Problem 1 Consider the planes \( x - y + 5z = 1 \) and \( x + y = 2 \). Find a point-vector representation of their line of intersection \( p + tv \).

Problem 2 Consider the plane \( P \) defined by \( 3x - 4y + z = 16 \).

a) Find an equation for the plane parallel to \( P \) and containing the point \((5, 0, -22)\).

b) Find the distance of the plane \( P \) from the origin.

Problem 3 Consider the vectors \( u = [1, -2, 2] \) and \( v = [4, 3, -1] \).

a) Find the angle between \( u, v \). Round the angle to two decimals in degrees.

b) Find the area of the parallelogram given by \( u \) and \( v \).

Problem 4 Consider the curve in the plane for \( t \in (-\pi, \pi) \) given by

\[
\begin{align*}
x &= t^2 - \cos(t) \\
y &= \sin(t).
\end{align*}
\]

a) Find all values of \( t \) where this curve is not smooth, or explain why there are none.

b) Find the velocity vector \( v \) and the acceleration vector \( a \) as functions of \( t \).

c) Find the speed at time \( t = \pi/2 \).

Problem 5 Consider the curve given by

\[
\mathbf{r}(t) = (3 + 2t)\mathbf{i} + t^2\mathbf{j} - t\mathbf{k}.
\]

a) Calculate the velocity vector \( v \) and the acceleration vector \( a \).

b) Find a point-vector representation of the tangent line to this curve at \( t = 2 \).

c) Find all times \( t \) when the velocity vector is perpendicular to the \( y \)-axis.

Problem 6 Find the limit

\[
L = \lim_{t \to 0} \frac{2e^t + \cos(t) - 3}{t} \mathbf{i} + \frac{4}{t-1} \mathbf{j} + \frac{\sin(t^2)}{t^2} \mathbf{k}
\]

as \( t \) approaches 0.
Problem 7  A spaceship travels with velocity vector \([10, 20, 30]\) initially when a rocket motor is ignited, providing a constant acceleration of \(a = [-12, 6, -4]\).

a) Find the velocity vector \(v\) at time \(t \geq 0\) as long as the motor is running.

b) If the initial position of the spaceship was \([1000, 0, 0]\), what is the position at \(t = 4\)?