6(6). Give the factored characteristic polynomial.
Classify each matrix in one of the following 3 ways:

- Diagonalizable: Give the eigenvalues.
- Nondiagonalizable due to nonreal characteristic root (give root).
- Nondiagonalizable due to an eigenvalue of degree $k > 1$ with an eigenspace dimension $< k$. Give the eigenvalue, its degree and the dimension of its eigenspace.

All numbers are in $\{-3, -2, -1, 0, 1, 2, 3\}$.

(a)(1) \[
\begin{bmatrix}
1 & 4 \\
1 & -2
\end{bmatrix}
\]

(b)(1) \[
\begin{bmatrix}
1 & 0 \\
-2 & 1
\end{bmatrix}
\]

(d)(2) \[
\begin{bmatrix}
1 & 2 & 3 \\
0 & -1 & 2 \\
0 & 0 & 2
\end{bmatrix}
\]

10(15). For each matrix, find a diagonal matrix $D$ and an invertible matrix $P$ such that $D = P^T A P$. Check that $D = P^T A P$. Multiply basis elements to eliminate fractions.

All integers are between -6 and 6.

(b) \[
\begin{bmatrix}
1 & 1 & 2 \\
0 & 1 & 0 \\
0 & 1 & 3
\end{bmatrix}
\]

18(2). Let $D = \begin{bmatrix} 2 & 0 \\ 0 & -2 \end{bmatrix}$. Compute $D^9$.

Hint, Compute $D$, $D^2$, $D^3$, ... and look for a pattern.

This exercise shows the advantages of diagonal form matrices.
Calculating $D^9$ for a nondiagonal matrix would be horrendous.
Leave numbers in exponential form, e.g., $3^x$.

Digit sum = 22, integer sum = 0.