Question (1)   (30 marks)

a) Stations A and B have the following geodetic coordinates (R = 6388 km)

$$\phi_A = 43° \ 15^\backslash \ 29^{\backslash\backslash} \ N, \ \lambda_A = 89° \ 59^\backslash \ 42^{\backslash\backslash} \ E \text{ and } h_A = 1382.618m$$

$$\phi_B = 83° \ 05^\backslash \ 21^{\backslash\backslash} \ N, \ \lambda_B = 19° \ 56^\backslash \ 12^{\backslash\backslash} \ W \text{ and } h_B = 1090.821m$$

Compute their geocentric coordinates and the distance between the two points ?

b) Given a spherical triangle ABC, where a = 165°; b = 100° and c = 75°. Solve the triangle to find its unknowns elements and calculate the area of triangle ?

## Question (2)   (40 marks)

a) A and B are a part of free triangulation network, their elevations are 86 m and 136 m respectively, and the distance between the two points equal 40 km. The intervening ground may be a level plane of elevation 59 m. If the government will begin in establishment a new city between of these two points. Find the maximum number of floors of any building in this city with height of every floor is 2.7, so that the line of sight from A to B will clear the obtained building by not less than 4 m (R = 6388 km and k = 0.08) ?

b) A and B are two triangulation stations , the level of which are 220 and 1160 m respectively, and 130 km distance. In between them C and D points the levels which are 308 and 632 m respectively. The distance AC = 50 km and the distance AD = 90 km. Does the point C or point D or both obstruct the line of sight from A to B ? If it does, what will be height of a signal over B so that the line of sight will clear the obstruction by not less than 2.0 m (Assume that k = 0.07 and R = 6370 km)?

Question (3)   (30 marks)
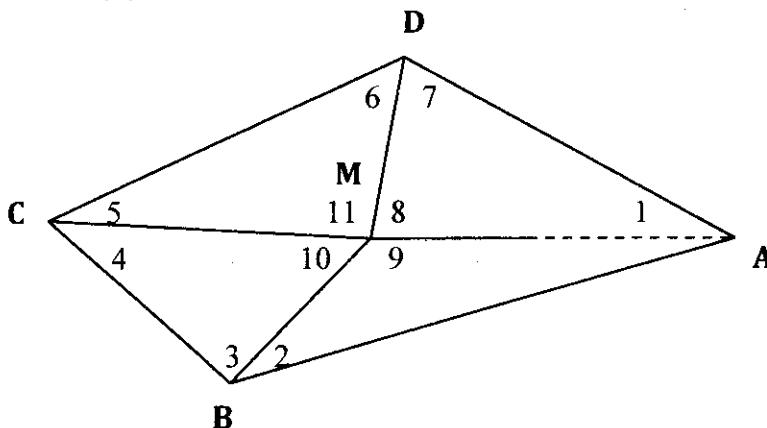
ABCDM is a is a part of a free triangulation network chose angles 1 to 11 as the following figure. Calculate the condition equations for its adjustment and write them?

With my best wishes .... **Prof. Dr / Mohamed Ismail Doma**

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