

The University of the State of New York

292D HIGH SCHOOL EXAMINATION

**TRIGONOMETRY**

Wednesday, August 23, 1944 — 3.30 to 6.30 p. m., only

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**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 1944 or number and length in minutes of lessons taken in summer of 1944 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 1944 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 a In triangle  $ABC$ , in which angle  $A$  is obtuse, derive the relationship  $\frac{a}{\sin A} = \frac{c}{\sin C}$  [4]

b Derive a formula for the area of a regular polygon of  $n$  sides circumscribed about a circle of radius  $r$ . [6]

22 Find, correct to the *nearest minute*, all values of  $x$  between  $0^\circ$  and  $360^\circ$  which satisfy the equation  $3 \sin^2 x - 2 \sin x - 1 = 0$  [10]

23 a Using only one set of axes, construct the graphs of  $y = \sin x$  and  $y = \sin 2x$  from  $x = 0$  to  $x = 2\pi$  radians inclusive. [3, 5]

b Does the period of the function  $y = \sin nx$  increase or decrease as  $n$  increases from 1? [2]

24 a State Napier's rules of circular parts. [4]

b State the law of sines for the oblique spherical triangle. [3]

c State or illustrate the law of cosines for the oblique spherical triangle. [3]

## TRIGONOMETRY

### Part III

Answer at least one question from part III.

25 A gun emplacement  $G$  is 2000 yards from  $O$ , an observation post. Find  $GE$ , the range of the gun required to destroy enemy installations at  $E$ , if angle  $EOG$  is  $63^\circ$  and angle  $EGO$  is  $75^\circ$ . [10]

26 An airplane pilot flying at an altitude of 3.5 miles notes that the angle of depression of a ball-bearing factory on level ground is  $12^\circ$ . If his speed is 300 miles per hour, find, correct to the nearest tenth of a minute, the time required to reach a point directly above the factory. [10]

27 In triangle  $ABC$ ,  $a = 24.40$ ,  $b = 56.20$  and  $C = 48^\circ 20'$ . Find  $A$  correct to the nearest minute. [10]

### Part IV

Answer at least one question from part IV.

28 In spherical triangle  $ABC$ ,  $a = 130^\circ$ ,  $b = 130^\circ$  and  $C = 68^\circ 52'$ . Find  $A$ . [10]

29 Find the shortest distance in nautical miles between New York ( $40^\circ 49' N$ ;  $73^\circ 58' W$ ) and Glasgow ( $55^\circ 53' N$ ;  $4^\circ 18' W$ ). [10]

## 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.

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| 1 Express $\cos 149^\circ$ as a function of an angle less than $45^\circ$ .  | 1.....  |
| 2 Find in square feet the area of a triangular building lot if two sides and the included angle are 100 feet, 80 feet and $27^\circ$ .   | 2.....  |
| 3 If $A$ is one of the acute angles of a right triangle and if $\tan A = 2\sqrt{2}$ , what is the value of $\sin A$ ?  | 3.....  |
| 4 If $\sec A = \frac{1}{2}\sqrt{5}$ , what is the value of $1 + \tan^2 A$ ?  | 4.....  |
| 5 Find, correct to the <i>nearest minute</i> , the positive acute angle whose tangent is 0.6059  | 5.....  |
| 6 Find $\log \cos 46^\circ 43'$  | 6.....  |
| 7 Find the logarithm of 48.56  | 7.....  |
| 8 If one leg of a right triangle is twice as long as the other, find, correct to the <i>nearest minute</i> , the smallest angle of the triangle.   | 8.....  |
| 9 If the sides of a triangle are 2, 3 and 4, what is the cosine of the largest angle?  | 9.....  |
| 10 In what quadrant does $A$ lie if $\sin A$ is greater than zero and $\cos A$ is less than zero?  | 10..... |
| 11 What values of $A$ between $0^\circ$ and $360^\circ$ satisfy the equation $1 + 2 \cos A = 0$ ?  | 11..... |
| 12 Express $\frac{\sin 2x}{\cot x}$ in terms of $\sin x$ .   | 12..... |
| 13 If $\cos x = a$ , express $\sin^2 \frac{x}{2}$ in terms of $a$ .  | 13..... |
| 14 Express in nautical miles the length of a great circle arc of $11^\circ 48'$ on the surface of the earth.   | 14..... |
| 15 $A$ and $B$ are radio receiving posts, $A$ being 40 miles due north of $B$ . Signals from an enemy transmitter are received at $B$ from the direction $N 70^\circ E$ ; at $A$ the same signals come directly from the east. How many miles from $A$ is the enemy transmitter? | 15..... |
| 16 Write the formula for finding $c$ in a right spherical triangle $ABC$ when $A$ and $B$ are given.   | 16..... |

Directions (questions 17–20) — Indicate the correct answer to *each* question by writing the letter  $a$ ,  $b$  or  $c$  on the line at the right.

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| 17 The number of degrees in two radians is approximately (a) $15^\circ$ , (b) $75^\circ$ , (c) $115^\circ$   | 17..... |
| 18 The number of mils in one right angle is (a) 800, (b) 1600, (c) 6400  | 18..... |
| 19 In the right spherical triangle $ABC$ , if $a = 50^\circ$ and $b = 125^\circ$ , then $c$ is (a) greater than $90^\circ$ , (b) equal to $90^\circ$ , (c) less than $90^\circ$                          | 19..... |
| 20 $\cos A - \cos B$ equals (a) $-2 \sin \frac{1}{2}(A + B) \sin \frac{1}{2}(A - B)$ , (b) $2 \cos \frac{1}{2}(A + B) \cos \frac{1}{2}(A - B)$ , (c) $2 \sin \frac{1}{2}(A + B) \sin \frac{1}{2}(A - B)$ | 20..... |