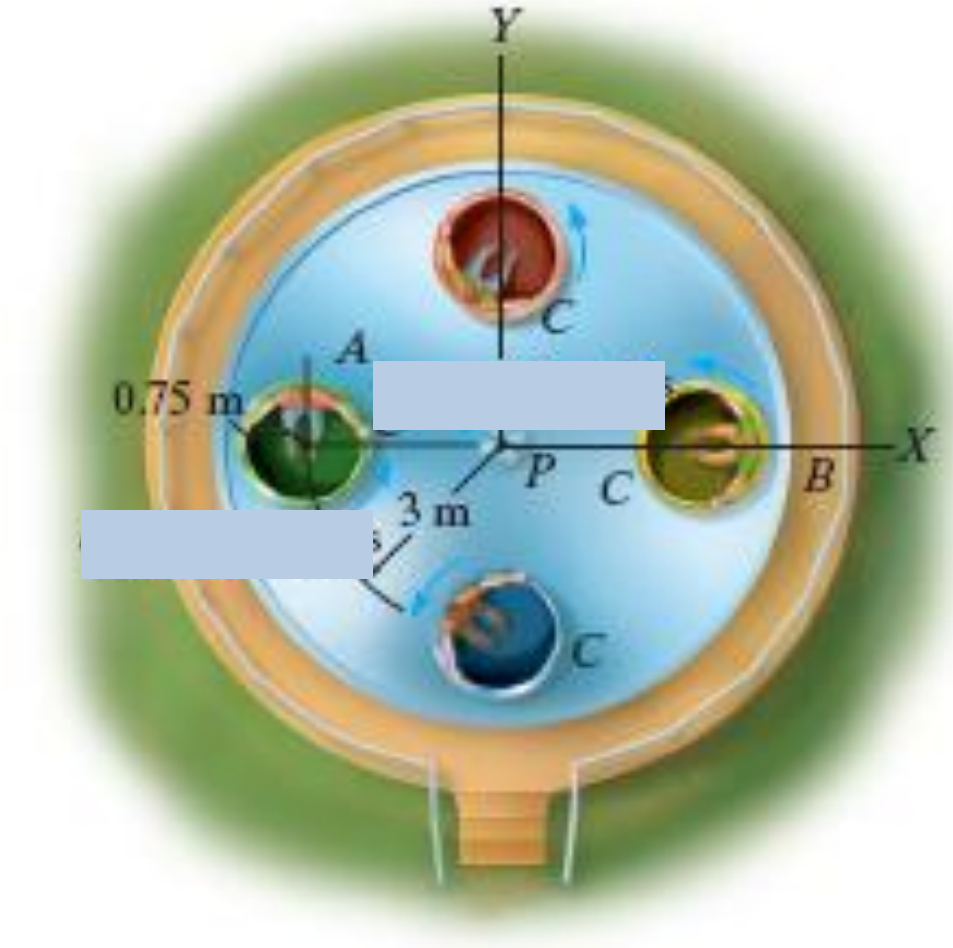
Coursework #C1

A ‘Spinning Tea Cup’ amusement ride as shown in the picture below consists of four self-rotating cups in which children sit. The cups have an angular velocity of ω rad/sec. These cups are in turn located on revolving floors whose angular velocity is Ω rad/sec. Given that humans can safely tolerate g-force up to 12g, **determine the amusement ride safe operating conditions, ie. maximum values of ω for a given range of Ω**

ILLUSTRATION ONLY

Given the following conditions:

- $2 \leq \Omega \leq 10$ rad/sec
- Cup radius is 75 cm
- Radial distance from centre of platform to centre of cup is 3m



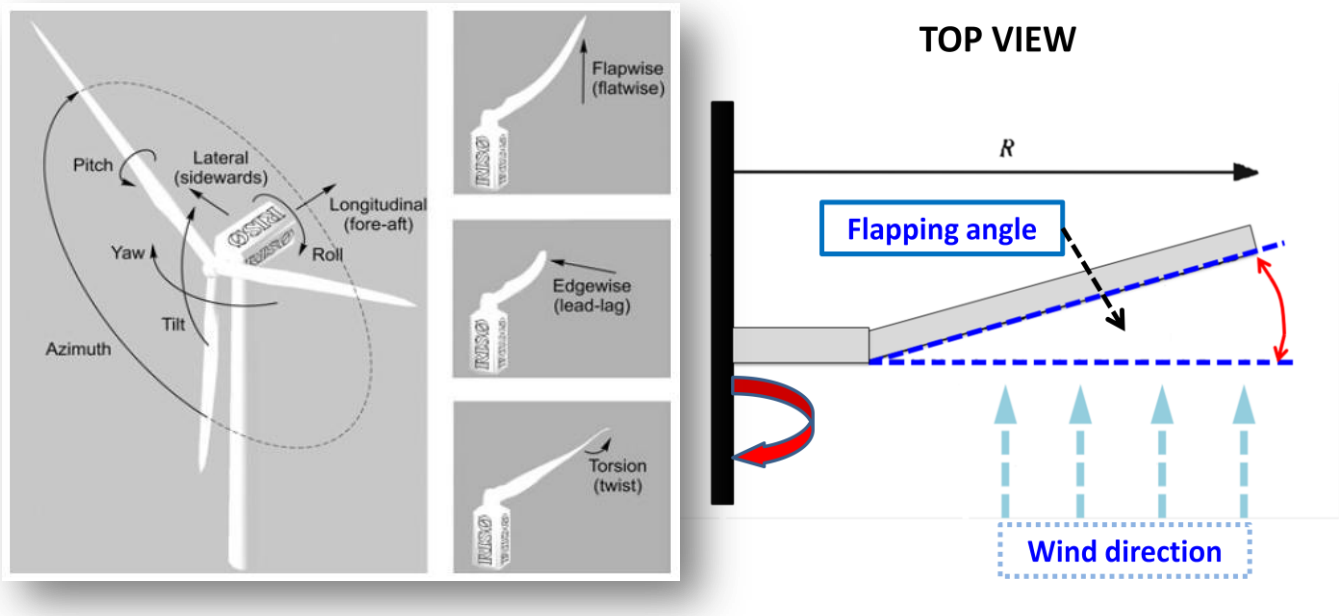
Task

Determine the magnitudes of the acceleration and velocity of the wind turbine rotor blade tip as a function of time. The rotor blade rotates at a constant angular velocity and it vibrates sinusoidally in the flapwise direction.

Given that the rotor blade rotational speed is 14 RPM.

The flapwise vibration can be described by the function $\beta = 2 + 2\cos(\omega t)$ [degrees]. The flapwise vibration frequency is three times the blade rotation frequency, ie. the flapwise vibration has completed three cycles during one complete revolution of the turbine blade.

The turbine blade is 55m long.



Task

Novak Djokovic is serving for a match. He is positioned on the baseline at the circle marked "A". He tries to land his service at the position marked by a yellow star in the figure below.

Given that his height is 188 cm, state reasonable assumptions about the arms length, racquet size, tennis ball and racquet coefficient of restitution and other relevant values to **determine the following**

(a) the optimum angle which the racquet makes with the ball during impact

(b) the racquet head velocity

so that the ball takes the shortest time to reach the other side of the court. Note that the ball must clear the net during its flight!