*The University of the State of New York*

EXAMINATION FOR QUALIFYING CERTIFICATES

# ADVANCED ALGEBRA

**Monday, September 17, 1923—1.15 to 4.15 p. m., only**

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*Answer eight questions. Each answer should be reduced to its simplest form. Papers entitled to less than 75 credits will not be accepted.*

1 *a* Find the value of the expression $x^3 - 2x + 5$ when $x = 2 + \sqrt{-3}$ [8½]

*b* Add graphically $4 + 2\sqrt{-1}$ and $-5 - \sqrt{-9}$ [4]

2 Solve the following equation and check *one* result:

$3x^2 = 9^{x+4}$ [12½]

3 *a* Transform the equation

$x^3 - 6x^2 + 12x + 19 = 0$

into an equation lacking the second term. [6½]

*b* Solve the resulting equation in *a* and from these results write the roots of the original equation. [6]

4 Extract the square root of

$x^3 + 4x^{\frac{3}{2}}y^{\frac{1}{2}} + 12y^3 + 6x^{\frac{1}{2}}y^{\frac{5}{2}} + 4xy + 9x^{-1}y^3$ [12½]

5 Two autos start together at the same place; one travels north at an average rate of 25 miles an hour and the other travels east at 28 miles an hour until they are 85 miles apart in a straight line. How long has each been traveling? [Find the result to the *nearest* tenth of an hour.] [12½]

6 Solve the following equation and check the result:

$$3\sqrt{2x+1} - 3\sqrt{2x-3} = \frac{4}{\sqrt{2x-3}}$$ [8½, 4]

7 *a* Five persons enter a seven passenger car for a ride; in how many ways can they be seated? [6½]

*b* In how many ways can a committee of 3 be selected from 11 persons so that a particular person *A* shall always be included? [6]

8 Find by Horner's method the positive root of the following equation correct to *two* decimal places:

$x^4 - 2x^3 + 4x^2 + 6x - 21 = 0$ [12½]



9 The sum of 10 numbers in an arithmetic progression is 190; the sum of the 4th and 8th terms exceeds the fifth term by 25. Find the first *four* terms of the progression. [12½]

10 A grocer wishes to mix 15 pounds of coffee costing 28 cents a pound with another grade of coffee costing 35 cents a pound in order to have a mixture that he can sell for 40 cents a pound. How many pounds of the better grade coffee must be used if the grocer is to make a profit of 25% on the cost? [12½]

11 *a* Plot the graph of the equation

$x^3 - 3x + 7 = y$ from $x = -3$ to $x = 2$ [8½]

*b* From the graph determine the nature of the roots of the equation $x^3 - 3x + 7 = 0$ and estimate *one* of them correct to the *nearest* tenth. [4]