Find the intersection of two planes Π_1 and Π_2 in the form $\boldsymbol{r} = \boldsymbol{a} + \lambda\boldsymbol{b}$ where the components of **b** are integers.

Π_1: $x + 2y - z = 5$
Π_2: $2x - y + 3z = -4$

$$x + 2y - z = 5 \qquad A$$
$$2x - y + 3z = -4 \qquad B$$

$3B$ $3x + 6y - 3z = 15$

Eliminate z

$A \times 3 + B$ $5x + 5y = 11$

write y in terms of x

$$5y = -5x + 11$$
$$y = -x + \frac{11}{5}$$

$$x + 2y - z = 5 \qquad A$$
$$2x - y + 3z = -4 \qquad B$$

$B \times 2$ $4x - 2y + 6z = -8$
A $x + 2y - z = 5$

Eliminate y

$B \times 2 + A$ $5x + 5z = -3$

write z in terms of x $z = -x - \frac{3}{5}$

So our equations become

$$x = x$$
$$y = -x + \frac{11}{5}$$
$$z = -x - \frac{3}{5}$$

Let $x = \lambda$

$$x = \lambda$$
$$y = -\lambda + \frac{11}{5}$$
$$z = -\lambda - \frac{3}{5}$$

Write in vector form

$$\boldsymbol{r} = \begin{pmatrix} 0 \\ \frac{11}{5} \\ -\frac{3}{5} \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ -1 \\ -1 \end{pmatrix}$$