13/A/E/6-21

EE24BTECH11040 - Mandara Hosur

E. Subjective Problems

- 1) a) PQ is a vertical tower. P is the foot and Q is the top of the tower. A, B, C are three points in the horizontal plane through P. The angles of elevation of Q from A, B, C are equal, and each is equal to θ . The sides of the triangle ABC are a, b, c; and the area of the triangle ABC is Δ . Show that the height of the tower is $\frac{abc \tan \theta}{4\Delta}$.
 - b) AB is a vertical pole. The end A is on the level ground. C is the middle point of AB. P is a point on the level ground. The portion CB subtends an angle β at P. If AP = nAB then show that $\tan \beta = \frac{n}{2n^2+1}$.

(1980)

2) Let the angles A, B, C of a triangle ABC be in A.P. and let $b: c = \sqrt{3}: \sqrt{2}$. Find the angle A.

(1981 - 2Marks)

3) A vertical pole stands at a point Q on a horizontal ground. A and B are points on the ground, d meters apart. The pole subtends angles α and β at A and B respectively. AB subtends an angle γ at Q. Find the height of the pole.

(1982 - 3Marks)

4) Four ships *A*, *B*, *C* and *D* are at sea in the following relative positions: *B* is on the straight line segment *AC*, *B* is due North of *D* and *D* is due west of *C*. The distance between *B* and *D* is 2 km. ∠*BDA* = 40°, ∠*BCD* = 25°. What is the distance between *A* and *D*? [Take sin 25° = 0.423]

(1983 - 3Marks)

5) The ex-radii r_1 , r_2 , r_3 of $\triangle ABC$ are in H.P. Show that its sides a, b, c are in A.P.

(1983 - 3Marks)

6) For a triangle ABC it is given that $\cos A + \cos B + \cos C = \frac{3}{2}$. Prove that the triangle is equilateral.

(1984 - 4Marks)

7) With usual notation, if in a triangle *ABC*; $\frac{b+c}{11}$ =

 $\frac{c+a}{12} = \frac{a+b}{13}$ then prove that $\frac{\cos A}{7} = \frac{\cos B}{19} = \frac{\cos C}{25}.$ (1984 – 4*Marks*)

8) A ladder rests against a wall at an angle α to the horizontal. Its foot is pulled away from the wall through a distance a, so that it slides a distance b down the wall making an angle β with the horizontal. Show that $a = b \tan \frac{1}{2} (\alpha + \beta)$.

 $(1\overline{9}85 - 5Marks)$

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9) In a triangle *ABC*, the median to the side *BC* is of length $\frac{1}{\sqrt{11-6\sqrt{3}}}$ and it divides the angle *A* into angles 30° and 45°. Find the length of the side *BC*.

(1985 - 5Marks)

10) If in a triangle ABC, $\cos A \cos B + \sin A \sin B \sin C = 1$, show that $a:b:c=1:1:\sqrt{2}$.

(1986 - 5Marks)

11) A sign-post in the form of an isosceles triangle ABC is mounted on a pole of height h fixed to the ground. The base BC of the triangle is parallel to the ground. A man standing on the ground at a distance d from the sign-post finds that the top vertex A of the triangle subtends an angle β and either of the other two vertices subtends the same angle α at his feet. Find the area of the triangle.

(1988 - 5Marks)

12) ABC is a triangular park with AB = AC = 100m. A television tower stands at the midpoint of BC. The angles of elevation of the top of the tower at A, B, C are 45° , 60° , 60° , respectively. Find the height of the tower.

(1989 - 5Marks)

13) A vertical tower PQ stands at a point P. Points A and B are located to the South and East of P respectively. M is the mid point of AB. PAM is an equilateral triangle; and N is the foot of the perpendicular from P on AB. Let AN = 20 metres and the angle of elevation of the top of the tower at N is $\tan^{-1} 2$. Determine the height of the tower and the angles of elevation of the top of the tower at A and B.

(1990 - 4Marks)

14) The sides of a triangle are three consecutive natural numbers and its largest angle is twice the smallest one. Determine the sides of the triangle.

$$(1991 - 4Marks)$$

15) In a triangle of base a the ratio of the other two sides is r < 1. Show that the altitude of the triangle is less than or equal to $\frac{ar}{1-r^2}$.

(1991 - 4Marks)

16) A man notices two objects in a straight line due west. After walking a distance c due north he observes that the objects subtend an angle α at his eye; and, after a further distance 2c due north, and angle β . Show that the distance between the objects is $\frac{8c}{3\cot\beta-\cot\alpha}$; the height of the man is being ignored.

(1991 - 4Marks)