Given $\log \sin A = 9.3402 - 10$. Find acute angle A correct to the nearest minute. | 8..... |
| 9 Find $\log \cos 84^\circ 14'$. | 9..... |
| 10 Find angle A of triangle ABC , correct to the nearest minute, if $\tan \frac{1}{2} A = 0.2456$ | 10..... |
| 11 Express in mils an angle of 9° . | 11..... |
| 12 If $\cos x = \frac{2}{3}$, find $\cos 2x$. | 12..... |
| 13 Express $\sin^2 \frac{1}{2} A$ in terms of $\cos A$. | 13..... |
| 14 Find the positive acute angle A for which $\cos (30^\circ + A)$ is equal to $\sin A$. | 14..... |
| 15 Write the formula for finding c of right spherical triangle ABC when A and b are known. | 15..... |
| 16 If $\sin x = \frac{2}{3}$ and x is an obtuse angle, what is the value of $\tan x$? | 16..... |
| 17 Find, correct to the nearest tenth of an inch, the arc of a circle intercepted by a central angle containing $\frac{\pi}{3}$ radians, if the radius of the circle is 5 inches long. | 17..... |

Directions (questions 18–20) — Indicate the correct answer to each question by writing the letter a , b or c on the line at the right.

- | | |
|---|---------|
| 18 $\sec (90^\circ - A)$ is equal to (a) $\cos A$, (b) $\csc A$, (c) $-\csc A$ | 18..... |
| 19 If $b = 3$, $a = 2$ and $A = 55^\circ$, the number of possible solutions of plane triangle ABC is (a) one, (b) two, (c) none | 19..... |
| 20 In the right spherical triangle ABC , if $a = 60^\circ$ and $b = 110^\circ$, then c is (a) greater than 90° , (b) equal to 90° , (c) less than 90° | 20..... |