KINEMATICS OF PARTICLES
- **PLANE MOTION**

**ASSIGNMENT 3** :   Due: Monday 2nd August, 2021

INSTRUCTIONS: Please show your working clearly and use the SI units for all your calculations.

Question 1

2/149 A jet plane flying at a constant speed v at an altitude h = 10 km is being tracked by radar located at O directly below the line of flight. If the angle θ is decreasing at the rate of 0.020 rad/s when θ = 60°, determine the value of $\ddot{r}$ at this instant and the magnitude of the velocity $\mathbf{v}$ of the plane.
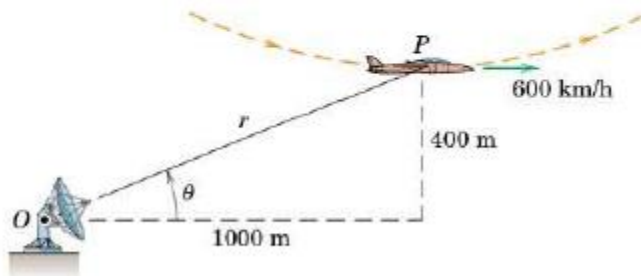
Ans. $\ddot{r}$ = 4.62 m/s², v = 960 km/h
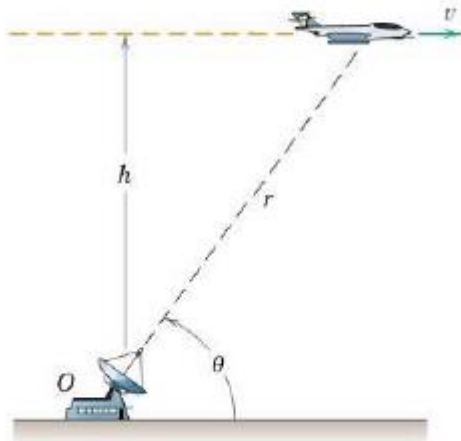
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Question 2

2/153 At the bottom of a loop in the vertical $(r\text{-}\theta)$ plane at an altitude of 400 m, the airplane P has a horizontal velocity of 600 km/h and no horizontal acceleration. The radius of curvature of the loop is 1200 m. For the radar tracking at O, determine the recorded values of $\ddot{r}$ and $\ddot{\theta}$ for this instant.
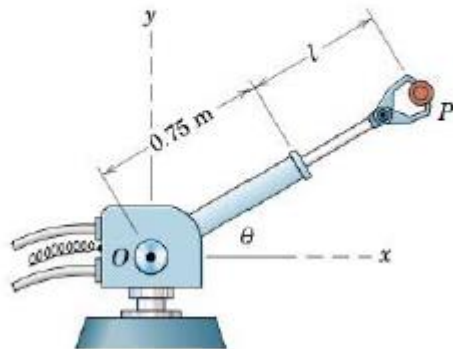
Ans. $\ddot{r} = 12.15$ m/s^2, $\ddot{\theta} = 0.0365$ rad/s^2

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Question 3

2/162 The robot arm is elevating and extending simultaneously. At a given instant, $\theta = 30°$, $\dot{\theta} = 10$ deg/s $=$ constant, $l = 0.5$ m, $\dot{l} = 0.2$ m/s, and $\ddot{l} = -0.3$ m/s^2. Compute the magnitudes of the velocity $\mathbf{v}$ and acceleration $\mathbf{a}$ of the gripped part P. In addition, express $\mathbf{v}$ and $\mathbf{a}$ in terms of the unit vectors $\mathbf{i}$ and $\mathbf{j}$.

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