The University of the State of New York

247TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Wednesday, January 22, 1930 — 1.15 to 4.15 p. m., only

Instructions

Do not open this sheet until the signal is given.

Answer all questions in part I and four 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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PLANE TRIGONOMETRY

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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. Each answer must be reduced to its simplest form.

1 Complete the following statement: The sine or cosine of any angle is never greater than .... *Ans*.....

2 Complete the formula $c^2 = a^2 + b^2$ ... , so that it will express the law of cosines. *Ans*.....

3 In triangle ABC, $\sin A = \frac{1}{2}$, $\sin B = \frac{1}{3}$ and $b = 6$; find a. *Ans*.....

4 Find *two* positive values of x less than 360° when $\sin x = \csc x$ *Ans*.....

5 Express cos 350° as a function of a positive angle less than 90°. *Ans*.....

6 When $\sin A = \frac{2}{3}$ and A is in the first quadrant, find cot A. [Leave answer in radical form.] *Ans*.....

7 Reduce 14° 20′ to radians. *Ans*.....

8 Given a right triangle whose sides are 5, 12 and 13; express as a common fraction the sine of the smallest angle. *Ans*.....

9 Find cos y if $y = \sin^{-1} \frac{3}{5}$ *Ans*.....

10 In a right triangle, $\sin A = \frac{5}{13}$ and $c = 72$; find a. *Ans*.....

11 Write the formula for sin $2A$ in terms of sin A and cos A. *Ans*.....

12 A ship sails directly northwest at the rate of 20 miles an hour. How many miles north of the starting point will the ship be at the end of one hour? [Give the answer to the *nearest mile.*] *Ans*.....

13 Find cos 42° 15′ 20″ *Ans*.....

14 Given $\sin x = 0.6194$; find x in degrees and minutes to the *nearest minute.* *Ans*.....

15 Find log tan 56° 48′ 15″ *Ans*.....

16 Given log cos $A = 9.82898 - 10$; find A in degrees, minutes and seconds. *Ans*.....

17 A 50-foot vertical pole casts a shadow 30 feet long; find to the *nearest minute* the angle of elevation of the sun. *Ans*.....

18 In an isosceles triangle, each of the equal sides is 40 and the altitude to the third side is 16; find to the *nearest minute* one of the equal angles. *Ans*.....

19 A troop of Boy Scouts wish to know the distance BC across a pond. They lay off a straight line perpendicular to BC at C and extend it 400 feet to A from which point B is visible. Angle BAC is 64°. Find to the *nearest foot* the distance across the pond. *Ans*.....

20 In a triangle, $a = 40$, $c = 50$ and $B = 58°$; find the area of the triangle. *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 plane trigonometry.

The minimum time requirement for plane trigonometry is five recitations a week for half a school year, or the equivalent.

Part II

Answer four questions from this part, selecting two questions from each group.

Group I

Answer two questions from this group.

21 Two sides of a parallelogram are 12 and 16 and the included angle is 64° 12′; find the shorter diagonal. [12½]

22 A flagpole 30 feet high stands on the top of a vertical cliff whose base forms a part of the shore of a lake. From a boat the angles of elevation of the top and bottom of the pole are 61° and 45° respectively. Find the height of the cliff to the *nearest foot*. [12½]

23 A captive balloon rests directly above a straight horizontal road. At two points on the road which are 2000 feet apart and on opposite sides of the balloon, the angles of elevation of the balloon are 46° and 59°. Find the height of the balloon. [12½]

Group II

Answer two questions from this group.

24 *a* Derive the formula for $\tan (x - y)$, starting with the formulas for $\sin (x - y)$ and $\cos (x - y)$ [7]

b Given $\sin A = \frac{3}{5}$, A being a positive acute angle; find $\tan \frac{1}{2}A$, using the formula for the tangent of half an angle. [5½]

25 *a* Prove that triangle ABC is isosceles if $b \cos A = a \cos B$ [7½]

b Solve the equation $\tan^2 x - 3 \tan x + 2 = 0$ for the two positive values of x less than 90°. [5]

26 *a* Complete the following table, using natural sines:

x	0°	30°	60°	90°	120°	150°	180°
$\sin x$	0	.50					

[5½]

b Plot the graph of $y = \sin x$, using the data shown in the table completed in answer to *a*. [5]

c What does the graph made in answer to *b* show regarding $\sin x$ as x increases from 0° to 90°? from 90° to 180°? [1, 1]

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