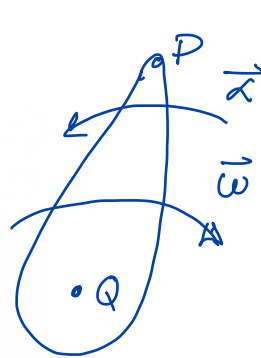
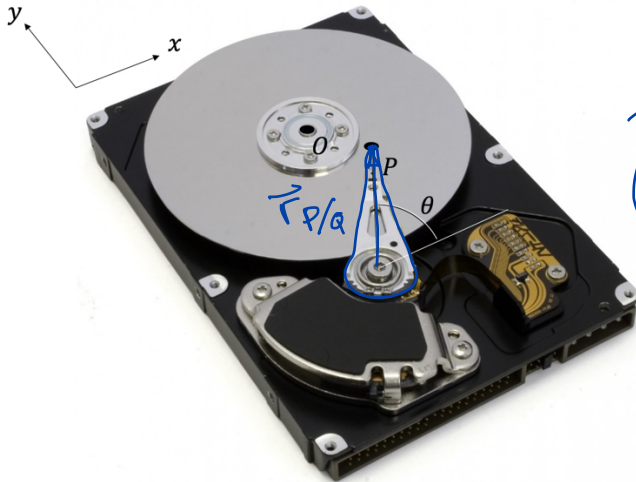


What is the velocity and acceleration of a point, P , on the read/write head of a hard drive? The actuator arm that supports the head has an angular velocity of 40 rad/s clockwise, and an angular acceleration of 200 rad/s^2 counter-clockwise. The actuator arm is at 60 degrees above the horizontal at this instant and the distance from P to the arm axle is 3.5 cm.



$$\vec{\omega} = -40 \text{ rad/s } \hat{k}$$

$$\vec{\alpha} = 200 \text{ rad/s}^2 \hat{k}$$

$$\vec{r}_{P/Q} = 0.035 (\cos 60^\circ \hat{i} + \sin 60^\circ \hat{j}) \text{ m}$$

$$\vec{v}_P = \vec{\omega} \times \vec{r}_{P/Q} = -40 \text{ rad/s } \hat{k} \times 0.035 (\cos 60^\circ \hat{i} + \sin 60^\circ \hat{j}) \text{ m}$$

$$= -40 (0.035) \cos 60^\circ \hat{j} + 40 (0.035) \sin 60^\circ \hat{i}$$

$$\vec{a}_P = (-34.1 \hat{i} - 45.0 \hat{j}) \text{ m/s}^2$$