

The University of the State of New York

298TH HIGH SCHOOL EXAMINATION

TRIGONOMETRY

Thursday, August 22, 1946 — 12 m. to 3 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 1946 or number and length in minutes of lessons taken in the summer of 1946 under a tutor licensed in the subject and supervised by the principal of the school you last attended.

The minimum time requirement is four or 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 (four 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 1946 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 $\cos(x + y)$ in which x , y and $x + y$ are positive acute angles. [10]

22 In order to determine the height of a tower that stands on level ground, the angle of elevation of its top is observed from a point A directly east of the foot of the tower and also from a point B 30 feet farther east. If the first angle contains x degrees and the second angle y degrees,

show that the height h of the tower is expressed by the formula $h = \frac{30 \sin x \sin y}{\sin(x - y)}$ [10]

23 Find all values of x between 0° and 360° which satisfy the equation $3 \cos^2 x + 2 \cos x = 0$. [Express approximate values of x correct to the nearest minute.] [10]

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24 a Complete the following table: [4]

x	$-\frac{\pi}{3}$	$-\frac{\pi}{6}$	0	$\frac{\pi}{6}$	$\frac{\pi}{3}$
$\tan x$					

b Draw the graph of $y = \tan x$ from $x = -\frac{\pi}{3}$ radians to $x = +\frac{\pi}{3}$ radians. [4]

c On the graph drawn in answer to b illustrate the fact that $\tan(-x)$ is equal to $-\tan x$ for values of x between $-\frac{\pi}{3}$ and $+\frac{\pi}{3}$ radians. [2]

Part III

Answer at least one question from part III.

25 In triangle ABC , $a = 717$, $b = 654$ and $c = 321$; find A correct to the *nearest minute*. [10]

26 At a certain instant, a lighthouse known to be 20 miles away bears N 60° E from a ship. The ship is sailing east at the rate of 15 miles an hour. How long will it take the ship to reach a point from which the lighthouse will bear N 54° W? [Express answer correct to the *nearest hour*.] [10]

27 A man travels east from A to B , a distance of 100 miles. He then desires to go to C , a point 240 miles directly southeast of A . Find, correct to the *nearest mile*, the distance from B to C . [10]

Part IV

Answer at least one question from part IV.

28 In spherical triangle ABC , $a = 80^\circ$, $b = 110^\circ$, $c = 90^\circ$; find B correct to the *nearest minute*. [10]

29 Find the great circle distance in nautical miles between New York ($40^\circ 49' N$, $73^\circ 58' W$) and San Francisco ($37^\circ 47' N$, $122^\circ 26' W$). [10]

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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 In what quadrant is angle A if both its cotangent and its cosine are positive? | 1..... |
| 2 If $\sin A = \frac{4}{5}$ and A is in the second quadrant, what is the value of $\cos A$? | 2..... |
| 3 In triangle ABC , $a = 8$, $b = 7$ and $c = 5$; find B . | 3..... |
| 4 Express in degrees $\frac{7\pi}{4}$ radians. | 4..... |
| 5 Find all values of A between 0° and 360° that satisfy the following equation: $1 - 2 \sin A = 0$ | 5..... |
| 6 A rectangle is 14 inches wide and 16 inches long. Find, correct to the nearest minute, the angle formed by the diagonal and the 16-inch side. | 6..... |
| 7 Find the value of $\tan 67^\circ 12'$. | 7..... |
| 8 Find, correct to the nearest minute, the angle whose cosine is .7663 | 8..... |
| 9 Find the 4-digit number whose logarithm is $9.3571 - 10$ | 9..... |
| 10 What is the value of $\sin (-240^\circ)$? [Answer may be left in radical form.] | 10..... |
| 11 Express $\sin 10^\circ \cos 30^\circ + \cos 10^\circ \sin 30^\circ$ in terms of a function of a single angle. | 11..... |
| 12 In right triangle ABC , hypotenuse $c = 31.5$ and $\sin A = \frac{2}{3}$. Find a . | 12..... |
| 13 Express $\sin 50^\circ - \sin 20^\circ$ as a product. | 13..... |
| 14 Express $\cos 2A$ in terms of $\cos A$. | 14..... |
| 15 If the graphs of $y = \sin x$ and $y = \cos x$ were drawn on the same set of axes, in how many points between $x = 0^\circ$ and $x = 360^\circ$ would they intersect? | 15..... |
| 16 Express $\sec x - \sin x \tan x$ in terms of $\cos x$. | 16..... |
| 17 In right spherical triangle ABC in which C is the right angle, A and B are known. Write the formula that should be used to find b . | 17..... |

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

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| 18 If $a = 2$, $b = 3$ and $A = 56^\circ$, the number of possible solutions of triangle ABC is (a) one, (b) two, (c) none | 18..... |
| 19 $\tan (90^\circ - x)$ is equal to (a) $\cot x$, (b) $\tan x$, (c) $-\cot x$ | 19..... |
| 20 In spherical triangle ABC in which $C = 90^\circ$, $b = 100^\circ$ and $a = 120^\circ$, c is (a) less than 90° , (b) equal to 90° , (c) greater than 90° | 20..... |