M233 Spring 2004 Homework Assignment 2

Due: 23 February 2004

1. Sketch the graph of $\mathbf{r}(t) = t^2\mathbf{i} - \ln(t)\,\mathbf{j} + 2t\mathbf{k}$ for $1/100 \leq t \leq 2$. Calculate the velocity vector $\mathbf{r}'(1)$, the unit tangent vector $\mathbf{T}(1)$, and the tangent line to the curve at the point $P_0 = (1, 0, 2)$. At what point does this tangent line intersect the xz-plane?

2. What Cartesian equation describes the normal plane to the curve $\mathbf{r}(t) = t^2\mathbf{i} - \ln(t)\,\mathbf{j} + 2t\mathbf{k}$ at

   $P_0 = (1, 0, 2)$?

3. Calculate the arc length of $\mathbf{r}(t) = t^2\mathbf{i} - \ln(t)\,\mathbf{j} + 2t\mathbf{k}$ between the points $(1, 0, 2)$ and $(e^2, -1, 2e)$

4. Calculate the principal unit normal vector $\mathbf{N}$ to $\mathbf{r}(t) = t^2\mathbf{i} - \ln(t)\,\mathbf{j} + 2t\mathbf{k}$ at $P_0 = (1, 0, 2)$. State symmetric equations for the normal line to $\mathbf{r}(t)$ at $P_0 = (1, 0, 2)$. (This is the line through P_0 with direction vector $\mathbf{N}$.) Calculate the unit binormal vector $\mathbf{B}$ to $\mathbf{r}(t) = t^2\mathbf{i} - \ln(t)\,\mathbf{j} + 2t\mathbf{k}$ at $P_0 = (1, 0, 2)$. Find a Cartesian equation for the osculating plane of $\mathbf{r}$ at $P_0 = (1, 0, 2)$.

5. Calculate the curvature of $\mathbf{r}(t) = t^2\mathbf{i} - \ln(t)\,\mathbf{j} + 2t\mathbf{k}$ at $P_0 = (1, 0, 2)$. Describe the circle of curvature of $\mathbf{r}$ at $P_0 = (1, 0, 2)$.