The University of the State of New York

256TH HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Thursday, January 26, 1933 — 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.

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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 Is the number $-\sqrt{5}$ real? [Answer *Yes* or *No.*] *Ans*.....

2 Is the number $-\frac{5}{7}$ irrational? [Answer *Yes* or *No.*] *Ans*.....

3 Find the square of $2 + 2i$ *Ans*.....

4 What is the slope of the line $2x - 3y = 5$? *Ans*.....

5 What is the equation of the line through the point $(-2, 5)$ and parallel to the line $y = 2x + 11$? *Ans*.....

6 Are the roots of the equation $2x^2 - 3x - 4 = 0$ real? [Answer *Yes* or *No.*] *Ans*.....

7 The graph of the equation $y = 2x^2 - 3x - 4$ cuts the x-axis (*a*) once, (*b*) twice or (*c*) not at all. Which is correct, *a*, *b* or *c*? *Ans*.....

8 The graph of the equation $y = 2x^2 - 3x - 4$ cuts the line $y = -6$ (*a*) once, (*b*) twice or (*c*) not at all. Which is correct, *a*, *b* or *c*? *Ans*.....

9 Find the sum of 7 terms of the series $4, -2, 1, \ldots$ *Ans*.....

10 If $f(x) = 2x^3 - x + 11$, what is the value of $f(-1)$? *Ans*.....

11 What is the remainder when $2x^5 - 7$ is divided by $x + 1$? *Ans*.....

12 What is the value of $(81x)^{-x}$ when $x = \frac{1}{3}$? *Ans*.....

13 Does the equation $x^5 - 5x + 3 = 0$ have any rational fractional roots? [Answer *Yes* or *No.*] *Ans*.....

14 Form an equation whose roots are one third those of the equation $2x^4 - 5 = 0$ *Ans*.....

15 Form an equation whose roots are the negative of those of the equation $2x^4 - 5 = 0$ *Ans*.....

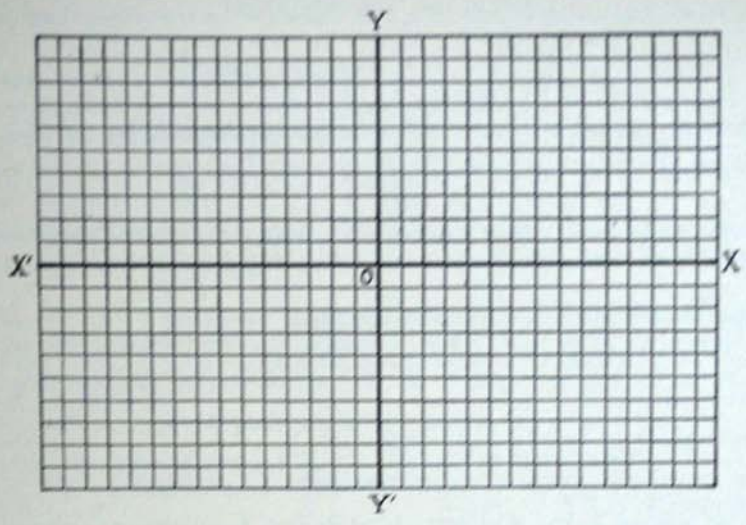
16–18 *a* How many ways are there of choosing a committee of two from a class of 21? *Ans*.....

b How many ways are there of choosing the committee if there are 11 boys and 10 girls in the class, and the committee is to consist of one boy and one girl? *Ans*.....

c If the committee is chosen by lot, what is the probability that the two members of the committee will *not* be of the same sex? *Ans*.....

19 Between what two successive integers does the logarithm of 3587 lie? *Ans*.....

20 On the diagram below find graphically the sum of $-\frac{1}{2} + i$ and $2 + 3i$



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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.

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. Purely arithmetical solutions for problems will not be accepted.

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 The first term of an arithmetic progression is 5 and the sum of the terms is 476. If the common difference is three times the number of terms, what is the number of terms? [10]

22 One root of the equation $x^4 - 6x^3 + 8x^2 + 12x - 20 = 0$ is $3 - i$; find the other roots. [10]

23 Find to the *nearest tenth* the positive root of the equation $x^3 - x^2 = 125$ [10]

24 A sum of $100 is placed at interest at 4%, the interest to be compounded semiannually. In how many years will the sum of money amount to $280? [10]

25 A and B, working together, can do a piece of work in a certain number of days. Working alone, A would take 9 days more, and B 4 days more, than they need when working together. How long would it take each of them working alone to do the piece of work? [8, 2]

26 *Prove* that the number of combinations of n different things taken r at a time is equal to the number of combinations of n different things taken $n - r$ at a time. [10]

27 A man starts at noon from Albany and walks at the rate of 4 miles an hour for two hours when he is picked up by a car going in his direction and rides 30 miles at the rate of 40 miles an hour; he then walks 5 miles back toward Albany at the rate of 4 miles an hour when a car picks him up again and he arrives in Albany at 5 p. m.

a Letting y represent his distance from Albany in miles and x the time in hours past noon, construct a graph covering the data and thus show that y is a function of x for values of x from 0 to 5. [6]

b From the graph made in answer to *a*, determine the man's distance from Albany at 3.30 p. m. [2]

c From the graph made in answer to *a*, determine the times when he passed a milestone on the road 25 miles from Albany. [2]

*28 Express the three roots of the equation $x^3 - 1 = 0$ in the polar form, $\rho(\cos\theta + i\sin\theta)$, giving the value of ρ and θ for each root. [10]

*29 A ball is thrown upward so that its distance x above the ground at the end of t seconds is given by the equation $x = 90t - 16t^2$. At the end of 3 seconds, how far is the ball from the ground? How fast is it moving? Is it moving upward or downward? [6, 2, 2]

*30 For what range of values of x is the function $y = \frac{x}{x^2 + 25}$ an increasing function? [10]

* This question is based on one of the optional topics in the syllabus.