\( x = \langle 0, -1, 3 \rangle \) and \( y = \langle -3, 1, 1 \rangle \)

\[ \cos \theta = \frac{x \cdot y}{|x||y|} = \frac{3}{\sqrt{10} \sqrt{11}} = \frac{3}{\sqrt{110}}, \text{ so } \theta = \cos^{-1} \left( \frac{3}{\sqrt{110}} \right) \]

3. \( \mathbf{n} = \langle 0, -1, 1 \rangle \), so the plane has equation

\[-y + z = d \text{ where } d = -2 + 3 = 1 \]

\[-y + z = 1 \]

4. \( \mathbf{n} = \langle 1, -2, -1 \rangle \), so the plane has equation

\[x - 2y - z = d \text{ where } d = 1 - 2(0) - (-3) = 4 \]

\[x - 2y - z = 4 \]

5. \( \mathbf{P}(5, 4, -1), \mathbf{Q}(3, 0, 3) \) \let \mathbf{a} = \mathbf{PQ} = \langle -5, -4, 4 \rangle \\using \mathbf{P} as the point gives \[x = 5 - 3t, \ y = 4 + 4t, \ z = -1 + 4t, t \in \mathbb{R} \]

\[ \text{Remark: Using } \mathbf{Q} \text{ instead would give } x = 2 - 3t, \ y = -4t, \ z = 3 + 4t, t \in \mathbb{R} \]

6. \( \mathbf{P}(2, -3, 1), \mathbf{Q}(-5, 2, 1) \) \let \mathbf{a} = \mathbf{PQ} = \langle 7, 5, 0 \rangle \\
using \mathbf{P} as the point gives \[x = 2 + 7t, \ y = -3 - 5t, \ z = 1, t \in \mathbb{R} \]

\[ \text{Remark: We could also use } -\mathbf{a} = \mathbf{PQ} \text{ as a direction vector, and we could use } \mathbf{Q} \text{ as the point.} \]

7. \[ \mathbf{n} = \langle 1, 2, 1 \rangle, \text{ so the plane has equation } x + 2y + z = d \text{ where } d = 1 + 2(-1) + 2 = 1 \]

\[ x + 2y + z = 1 \]

8. \[ \mathbf{P}(0, -3, 2), \mathbf{Q}(1, -2, 3) \] \let \mathbf{a} = \mathbf{PQ} = \langle -1, 1, 1 \rangle \]

\[ \text{The line is given by } x = -t, \ y = -3 + t, \ z = 2 + t, t \in \mathbb{R} \]

9. \[ \text{The plane and line intersect where } (\mathbf{n} \cdot \mathbf{r}) + (\mathbf{n} \cdot \mathbf{d}) = 0 \]

\[-t - 2(-3 + t) = 1 \]

\[ t - 6 + 2t = 1, \ 3t = 5, \ t = \frac{5}{3} \]

\[ x = -\frac{5}{3}, \ y = -\frac{1}{3}, \ z = \frac{9}{4} \]

10. \[ x + 2y - z = -1 \] has normal vector \( \mathbf{n} = \langle 1, 2, -1 \rangle \).

\( \text{since the line is perpendicular to the plane,} \)

\( \mathbf{n} \) is a direction vector for the line:

\[ x = 5 + t, \ y = -3 + 2t, \ z = 4 - t, \ t \in \mathbb{R} \]