Name-Surname:
No. :

Istanbul Technical University Faculty of Aeronautics and Astronautics **16.10.2017**
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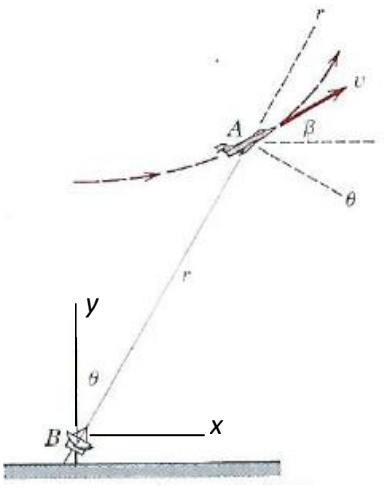
11729 DNK201E Dynamics

Quiz – 1

Problem: During a portion of a vertical loop, an airplane flies in an arc of radius $\rho = 600\ m$ with a constant speed $v = 400\ km/h$. When the airplane is at *A*, the angle made by $\vec{v}$ with the horizontal is $\beta = 30°$, and radar tracking gives $r = 800\ m$ and $\theta = 30°$.



(a) Calculate v_r, v_θ, a_r, and $\ddot{\theta}$ for this instant.

Ans. $v_r = 96.2\ m/s$, $v_\theta = 55.6\ m/s$
$a_r = 10.29\ m/s^2$, $\ddot{\theta} = -0.0390\ rad/s^2$

(b) Find the position vector of the airplane at point *A* in the xy-frame.

(c) Calculate the magnitudes of velocity and acceleration vectors at the point *A*.

If possible,

(d) find v_x, v_y, a_x, and a_y;

(e) find the components of the velocity and acceleration vectors in spherical coordinates; (r and θ are given in the figure, ϕ =?)

(f) find the tangential and normal components of the resultant acting on the airplane at the point *A*, if the mass of the airplane is $m = 10.000\ kg$;

(g) find the rate of work done by the resultant at the point *A*;

(h) find the rate of work done by weight of the airplane at the point *A.*

If you think it is not possible to find exact values of the quantities given above then explain why.