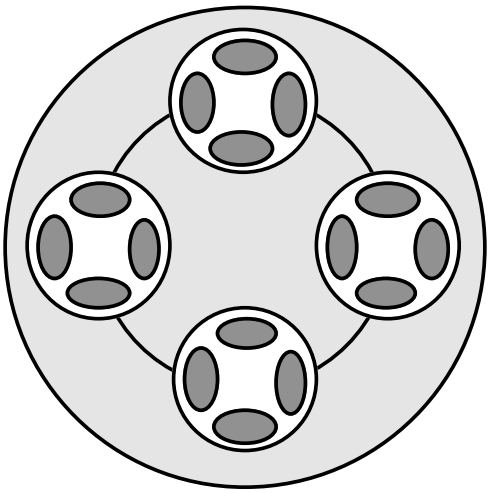
CENTRIFUGE - AP



DATA:

Radius of primary axis (measured from center of ride to center of car cluster): _____

Radius of secondary axis (measured from center of car cluster to center of car): _____

Indicate on diagram above the directions of rotation (as seen from above)

Time for one rotation of the total ride: _____

Time for one rotation of the car cluster: _____

Maximum lateral acceleration ($\mathbf{a_L}$): _____ g's (measured on the ride at full speed)

Minimum lateral acceleration ($\mathbf{a_L}$): _____ g's (measured on the ride at full speed)

In the problem that follows, ignore the fact that the entire ride is set at an angle to the horizontal. Consider the ride as if it were running in a horizontal manner.

PROBLEM

This is a place where your expertise in calculus will shine through. Good luck.

1. Given the rotation speed and the radius of the car cluster, write an equation to describe the velocity vs. time for an individual car in the frame of reference of the car cluster.

2. Given the rotation speed and the radius of the car cluster on the total ride platform, write an equation to describe the velocity vs. time for a car cluster in the frame of reference of the stationary ground around the ride.

3. Combine the results of your two equations to predict the overall motion of an individual car relative to the stationary ground.

4. Sketch the graph that is formed by this equation. (If possible, plot it on a graphing calculator, if you brought one, to check it out.)

5. Find the maximum and minimum accelerations (dv/dt) of an individual car as given by your equations.

6. Compare your measured accelerations with the calculated values.

$$\mathbf{a_c = v^2 / R = 4\ \pi^2\ R / T^2}$$