MATH 2153 - Calculus III – Recitation 3

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1. (a) Give the parametric equations for the line through the points $P = (1, 2, 2)$, $Q = (3, 0, -1)$

   (b) Give the vector equation for the line through the point $(-1, 1, 3)$, parallel to the vector $\langle 2, -3, 4\rangle$.

2. (a) Decide if the lines $\mathbf{r}(t) = \langle 1+t, 2-t, 3-3t\rangle$ and the line $\mathbf{q}(s) = \langle -1+s, 2-2s, -2-s\rangle$ intersect, and if so, give their intersection points.

   (b) Do the lines $\mathbf{r}(t) = \langle 3+t, 2-t, 3-3t\rangle$ and $\mathbf{q}(s) = \langle 4+s, 2-2s, -2-s\rangle$ intersect?

3. Draw the curve $\mathbf{r}(t) = \langle t\cos t, t\sin t, t\rangle$ for $t \geq 0$. (*Hint:* Draw the projection to the xy-plane first).

4. Suppose $\mathbf{r}(t) = \langle f(t), g(t), h(t)\rangle$ is defined on $\mathbb{R}$ and f is not continuous at $t = 1$. Can $\mathbf{r}$ be continuous at $t = 1$?

5. Compute the unit tangent vector $\mathbf{T}(t)$ to the function $\mathbf{r}(t) = (\ln t)\,\mathbf{i} + \frac{1}{t}\,\mathbf{j} + \frac{1}{t^2}\,\mathbf{k} \quad (t > 0)$. Is $\mathbf{T}(t)$ continuous on its domain?

6. The acceleration of an object with initial position vector $\mathbf{r}(0) = 2\mathbf{i}$ and initial velocity vector $\mathbf{v}(0) = 3\mathbf{i} - 3\mathbf{j}$ is given by the vector-valued function $\mathbf{a}(t) = t^2\,\mathbf{i} + e^t\,\mathbf{j} \quad (t \geq 0)$.

   (a) Give the velocity function $\mathbf{v}(t)$.

   (b) Give the position function $\mathbf{r}(t)$.

7. A ball rolls of the edge of a table 1 m high with the speed of 2 m/s. Find the distance d from the table to where the ball lands.