

# Workbook



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# Polar Coordinates

## Polar Coordinates

### Questions

**1) Man Riding a Motorbike.**

A motorcyclist begins her motion from rest.

Her distance from the starting point is given by  $r = ct$ , where  $c$  is a constant.

The motorcyclist also has a constant angular velocity of  $\omega$ .

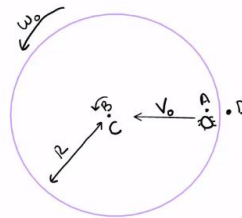
Find the maximal distance the motorcyclist will reach when given the coefficient of static friction  $\mu_s$ .

**2) Carrousel.**

A ladybird moves along a carrousel which has constant angular velocity,  $\omega_0$ .

The carrousel has radius  $R$ . The ladybird moves from one end of the carrousel to the center at a constant velocity  $v_0$ , relative to the carrousel.

- a. Find the position of the ladybird, in Cartesian coordinates and in polar coordinates, relative to the following observers:
  - i. Observer A – standing on the carrousel at the ladybirds starting point.
  - ii. Observer B – standing at the center of the carrousel.
  - iii. Observer C – standing at the center of the carrousel but not rotating with it.
  - iv. Observer D – standing at the edge of the carrousel but not rotating with it.
- b. Find the velocity and acceleration of the ladybird relative to the different observers.



### Answer Key

1) 
$$r_{\max} = \sqrt{(\mu_s g)^2 - (2_c \omega_0)^2} \left( \frac{1}{\omega_0} \right)$$

2) Refer to the video.