13. A line, \( L \), has equation \( \frac{x+1}{2} = \frac{y-2}{1} = \frac{z}{-1} \).

(a) Find the Cartesian equation of the plane, perpendicular to the line \( L \), which passes through the point \( P(1,1,0) \).

(b) Find the shortest distance from \( P \) to \( L \) and explain why this is the shortest distance.
<table>
<thead>
<tr>
<th>Question</th>
<th>Generic scheme</th>
<th>Illustrative scheme</th>
<th>Max mark</th>
</tr>
</thead>
</table>
| 13. (a)  | •¹ find normal vector  
•² substitute into equation of the plane  
•³ find the equation of plane | •¹ $2i + j - k$  
•² $2x + y - z = d$  
•³ $2x + y - z = 3$ | 3 |
| (b)      | •⁴ find parametric equations for the line  
•⁵ substitute into equation of plane  
•⁶ solve for $t$  
•⁷ calculate coordinates  
•⁸ components of $PQ$  
•⁹ find shortest distance  
•¹⁰ explanation | •⁴ $x = -1 + 2t$, $y = 2 + t$, $z = -t$  
•⁵ $2(-1 + 2t) + (2 + t) - (-t) = 3$  
•⁶ $\frac{1}{2}$  
•⁷ $(0, \frac{5}{2} - \frac{1}{2})$  
•⁸ \[
\begin{bmatrix}
1 \\
3 \\
-1 \\
\end{bmatrix} \\
\begin{bmatrix}
\frac{3}{2} \\
\frac{1}{2} \\
\end{bmatrix}
\]  
•⁹ $\sqrt{7}$  
•¹⁰ $PQ$ is perpendicular to $L$. | 7 |