The University of the State of New York

265TH HIGH SCHOOL EXAMINATION

MATHEMATICS — Third Year

Wednesday, January 22, 1936 — 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.

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.

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 In a circle whose radius is 10 inches, find the length in inches of the arc of a central angle of two radians. *Ans*.....

2 Write the equation of the straight line whose slope is — 1 and which passes through the origin. *Ans*.....

3 Find the sum of the roots of the quadratic equation $3x^2 + 7x + c = 0$ *Ans*.....

4 Express tan $(A + B)$ in terms of tan A and tan B. *Ans*.....

5 Find the number whose logarithm is 8.3253 — 10 *Ans*.....

6 Find log cos 49° 39′ *Ans*.....

7 Find, correct to the *nearest minute*, the angle in the third quadrant whose tangent is 0.7641 *Ans*.....

8 Find the value of $(10)^2 \times (10)^0 \times (10)^{-2}$ *Ans*.....

9 Find the value of $\log 10a - \log a$ *Ans*.....

10 Given $3^y = 9^x$; express y as a function of x. *Ans*.....

11 If x is an angle in the first quadrant and $x = \sin^{-1} \frac{\sqrt{2}}{2}$, find cos x. *Ans*.....

12 Find the discriminant of the equation $x^2 - 3x + 5 = 0$ *Ans*.....

13 Find the area of triangle ABC, if $a = 4$, $b = 7$ and $C = 30°$ *Ans*.....

14 Tan 210° is (a) equal to, (b) greater than or (c) less than sin 135°; which is correct, (a), (b) or (c)? *Ans*.....

15 Write the middle term of the expansion $(x + \frac{1}{x})^6$ *Ans*.....

16 What is the smallest positive value of x that satisfies the equation $2\cos^2 x + \cos x = 0$? *Ans*.....

17 Insert *three* arithmetic means between 1 and — 1. *Ans*.....

18 Write the numerical value of the tangent of an angle whose terminal side passes through the point whose abscissa is — 12 and whose ordinate is — 5. *Ans*.....

19 The cost of sending a telegram is 44 cents for the first 10 words or less and 3 cents for each additional word. Write the formula expressing c (the cost in cents) in terms of w (the number of words), where w is greater than 10. *Ans*.....

20 In the equation $y^2 = (x - 1)(x - 2)$, y is real when x is between (a) 0 and 1 or (b) 1 and 2. Which is correct, (a) or (b)? *Ans*.....

See instructions for groups II and III on page 1.

Group II

Answer three questions from this group.

21 Solve the following pair of simultaneous equations for x and y and correctly group your answers:

$$x^2 + y^2 = 29$$
$$xy = 10 \qquad [8, 2]$$

22 Two numbers are made up of the same two digits but in reverse order. The sum of the two numbers exceeds the sum of the two digits by 70; the difference between the two digits is 5. Find the two numbers. [7, 3]

23 In 1933, a farmer sold 60 hogs and 1000 chickens for \$1050. In 1934, he sold $\frac{3}{4}$ as many hogs and $\frac{4}{5}$ as many chickens as in 1933. However, by raising the price of hogs \$4 each and the price of chickens 21¢ each, he realized \$1080. At what price did he sell his hogs and chickens in 1933? [7, 3]

24 A cylindric vessel is partly filled with liquid of density d. If R is the radius of the base of the vessel and h is the depth of the liquid, then the weight W of the liquid is given by the formula $W = \pi R^2 hd$

Using logarithms, compute d to the *nearest tenth*, when $W = 122.4$, $R = 0.5$, $h = 2.7$ and $\pi = 3.14$ [10]

25 *a* Draw the graph of $y = x^2 + x - 4$ from $x = -4$ to $x = +3$ inclusive. [7]

b From the graph made in answer to *a* determine, correct to the *nearest tenth*, the roots of $x^2 + x - 4 = 0$ [3]

*26 *a* State the Factor Theorem. [3]

b Factor $x^3 - 2x^2 - x - 6$ [7]

Group III

Answer two questions from this group.

27 *a* Solve for all positive values of x between $0°$ and $360°$ that satisfy the equation $4 \cos^2 x + 8 \sin x - 7 = 0$ [6]

b Show that $\dfrac{2 \tan x}{\sec^2 x} = \sin 2x$ [4]

28 A, B and C are three marking buoys for a yacht race. AC is 19.4 miles long, $\angle BAC = 63° 20'$, $\angle ACB = 49° 10'$. Find the length of the course. [10]

29 Derive the law of cosines for the case in which the triangle is acute. [10]

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