1. Find parametric equations and symmetric equations of the line through the points (3, 7, 1) and (3, 4, 5).

Let \( \vec{r}_0 = \langle 3, 7, 1 \rangle \), \( \vec{r}_1 = \langle 3, 4, 5 \rangle \).

Then let \( \vec{r}(t) = \vec{r}_0 + t(\vec{r}_1 - \vec{r}_0) = \langle 3, 7, 1 \rangle + t \langle 0, -3, 4 \rangle = \langle 3, 7 - 3t, 1 + 4t \rangle \).

\[
\begin{align*}
  x &= 3 + 3t \\
  y &= 7 - 3t \\
  z &= 1 + 4t
\end{align*}
\]

2. Find the point of intersection of the line \( x = 1 + 2t \), \( y = 2 + t \), \( z = 4 \), with the plane \( x + y + z = 10 \).

Substitute the line into the plane equation:

\[
\begin{align*}
  (1 + 2t) + (2 + t) + 4 &= 10 \\
  3t + 7 &= 10 \\
  3t &= 3 \\
  t &= 1
\end{align*}
\]

\( \therefore (x, y, z) = (1 + 2(1), 2 + 1, 4) = (3, 3, 4) \)

3. One plane has axis intercepts (3, 0, 0), (0, 3, 0), and (0, 0, 6). A second plane has axis intercepts (9, 0, 0), (0, 9, 0), and (0, 0, 18).

a. Find an equation of the first plane.

\[
\frac{x}{3} + \frac{y}{3} + \frac{z}{6} = 1 \quad \text{or} \quad 2x + 2y + z = 6
\]

b. Find an equation of the second plane.

\[
\frac{x}{9} + \frac{y}{9} + \frac{z}{18} = 1 \quad \text{or} \quad 2x + 2y + z = 18
\]

c. Find the distance between the two planes.

Let \( \vec{n} = \langle 2, 2, 1 \rangle \).

Then \( |\vec{n}| = \sqrt{2^2 + 2^2 + 1^2} = 3 \) and \( \frac{\vec{n}}{|\vec{n}|} = \langle \frac{2}{3}, \frac{2}{3}, \frac{1}{3} \rangle \) is a unit vector.

Plane 1: \( \frac{2}{3} x + \frac{2}{3} y + \frac{1}{3} z = 2 \) lies 2 units from the origin.

Plane 2: \( \frac{2}{3} x + \frac{2}{3} y + \frac{1}{3} z = 6 \) lies 6 units from the origin.

\( \therefore \text{The two planes lie } 6 - 2 = 4 \text{ units apart} \).