Reading Question Week 4 Day 1

Write your name, section, and table number on the upper right hand corner of your answer and hand it in at the start of class that day.

Sept 23/24 W04D1 Circular Motion Kinematics
Reading Assignment:
Chapter 6 Circular Motion, Sections 6.1-6.2

Reading Questions

(1) In a cylindrical coordinate system with unit vectors $(\hat{r}, \hat{\theta}, \hat{k})$, consider a point-like object traveling in a circle at non-constant speed in the $z = 0$ plane centered about the origin. (a) Do the unit vectors $\hat{r}$ and $\hat{\theta}$ point in the same direction at every point on the circular path? (b) Write a vector description of the angular velocity. Under what conditions is the appropriate component positive, zero, or negative? (c) Using any of the methods in today’s readings, calculate the velocity and acceleration of the object in polar coordinates. Do not just write down formulae. (d) Explain why the radial component of the acceleration points towards the center of the circle and has magnitude $\frac{v^2}{R} = R\omega^2 = R 4\pi^2 f^2 = R \frac{4\pi^2}{T^2}$.

(2) An object moves in a circle of radius $R$ at non-constant speed. The particle makes an angle $\theta(t)$ with the positive horizontal axis, which varies in time according to $\theta(t) = Br^2$. Write down expression for the angular velocity vector, the velocity vector and the acceleration vector in cylindrical coordinates.