Problem 1: Do problem 39 from section 5.3.

Problem 2: Do problems 6 from section 6.1.

Problem 3: Problem 19 section 6.1.

Problem 4: Problem 9 section 6.2.

Problem 5: Do problem 11 in section 6.2.

Problem 6: Do problem 12 in section 6.2.

Problem 7: Let $Q$ be an $n$ by $n$ orthogonal matrix. Let $A$, $B$, and $C$ be $n$ by $n$ matrices.

(a) Show that $\det(QAQ^T) = \det(A)$.

(b) The trace of $A$ is the sum of the diagonal entries. $\text{tr}A = \sum_{i=1}^{n}a_{ii}$. Show that $\text{tr}(BC) = \text{tr}(CB)$.

(c) Use the result of part (b) to show that $\text{tr}(QAQ^T) = \text{tr}(A)$.

(d) Consider the matrix $A - \lambda I$. Use the big determinant formula to show that $\det(A - \lambda I)$ is a polynomial of degree $n$. 
(e) So now we have
\[ \det(A - \lambda I) = \sum_{i=0}^{n} c_i \lambda^i, \]
where \( c_i \) just denotes the coefficient of the term \( \lambda^i \) in this polynomial. In the case that the dimension of \( A \) is 2 by 2, identify the coefficients of this polynomial in terms of trace and determinant.

(d) Show that each coefficient \( c_i \) is invariant in the sense that, given orthogonal matrix \( Q \):
\[ \det(QAQ^T - \lambda I) = \det(A - \lambda I). \]