PLANE TRIGONOMETRY

Wednesday, January 23, 1929 — 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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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 Given a right triangle in which the hypotenuse is double the shortest side; find the tangent of the smaller acute angle.

Ans............

2 Write the sine of the largest angle of the triangle whose sides are 30, 40 and 50.

Ans............

3 What is the cosine of either acute angle in an isosceles right triangle?

Ans............

4 In a right triangle, tan $A = .75$; find sec A.

Ans............

5 In a right triangle, sin $A = \frac{3}{8}$ and $c = 20.5$; find a.

Ans............

6 In triangle ABC if $A = 50°$ and $C = 110°$, find to the *nearest tenth* the ratio $a:b$. [Use table of natural functions.]

Ans............

7 Solve $4 \sin x = \csc x$ for the positive acute value of x.

Ans............

8 As an angle increases from $0°$ to $90°$, which three of its six trigonometric functions increase?

Ans............

9 The sine and cosine of a certain angle are $\frac{7}{25}$ and $\frac{24}{25}$ respectively; find its tangent to *two* decimal places.

Ans............

10 Using the tables of natural functions, find to the *nearest hundredth* the base of an isosceles triangle whose vertex angle is $72°$ and each of whose equal sides is 6.

Ans............

11 A transit is placed on top of a vertical cliff 80 feet above the level of a lake from whose shore the cliff rises. The transit shows the angle of depression of a boat on the lake to be $14°$. Find to the *nearest hundredth* the distance of the boat from the foot of the cliff.

Ans............

12 Reduce 2 radians to degrees and minutes.

Ans............

13 Find the logarithm of the tangent of $24° \ 30' \ 15''$.

Ans............

14 The logarithm of the sine of a certain angle is $9.82831 - 10$; write the angle in degrees and minutes.

Ans............

15 Write the formula for tan $(x + y)$ in terms of tan x and tan y.

Ans............

16 What word is omitted in the following law?
The sides of a triangle are proportional to the ... of the opposite angles.

Ans............

17 Find the area of a parallelogram if two of the sides are 8 and 12.5 and the angle included between these sides is $26°$. [Use natural functions.]

Ans............

18 Express tan $(-210°)$ in terms of a function of a positive acute angle.

Ans............

19 Write the values of sine $180°$ and sine $270°$.

Ans............

20 In a triangular plot of ground ABC, the distance from A to B is 130 feet, from B to C 50 feet and from C to A 120 feet; find angle BAC 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 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 The angle of elevation of the top of a hill at a point *P* on a horizontal plane is 30°. At a point *R* on the plane and 200 feet nearer the foot of the hill, the angle of elevation is 42° 20′. How high above the level of the plane is the top of the hill? [12½]

22 Along the shore of a lake is a straight stretch of state highway 2650 feet long. At one end of this piece of road the angle which a straight line sighted to an ice house on the opposite shore makes with the road is 40° 12′. At the other end the angle to the same point is 74° 28′. What is the shortest distance from the ice house to the road? [12½]

23 A ship *B* is 12 miles S. 45° W. of a lighthouse *A*, and sails S. 50° E. to *C*, a distance of 15 miles. Find *AC*, the distance of the ship from the lighthouse. [12½]

Group II
Answer two questions from this group.

24 *a* Starting with the formula for sin (*A* + *B*), derive the formula for sin 2*A*. [4]

b Starting with the formula for cos 2*A*, derive the formula for sin ½*A*. [8½]

25 Prove the following identities:

$$\tan x + \tan y = \frac{\sin (x + y)}{\cos x \cos y} \quad [4]$$

$$\cot x - \tan x = 2 \cot 2x \quad [8½]$$

26 Indicate whether *each* of the following statements is true or false: [Write the letters *a*, *b*, *c*, *d*, *e* in a column and then write the word *true* or *false* after each letter.]

a The functions of angles change at the same rate as the angles. [2½]

b In the equation $3 \tan^2 x - \sec^2 x = 1$, *x* may equal 45°. [2½]

c If $y = \sin^{-1} \frac{1}{2}$, then $\tan y = \frac{1}{2}\sqrt{2}$ when *y* is in the first quadrant. [2½]

d If $b \sin A = a \sin B$, the triangle *ABC* can not be a right triangle. [2½]

e The value of the secant of any angle is never less than 1. [2½]