

25%(1): Consider forced oscillation

$$\frac{d^2x}{dt^2} + 2\beta\frac{dx}{dt} + \omega_0 = A\cos(\omega t).$$

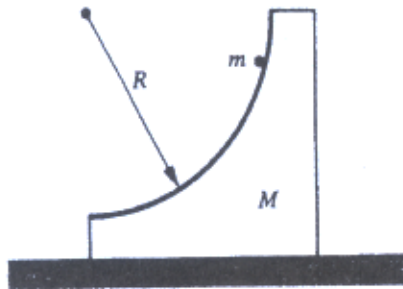
Find the phase difference between driving force and the resultant motion.

25%(2): Prove Liouville's theorem

$$\frac{d\rho}{dt} = 0,$$

where ρ is the phase density.

25%(3): A particle of mass m slides down a smooth circle wedge of mass M as shown in figure. The wedge rests on a smooth horizontal table, find (a)(15%) the equation of motion of m and M . (b)(10%) the ratio of vertical and horizontal reactions between the particle and the wedge.



25%(4): A free symmetric top rotating stably with frequency $\bar{\omega}$, what angular velocity does the symmetry axis rotate about the constant angular momentum \vec{L} ?