

TRIGONOMETRY

Thursday, January 22, 1920—1.15 to 4.15 p. m., only

Write at top of first page of answer paper (a) name of school where you have studied, (b) number of weeks and recitations a week in trigonometry.

The minimum time requirement for plane trigonometry is two recitations a week for a school year; for plane and spheric trigonometry three recitations a week for a school year.

Students taking this examination may use textbooks and notes prepared previous to the examination, but there must be no communication among students after the examination has begun.

Candidates for plane trigonometry should answer six questions, including three from group I and three from group II.

Candidates for plane and spheric trigonometry should answer six questions, including two from group I, two from group II and two from group III.

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.

Group I

1 a Prove $\frac{1 - \sin A}{1 + \sin A} = (\sec A - \tan A)^2$

b Prove without using the tables: $\frac{\sin 75^\circ + \sin 15^\circ}{\sin 75^\circ - \sin 15^\circ} = \sqrt{3}$

2 a Compute the value of $\sqrt[3]{\frac{(5.162)(0.0913)^2}{10.132}}$.

b Solve for x : $\log\left(\frac{1}{x}\right)^3 = 3$

3 a Find the numerical values of the following:

$$\cos 240^\circ; \cot 750^\circ; \sin(-225^\circ); \tan 540^\circ$$

b Why can the value of the sine of an angle never be greater than 1?

c Why is there no limit to the value of the tangent of an angle?

4 Solve for values less than 360° and check:

$$\sin^2 x - \cos x = \frac{1}{2}$$

Group II

5 In the triangle ABC , $a = 22.531$, $b = 34.645$, $C = 43^\circ 31'$.

6 Find the perimeter and the area of a regular decagon circumscribed about a circle whose radius is 12 units.

7 To find the height of an inaccessible object a horizontal base line CD , 250 feet long, is measured directly toward the foot A of the object AB ; the angles of elevation $ADB = 48^\circ 20'$, and $ACB = 38^\circ 40'$. Find height AB .

8 A and B are 1 mile apart on a straight road and C is a distant object on the same horizontal plane. The angles ABC and BAC are observed to be 120° and 45° respectively. Show (without the use of tables) that the distance from A to C is approximately 3.346 miles.

Group III

9 In a spheric triangle $a = 108^\circ 30'$, $b = 131^\circ 35'$, $c = 84^\circ 46'$; find A , B and C .

10 Solve the right spheric triangle ABC , given $C = 90^\circ$, $a = 14^\circ 16'$, and $A = 37^\circ 36'$.

11 Quito is on the equator in longitude $78^\circ 50'$ W.; New York is in latitude $40^\circ 43'$ N., longitude 74° W. Find the distance between these two cities, assuming that the radius of the earth is 3956 miles. [Solve by using the polar triangle.]

12 In a right spheric triangle, show that

$$\tan a \cos c = \sin b \cot B$$