1) Consider the following sets of equations. For each set, determine if the equations are homogeneous or inhomogeneous, and whether the solution is trivial, infinite, or unique. If there is a unique solution, write it down. If there are an infinite number of solutions, pick one and show that it works. Check your results in Mathematica. For the equations that have a unique solution, graph the lines or planes in Mathematica to help visualize the solution.

(a) $\begin{aligned} 3x-2y&=5 \\ -x-7y&=2 \end{aligned}$ (b) $\begin{aligned} 5x+2y&=-1 \\ 15x+6y&=-10 \end{aligned}$ (c) $\begin{aligned} 2x-y&=0 \\ -x-y&=0 \end{aligned}$

(d) $\begin{aligned} 6x+4y&=2 \\ 3x-5y&=-34 \end{aligned}$ (e) $\begin{aligned} 5x+2y&=0 \\ 15x+6y&=0 \end{aligned}$ (f) $\begin{aligned} 4y+3z&=8 \\ 2x-z&=2 \\ 3x+2y&=5 \end{aligned}$

(g) $\begin{aligned} x+y-z&=9 \\ 8y+6z&=-6 \\ -2x+4y-6z&=40 \end{aligned}$ (h) $\begin{aligned} 1.3x-9.1y+11.7z&=0 \\ -0.9x+6.3y-8.1z&=0 \end{aligned}$

2) Consider the following sets of equations. For each case, discuss whether you think the equations have no solutions, a unique solution, or an infinite number of solutions. Then use Mathematica to check your reasoning.

(a) $\begin{aligned} 7x-4y-2z&=-6 \\ 16x+2y+z&=3 \end{aligned}$ (b) $\begin{aligned} 12x-26y+34z&=18 \\ -30x+65y-85z&=-46 \end{aligned}$ (c) $\begin{aligned} x-y+z&=0 \\ -x+y-z&=0 \\ 10y+25z&=90 \\ 20x+10y&=80 \end{aligned}$

3) Find the eigenvalues and eigenvectors for each of the following matrices.

(a) $\mathbf{M}_1=\begin{pmatrix} -1 & 2 & 1 \\ 2 & 3 & 0 \\ 1 & 0 & 3 \end{pmatrix}$ (b) $\mathbf{M}_2=\frac{1}{3}\begin{pmatrix} -1 & 2 & 2 \\ 2 & -1 & 2 \\ 2 & 2 & -1 \end{pmatrix}$