Math 312 - AB1   Assignment # 2
Due January 30, 2007

Instructions

- This assignment is to be done by you individually - no group work.

- Show all main steps, and give exact answers to all problems.

- Please label the solutions #1, #2, ... on your assignment, rather than by corresponding textbook numbers.

- Bonus marks are available for well-written correct solutions to problems which (i) nobody else solved correctly, or (ii) nobody else attempted by your method.

1. Define $\vec{F}(t) = (3t)\hat{i} + 4\hat{j} + (3t^3 - 8t)\hat{k}$.

   (a) Find $\vec{F}'(t)$ and $\vec{F}''(t)$.
   (b) Show that $\vec{F}'(t)$ is always parallel to the xz-plane.
   (c) For which value(s) of t is $\vec{F}'(t)$ parallel to the xy-plane?
   (d) Find the speed v and unit tangent $\hat{T}$ for this curve when $t = 2$.

2. Define $\vec{F}(t) = 4\cos(t)\hat{i} + 4\sin(t)\hat{j}$, and $\vec{G}(t) = 2t\hat{i} - 3\hat{j} + t^2\hat{k}$.

   (a) Find $\dfrac{d}{dt}\left(|\vec{F}(t)|\right)$.

   (b) Find $\left|\dfrac{d}{dt}\left(\vec{F}(t)\right)\right|$.

   (c) Verify Equation (2.6) on text page 69 for this $\vec{F}(t)$ and $\vec{G}(t)$.
   (d) Verify Equation (2.7) on text page 69 for this $\vec{F}(t)$ and $\vec{G}(t)$.

3. Let C be the (directed) curve parameterized by

$$x = 3e^t \cos(t) \ , \ y = 5e^t \sin(t) \ , \ z = -4e^t \cos(t)$$

   (a) Find the arc length of C as $0 \le t \le 2\pi$.
   (b) Reparametrize the curve C in terms of arc length (as in text example 2.15).
   (c) Find two equations, each involving one or more of the variables x, y, z, which together express points on the curve C non-parametrically. (This is like finding *equations form of a line*.)

4. #8 from Section 2.2

5. Parametrize the right-handed helix whose axis is the line $x = y$ in the xy-plane, and which has radius 2 and pitch $\pi/3$.

6. #7 from Section 2.3

7. #16 from Section 2.3

8. #3 from Section 2.4

9. #7 from Section 2.4