

TRIGONOMETRY

Tuesday, June 16, 1908—9.15 a. m. to 12.15 p. m., only

Candidates for plane trigonometry will answer six questions, selecting three from group I and three from group II.

Candidates for plane and spheric trigonometry will answer two questions from group I, two questions from group II and three questions from group III.

Candidates for spheric trigonometry who have previously passed plane trigonometry will answer three questions from group III.

A, B and C represent the angles of a triangle, a, b and c the opposite sides. In a right triangle C represents the right angle.

Give special attention to arrangement of work.

Group I 1 Given $4 \sin x = \operatorname{cosec} x$; find x .

2 Prove that the cosine of the sum of two angles is equal to the product of the cosines less the product of their sines.

3 Prove that the sides of a triangle are proportional to the sines of the opposite angles.

4 Write with the proper algebraic sign the numeric value of each of six functions of 225° .

Group II 5 Two sides of a triangle, including an acute angle, are 5 and 7; the area is 14. Find the angles.

6 A horizontal line AB is measured 1200 feet long; from a point in AB a balloon ascends vertically till its elevation angles at A and B are $64^\circ 15'$ and $48^\circ 20'$ respectively. Find the height of the balloon.

7 From the top of a cliff 378 feet above the sea the angles of depression of two boats in line with the observer are observed to be $10^\circ 50'$ and $29^\circ 20'$ respectively; find the distance between the boats.

8 A vertical pole 40 feet high casts a shadow 30 feet long; find the angle of elevation of the sun.

Group III 9 Assuming the earth to be spheric, with radius 3956 miles, find the shortest distance between Havana, latitude $23^\circ 9' N.$, longitude $82^\circ 22' W.$, and Gibraltar, latitude $36^\circ 9' N.$, longitude $5^\circ 21' W.$

Or

A ship is sailing westward on a great circle which passes through New York and Paris; find its latitude when it crosses the meridian 30° west. [New York is $40^\circ 43' N.$, $74^\circ W.$; Paris is $48^\circ 50' N.$, $2^\circ 20' E.$]

10 Given in a spheric triangle $A=150^\circ$, $B=131^\circ$, $C=115^\circ$; find a .

11 Given in a spheric triangle $a=101^\circ$, $b=49^\circ$, $c=60^\circ$; find C .

12 Find the area of a spheric triangle whose angles are $A=80^\circ$, $B=110^\circ$, $C=130^\circ$; radius of the sphere 6 inches.