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 \( \mathbf{r}(t) = (f(t), g(t), h(t)) \) 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 \( \mathbf{r}(t) = (\ln t) \mathbf{i} + \frac{1}{t} \mathbf{j} + \frac{1}{t^2} \mathbf{k} \ (t > 0) \). 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 \( \mathbf{a}(t) = t^2 \mathbf{i} + e^t \mathbf{j} \ (t \geq 0) \).

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

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

7. A ball rolls off 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.

![Diagram of a ball rolling off a table]