Problem Set 1 - Math Tutorial Calculus II

1. Write the vectors $(9, 6)$ and $(1, 2, -3)$ using the standard basis vectors of $\mathbb{R}^2$ and $\mathbb{R}^3$, respectively. Draw both vectors in in the xy-coordinate system and xyz-coordinate system.

2. Find the displacement vector from $P_1 = (1, 0, 2)$ to $P_2 = (2, 1, 7)$. Sketch the two points P_1, P_2 and their displacement vector.

3. Let $\mathbf{a} = (2, 0)$ and $\mathbf{b} = (1, 1)$. For $0 \leq s \leq 1$ and $0 \leq t \leq 1$, consider the vector $\mathbf{x} = s\mathbf{a} + t\mathbf{b}$. Explain why the vector x lies in the parallelogram determined by $\mathbf{a}$ and $\mathbf{b}$.

4. Give a set of parametric equations for the line in $\mathbb{R}^3$ which goes through the point $(12, -2, 0)$ that is parallel to the vector $5\mathbf{i} - 12\mathbf{j} + \mathbf{k}$. Moreover, write down the symmetric equations describing that line.

5. Find where the line given by $x = 3t - 5$, $y = 2 - t$, $z = 6t$ intersects the plane $x + 3y - z = 19$.

6. Do the parametric equations $x = 5t^2 - 1$, $y = t^2 + 3$ and $z = 1 - t^2$ determine a line? Explain.

7. Find the points of intersection of the line $x = 2t - 3$, $y = 3t + 2$, $z = 5 - t$ with each of the coordinate planes $x = 0$, $y = 0$ and $z = 0$.