The University of the State of New York

280TH HIGH SCHOOL EXAMINATION

# INTERMEDIATE ALGEBRA

Wednesday, January 22, 1941 — 9.15 a. m. to 12.15 p. m., only

## Instructions

*Do not open this sheet until the signal is given.*

### Part I

*This part is to be done first and the maximum time allowed for it is one and one half hours.* Merely write the answer to each question in the space at the right; 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, since *no credit will be given any answer in part I which is not correct and in 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.

### Parts II, III and IV

Write at top of first page of answer paper to parts II, III and IV (*a*) name of school where you have studied, (*b*) number of weeks and recitations a week in intermediate algebra.

The minimum time requirement is five recitations a week for half a school year after the completion of elementary algebra.

The use of the slide rule will be allowed for checking but all computations with tables must be shown on the answer paper.

**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 correct answer will receive 2 credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.**

1 Express $\sqrt{-4}$ in terms of $i$. 1.....

2 If a man can do a piece of work in 12 hours, what fractional part of the work can he do in $x$ hours? 2.....

3 Factor $x^{2a} - 9$ 3.....

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

5 Write the equation which expresses the relation between $x$ and $y$ as indicated in the following table:

| $x$ | 0 | 2 | 4 | 6 |
|---|---|---|---|---|
| $y$ | 4 | 8 | 12 | 16 |

5.....

6 Find the value of $x$ which satisfies the equation $\sqrt{2x - 3} = 2$ 6.....

7 Find the *fifth* term of the series 2, 3, $4\frac{1}{2}$, ... 7.....

8 Write the equation of the straight line whose slope is 3 and whose $y$ intercept is $-1$. 8.....

9 For what positive value of $x$ is the expression $x^2 - 5x - 6$ equal to zero? 9.....

10 Express $\dfrac{\sqrt{3} + 2}{\sqrt{3}}$ as a fraction with a rational denominator. 10.....

11 Simplify: $-\dfrac{1}{1-a} \div \dfrac{a}{a-1}$ 11.....

12 In triangle $ABC$, angle $C = 90°$, angle $A = 42°$, and $AB = 100$ feet; find the length of $AC$ correct to the *nearest foot*. 12.....

13 Write in the form $x^2 + px + q = 0$ the equation whose roots are 2 and $-3$. 13.....

14 If $n$ pencils cost $S$ cents, how many cents would $P$ of these pencils cost? 14.....

Directions (questions 15–22) — Write on the dotted line at the right the expression which, if inserted in the corresponding blank, will make the statement true.

15 The formula for $S$, the sum of an arithmetic series, in terms of the first term $a$, the last term $l$ and the number of terms $n$, is $S =$ .... 15.....

16 The formula for $S$, the sum of a geometric series, in terms of the first term $a$, the ratio $r$ and the number of terms $n$, is $S =$ .... 16.....

17 The logarithm of 13.43 is .... 17.....

18 The number, correct to *four figures*, whose logarithm is 9.5979–10, is .... 18.....



[OVER]

19 The value of $2^{-4}$ is .... 19.....

20 The first *three* terms in the expansion of $(a - b)^7$ are .... 20.....

21 The formula $V = \frac{\pi r^2 h}{3}$ when solved for $h$ is $h =$ .... 21.....

22 The *two* arithmetic means between 4 and $-2$ are .... 22.....

Directions (questions 23–25) — Indicate the correct answer to each question by writing on the dotted line at the right the letter $(a)$, $(b)$ or $(c)$.

23 Which of the following numbers can be the discriminant of a quadratic equation whose roots are real, unequal and irrational: $(a)$ 1, $(b)$ $-3$, $(c)$ 5? 23.....

24 Which of the following is the equation of a parabola: $(a)$ $xy = 4$, $(b)$ $y = x^2 + 4$, $(c)$ $x^2 = 4 - 2y^2$? 24.....

25 Which of the points whose coordinates are given below, does *not* lie on the graph of the equation $y = x^2 - 4x$?

$(a)$ $x = 0$, $y = 0$
$(b)$ $x = 1$, $y = -3$
$(c)$ $x = -1$, $y = -3$ 25.....



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See instructions for parts II, III and IV on page 1.

## Part II

**Answer three questions from this part.**

26 Find, correct to the *nearest tenth*, the roots of the equation $2x^2 - 10x = 9$ [10]

27 Solve the following pair of equations, group your answers, and check *one* set:

$$x^2 + y^2 = 25$$
$$y = 2x + 5$$ [7, 1, 2]

28 Using logarithms, find, correct to the *nearest hundredth*, the value of $\frac{.849 \times 21.5}{\sqrt[3]{.0187}}$ [10]

29 *a* Using the same set of axes, draw the graphs of the equations $xy = 12$ and $x - y = 1$ [6, 2]

*b* From the graphs made in answer to *a*, determine the values of $x$ and $y$ common to the two equations. [2]

30 A man desiring to pay a debt of $340 finds that he can pay $25 the first month and thereafter increase each monthly payment $2 over that of the previous month. How long will it take him to pay the debt if the interest is not included? [10]

*31 The height of a rectangular bin is 1 foot more than the width and the length is 2 feet more than the width. If the capacity of the bin is 210 cubic feet, find the dimensions of the bin. [10]

## Part III

**Answer one question from this part.**

32 A and B start from the same point and travel along roads that are at right angles to each other. A travels 3 miles an hour faster than B. At the end of 2 hours they are 30 miles apart. Find their rates. [10]

33 Write the equations that would be used in solving the following problems. In each case state what the unknown letter or letters represent. [Solution of the equations is not required.]

*a* The numerator and denominator of a fraction are in the ratio 5:4. If 5 is added to the numerator and 12 is subtracted from the denominator, the value of the resulting fraction is $\frac{5}{2}$. Find the original fraction. [5]

*b* A dealer bought a number of sheep for $440. After 5 had died, he sold the rest of the sheep at a profit of $2 each, thereby making $60 on the whole transaction. How many sheep did he buy? [5]

## Part IV

**Answer one question from this part.**

34 Each of the following statements is sometimes true and sometimes false. In *each* case give *one* illustration in which it is true and *one* illustration in which it is false.

*a* The square of a number is greater than the number. [2]

*b* A root of a negative number is a real number. [2]

*c* The product of two binomials is a trinomial. [2]

*d* The graphs of two quadratic equations of the form $ax^2 + by^2 = c$ and $dx^2 + ey^2 = f$ intersect in four points. [2]

*e* The graph of an equation of the form $ax^2 + by^2 = c$ is an ellipse. [2]

35 Given the equation $x^2 + 2x + k = 0$

*a* Express the discriminant $d$ of this equation in terms of $k$. [3]

*b* Using the vertical axis to represent $d$, draw the graph of the equation obtained in answer to *a*. [3]

*c* Explain how the graph can be used to determine that *each* of the following statements is true:

(1) All values of $k$ which are less than 1 will make the roots of the equation $x^2 + 2x + k = 0$ real and unequal. [2]

(2) All values of $k$ which are greater than 1 will make the roots of the equation $x^2 + 2x + k = 0$ imaginary. [2]

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