The University of the State of New York

259TH HIGH SCHOOL EXAMINATION

MATHEMATICS — Third Year

Thursday, January 25, 1934 — 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 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 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.

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.

In both parts of this examination the use of the slide rule will be allowed for checking; in part II all computations with tables must be shown on the answer paper.

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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 2½ credits assigned to it; no partial credit should be allowed. Each answer must be reduced to its simplest form.

1 In which quadrant is the angle $\frac{7\pi}{5}$ radians? *Ans*.....

2 As an angle increases from 0° to 90°, which *three* of its six trigonometric functions increase? *Ans*.....

3 Find the arithmetic mean between 3 cos x and — cos x. *Ans*.....

4 Find the logarithm of 14.87 *Ans*.....

5 Express cos 335° as a function of a positive angle less than 90°. *Ans*.....

6 Write the quadratic equation with integral coefficients whose roots are $\frac{3}{2}$ and — 1. *Ans*.....

7 Find the tangent of the angle which the graph of $y = 3x - 7$ forms with the x-axis. *Ans*.....

8 Solve the equation $x^2 - 2x + 2 = 0$ and write the answers in terms of i. *Ans*.....

9 Solve the equation $\frac{3}{\sqrt{\tan x + 4}} = \sqrt{\tan x + 4}$ for the value of x in the second quadrant. *Ans*.....

10 In the triangle ABC, if $a = 7$, $b = 5$, $c = 6$, find the value of cos A. *Ans*.....

11 Find the value of $27^{-\frac{2}{3}} + 64^0$ *Ans*.....

12 For what values of angle A between 0° and 360° does the graph of cos A cross the x-axis? *Ans*.....

13 If tan $A = a$ and tan $B = -\frac{1}{a}$, find the value of tan $(A + B)$. *Ans*.....

14 If x varies as y^2, and $x = 4$ when $y = 8$, find x when $y = 2$ *Ans*.....

15 Write the first *three* terms of the expansion $(c - d)^5$ *Ans*.....

16 Given $A = \sin^{-1} \frac{1}{3}$, A being a positive obtuse angle; find A correct to the *nearest minute*. *Ans*.....

17 Write the equation of the straight line that passes through the point (2, 9) and has the slope 2. *Ans*.....

18 Is it possible to have a triangle ABC in which $a = 21$, $b = 32$, $A = 115°$? [Answer *Yes* or *No*.] *Ans*.....

19 In the series sin x, tan x, sin x sec^2 x, ... find the ratio in terms of cos x. *Ans*.....

20 If log cos $A = 9.8119 - 10$, find angle A correct to the *nearest minute*. *Ans*.....

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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 (1) elementary algebra, (2) mathematics, third year.

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

Part II

Answer five questions from this part, selecting three questions from group I and two from group II.

Group I

Answer three questions from this group.

21 Solve the following set of equations and group your answers:

$$x^2 + xy + y^2 = 39$$
$$x + y + 2 = 0 \qquad [8, 2]$$

22 Two trains run at uniform rates for a distance of 120 miles. One train travels 5 miles an hour faster than the other and takes 20 minutes less time to travel the distance. Find the rate of the faster train. [6, 4]

23 A machine is worth at the end of each year only 90% of what it was worth at the beginning of the same year. If the machine cost \$1500, find to the *nearest dollar* its value at the end of 6 years. [Solve by using the proper progression formula.] [10]

24 How many pounds of a 4% solution of salt must be added to 25 pounds of a 12% solution in order to obtain a mixture that is 10% salt? [7, 3]

25 *a* Plot the graph of $x^2 + y^2 = 25$ [3]

b On the same set of axes used in answer to *a*, plot the graph of $xy = 12$ from $x = -6$ to $x = +6$ inclusive. [5]

c From the graphs made in answer to *a* and *b*, obtain the values of x and y that satisfy both equations. [2]

Group II

Answer two questions from this group.

26 *a* Prove the identity: $\sec A + \csc A = \dfrac{1 + \tan A}{\sin A}$ [4]

b Solve the following equation for values of x between 90° and 270°:

$$\cos 2x \sec x + \sec x + 1 = 0 \qquad [6]$$

27 Two straight railroad tracks that form an angle of 74° with each other start from the same station. Two trains leave this station at the same time, one on each track, and run at rates of 35 and 45 miles an hour. Find to the *nearest mile* the distance between the two trains at the end of 30 minutes. [10]

28 A flagstaff s feet high stands on the top of a tower. From a point in the plane on which the tower stands, the angles of elevation of the top and bottom of the flagstaff are observed to be A and B respectively. Show that the height h of the tower is given by the formula

$$h = \frac{s \tan B}{\tan A - \tan B} \qquad [10]$$

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