

Math 2415

Homework on 13.2

1. Find a parametrization of the tangent line to the helix $\mathbf{r}(t) = 2t\mathbf{i} + \sin t\mathbf{j} + \cos t\mathbf{k}$ at the point where $t = \pi$. In which point does this line intersect the xy -plane?
2. Find the velocity and acceleration vectors and a parametrization for the tangent line for the curve $\mathbf{r}(t) = t \sin t\mathbf{i} + t \cos t\mathbf{j} + \sqrt{3}\mathbf{k}$ at $t = 0$.
3. Below are two parameterizations describing the motion of a particle around the circle $x^2 + y^2 = 1$. For each parameterization answer the following questions.
 - (i) Does the particle have constant speed? If so, what is this constant speed?
 - (ii) Is the particle's acceleration vector always orthogonal to the velocity vector?
 - (iii) Is the particle travelling clockwise or counter-clockwise?
 - (iv) Where is the particle at time $t = 0$?
 - (a) $\mathbf{r}(t) = (\cos(t - \pi/2), \sin(t - \pi/2))$
 - (b) $\mathbf{r}(t) = (\cos(t^2), \sin(t^2))$
4. Let $(x, y, z) = \mathbf{r}(t)$ be a parametrized curve that lies on the sphere of radius one centered at the origin. Let $\mathbf{v}(t) = \mathbf{r}'(t)$ be the velocity of the parametrized curve. Show that $\mathbf{r}(t)$ and $\mathbf{v}(t)$ are perpendicular for all t .