ADVANCED ALGEBRA

Monday, June 12, 1911—9.15 a. m. to 12.15 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 algebra. The minimum time requirement is five recitations a week in algebra for two school years.

Answer eight questions. No credit will be allowed unless all operations (except mental ones) necessary to find results are given; simply indicating the operations is not sufficient.

1 Find the number of inscribed triangles that can be formed by joining 15 points on the circumference of a circle.

2 Derive the formula for finding P permutations of n things taken r at a time.

3 Find the roots of $4x^2 + 8x + 5 = 0$ and represent them graphically.

4 Prove that the interchange of any two adjacent columns of a determinant changes the sign of the determinant.

5 Solve by determinants $\begin{cases} x + 2y + 3z = 13 \\ 2x + y + z = 7 \\ 3x + 4y + 3z = 21 \end{cases}$

6 Show that the equation $x^3 + px + q = 0$ has but one real root if p and q are positive, and that such real root is negative.

7 In the equation $x^3 - 3x - 4 = 0$, find by Horner's method, to *two* decimal places, the root lying between 2 and 3.

8 Construct from $x = -2$ to $x = +3$ the graph of the equation $x^3 - 2x^2 - 2x + 3 = y$ and from this graph locate the roots of the equation.

9 The roots of the equation $4x^3 - 12x^2 + 11x - 3 = 0$ are in arithmetical progression; find these roots.

10 Transform the equation $5x^3 - 6x^2 - 3x + 8 = 0$ into an equation with integral coefficients, the coefficient of the highest power being unity. How are the roots of the transformed equation related to those of the given equation?