Examination Department

139TH EXAMINATION

PLANE TRIGONOMETRY

August 1896 — Three hours, only

100 *credits, necessary to pass,* 75

Answer 10 *questions but* **no more.** *If more than* 10 *questions are answered only the first* 10 *of these answers will be considered. Division of groups is not allowed. A, B and C represent the angles of a triangle, a, b and c the opposite sides and S the area. In a right triangle C represents the right angle and c the hypotenuse. Each complete answer will receive* 10 *credits.*

1 Define *cotangent, angle of elevation, horizontal angle, negative augle, angle of second quadrant.*

2 *a* Express in terms of functions of positive angles less than 45°, sin 120°, cos 215°, tan 129° 10′, sec (−78°), ctn (−333°).

b Express tan A, sec A, cos A, cosec A, ctn A in terms of sin A.

3 Find numeric values of six functions of 30° using an equilateral triangle and bisecting one of its angles.

4 Construct right triangles from the following data: (*a*) $a=2$, $\tan A=\frac{4}{3}$; (*b*) $b=4$, $\cos B=\frac{2}{5}$.

5 Prove by the use of a right triangle (*a*) $\sin^2 A+\cos^2 A=1$; (*b*) $1+\tan^2 A=\sec^2 A$; (*c*) $\tan A=\frac{\sin A}{\cos A}$; (*d*) $\operatorname{ctn} A=\frac{\cos A}{\sin A}$; (*e*) $1+\operatorname{ctn}^2 A=\operatorname{cosec}^2 A$.

6 *Derive* value of cos $(x+y)$ in terms of functions of x and y.

7 Solve $\cos^2 x-\sin^2 x=\sin x$ for sin x, and state the corresponding value of x when it is an angle in the first quadrant.

8 Prove $\tan 50°+\operatorname{ctn} 50°=2 \sec 10°$.

9 In a right triangle $a=15$ inches and $\sin A=.2$; find sin B, tan A, b, c, S.

10 Prove that in any oblique triangle the sides are proportional to the sines of the opposite angles.

11 State formula and give outline of work necessary to solve an oblique triangle having given two sides and the angle opposite one of them.

12–13 An observer standing on an eminence *whose hight* above a certain level plain *is known*, sights two objects on that plain. What angles must be measured and what formulas used to determine the distance between those objects?

14–15 Construct figure and explain fully (giving formulas) how you, being on one side of an impassable stream, could find the distance between two trees on the opposite side.