Groupwork 3: Section 12.1-12.4

You should work on and discuss this worksheet with members of your group. Your TA will assist as needed. Turn in your solutions either on this sheet or a separate sheet of paper. Be sure to include your name!

1. (a) Sketch the curve with position vector $\mathbf{r}(t) = t\mathbf{i} + \cos(\pi t)\mathbf{j} + \sin(\pi t)\mathbf{k}$, for $t \geq 0$.

    (b) Find the velocity and acceleration functions for this curve.

2. Find the position function for a particle that starts at the origin with initial velocity $\mathbf{i} - \mathbf{j} + 3\mathbf{k}$, and has acceleration given by $\mathbf{a}(t) = 6t\mathbf{i} + 12t^2\mathbf{j} - 6t\mathbf{k}$.

3. The helix $\cos t\mathbf{i} + \sin t\mathbf{j} + t\mathbf{k}$ intersects the curve $(1+t)\mathbf{i} + t^2\mathbf{j} + t^3\mathbf{k}$ at the point $(1, 0, 0)$. Find the angle of intersection of these curves at the point of intersection.

4. Find the length of a circular helix with equation $\mathbf{r}(t) = \cos t\mathbf{i} + \sin t\mathbf{j} + t\mathbf{k}$ from the point $(1, 0, 0)$ to the point $(1, 0, 2\pi)$. Is this curve closed? Is the given parametrization smooth?

5. At what point(s) (x_0, y_0, z_0) does the curve $\mathbf{r}(t) = t\mathbf{i} + (2t - t^2)\mathbf{k}$ intersect the paraboloid $z = x^2 + y^2$?

6. TRUE or FALSE?

    (a) The curve with vector equation $\mathbf{r}(t) = t^3\hat{\imath} + 2t^3\hat{\jmath} + 3t^3\hat{k}$ for $-\infty < t < \infty$ is a line.

    (b) Different parametrizations of the same curve result in identical tangent vectors at a given point on the curve.

    (c) If $\|\mathbf{r}(t)\| = 1$ for all t, then $\|\mathbf{r}'(t)\|$ is a constant.