The University of the State of New York

229TH HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Monday, June 18, 1923—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 (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. Each answer should be reduced to its simplest form.

In the examination in advanced algebra the use of the slide rule will be allowed for checking, provided all computations with tables are shown on the answer paper.

1 If one root of $x^4 - 2x^3 + x^2 + 6x + 14 = 0$ is $2 + \sqrt{-3}$, find the other roots. [12½]

2 Expand by the binomial theorem and simplify, expressing the result with positive exponents and rational denominators:

$$\left(\sqrt{2a} + \frac{1}{2\sqrt[3]{-2a}}\right)^4 \qquad [12\tfrac{1}{2}]$$

3 *a* Prove that if a set of numbers are in geometric progression their logarithms are in arithmetic progression. [6]

b By the use of a formula determine the number of terms that must be taken in the series 2, 5, 8, 11 . . . so that the sum shall be 345. [6½]

4 *a* Plot the graph of $y = 3x^3 - 16x^2 + 15x + 18$ from $x = -1$ to $x = +4$ [7½]

b From the graph determine the roots of

$$3x^3 - 16x^2 + 15x + 18 = 0 \qquad [2]$$

c From the graph determine approximately the roots of

$$3x^3 - 16x^2 + 15x = -8 \qquad [2]$$

d From the graph determine the nature of the roots of

$$3x^3 - 16x^2 + 15x = -30 \qquad [1]$$

5 Solve for x and y and group your answers:

6 *a* Obtain all the information possible concerning the roots of the following equation by the use of Descartes' rules and by inspection of the constant term:

$$x^3 - 3x + 2 = 0 \qquad [6\tfrac{1}{2}]$$

b For what values of k will the roots of

$$x^2 + kx + (k - 3) = 0 \text{ be equal?} \qquad [6]$$

7 *a* How many arrangements of the letters of the word *logarithm* can be made, if all the letters are used at a time and if each arrangement begins with a vowel and ends with a consonant? [6]

b How many arrangements, each consisting of three consonants and two vowels, can be formed from the same word? [6½]

8 The formula for the amount (A) of P dollars at 6% interest for n years, compounded quarterly, is $A = P(1.015)^{4n}$. Find the length of time it will take \$524 to amount to \$1146, if the rate of interest is 6% and if the interest is compounded quarterly. [12½]

9 By the use of Horner's method find to the *nearest tenth* the positive root of $x^3 - x^2 + x - 10 = 0$ [12½]

10 Two towns, A and B, are 60 miles apart. An automobile starts from A and proceeds to B at the rate of 20 miles an hour. A second automobile starts from A 20 minutes after the first and goes the first half of the distance at a certain rate and the second half of the distance at a rate 10 miles per hour faster, arriving at B 10 minutes ahead of the first automobile. Find the original rate of the second automobile. [9, 3½]

11 Solve graphically the following set of equations:

$$x^2 + 4y^2 = 100$$
$$y = x^2 - 2x - 3 \qquad [12\tfrac{1}{2}]$$