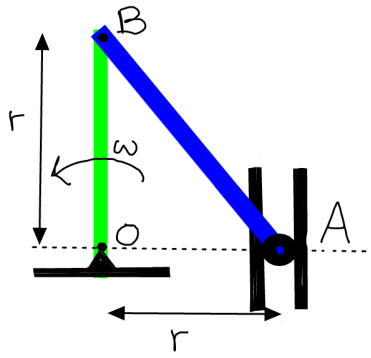
ENGN 0040: Dynamics and Vibrations, Spring 2014

Homework 7: Rigid Body Kinematics
Due Friday April 11th

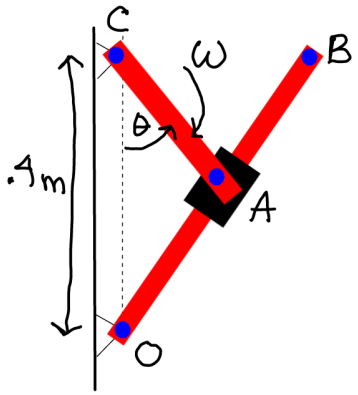
Problem 1: In the 2-link system shown below, link OB has a constant angular velocity ω. For the instant in time shown:



1.1. Determine the linear velocity vectors at points A and B.

1.2. Determine the linear acceleration vectors at points A and B.

Problem 2: The rod OB slides through the collar pivoted to the rotating link at A. Link CA is rotating at a constant angular velocity of 3 rad/s in the clockwise direction when $\theta = 45$ deg. Link CA has a length of 0.2 m.



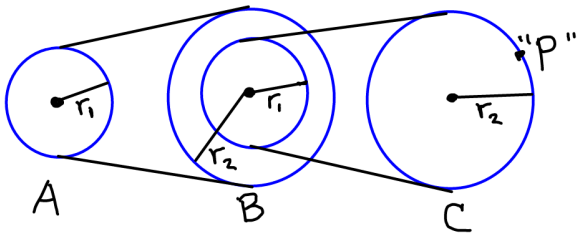
2.1. What is the velocity and acceleration of the collar A?

2.2. What is the angular velocity and acceleration of link OB?

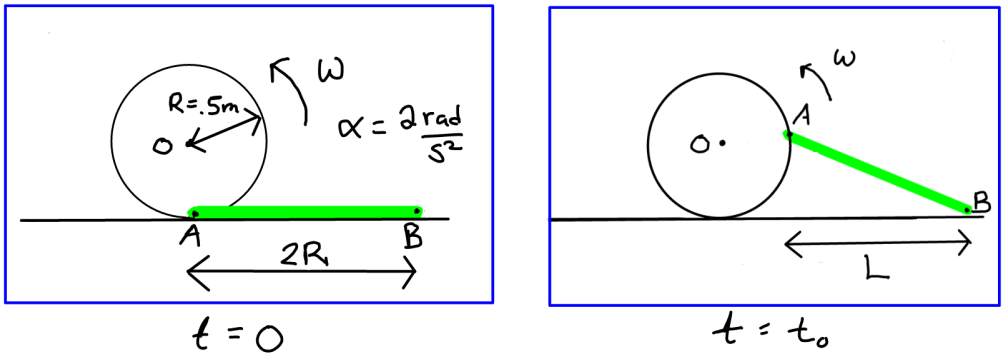
Problem 3: A V-belt speed reduction drive is shown where pully A drives the two integral pulleys B which in turn drive pulley C. If A starts at rest at time $t = 0$, and is given a constant acceleration α_1, then:

3.1. Derive an expression for the angular velocity of C at time t.

3.2. What is the (magnitude of) acceleration of the point "P" at time t?



Problem 4: The wheel below has a radius $R = 0.5\ m$ and is connected to a rigid link of length $2R$. The system is at rest at $t = 0$, and subsequently is subjected to constant angular acceleration $\alpha = 2\ rad/s^2$. At time $t = t_o$ the wheel has turned 90 degrees. The wheel rolls without slipping.



4.1. Determine the value of t_o and the value of ω at t_o.

4.2. Determine the velocity and acceleration of point "O" at $t = t_o$.

4.3. Determine the velocity and acceleration of point "B" at $t = t_o$.