

The University of the State of New York

262D HIGH SCHOOL EXAMINATION

ADVANCED ALGEBRA

Thursday, January 24, 1935 — 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 Transform the equation $x^3 - 2x + 1 = 0$ into an equation whose roots are *twice* the roots of the given equation. Ans.....

2 Transform the equation $y^3 - 6y^2 + 4y - 7 = 0$ into an equation whose roots are *less by 2* than the roots of the given equation. Ans.....

3 Is the statement below true or false?
The equation $x^4 - 3x^2 - 7 = 0$ has two real roots. Ans.....

4 What is the sum of the roots of the equation
 $2x^5 - 4x^4 + 2x^3 - 15 = 0$? Ans.....

5 Find, correct to the *nearest tenth*, the value of $(1.07)^{\dagger}$ Ans.....

6 Given $y = 3x - x^2$; write x as a function of y ; that is, solve for x in terms of y . Ans.....

7 Perform the indicated operation: $\left(\frac{p}{q}\right)^n \times q^{n-1}$ Ans.....

8 In solving the equation $x^4 + 3x^3 + 5x^2 + 12x - 24 = 0$ by "trial," state which of the following numbers should *not* be tried:
(a) -4 , (b) $-\frac{3}{2}$, (c) 6 Ans.....

9 Write in the form $a + bi$ the product of $2 + i$ and $1 - i$ Ans.....

10 Write the first *three* terms of the expansion $\left(x - \frac{1}{x}\right)^4$ Ans.....

11 Write the equation for the following statement: A quantity x varies directly as the square of another quantity y . Ans.....

12 Find the equation of the line passing through the point $(3, 4)$ and parallel to the line whose equation is $2x - y = 7$ Ans.....

13 In how many points does the graph of $x^2 + y^2 = 25$ intersect the graph of $4x^2 + y^2 = 36$? Ans.....

14 How many committees of 3 men each can be formed from a group of 5 men? Ans.....

15 If from a bag containing 3 white balls and 5 black balls a ball is drawn at random, what is the probability that the ball is white? Ans.....

16 A telephone system uses four different letters, P, R, S, T , and the four digits, 3, 5, 7, 8. What is the maximum number of "telephone numbers" that the system can have, if each consists of a letter followed by a four-digit number in which the digits may be repeated? Ans.....

17 If the arithmetic mean between two numbers m and n is equal to their geometric mean, then (a) $m > n$, (b) $m = n$ or (c) $m < n$. Which is true, (a), (b) or (c)? Ans.....

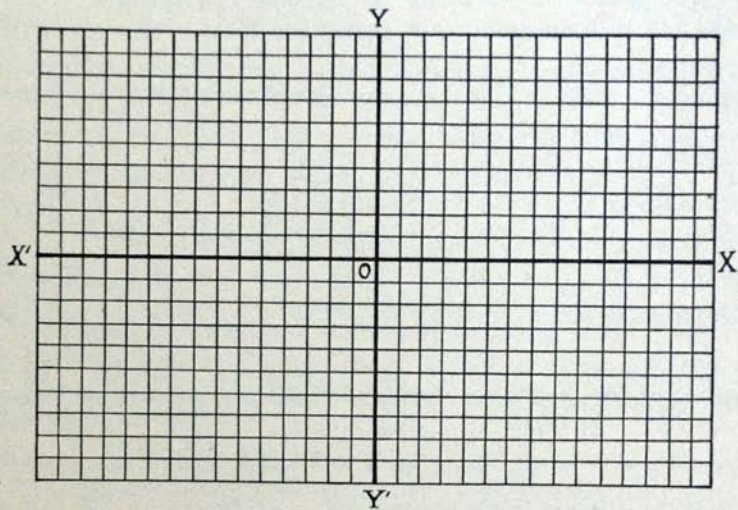
18 Given $f(x) = 0$; we find that $f(2)$ is positive and $f(3)$ is also positive. Is it possible for $f(x) = 0$ to have a real root between $x = 2$ and $x = 3$? [Answer *Yes* or *No*.]

Ans.....

19 If $y = 2^x$ and $x = \log_b y$, find the value of b .

Ans.....

20 On the diagram below draw the graph of the equation $y = (\frac{1}{2})^x$, using values of x from -2 to $+2$ inclusive.



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Write at top of first page of answer paper to part II (a) name of school where you have studied, (b) number of weeks and recitations a week in advanced algebra.
The minimum time requirement is five recitations a week for half a school year after the completion of intermediate algebra.

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 Find, correct to the nearest tenth, the real root of the equation $x^3 + 5x - 9 = 0$ [10]
- 22 In a geometric progression of four terms in which the ratio is positive, the sum of the first two terms is 10 and the sum of the last two terms is $22\frac{1}{2}$; find the progression. [10]
- 23 The equation $x^3 - 3x^2 + k = 0$ has two equal roots; determine the values of k . [10]
- 24 The number (n) of vibrations per second made by a stretched string is given by the formula $n = \frac{1}{2L} \sqrt{\frac{Mg}{m}}$; find n , if $L = 78.50$, $M = 5467$, $g = 980.1$ and $m = .0065$ [10]
- 25 A rectangular piece of tin three fourths as wide as it is long is made into a box by cutting out a 2-inch square from each corner and turning up the sides. Cutting out a 3-inch square from each corner would diminish the volume of the box by 12 cubic inches. What are the dimensions of the piece of tin? [10]
- 26 If m is a root of the equation $x^3 + px^2 + qx + s = 0$ and m, p, q and s are integers, prove that m must be a factor of s . [10]
- 27 a Using the same set of axes, plot
 (1) $xy = 16$ [In particular, locate the points whose abscissas are: $-8, -4, -2, -1, 1, 2, 4, 8$] [6]
 (2) $5x - 3y + 1 = 0$ [2]
 b From the graphs drawn in answer to a, find, correct to the nearest tenth, the values of x and y that satisfy both equations. [2]
- *28 In a recent study of the marks in an examination in eighth-year mathematics, the marks (to the nearest 5%) were distributed as follows:

Marks	45	50	55	60	65	70	75	80	85	90	95	100
Number of pupils	3	3	6	15	19	26	23	20	16	9	8	2

- a What mark represents the mode? [2]
 b Which of the marks, 70, 75 or 100, most nearly represents the median? [2]
 c Find the arithmetic mean. [6]
- *29 A bullet is fired vertically upward with a muzzle velocity of 400 feet per second. If the resistance of the air is neglected, the height of the bullet (s), t seconds after the discharge, is given by the formula $s = 400t - 16t^2$
 a How high will the bullet rise? [6]
 b How long will it be in the air? [2]
 c What will be its velocity when it strikes the ground? [2]

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