

**Question 1.** (5 marks) Given the following planes:  $\mathcal{P}_1 : x + y + kz = 0$ ,  $\mathcal{P}_2 : x + ky + z = 0$ ,  $\mathcal{P}_3 : kx + y + z = 0$ . Find the value(s) of  $k$ , if any, such that the intersection between the planes is a point, a line, or a plane.

**Question 2.** Given two planes:

$$\begin{aligned}\mathcal{P}_1 &: x - 2y + z = 1 \\ \mathcal{P}_2 &: -4x + 8y - 4z = -4\end{aligned}$$

- a. (1 mark) Give an argument to explain why the intersection of the two planes is a plane.
- b. (2 marks) Find the solution set of the associated homogeneous linear system.
- c. (2 marks) Show that the solution set of the associated homogeneous linear system is orthogonal to the rows of the coefficient matrix of the system.
- d. (2 marks) Give a geometrical interpretation to part c).
- e. (1 mark) Find a particular solution of the linear system by inspection.
- f. (2 marks) Without solving the linear system directly find the solution to the linear system.
- g. (2 marks) Give a geometrical interpretation on how the solution was found in part f).