1. (a) $\det(A^{-1}) = 1/\det(A) = 1/3$.
   
   (b) $A$ has full rank since it is nonsingular. Thus $\text{rank } A = 3$.
   
   (c) not enough information
   
   (d) $\det(A^T B) = \det(A^T) \det(B) = \det(A) \det(B) = 6$.

2. Since $\det(A - \lambda I) = \lambda^2 - \lambda - 2 = (\lambda - 2)(\lambda + 1)$, the eigenvalues are 2 and $-1$.

3. Recall that $[T]_B = [[b_1]_B [b_2]_B]$. Since $T(b_1) = \begin{bmatrix} 0 \\ 1 \end{bmatrix} = b_2$
   and $T(b_2) = \begin{bmatrix} 1 \\ 0 \end{bmatrix} = -b_1 + b_2$, we have $[T]_B = \begin{bmatrix} 0 & -1 \\ 1 & 1 \end{bmatrix}$.

4. (a) Since the dimension of an eigenspace cannot exceed the multiplicity of a root of the characteristic polynomial, it is at most 3. Thus the possible values are 1, 2 and 3.

   (b) No. The sum of the dimensions of the eigenspaces is at most $2 + 2 + 3 = 7$, which is less than 8, the size of $A$.

   (c) It must be singular since zero is an eigenvalue.

   (d) The only possible values are the eigenvalues, namely 0, 1 and $-2$. 