1. Let $A = \begin{bmatrix} 2 & -1 & -1 \\ 0 & 4 & 0 \\ 6 & 3 & 7 \end{bmatrix}$; let $\mathbf{v} = \begin{bmatrix} 1 \\ 0 \\ -3 \end{bmatrix}$.

1A. Find $A\mathbf{v}$. The result tells you one eigenvalue of A. What is that eigenvalue?

1B. FACT: Another eigenvalue of A is $\lambda = 4$ and it has multiplicity 2 (you do NOT have to show this). Find a basis for the eigenspace corresponding to $\lambda = 4$.

1C. Find a pair of matrices P and D that show A is diagonalizable (according to our definition of diagonalization); just give P and D and label them (you do NOT need to find P^{-1} or compute PDP^{-1}). If A is not diagonalizable, explain why it isn't.

2. Let $\mathbf{a} = \begin{bmatrix} 3 \\ -4 \\ 5 \end{bmatrix}$, $\mathbf{b} = \begin{bmatrix} 4 \\ x \\ 4 \end{bmatrix}$ and $\mathbf{c} = \begin{bmatrix} 10 \\ 5 \\ 1 \end{bmatrix}$.

2A) Find a unit vector in the direction of $\mathbf{a}$.

2B) Find all values of x for which $\mathbf{a} \perp \mathbf{b}$.

2C) Find the distance between $\mathbf{a}$ and $\mathbf{c}$; show your work.