The University of the State of New York

253D HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Thursday, January 28, 1932 — 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 $2\frac{1}{2}$ credits assigned to it; no partial credit should be allowed. Each answer must be reduced to its simplest form.

1–2 *a* What is the value of the fraction $\frac{7-x^2}{x-1}$ when $x = -5$? *Ans. a*.........

b What value of x other than -5 will give the fraction the same value as that found in answer to *a*? *b*........

3 What is the value of $x^{\frac{2}{3}} - 3^x$, if $x = -1$? *Ans*...............

4 If the sum of the roots of the equation $ax^2 + 10x + 8 = 0$ is 5, what is the product of the roots? *Ans*...........

5 Write the *fourth* term of the progression $\frac{4}{3}$, 2, 3, ... *Ans*...........

6 If r, c and A are respectively the radius, circumference and area of a circle, then $c = 2\pi r$ and $A = \pi r^2$. Express A as a function of c. *Ans*...........

7 If $10^{.3010} = 2$, what is the value of $10^{2.3010}$? *Ans*...........

8 If $y = \log_{10}3$, what is the value of 10^{-y}? *Ans*...........

9 Find and simplify the *sixth* term in the expansion of $(4x + \frac{1}{2})^7$ *Ans*...........

10 Solve the equation $9^r = \frac{1}{3}$ *Ans*...........

11 Write an equation with *integral* coefficients whose roots are -3, $\frac{1}{2}$ and 0. *Ans*...........

12 One root of the equation $2x^3 - 3x^2 + 6x - 9 = 0$ is $-\sqrt{-3}$. What are the other two roots? *Ans*...........

13 The graph of the equation $y = x^4 - x^2 - 1$ cuts the x-axis (*a*) once, (*b*) twice, (*c*) four times or (*d*) not at all; which is correct, (*a*), (*b*), (*c*) or (*d*)? *Ans*...........

14 Form an equation whose roots are three times the roots of the equation $x^3 + 5 = 0$ *Ans*...........

15 Form an equation whose roots are greater by 1 than the roots of the equation $x^3 + 5 = 0$ *Ans*...........

16 How many diagonals has a regular polygon of 21 sides? [A diagonal of a polygon is a line joining any two vertices that are not adjacent.] *Ans*...........

17 How many three-digit numbers can be formed from the digits 3, 4, 5, 6, 7, if no digit is repeated in any number? *Ans*...........

18 If x represents the number of minutes past 6 o'clock at any time between 6 o'clock and 6.30, and y represents the number of minute spaces between the hands, express y as a function of x. [Note — The minute hand moves 12 times as fast as the hour hand.] *Ans*...........

[3]

19 Express in the form $a + bi$ the quotient obtained by dividing   *Ans* . . . .
   $-1 + 3i$ by i.

20 On the diagram below plot the points representing the two complex numbers i and $-1 + 3i$, and then construct the point that represents their sum.
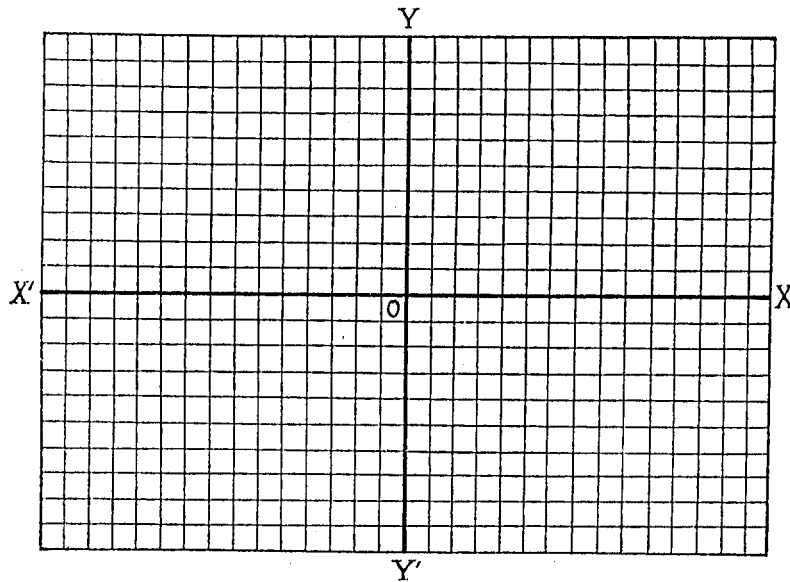
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Write at top of first page of answer paper (*a*) name of school where you have studied, (*b*) number of weeks and recitations a week in (1) elementary algebra, (2) intermediate algebra, (3) advanced algebra. The minimum time requirement is five recitations 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.

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 Solve the following set of equations and group your answers:

$$\frac{2y + 5}{x} = 7$$

$$\frac{x + 1}{x} = 5y - 3x \qquad [10]$$

22 The equation $x^4 - x^3 + 5x^2 + 7x + 24 = 0$ has four complex roots and the sum of three of them is $2 + i\sqrt{2}$; find all the roots. [10]

23 Given the equation $x^3 - 9x^2 + 23x - 15 = 0$; form a new equation whose roots are less by 3 than those of the given equation. Solve this new equation and from its roots find the roots of the given equation. [10]

24 Two sums of money draw interest for 10 years and produce the same amount (principal + interest) at the end of the period. One sum is $100, which draws interest at 4% compounded annually; the other sum draws simple interest at 5%. How large is the second sum of money? [10]

25 The length of a rectangular box is twice its width, and its depth is 1 foot greater than its width. If its volume is 64 cubic feet, find its width to the *nearest tenth of a foot*. [2, 8]

26 A boy says that he has only half dollars and dimes in his pocket, 6 more half dollars than dimes, $4.50 altogether. Investigate the number of each kind of coin and explain the meaning of the results that you obtain. [10]

27 Do the graphs of the following equations intersect; if so, at what points? [Show work necessary in reaching your conclusion.]

$$y = \frac{1}{4(x - 1)}$$

$$4x + y - 5 = 0 \qquad [10]$$