3. For this line, we have \( \mathbf{r}_0 = 2\mathbf{i} + 2.4\mathbf{j} + 3.5\mathbf{k} \) and \( \mathbf{v} = 3\mathbf{i} + 2\mathbf{j} - \mathbf{k} \), so a vector equation is
\[
\mathbf{r} = \mathbf{r}_0 + t\mathbf{v} = (2\mathbf{i} + 2.4\mathbf{j} + 3.5\mathbf{k}) + t(3\mathbf{i} + 2\mathbf{j} - \mathbf{k}) = (2 + 3t)\mathbf{i} + (2.4 + 2t)\mathbf{j} + (3.5 - t)\mathbf{k}
\]
and parametric equations are 
\[
x = 2 + 3t, \quad y = 2.4 + 2t, \quad z = 3.5 - t.
\]

4. This line has the same direction as the given line, \( \mathbf{v} = 2\mathbf{i} - 3\mathbf{j} + 9\mathbf{k} \). Here \( \mathbf{r}_0 = 14\mathbf{j} - 10\mathbf{k} \), so a vector equation is
\[
\mathbf{r} = (14\mathbf{j} - 10\mathbf{k}) + t(2\mathbf{i} - 3\mathbf{j} + 9\mathbf{k}) = 2t\mathbf{i} + (14 - 3t)\mathbf{j} + (-10 + 9t)\mathbf{k}
\]
and parametric equations are 
\[
x = 2t, \quad y = 14 - 3t, \quad z = -10 + 9t.
\]

7. The vector \( \mathbf{v} = \langle -4, -1, 3, -3, 0, -2 \rangle = \langle -5, 0, -2 \rangle \) is parallel to the line. Letting \( P_0 = (1, 3, 2) \), parametric equations are
\[
x = 1 - 5t, \quad y = 3 + 0t = 3, \quad z = 2 - 2t,
\]
while symmetric equations are
\[
\frac{x - 1}{-5} = \frac{z - 2}{-2}, \quad y = 3.\] Notice here that the direction number \( b = 0 \), so rather than writing \( \frac{y - 3}{0} \) in the symmetric equation we must write the equation \( y = 3 \) separately.

11. The line has direction \( \mathbf{v} = \langle 1, 2, 1 \rangle \). Letting \( P_0 = (1, -1, 1) \), parametric equations are \( x = 1 + t, \ y = -1 + 2t \), \( z = 1 + t \)
and symmetric equations are \( x - 1 = \frac{y + 1}{2} = z - 1 \).

13. Direction vectors of the lines are \( \mathbf{v}_1 = \langle -2 - (-4), 0 - (-6), -3 - 1 \rangle = \langle 2, 6, -4 \rangle \) and \( \mathbf{v}_2 = \langle 5 - 10, 3 - 18, 14 - 4 \rangle = \langle -5, -15, 10 \rangle \), and since \( \mathbf{v}_2 = -\frac{5}{2}\mathbf{v}_1 \), the direction vectors and thus the lines are parallel.

17. From Equation 4, the line segment from \( \mathbf{r}_0 = 2\mathbf{i} - \mathbf{j} + 4\mathbf{k} \) to \( \mathbf{r}_1 = 4\mathbf{i} + 6\mathbf{j} + \mathbf{k} \) is
\[
\mathbf{r}(t) = (1 - t)\mathbf{r}_0 + t\mathbf{r}_1 = (1 - t)(2\mathbf{i} - \mathbf{j} + 4\mathbf{k}) + t(4\mathbf{i} + 6\mathbf{j} + \mathbf{k}) = (2i - j + 4k) + t(2i + 7j - 3k), 0 \leq t \leq 1.
\]

20. The lines aren’t parallel since the direction vectors \( \langle 2, 3, -1 \rangle \) and \( \langle 1, 1, 3 \rangle \) aren’t parallel. For the lines to intersect we must be able to find one value of \( t \) and one value of \( s \) that produce the same point from the respective parametric equations. Thus we need to satisfy the following three equations: \( 1 + 2t = -1 + s, \ 3t = 4 + s, \ 2t = 1 + 3s \). Solving the first two equations we get \( t = 6, \ s = 14 \) and checking, we see that these values don’t satisfy the third equation. Thus \( L_1 \) and \( L_2 \) aren’t parallel
and don’t intersect, so they must be skew lines.

21. Since the direction vectors \( \langle 1, 2, 3 \rangle \) and \( \langle -4, -3, 2 \rangle \) are not scalar multiples of each other, the lines are not parallel, so we check to see if the lines intersect. The parametric equations of the lines are \( L_1: \ x = t, \ y = 1 + 2t, \ z = 2 + 3t \) and \( L_2: \ x = 3 - 4s, \ y = 2 - 3s, \ z = 1 + 2s \). For the lines to intersect, we must be able to find one value of \( t \) and one value of \( s \) that produce the same point from the respective parametric equations. Thus we need to satisfy the following three equations:
\[
t = 3 - 4s, \ 1 + 2t = 2 - 3s, \ 2 + 3t = 1 + 2s.
\]
Solving the first two equations we get \( t = -1, \ s = 1 \) and checking, we see that these values don’t satisfy the third equation. Thus the lines aren’t parallel and don’t intersect, so they must be skew lines.
22. Since the direction vectors \((2, 2, -1)\) and \((1, -1, 3)\) aren’t parallel, the lines aren’t parallel. Here the parametric equations are \(L_1: x = 1 + 2t, y = 3 + 2t, z = 2 - t\) and \(L_2: x = 2 + s, y = 6 - s, z = -2 + 3s\). Thus, for the lines to intersect, the three equations \(1 + 2t = 2 + s, 3 + 2t = 6 - s,\) and \(2 - t = -2 + 3s\) must be satisfied simultaneously. Solving the first two equations gives \(t = 1, s = 1\) and, checking, we see that these values do satisfy the third equation, so the lines intersect when \(t = 1\) and \(s = 1\), that is, at the point \((3, 5, 1)\).