The University of the State of New York

236TH HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Thursday, June 17, 1926 — 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 One root of the equation $4x^4 - 16x^3 + 17x^2 + 12x - 15 = 0$ is $2 - \sqrt{-1}$; find the other roots. [12½]

2 Given $x = -\frac{1}{2} + \frac{\sqrt{-3}}{2}$ and $y = -\frac{1}{2} - \frac{\sqrt{-3}}{2}$

a Show that $x^2 = y$ and $y^2 = x$; also find x^3. [9]

b Find $x - y$ graphically. [3½]

3 Find to the *nearest hundredth* the positive root of

$$x^3 + 2x^2 + x - 7 = 0 \quad [12\frac{1}{2}]$$

4 *a* By the use of logarithms find the sum of the progression 1, 1.06, $(1.06)^2$, . . . to 10 terms. [6]

b In a potato race 20 potatoes and a basket are placed in a straight line, the potatoes being 2 yards apart and the basket being at one end of the line and 8 yards from the nearest potato. How far must a boy run to bring all the potatoes to the basket, if he starts at the basket and takes one potato at a time? [6½]

5 A student in college received scholarship aid amounting to $460. In recognition of this, 25 years after he graduated he presented his college with $1200. If interest is regarded as beginning on the date of graduation and as compounded annually, what rate of interest did he pay? [12½]

6 *a* How many different integers consisting of *five* digits each can be formed by using only the digits 1, 3, 4, 5, 7, if no digit is repeated in any integer? [6½]

b A class consists of 20 boys and 15 girls; in how many ways can a committee of 3 boys and 2 girls be formed? [6]

7 *a* Find the arithmetic mean between the roots of the equation $19x^2 - 380x + 137 = 0$ [3]

b **Expand** $(a + b)^{-3}$ to *four* terms by the binomial formula. [6½]

c Show that the equation $x^5 + 2x^4 - 3x^3 + x^2 - x + 7 = 0$ has one and only one negative root. [3]

8 The third term of a decreasing geometric progression is 1 and the sum to infinity is 8; find the rational value of the ratio r and of the first term a. [12½]

9 *a* Find the values of k that will make the values of x equal in the solution of the following simultaneous equations:

$$(x - k)^2 + (y - 3)^2 = 5$$
$$2x - y + 3 = 0 \quad [6]$$

b Transform $6x^3 + x^2 - 4x + 1 = 0$ into an equation that can not have a rational fractional root. [No solution required for either equation.] [6½]

10 In the equation $x^3 + 2x^2 - 20x + k = 0$, find k if two of the roots of the equation are equal. [12½]

11 One man, A, sets out to walk to a town 7 miles off and 20 minutes later another man, B, starts from the same place as A to follow him. When B has overtaken A, he immediately turns back and reaches the place from which he started at the same instant that A reaches his destination. If B walked at the rate of 4 miles an hour, find A's rate of walking. [12½]

12 Plot (*a*) the curve represented by the equation $y = 2x^3 - 7x^2 - 2x + 12$ from $x = -2$ to $x = +4$ inclusive, (*b*) the straight line represented by the equation $y = 4x + 2$. From the graph estimate to the *nearest tenth* the values of x and y corresponding to the points of intersection. [7, 2½, 3]