1- Prove the law of cosines for a triangle.

$$C = \sqrt{A^2 + B^2 - 2AB \cos \alpha}.$$

2- Given three vectors **A**, **B**, and **C**, obtain the expressions of (a) **A.B**,(b) **A** × **B**, and (c) **C** .(**A** × **B**) in the orthogonal curvilinear coordinate system (u_1, u_2, u_3). **A**=A_1u_1+A_2u_2+A_3u_3 , **B**=B_1u_1+B_2u_2+B_3u_3 , ...

3- (a) Write the expression of the vector going from point P1=(1, 2, -1) to point *P2=(3, -2, -4)* in Cartesian coordinates. (b) What is the length of this line?

4- Express the vector **A** = a_r (2 cos φ) - a_φ $2r$ + a_z 2 in Cartesian coordinates.

5- The position of a point P in spherical coordinates is (8, 120°, 330°). Specify its location (determine the vector: OP) (a) in Cartesian coordinates, and (b) in cylindrical coordinates.

6- Determine the values of the following products of base vectors:

a) a_x . a_φ b) a_θ.a_y c) a_r × a_x

d) a_R · ar   e) a_y · a_R f) a_R .az

g) a_R ×az   h) a_θ.az   i) az×a_θ

7- Find the component of the vector **A** =-a_y z + a_z y at the point P_1 (0, - 2, 3), which is directed toward the point P_2($\sqrt{3}$ -60°, 1).

(در واقع تصویر بردار **A** روی بردارP_2 P_1 خواسته شده و مشخص است که نقطه اول دکارتی و دومی استوانه ای داده شده است.)