The University of the State of New York

TRIGONOMETRY

Thursday, August 19, 1943 — 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) name of school 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 1943 or number and length in minutes of lessons taken in summer of 1943 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 1943 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 law of cosines for an acute plane triangle. [10]

22 Solve $\sec^2 x + \tan x = 3$ for positive angles less than 180° and check *one* of your answers. [10]

23 The angles of elevation of the top of a tower from two points on level ground in front of the tower and in line with the base are A and B (A being greater than B). If the distance between the two points is d, derive the formula for the height h of the tower in terms of d and the cotangents of A and B. [10]

24 Derive the law of sines for the spherical triangle. Consider only the case in which the triangle is acute. [10]

Part III
Answer at least one question from part III.

25 Two ships, *A* and *B*, are sailing toward a port *P*. When *A* is 15 miles from *P* and *B* is 10 miles from *P*, *A* and *B* are 12 miles apart. Find the angle that the lines of direction in which the ships are sailing make with each other. [10]

26 In right triangle *RST*, *RS* represents the velocity of a plane flying east at the rate of 200 m. p. h., *ST* the velocity of a 20 m. p. h. wind from the north and *RT* the ground speed of the plane.
  a Find *RT*, correct to the *nearest mile*. [3]
  b Find, correct to the *nearest minute*, the drift angle *SRT*. [4]
  c In two hours how far will the plane have drifted to the south? [3]

27 Two tunnels, *AB* and *BC*, meeting at an angle of 60° 32′, are respectively 800 yards and 900 yards long. If a tunnel is constructed from *A* to *C*, what angle will this tunnel make with *AB*? [10]

28 A radio receiving station is situated N. 40° E. of a village. Three and one-half miles east of the village is a school from which the bearing of the radio station is N. 56° 45′ W. How far from the school is the radio station? [10]

Part IV
Answer at least one question from part IV.

29 In spherical triangle *ABC, C* = 45° 10′, *c* = 90° and *a* = 135° 20′; find *A*. [10]

30 Find the distance, correct to the nearest *ten nautical miles,* between Navesink, New Jersey, (40° 24′ N., 73° 59′ W.) and Madrid, Spain (40° 24′ N., 3° 41′ W.) [10]

[2]

TRIGONOMETRY

Fill in the following lines:

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

Part I

Answer all questions in this part. Each correct answer will receive 2½ credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

1 On a map, the distance from G to T is 5.5 cm. If G is known to be 880 yards from T, how many yards does 1 cm on the map represent? 1................

2 In triangle ABC, if $\cos A = \frac{4}{5}$, what is the value of $\tan A$? 2................

3 Find the value of $\sin (x + y)$ if $\sin x = \frac{1}{2}$, $\cos y = \frac{1}{2}$ and x and y are positive acute angles. 3................

4 Find the acute angle whose tangent is equal to $\cot 14°\ 30'$ 4................

5 Find the positive acute angle A for which $\log \cos A = 9.9648 - 10$ 5................

6 Find $\log \sin 58°\ 26'$ 6................

7 Find $\sin 141°\ 12'$ 7................

8 Express $\dfrac{6\pi}{5}$ radians in degrees. 8................

9 The lookout of a battleship, 33 yards above water level, sights the periscope of a submerging submarine. If the line from the eye of the lookout to the periscope is inclined at an angle of 4° to the horizontal, find, correct to the *nearest yard,* the distance of the ship from the submarine. 9................

10 Express $\sec A$ in terms of $\tan A$, if A is an acute angle. 10................

11 Two streets intersect at an angle of 63°. A corner lot has a frontage of 70 feet on one street and 80 feet on the other. Find the area of the lot correct to the *nearest square foot.* 11................

12 Is $\sin x$ always equal to $\sin (360° + x)$, sometimes equal to $\sin (360° + x)$, or never equal to $\sin (360° + x)$? 12................

13 Express 200 mils in degrees and minutes. 13................

14 Express in nautical miles the length of a great circle arc of 60° 24' on the surface of the earth. [The length of a great circle arc of $1' = 1$ nautical mile.] 14................

15 A ship sails at the rate of 12 knots. How long does it take to go 2 nautical miles? [A knot is a rate of one nautical mile an hour.] 15................

16 What is the length in inches of an arc intercepted by a central angle containing 1 radian in a circle whose radius is 1 inch? 16................

17 In a plane triangle $A = 30°$, $b = 6$ and $a = 5$. Find B correct to the *nearest degree.* 17................

18 C is the right angle of a spherical triangle ABC. Write the formula for finding c when A and b are given. 18................

19 Can two spherical triangles, only one spherical triangle, or no spherical triangle, be formed in which $a = 105°$, $C = 90°$ and $A = 84°$? 19................

20 In a spherical triangle ABC in which $C = 90°$, $a = 105°$ and $b = 115°$, is c greater than 90°, less than 90° or equal to 90°? 20................

[3]