1. \( \mathbf{b} \in \text{span} \left( \mathbf{v}_1, \mathbf{v}_2 \right) \)

2. \( \mathbf{b} = \mathbf{v}_1 + 2 \mathbf{v}_2 \)

3. \( \mathbf{E} \) is identity (all invertible \( nxn \) matrices reduce to the identity)

4. All of them. If an \( nxn \) matrix reduces to identity, it must be invertible \( \Rightarrow A \mathbf{x} = 0 \) has only the trivial sol'n \( \Rightarrow \) its columns cannot be expressed as a linear combination of each other. For each matrix in the problem, there is one that slice lies in the \( x_2 = 0 \) plane. The other two both do not lie in lie in this plane, nor are they multiples of each other. So the columns cannot possibly be linear combinations of each other.
The parabola has the form

\[ y = ax^2 + bx + c \]

We need to find the constants \( a, b, c \) from the 3 data points:

\((-1, 9)\) \quad 9 = a - b + c

\((1, 5)\) \quad 5 = a + b + c

\((2, 12)\) \quad 12 = a + 2b + 4c

So, the matrix equation is:

\[
\begin{pmatrix}
1 & -1 & 1 \\
1 & 1 & 1 \\
2 & 4 & 4
\end{pmatrix}
\begin{pmatrix}
a \\
b \\
c
\end{pmatrix} =
\begin{pmatrix}
9 \\
5 \\
12
\end{pmatrix}
\]