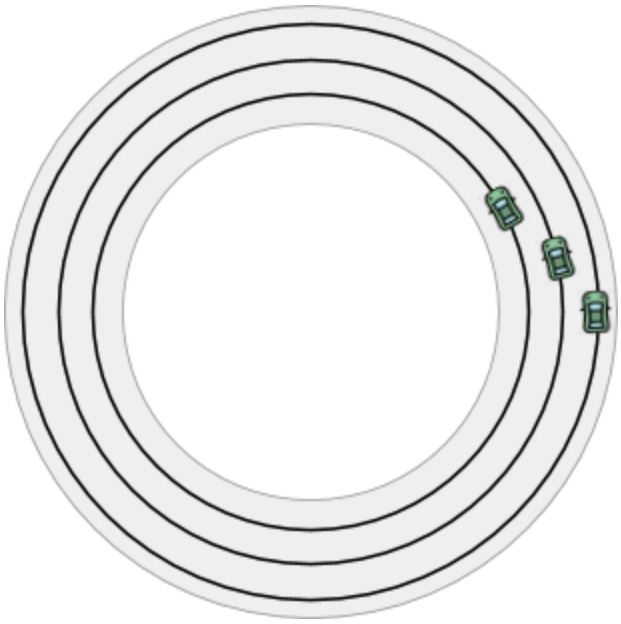
PAL Problem Set 11 for Phys 5A (Rotational Motion)

Always explain your answers and show your work.

Problem 1 - The toy race track in the figure has three lanes, and cars cannot change lanes. The centerlines of any two adjacent lanes are 10 cm apart, and the innermost lane has a radius of 1 meter.

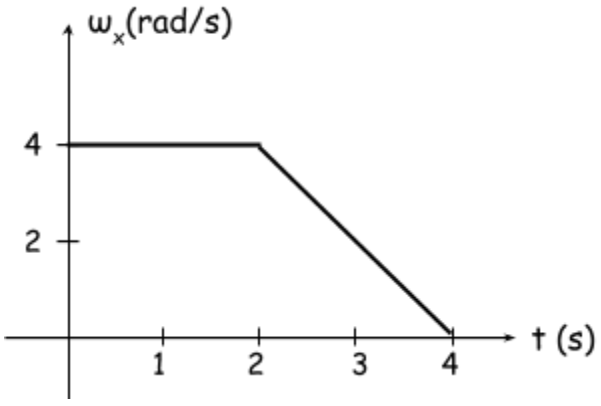


A. If each car has the same average speed, compare the time intervals needed for the cars to complete 20 laps.

Assume that all three cars start beside each other and cross the finish at the same instant to answer parts B-D.

B. How do the average speeds of the cars compare?
C. How do the average *angular* speeds of the cars compare?
D. How does the centripetal acceleration of the three cars compare?
E. Assume that the outermost car (#3) takes 10 seconds to complete one lap around the track. Calculate its average speed, angular speed, and centripetal acceleration. Pay attention to the units!

Problem 2 - This is the angular velocity graph of a wheel. Draw the *angular* position vs. time for this motion. Assume that $\theta_i = 0$



Problem 3 - Starting from rest, a wheel with constant angular acceleration turns through an angle for 25 radians in a time t. Through what angle will it have turned after a time 2t?