Tutorial Worksheet

Show all your work.

1. The initial position and velocity of an object moving with acceleration $\mathbf{a} = e^t\mathbf{i}$ are $\mathbf{r}(0) = 2\mathbf{i} + 3\mathbf{j} + 2\mathbf{k}$ and $\mathbf{v}(0) = \mathbf{i} + \mathbf{j} + \mathbf{k}$. Find its position at time t.

2. Find the equations for the normal and osculating planes to the curve $\mathbf{r}(t) = 2\cos(3t)\mathbf{i} + t\mathbf{j} + 2\sin(3t)\mathbf{k}$ at the point $(-2, \pi, 0)$.

3. Find the unit tangent, unit normal, and binormal vectors to the curve $\mathbf{r}(t) = \langle t^2, t^3, t^4 + t^2 \rangle$ at $t = 1$.

4. Find the length of the curve $\mathbf{r}(t) = \langle e^{2t}, t, 2e^t \rangle$ on the interval $0 \leq t \leq 3$.