Consider the plane $x - 2y + 4z = -15$ and the line

$x = 3 + k\lambda$

$y = -2 + \lambda$

$z = (2k + 6) - 2\lambda$

The line and the plane are perpendicular. Find

a) The value of k

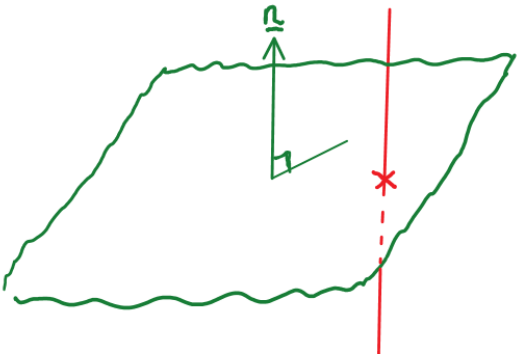
b) The coordinates of the point of intersection of the line and the plane.

a)

Normal to the plane $= \begin{pmatrix} 1 \\ -2 \\ 4 \end{pmatrix}$

Direction of line $= \begin{pmatrix} k \\ 1 \\ -2 \end{pmatrix}$

If line and plane are **perpendicular**, then line is **parallel** to normal to the plane



$$\begin{pmatrix} 1 \\ -2 \\ 4 \end{pmatrix} = a\begin{pmatrix} k \\ 1 \\ -2 \end{pmatrix}$$

$$\begin{pmatrix} 1 \\ -2 \\ 4 \end{pmatrix} = -0.5\begin{pmatrix} k \\ 1 \\ -2 \end{pmatrix}$$

$$k = -0.5$$

b)

Equation line $x = 3 - 0.5\lambda$

$y = -2 + \lambda$

$z = 5 - 2\lambda$

Substitute these values into equation of the plane

$$(3 - 0.5\lambda) - 2(-2 + \lambda) + 4(5 - 2\lambda) = -15$$

Solve for λ $3 - 0.5\lambda + 4 - 2\lambda + 20 - 8\lambda = -15$

$42 = 10.5\lambda$

$\lambda = 4$

Substitute in to equation of line

$x = 3 - 0.5(4) = 1$

$y = -2 + (4) = 2$

$z = 5 - 2(4) = -3$

Point of intersection $(1,2,-3)$