

KING SAUD UNIVERSITY
College of Engineering
Mechanical Engineering Department

GE 202 DYNAMICS

Final Exam

1 / 7 / 1431H (13/ 06 / 2010G)

(Duration of exam: 3 hours)

Problem 1:

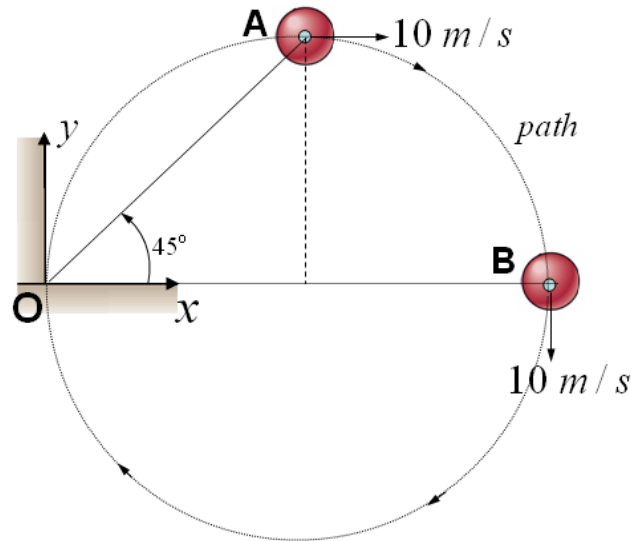
A circular path with radius $r = 40\text{ m}$ is shown with two particles, one at A and another at B. Each particle is moving with a constant velocity of 10 m/s .

a) Find for particle A:

$$v_r, v_\theta$$

$$a_n, a_t, a_r, a_\theta$$

b) Find $\vec{v}_{A/B}$, $\vec{a}_{A/B}$

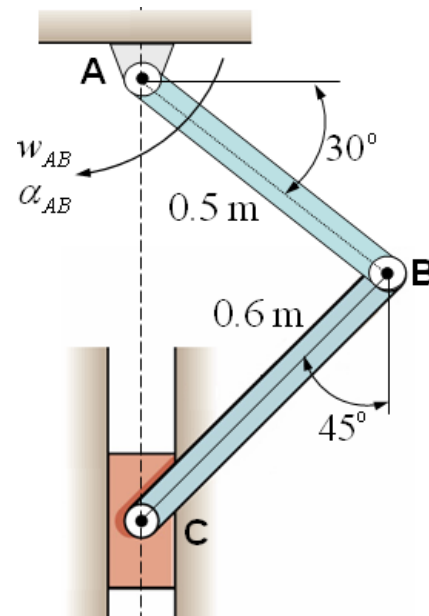


Problem 2:

At the shown instant the link AB has a clockwise angular velocity of 3 rad/s and angular acceleration of 5 rad/s^2 . At this instant;

a) Calculate the angular velocity and angular acceleration of link BC, w_{BC}, α_{BC} ?

b) Calculate the velocity and acceleration of the collar C, v_C, a_C ?

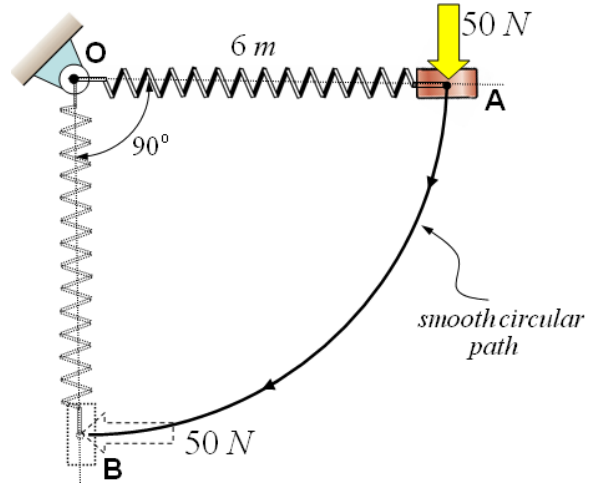


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Problem 3:

The 5-kg collar is released from rest at position A and slides on smooth circular path shown in **horizontal plane** under the tangential force 50 Newton. The spring stiffness $k = 30 \text{ N/m}$, and it has an unstretched length of 4m . Calculate:

- The velocity of the collar at position B.
- The normal force at position B.
- Linear impulse from A to B.
- Angular impulse about O from A to B.

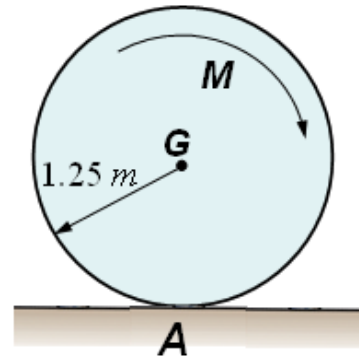


Problem 4:

The 4-kg wheel shown in the figure has a radius of gyration $k_G = 0.4 \text{ m}$ about G . If a 10 Nm moment M is applied to the wheel. Show if the wheel slips or not?

Given: $\mu_s = 0.3$ and $\mu_k = 0.25$.

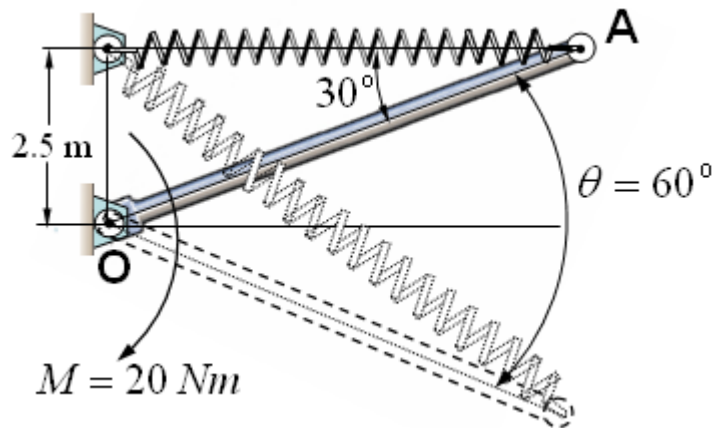
- Calculate the acceleration of its mass center G , \bar{a}_G ?
- Calculate the angular acceleration of the wheel, α ?



Note: $I_G = m (k_G)^2$.

Problem 5:

The 8-kg slender bar OA is released from rest in the position shown in a **vertical plane** under constant moment $M = 20 \text{ Nm}$. The spring stiffness is 10 N/m , and its unstretched length is 3 meter. Calculate the angular velocity of the bar as the position $\theta = 60^\circ$ is passed.



Note: $I_o = \frac{1}{3} m L^2$, where m is the mass and L is the length of the slender bar.