

The University of the State of New York

250TH HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Thursday, January 22, 1931 — 9.15 a. m. to 12.15 p. m., only

Instructions

Do not open this sheet until the signal is given.

Answer all questions in part I and five questions from part II.

Part I is to be done first and the maximum time to be allowed for this part is one and one half hours. Merely place the answer to each question in the space provided; no work need be shown.

If you finish part I before the signal to stop is given you may begin part II. However, it is advisable to look your work over carefully before proceeding to part II, since *no credit will be given any answer in part I which is not correct and reduced to its simplest form.*

When the signal to stop is given at the close of the one and one half hour period, work on part I must cease and this sheet of the question paper must be detached. The sheets will then be collected and you should continue with the remainder of the examination.

ADVANCED ALGEBRA

Thursday, January 22, 1931

Fill in the following lines:

Name of school.....Name of pupil.....

Detach this sheet and hand it in at the close of the one and one half hour period.

Part I

Answer all questions in this part. Each question has 2½ credits assigned to it; no partial credit should be allowed. Each answer must be reduced to its simplest form.

1 Give a positive value of k such that the graph of $y = 4x^2 + kx + 1$ will be tangent to the x -axis. Ans.....

2-3 Are the roots of the equation $2x^2 - 6x + 5 = 0$ Ans. a.....

(a) rational, (b) real? [Answer yes or no.] b.....

4 Divide $\sqrt{-7} - 3$ by $-\sqrt{-1}$ and express the result in the form $a + bi$ Ans.....

5 The two complex numbers $3 - \sqrt{-1}$ and $3\sqrt{-1}$ are represented graphically by the points A and B respectively; which of these points is at the greater distance from the origin? Ans.....

6 Write the first three terms of the expansion $(2x - \frac{1}{2})^5$ Ans.....

7 A sum of x dollars is placed at 4% interest, compounded semi-annually. Write the formula for the total amount (y) accumulated in n years. Ans.....

8 How many numbers of three digits each can be written with the digits 1 to 9 inclusive, no digit being repeated in any number? Ans.....

9 In how many different ways can a committee of 2 boys and 1 girl be selected from a class of 5 boys and 3 girls? Ans.....

10 By means of logarithms find the fifth root of 46 correct to the nearest tenth. Ans.....

11 If $100^x = 20$, what is the value of x ? Ans.....
 $[\log_{10} 2 = .3010]$

12 Find the three roots of the following equation, knowing that their sum is 2:
 $x^3 - kx^2 + (k - 2)x + (k^2 - 4) = 0$ Ans.....

13 Transform the equation $3x^2 + 6x + 7 = 0$ into an equation whose first-degree term is lacking. Ans.....

14 Write the equation whose roots are twice the roots of
 $x^2 - 7x + 6 = 0$ Ans.....

15 Form an equation of the third degree with rational coefficients, two of whose roots are $\sqrt{7}$ and -2 . Ans.....

179

ADVANCED ALGEBRA

Thursday, January 22, 1931

Write at top of first page of answer paper (a) names of schools 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.

Part II

Answer five questions from this part. Full 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.

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.

21 In a set of four numbers, the first three are in geometric progression, the last three are in arithmetic progression with a common difference of 6, and the first number is the same as the fourth. Find the four numbers. [10]

22 The only real root of the equation $x^3 - 73x^2 = 30,000,000$ lies between 300 and 400; find this root to the nearest integer. [10]

[Suggestion: Begin either by dividing the roots by 100 or by diminishing the roots by 300.]

23 A can do a piece of work in 3 days less time than B and in 9 days less time than C; the three of them working together can do it in 4 days. How long will it take each of them working alone? [5, 5]

24 In the equation $x^3 - x^2 - 3x + k = 0$, k is a real number and the sum of two roots is $\frac{7 + i\sqrt{3}}{4}$; find all the roots and the value of k . [8, 2]

25 Prove that if $a + bi$ is a root of a polynomial equation with real coefficients, then $a - bi$ must be a root also. [10]

26 A man made an automobile trip of 336 miles, using 24 gallons of a certain grade of gasoline. If he had paid 2 cents more a gallon for a higher grade of gasoline, he would have gone 2 miles farther on each gallon and would have saved 18 cents on the total cost. What did he pay a gallon for the grade of gasoline he used? [7, 3]

27 By graphic methods find the real solutions of the following set of equations, approximating them to the nearest tenth:

$$x^2 - y = 4$$

$$y^2 - x = 1 \quad [4, 4, 2]$$

16-17 Does the graph of $y = 3x^2 + 5x - 7$ cut the x -axis (a) at any point to the right of the origin, (b) at any point to the left of the origin?

Ans. a.

b.

18 Given $x = \frac{2y}{y^2 - 1}$; express y as a function of x .

Ans.

19 If 100 terms of the geometric progression $1 + \frac{7}{8} + \frac{49}{64} + \frac{343}{512} \dots$ are added, will the sum be greater or less than 8?

Ans.

20 A man starts to walk a distance of 40 miles. After walking x hours at the rate of 4 miles an hour, he is picked up by a motorist and finishes the trip at the rate of w miles an hour. Letting y represent the time (in hours) for the whole trip, express y as a function of x .

Ans.