The University of the State of New York

271st High School Examination

MATHEMATICS — Third Year

Wednesday, January 26, 1938 — 9.15 a. m. to 12.15 p. m., only

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Instructions

Do not open this sheet until the signal is given.

Group I

This group 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 group I before the signal to stop is given you may begin group II. However, it is advisable to look your work over carefully before proceeding, since *no credit will be given any answer in group 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 group 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.

Groups II and III

Write at top of first page of answer paper to groups II and III (*a*) name of school where you have studied, (*b*) number of weeks and recitations a week in mathematics third year.

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

In this examination the customary lettering is used. A, B and C represent the angles of a triangle ABC; a, b and c represent the respective opposite sides. In a right triangle, C represents the right angle.

Give special attention to neatness and arrangement of work.

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

Answer *five* questions from these two groups, including at least *two* questions from each group.

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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.

Group I

Answer all questions in this group. Each correct answer will receive 2½ credits. No partial credit will be allowed. Each answer must be reduced to its simplest form.

1 Find, correct to *two decimal places*, the number whose logarithm is 1.6057 1.....

2 Find log cos 42° 38′ 2.....

3 Factor $5x^2 - 7x - 6$ 3.....

4 The roots of the equation $6x^2 - 3x - 2 = 0$ are (*a*) real and equal, (*b*) real, unequal and rational or (*c*) real, unequal and irrational. Which is correct, (*a*), (*b*) or (*c*)? 4.....

5 Write the positive value of $\cos\left(\sin^{-1}\frac{\sqrt{2}}{2}\right)$ 5.....

6 Express 7×10^{-3} as a decimal. 6.....

7 Find the positive value of x that satisfies the equation $\sqrt{10x^2 - 9} - x = 0$ 7.....

8 Given the formula $A = P + Prt$; express P as a function of A, r and t. 8.....

9 What is the slope of the line whose equation is $x - 4y = 20$? 9.....

10 Write the equation of the straight line passing through the points whose coordinates are given in the following table:

x	−2	1	3	4	5
y	−6	0	4	6	8

10.....

11 Express tan 285° as a function of a positive angle less than 45°. 11.....

12 What is the sum of the roots of the equation $2x^2 - 3x + k = 0$? 12.....

13 In triangle ABC, $a = 6$, $b = 4$, $\cos C = \frac{9}{16}$; find c. 13.....

14 Find the common difference in the arithmetic progression in which the sum is 637, the first term is 7 and the number of terms is 13. 14.....

15 The first term of a geometric progression is 4 and the sixth term is 128; find the common ratio. 15.....

16 Write the first *two* terms of the expansion $(2a + \frac{1}{2})^6$ 16.....

17 In triangle ABC, $a = 3\sqrt{2}$, $b = 2\sqrt{3}$, $A = 60°$; find B. 17.....

18 Find the value of x between 90° and 180° that satisfies the equation $4\sin^2 x - 3 = 0$ 18.....

19 In a circle whose radius is 20 a chord has an arc of 78°. Find, correct to the *nearest integer*, the distance of the chord from the center of the circle. 19.....

20 What function other than the sine and cotangent decreases as the angle increases from 90° to 180°? 20.....

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See instructions for groups II and III on page 1.

Answer five questions from groups II and III, including at least two questions from each group.

Group II

Answer at least two questions from this group.

21 Find, correct to the *nearest tenth*, the numerical values of tan x in the equation
$\sec^2 x - 4 \tan x - 7 = 0$ [10]

22 Solve the following pair of simultaneous equations, group your answers and check *one* set:
$$x^2 - 3xy + y^2 = -11$$
$$y - x = -1 \quad [7, 1, 2]$$

23 A certain alloy of copper and tin, weighing 24 pounds, is 35% copper. How many pounds of copper must be added so that the new alloy shall be 40% copper? [7, 3]

24 A farmer bought six cows and seven sheep for $880. Later he sold them, making a profit of 25% on the cows but losing $5 per head on the sheep. He made a profit of $115 on the entire transaction. What was the price paid for each cow and each sheep? [7, 3]

25 *a* Draw the graph of the equation $y = x^2 + 3x + 6$, from $x = -4$ to $x = +1$ inclusive. [6]

b How do you determine from the graph whether the roots of the equation $x^2 + 3x + 6 = 0$ are real or imaginary? [1]

c What is the abscissa of the minimum point? [1]

d On the graph made in answer to *a*, draw the straight line that will enable you to solve graphically the equation $x^2 + 3x + 6 = 8$ [2]

Group III

Answer at least two questions from this group.

26 The base of a triangle is 425 feet and the base angles are 73° 15′ and 65° 20′. Find, correct to the *nearest foot*, the length of the altitude upon the base. [5, 5]

27 A ship sails southeast from a certain harbor a distance of 210 miles. It then changes its course to due east and travels a distance of 315 miles. Find, correct to the *nearest mile*, the distance of the ship from the harbor. [5, 5]

28 *a* Prove the identity: $\tan 2x = \dfrac{2 \sin x}{\cos x - \sin x \tan x}$ [6]

b Derive the law of sines for the acute triangle. [4]

29 Starting with the law of sines, derive the law of tangents. [10]

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