MATH 1554 Linear Algebra: Inner product spaces

1. What is an inner product space?

A. A space with a norm
B. A space with an inner product
C. A space with an orthonormal basis
D. A space with a metric

2. Which of the following is not an example of an inner product space?

A. The set of all real numbers with the usual inner product
B. The set of all vectors in R^n with the usual inner product
C. The set of all polynomials with the inner product defined by <f,g> = int_0^1 f(x)g(x) dx
D. The set of all matrices with the inner product defined by <A,B> = trace(AB^T)

3. Which of the following is not a property of an inner product space?

A. The inner product is linear in the first argument
B. The inner product is linear in the second argument
C. The inner product is symmetric
D. The inner product is positive definite

4. Which of the following is not a consequence of the Cauchy-Schwarz inequality?

A. If ||f|| = ||g|| = 1 then |<f,g>| <= 1
B. If ||f|| = 1 and ||g|| = 2 then |<f,g>| <= 2
C. If ||f|| = 2 and ||g|| = 1 then |<f,g>| <= 1
D. If ||f|| = 1 and ||g|| = 1 then |<f,g>| = 1

5. Which of the following is not a property of an orthonormal set?

A. The vectors are linearly independent
B. The vectors have norm 1
C. The vectors are orthogonal
D. The vectors form a basis

6. Which of the following is not a property of an orthogonal projection?

A. The projection is onto a subspace
B. The projection is one-to-one
C. The projection is onto the orthogonal complement of the subspace
D. The projection is onto the span of the subspace

7. Which of the following is not a property of an orthogonal matrix?

A. The matrix is invertible
B. The matrix is unitary
C. The matrix is orthogonal
D. The matrix is symmetric

8. Which of the following is not a property of an eigenvector?

A. The vector is in the null space of the matrix
B. The vector is in the range of the matrix
C. The vector is an eigenvector of the matrix
D. The vector is in the column space of the matrix

9. Which of the following is not a property of an eigenvalue?

A. The eigenvalue is in the null space of the matrix
B. The eigenvalue is in the range of the matrix
C. The eigenvalue is an eigenvalue of the matrix
D. The eigenvalue is in the column space of the matrix

10. Which of the following is not a property of a diagonal matrix?

A. The matrix is invertible
B. The matrix is unitary
C. The matrix is diagonal
D. The matrix is symmetric

11. Which of the following is not a property of a symmetric matrix?

A. The matrix is invertible
B. The matrix is unitary
C. The matrix is symmetric
D. The matrix is diagonal

12. Which of the following is not a property of a Hermitian matrix?

A. The matrix is invertible
B. The matrix is unitary
C. The matrix is Hermitian
D. The matrix is diagonal

13. Which of the following is not a property of a unitary matrix?

A. The matrix is invertible
B. The matrix is unitary
C. The matrix is Hermitian
D. The matrix is diagonal

14. Which of the following is not a property of an orthonormal basis?

A. The vectors are linearly independent
B. The vectors have norm 1
C. The vectors are orthogonal
D. The vectors form a basis

15. Which of the following is not a property of a Gram-Schmidt process?

A. The process is used to orthonormalize a set of vectors
B. The process is used to orthogonalize a set of vectors
C. The process is used to find an orthonormal basis for a set of vectors
D. The process is used to find an orthogonal basis for a set of vectors

16. Which of the following is not a property of the QR factorization?

A. The QR factorization is used to find an orthonormal basis for a set of vectors
B. The QR factorization is used to find an orthogonal basis for a set of vectors
C. The QR factorization is used to find the QR factorization of a matrix
D. The QR factorization is used to find the eigenvalues of a matrix

17. Which of the following is not a property of the singular value decomposition?

A. The singular value decomposition is used to find an orthonormal basis for a set of vectors

B. The singular value decomposition is used to find an orthogonal basis for a set of vectors
C. The singular value decomposition is used to find the QR factorization of a matrix
D. The singular value decomposition is used to find the eigenvalues of a matrix

18. Which of the following is not a property of the spectral theorem?

A. The spectral theorem is used to find an orthonormal basis for a set of vectors
B. The spectral theorem is used to find an orthogonal basis for a set of vectors
C. The spectral theorem is used to find the QR factorization of a matrix
D. The spectral theorem is used to find the eigenvalues of a matrix

19. Which of the following is not a property of the eigenvalue decomposition?

A. The eigenvalue decomposition is used to find an orthonormal basis for a set of vectors
B. The eigenvalue decomposition is used to find an orthogonal basis for a set of vectors
C. The eigenvalue decomposition is used to find the QR factorization of a matrix
D. The eigenvalue decomposition is used to find the eigenvalues of a matrix

20. Which of the following is not a property of the characteristic polynomial?

A. The characteristic polynomial is used to find an orthonormal basis for a set of vectors
B. The characteristic polynomial is used to find an orthogonal basis for a set of vectors
C. The characteristic polynomial is used to find the QR factorization of a matrix
D. The characteristic polynomial is used to find the eigenvalues of a matrix

1. B
2. D
3. D
4. D
5. D
6. D
7. D
8. D
9. D
10. D
11. D
12. D
13. D
14. D
15. B
16. C
17. C
18. D
19. C
20. D