1) For each of the following set of equations write and row reduce the augmented matrix to find out whether the given set of equations has exactly one solution, no solutions, or an infinite set of solutions. Check that your answers satisfy the equations. Check your results in Mathematica.

(a) $$\begin{aligned} 4x + 4y - 12z &= 2 \\ 6x - 2y + 7z &= 3 \\ 8x + 3y - 8z &= 9 \end{aligned}$$

(b) $$\begin{aligned} x + 3y &= 4 \\ x - 2y + z &= 1 \\ 2x + y + z &= 5 \end{aligned}$$

2) Find the determinant for each of the following matrices. Check your results in Mathematica.

(a) $$\begin{pmatrix} 5 & 17 & 3 \\ 2 & 4 & -3 \\ 11 & 0 & 2 \end{pmatrix}$$

(b) $$\begin{pmatrix} 1 & 1 & 1 & 1 \\ 1 & 2 & 3 & 4 \\ 1 & 3 & 6 & 10 \\ 1 & 4 & 10 & 20 \end{pmatrix}$$

3) Use Cramer's rule to solve (a) in problem 1. Do it first by hand, and then use Mathematica to help you (see if you can use only one line of Mathematica code to find x – similarly for y and z). Why didn't I ask you to use Cramer's rule on (b) in problem 1?

4) Find the angle between the space diagonal of a cube and a diagonal of a face of the cube.

5) Show that the vectors $2\hat{x} - 1\hat{y} + 4\hat{z}$ and $5\hat{x} + 2\hat{y} - 2\hat{z}$ are orthogonal. Find a third vector perpendicular to both.

6) Find the symmetric equations and parametric equations for a line through the point $P = (4, -1, 3)$ and parallel to the vector $\vec{A} = 1\hat{x} - 2\hat{z}$

7) Find the equation of the plane through the points $P_1 = (0, 1, 1)$, $P_2 = (2, 1, 3)$, and $P_3 = (4, 2, 1)$.