1. Work Problem 6.2 (p. 76) from the text. For the following matrices, compute $AA^T$, $A^TA$, $(A^TA)^2$, $(A + B)(A - B)^T$, where

\[
A = \begin{pmatrix} 5 & -3 & 0 \\ 6 & 1 & -4 \end{pmatrix}
\]

and

\[
B = \begin{pmatrix} -2 & 4 & -1 \\ 1 & 1 & 5 \end{pmatrix}
\]

2. Work Problem 6.7 (p. 76) from the text. If

\[
A = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}
\]

verify that

\[
A^n = \begin{pmatrix} \cos n\theta & -\sin n\theta \\ \sin n\theta & \cos n\theta \end{pmatrix}
\]

for $n = 2, 3, 4$. What does this mean in terms of rotations through an angle $\theta$? (Use the Maple command `map(combine, A^2)`, etc., which operates on each entry separately. Type `?map` for information.)

3. a. Work Problem 6.11 (p. 77) from the text. Verify the basic relation $(AB)^{-1} = B^{-1}A^{-1}$, where

\[
A = \begin{pmatrix} 0 & -2 & -1 \\ -2 & 3 & 2 \\ -1 & 2 & 1 \end{pmatrix}
\]

and

\[
B = \begin{pmatrix} 1 & 2 & 3 \\ 2 & 3 & 4 \\ 3 & 4 & 6 \end{pmatrix}
\]

b. Find the eigenvalues and eigenvectors for both $A$ and $B$. Also, find the characteristic matrix and characteristic polynomial for $A$.

4. Solve the following linear system of equations (if a solution exists)

\[
\begin{align*}
2x + y - 3z &= 4 \\
x - y + 2z &= 7 \\
x + 5y - 12z &= -13
\end{align*}
\]

5. Work Problem 7.11 (p. 86) from the text. Show that $A$ and $B = P^{-1}AP$ have the same eigenvalues and establish the relation between their eigenvectors, where $A$ and $P$ are as follows:

\[
A = \begin{pmatrix} -1 & -3 & 3 \\ -6 & 2 & 6 \\ -3 & 3 & 5 \end{pmatrix}
\]

and

\[
P = \begin{pmatrix} 3 & -1 & 1 \\ -15 & 6 & -5 \\ 5 & -3 & 2 \end{pmatrix}
\]