1. Consider a line that passes through the point \( P = (0, -1, 0) \) and is parallel to the vector \( \mathbf{v} = (2, 1, 3) \). Also consider the plane \( 2x + y + 2z = 3 \).

(a) Find a parameterization of the line.

\[ \text{Solution:} \] Use the point as the position vector, \( \mathbf{r}_0 = \overrightarrow{OP} = (0, -1, 0) \), where \( O \) is the origin. The vector from \( P \) to any other point on the line is parallel to \( \mathbf{v} \), and is therefore a scalar multiple of \( \mathbf{v} \), written as \( (2t, t, 3t) \). Thus the equation for the line is \( \mathbf{r}_0 + t \mathbf{v} = (2t, t - 1, 3t) \).

(b) Find the point where the line intersects the plane.

\[ \text{Solution:} \] Plug the \( x, y, \) and \( z \) components of the line into the plane. The result is \( 2(2t) + (t - 1) + 2(3t) = 3 \). Solving for \( t \) yields \( t = \frac{4}{11} \). Plugging this into the line equation gives the intersection point \( \left( \frac{8}{11}, -\frac{7}{11}, \frac{12}{11} \right) \).