Eastern **M**editerranean **U**niversity
Faculty of Engineering
Department of **M**echanical **E**ngineering

Rigid Body Dynamics (MENG233)

Instructor:
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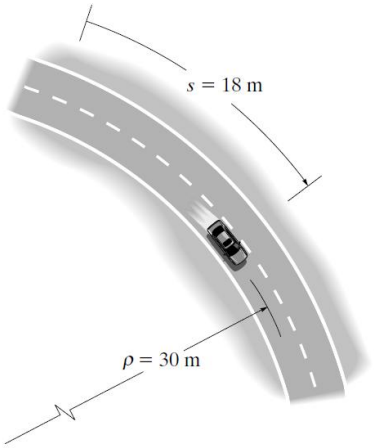
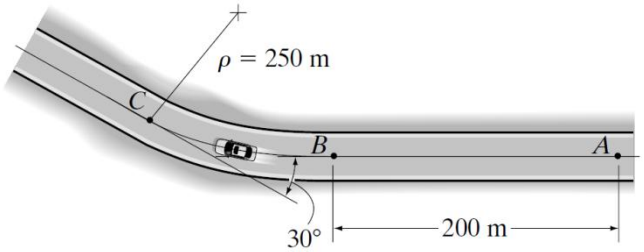
Homework #2

Submission Deadline: 14 November 2013

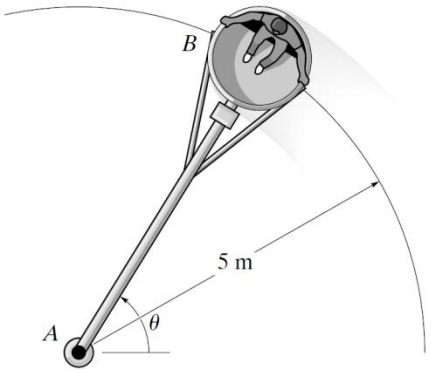
1- The car travels along the circular path such that its speed is increased by $a_t = (0.5e^t)$ m/s^2, where *t* is in seconds. Determine the magnitudes of its velocity and acceleration after the car has traveled s = 18 m starting from rest. Neglect the size of the car.



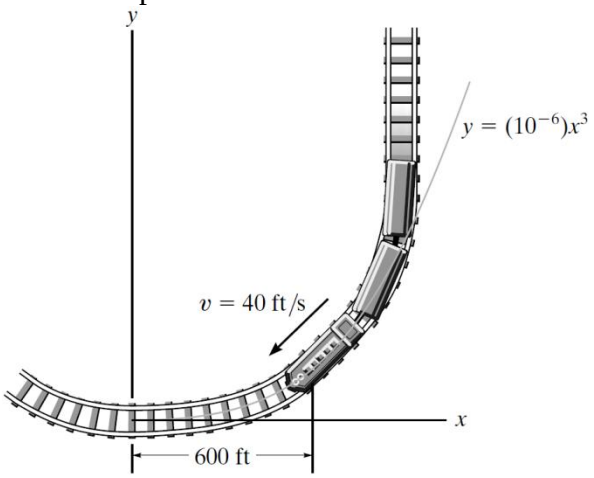
2- When the car reaches point *A* it has a speed of 25 m/s. If the brakes are applied, its speed is reduced by $a_t = (-1/4t^{1/2})$ m/s^2. Determine the magnitude of acceleration of the car just before it reaches point *C*.



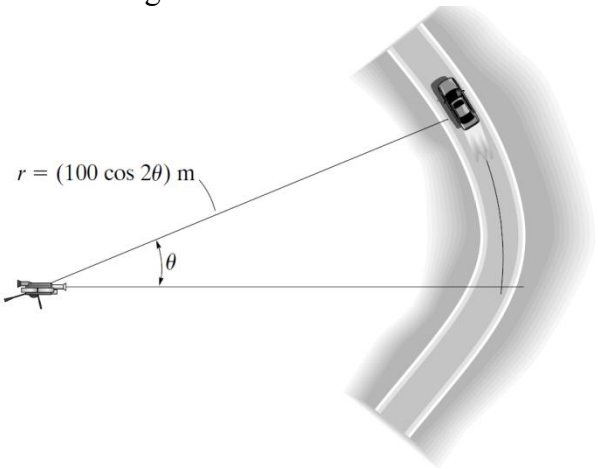
3- Car *B* turns such that its speed is increased by $(a_t)_B = (0.5e^t)$ m/s^2, where *t* is in seconds. If the car starts from rest when θ = 0°, determine the magnitudes of its velocity and acceleration when the arm *AB* rotates θ = 30°. Neglect the size of the car.



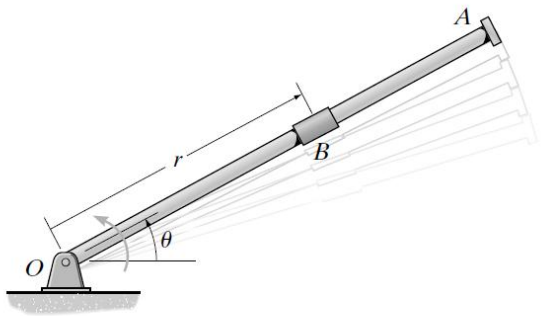
4- A spiral transition curve is used on railroads to connect a straight portion of the track with a curved portion. If the spiral is defined by the equation $y = (10^{-6})\, x^3$, where *x* and *y* are in feet, determine the magnitude of the acceleration of a train engine moving with a constant speed of 40 ft/s when it is at point x = 600 ft.



5- The driver of the car maintains a constant speed of 40 m/s. Determine the angular velocity of the camera tracking the car when θ = 15°.



6- Rod *OA* rotates counterclockwise with a constant angular velocity of $\dot{\theta}$ = 6 rad/s through mechanical means collar *B* moves along the rod with a speed of $\dot{r} = (4t^2)$ m/s, where *t* is in seconds. If r = 0, when t = 0 determine the magnitudes of velocity and acceleration of the collar when t = 0.75 s.



7- For a short time the jet plane moves along a path in the shape of a lemniscates, $r^2 = (2500 \cos(2\theta))\ km^2$. At the instant $\theta = 30°$, the radar tracking device is rotating at $\dot{\theta} = 5(10^{-3})$ rad/s with $\theta = 2(10^{-3})$ rad/s^2.Determine the radial and transverse components of velocity and acceleration of the plane at this instant. **12–194**