

2. b) The direction vector for l is

$$\underline{d} = \underline{n} = \begin{bmatrix} -3 \\ -3 \\ 3 \end{bmatrix}$$

So l has equation

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} + t \underline{d} = \begin{bmatrix} 2 \\ 3 \\ 4 \end{bmatrix} + t \begin{bmatrix} -3 \\ -3 \\ 3 \end{bmatrix}$$

Thus

$$\begin{aligned} x &= 2 - 3t \\ y &= 3 - 3t \\ z &= 4 + 3t \end{aligned}$$

The equation of the plane is

$$-x - y + z = 2$$

$$-(2 - 3t) - (3 - 3t) + (4 + 3t) = 2$$

$$-2 + 3t - 3 + 3t + 4 + 3t = 2$$

$$9t - 1 = 2$$

$$9t = 3 \rightarrow t = \frac{1}{3}$$

Thus

$$\begin{aligned} x &= 2 - 3 \cdot \frac{1}{3} = 2 - 1 = 1 \\ y &= 3 - 3 \cdot \frac{1}{3} = 3 - 1 = 2 \\ z &= 4 + 3 \cdot \frac{1}{3} = 4 + 1 = 5 \end{aligned}$$

The point of intersection is $(1, 2, 5)$.