1. (1 point) 
Find the best (least squares) straight-line fit $C +Dt$ to the measurements $b = 4$ at $t = -2$, $b = 3$ at $t = -1$, $b = 1$ at $t = 0$, and $b = 0$ at $t = 2$.

2. (1 point) 
Find orthogonal vectors $q_1, q_2, q_3$ in the subspace $S$ spanned by $a = (0, 0, 1, 0, 1), b = (-1, 0, 0, 1, 0), c = (0, -1, 1, 0, -1)$. Add one more vector to your list to create an orthogonal basis for some 4-dimensional subspace of $\mathbb{R}^5$.

3. (1 point) 
Using cofactor expansion compute the determinant of $A$ (show your work!):

$$A = \begin{bmatrix}
  a^2 & 1 & 1 & 1 \\
  1 & 0 & 0 & 1 \\
  1 & 1 & 0 & 1 \\
  1 & 1 & 1 & a
\end{bmatrix}$$

4. (2 points) 
Find the eigenvalues and eigenvectors (a basis for each eigenspace) corresponding to the matrix:

$$A := \begin{bmatrix}
  0 & -2 & -3 \\
  1 & 3 & 3 \\
  0 & 0 & 1
\end{bmatrix}$$

5. (3 points) 
The sets $L_1 = \{P(x) = (0, x, x) : x \in \mathbb{R}\}$ and $L_2 = \{Q(y) = (2y, y, -1) : y \in \mathbb{R}\}$ are two lines in space.

(a) Choose the values of $x$ and $y$ that minimize the squared distance $\|P(x) - Q(y)\|^2$.

(b) If a rocket starts at the origin ($P(0) = (0, 0, 0)$) and moves towards $P_4 = (0, 3, 3)$ following the line $L_1$ with speed 1 unit of length per second, how long would it take to reach $P_4$?