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 (1) elementary algebra, (2) intermediate algebra, (3) advanced algebra.
The minimum time requirement is five recitations a week in algebra for two school years.

Answer eight questions. Credit will not be granted unless all operations (except mental ones) necessary to find results are given; simply indicating the operations is not sufficient. Each answer should be reduced to its simplest form.

1. For what values of $k$ does the equation $(x + k)x - (k - 3) = 0$ have its roots equal? Give a value of $k$ that makes both roots rational.

2. Determine $k$ and $m$ so that the equation
   \[ x^2 + 2kx + 3mx - k + 2m + 7 = 0 \]
   shall have both roots equal to zero.

3. What is the value of $x^3 + 3x^2 - 7x + 10$ when $x = 1 - i$?
   \[ i = \sqrt{-1} \]

4. In the system of equations
   \[
   \begin{align*}
   2x + 3y + z + 3 &= 0 \\
   2x - 3y + 3z &= 2 \\
   -x + 2y + 5z &= 5
   \end{align*}
   \]
   find the value of $z$ by the use of determinants.

5. a. In how many ways can 7 boys stand in line, only 2 being willing to stand at the extremities of the line?
   b. Of 8 books of the same size, a shelf will hold 5; how many different arrangements may be made on the shelf?

6. a. Prove that if all of the elements of a row of a determinant are zero, the value of the determinant is zero. [43]
   b. Solve $x(x + 1)(x + 2)(x + 3) = 24$ [8]

7. a. What information regarding the roots of the equation
   \[ x^6 - 4x^4 + 2x + 1 = 0 \]
   is obtainable by the application of Descartes' rule?
   b. From a sketch of the graph of the equation
   \[ f(x) = x^6 - 4x^4 + 2x + 1 = y \]
   estimate the values of the real roots of $f(x) = 0$.

8. It is desired to double the capacity of a tank $3 \times 4 \times 5$ feet by making equal elongations of its dimensions; find the elongation of each dimension.

9. Prove that if a rational integral equation with real coefficients has the complex number $c + id$ for a root, it must also have the number $c - id$ for a root.

10. Compute by Horner's method, to two decimal places, one root of the equation $x^4 + 2x^2 - 2x - 4 = 0$