Q 109: Find the vector equation of the line passing through the point $\begin{pmatrix} 1 \\ 2 \\ -4 \end{pmatrix}$ and perpendicular to the two lines

$\frac{x-8}{3} = \frac{y+19}{-16} = \frac{z-10}{7}$ and

$\frac{x-15}{3} = \frac{y-29}{8} = \frac{z-5}{5}$

Sol: The vector perpendicular to the 2 lines can be calculated by taking the cross-product of lines.

$$a = \begin{vmatrix} i & j & k \\ 3 & -16 & 7 \\ 3 & 8 & -5 \end{vmatrix}$$

$= i(-16 * (-5) - 8 * 7) - j(3 * (-5) - 3 * 7) + k(3 * 8 - (-16) * 3)$

$$= 24i + 36j + 72k$$

It passes through (1 2 -4) so the equation of vector is
$(i + 2j - 4k) + L(24i + 36j + 72k)$
,where L is any constant

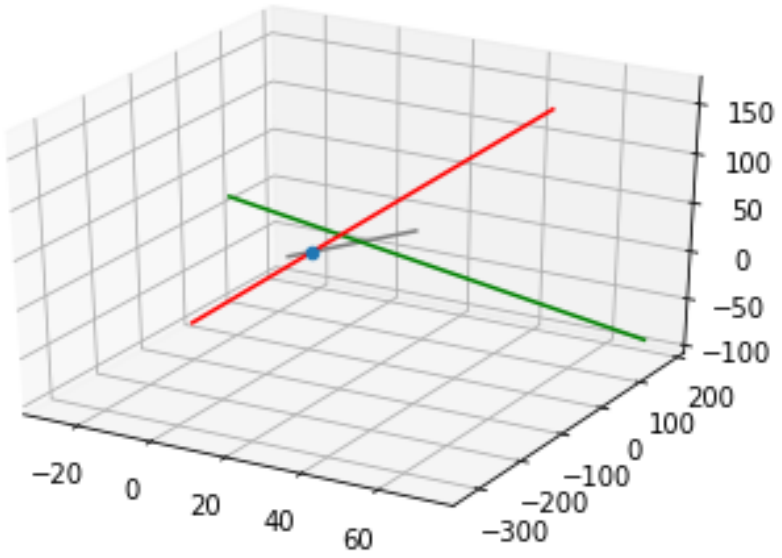

Figure 1: perpendicular