Problem Set 2

Uniform and Non-uniform Circular Motion

1. The vector position of a particle varies in time according to the expression $\mathbf{r} = \left(3.00\hat{\mathbf{i}} - 6.00t^2\hat{\mathbf{j}}\right)$m . (a) Find expressions for the velocity and acceleration as functions of time. (b) Determine the particle's position and velocity at $t = 1.00$ s.

2. Compute the radial acceleration of a point on the surface of the Earth at the equator, due to the rotation of the Earth about its axis. The radius of the earth is 6.37x10 $6.37x10^6$ m.

3. A tire 0.500 m in radius rotates at a constant rate of 200 rev/min. Find the speed and acceleration of a small stone lodged in the tread of the tire (on its outer edge).

4. An automobile whose speed is increasing at a rate of 0.600 m/s² travels along a circular road of radius 20.0 m. When the instantaneous speed of the automobile is 4.00 m/s, find (a) the tangential acceleration component, (b) the centripetal acceleration component, and (c) the magnitude and direction of the total acceleration.

5. The Figure shown represents the total acceleration of a particle moving clockwise in a circle of radius 2.50 m at a certain of time. At this instant, find (a) the radial acceleration, (b) the speed of the particle, and (c) its tangential acceleration.