Math 135 - Winter 2000

Homework to be done by February 24th

Homework to be done by March 9th


Section 13.1: Problems

Section 13.2: Problems

Section 13.3: Problems

Section 9.8: Problems

Section 13.4: Problems

1. Let \( \mathbf{r}(t) \) denote the position of a moving particle in 3-space at time \( t \). Also, let \( \mathbf{v}(t) = \frac{d\mathbf{r}}{dt} \) be its velocity, \( v(t) = \|\mathbf{v}(t)\| \) its speed, and \( \mathbf{a}(t) = \frac{d\mathbf{v}}{dt} \) its acceleration. Assume that the speed is never zero.

1.1. Show that the derivative of the speed is the component of the acceleration in the direction of motion:

\[
\frac{dv}{dt} = \text{comp}_{\mathbf{v}(t)} \mathbf{a}(t).
\]

1.2. Show that the speed is constant if and only if \( \mathbf{a}(t) \perp \mathbf{v}(t) \) for all \( t \).

2. Find the length of the curve

\[
\mathbf{r}(t) = [\log t] \mathbf{i} + [\log(4-t)] \mathbf{j} + \left[ \int_1^t \frac{\sqrt{8s - 2s^2}}{s(4-s)} \, ds \right] \mathbf{k}, \quad 1 \leq t \leq 2.
\]