

The University of the State of New York

256TH HIGH SCHOOL EXAMINATION

PLANE TRIGONOMETRY

Thursday, January 26, 1933—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.*

*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.

# PLANE TRIGONOMETRY

Thursday, January 26, 1933

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  $2\frac{1}{2}$  credits assigned to it. Each answer must be reduced to its simplest form.

- 1 Express  $\cot 60^\circ$  as a function of  $30^\circ$ . Ans.....
- 2 Express  $\tan A$  in terms of  $\cos A$ . Ans.....
- 3 If  $A = \tan^{-1} \sqrt{3}$ , find  $\tan 2A$ . Ans.....
- 4 Is  $\sin 60^\circ$  equal to, greater than or less than  $\sin 120^\circ$ ? Ans.....
- 5 Express  $\cos 320^\circ$  as a function of a positive angle less than  $45^\circ$ . Ans.....
- 6 If  $2 \cos^2 x = 1$ , find *two* values of  $x$  between  $90^\circ$  and  $270^\circ$ . Ans.....
- 7 As  $\cos A$  varies from 1 to  $-1$ , does the positive angle  $A$  increase or decrease? Ans.....
- 8 Find  $\sin (-72^\circ)$  Ans.....
- 9 Find  $\log \cos 38^\circ 26'$  Ans.....
- 10 Given  $\log \tan A = 0.2264$ ; find  $A$  to the *nearest minute*, if  $A$  is a positive acute angle. Ans.....
- 11 A balloon ascends along a line inclined  $50^\circ$  to the horizontal with a velocity of 30 miles an hour. After 15 minutes what is its altitude to the *nearest tenth* of a mile? Ans.....
- 12 The base of a rectangle is 8 feet, the altitude is 5 feet; find to the *nearest degree* the angle that the diagonal makes with the base. Ans.....
- 13 Find the numerical value of  $\sin 270^\circ + \cos 360^\circ$  Ans.....
- 14 What is the value in degrees of  $\frac{5\pi}{6}$  radians? Ans.....
- 15 Two sides of a triangle are 15 and 24 and the included angle is  $60^\circ$ ; find the third side. Ans.....
- 16 Express  $\sin^2 \frac{1}{2} x$  in terms of a function of  $x$ . Ans.....
- 17 If  $\cos A = \frac{1}{\sqrt{2}}$ , find  $\cos 2A$ . Ans.....
- 18 For what acute angle does the tangent equal the cotangent? Ans.....
- 19 In the triangle  $ABC$ ,  $a = 10$ ,  $c = 20$  and  $B = 67^\circ$ ; find the area. Ans.....
- 20 For what value of  $A$  between  $0^\circ$  and  $180^\circ$  do the graphs of  $\sin A$  and  $\cos A$  have a point in common? 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 A railway runs up from  $A$  to  $B$ , a distance of 1250 feet, at an angle of  $8^\circ 12'$  with the horizontal. It then runs up from  $B$  to  $C$ , a distance of 375 feet, at an angle of  $7^\circ 26'$  with the horizontal. Find to the nearest foot the height of  $C$  above the horizontal plane of  $A$ . [ $12\frac{1}{2}$ ]

22 A man standing on one bank of a river observes that the angle subtended by a tree directly opposite him on the other bank is  $35^\circ 18'$ . When he walks back from the river 140 feet in a direct line from the tree, he finds the angle to be  $19^\circ 14'$ . Find the height of the tree and the width of the river. [ $12\frac{1}{2}$ ]

23 Two straight roads from a town  $P$  form an angle of  $63^\circ 28'$ . Town  $A$  is 21 miles from  $P$  on one road and town  $B$  is 32.8 miles from  $P$  on the other road. How far is  $A$  from  $B$ ? [ $12\frac{1}{2}$ ]

### Group II

Answer two questions from this group.

24 a Starting with the formulas for  $\sin(x + y)$  and  $\cos(x + y)$ , derive the formula for  $\tan(x + y)$  [ $6\frac{1}{2}$ ]

b Prove the identity:  $\cos 2A = \frac{2 - \sec^2 A}{\sec^2 A}$  [6]

25 Solve for positive values of  $x$  less than  $360^\circ$  and check two of the solutions:  
 $3 \tan^2 x - 4 \sin^2 x = 1$  [ $10\frac{1}{2}$ , 2]

26 a Draw the graph of  $y = \tan x$  for values of  $x$  from  $0^\circ$  to  $180^\circ$ . [ $10\frac{1}{2}$ ]

b From the graph made in answer to a, determine the value of  $x$  in the equation  $2 \tan x = 3$ , indicating on the graph point  $P$ , from which this value is obtained. [2]