Part I. All HW problems of covered sections of Chapters 3,5,6,7. Note again that Chapter 3 is included in the final. Review problems of Chapter 3 on Review 1.

Part II. True or False (Some of these problems require calculations)

1. The equation $(AB)^T = A^T B^T$ for all $n \times n$ matrices $A$ and $B$.

2. All nonzero symmetric matrices are invertible.

3. If $\vec{u}$ is a unit vector in $\mathbb{R}^n$, and $L = \text{span}(\vec{u})$, then $\text{proj}_L(\vec{x}) = (\vec{x} \cdot \vec{u})\vec{u}$ for all $\vec{x}$ in $\mathbb{R}^n$.

4. If $A$ and $B$ are symmetric $n \times n$ matrices, then $ABBA$ must be symmetric as well.

5. There exists a subspace $V$ of $\mathbb{R}^5$ such that $\dim(V) = \dim(V^\perp)$, where $V^\perp$ is the orthogonal complement of $V$.

6. If $\vec{x}$ and $\vec{y}$ are two vectors in $\mathbb{R}^n$, then the equation $\|\vec{x} + \vec{y}\|^2 = \|\vec{x}\|^2 + \|\vec{y}\|^2$ must hold.

7. If $A$ is any matrix with $\text{Ker}(A) = \{\vec{0}\}$, then the matrix $AA^T$ represents the orthogonal projection onto the range of $A$.

8. If $V$ is a subspace of $\mathbb{R}^n$ and $\vec{x}$ is a vector in $\mathbb{R}^n$, then vector $\text{proj}_V \vec{x}$ must be orthogonal to vector $\vec{x} - \text{proj}_V \vec{x}$.

9. The formula $\text{ker}(A) = \text{ker}(A^T A)$ holds for all matrices $A$.

10. If the entries of two vectors $\vec{v}$ and $\vec{w}$ in $\mathbb{R}^n$ are all positive, then $\vec{v}$ and $\vec{w}$ must enclose an acute angle.

11. The formula $\text{ker}(B^T) = \text{im}(B^T)$ holds for all matrices $B$.

12. The eigenvalues of any triangular matrix are its diagonal entries.

13. The algebraic multiplicity of an eigenvalue cannot exceed its geometric multiplicity.

14. If an $n \times n$ matrix $A$ is diagonalizable (over $\mathbb{R}$), then there must be a basis of $\mathbb{R}^n$ consisting of eigenvectors of $A$.

15. If the standard vectors $\vec{e}_1, \ldots, \vec{e}_n$ are eigenvectors of an $n \times n$ matrix $A$, the $A$ must be diagonal.

16. If $\vec{v}$ is an eigenvector of $A$, the $\vec{v}$ must be an eigenvector of $A^3$ as well.

17. If $0$ is an eigenvalue of a matrix $A$, the $\text{det}(A) = 0$.

18. If $1$ is the only eigenvalue of an $n \times n$ matrix $A$, then $A$ must be $I_n$.

19. If $A$ and $B$ are $n \times n$ matrices, if $\alpha$ is an eigenvalue of $A$, and if $\beta$ is an eigenvalue of $B$, then $\alpha \beta$ must be an eigenvalue of $AB$.

20. If $3$ is an eigenvalue of $A$, then $9$ must be an eigenvalue of $A^2$. 
21. If two $n \times n$ matrices $A$ and $B$ are diagonalizable, the $AB$ must be diagonalizable as well.

22. If an invertible matrix $A$ is diagonalizable, then $A^{-1}$ must be diagonalizable as well.

23. If vector $\vec{v}$ is an eigenvector of both $A$ and $B$, then $vecv$ must be an eigenvector of $A + B$.

24. If an $n \times n$ matrix $A$ is diagonalizable, then $A$ must have $n$ distinct eigenvalues.

25. If a matrix is diagonalizable, then the algebraic multiplicity of each eigenvalue $\lambda$ must equal the geometric multiplicity of $\lambda$.

26. If an $n \times n$ matrix $A$ is diagonalizable (over $R$), then every vector $\vec{v}$ in $R^n$ can be expressed as a sum of eigenvectors of $A$.

27. If $A$ is a $2 \times 2$ matrix with eigenvalues 3 and 4, and if $\vec{u}$ is a unit eigenvector of $A$, then the length of the vector $A\vec{u}$ cannot exceed 4.