

Math 1104A – Exam Review – part 2

1. Let $\underline{u} = (1,4,2,1)$ and $\underline{v} = (2,k,0,k+3)$ then \underline{u} and \underline{v} are orthogonal if and only if

- (a) $k = 0$ (b) $k = 0, -1$ (c) $k = -1$ (d) $k \neq -1$

2. If $z = 1+i$ and $w = 3-2i$ then $z \cdot \bar{w}$ is

- (a) $3-2i$ (b) $1+5i$ (c) $5+i$ (d) $5-i$

3. If $A = \begin{bmatrix} 2 & 3 & 1 \\ 0 & 2 & 4 \\ 6 & 4 & 2 \end{bmatrix}$ and $B = [1 \ 2 \ 3]$ then the third row of AB^T is

- (a) 16 (b) 20 (c) $[6 \ 8 \ 6]$ (d) 15

4. If $A = \begin{bmatrix} 1 & 2 & -3 & 0 \\ 2 & 4 & -2 & 2 \\ 3 & 6 & -4 & 3 \end{bmatrix} \sim \begin{bmatrix} 1 & 2 & -3 & 0 \\ 0 & 0 & 4 & 2 \\ 0 & 0 & 0 & 2 \end{bmatrix}$ then a basis of the column space of A is

- (a) $[1 \ 0 \ 0]$ (b) $[1 \ 0 \ 0], [-3 \ 4 \ 0]$ (c) $[1 \ 2 \ -3 \ 0]$ (d) $[1 \ 2 \ 3], [-3 \ -2 \ -4], [0 \ 2 \ 3]$

5. If $A = \begin{bmatrix} 1 & 2 & -3 & 0 \\ 2 & 4 & -2 & 2 \\ 3 & 6 & -4 & 3 \end{bmatrix} \sim \begin{bmatrix} 1 & 2 & -3 & 0 \\ 0 & 0 & 4 & 2 \\ 0 & 0 & 0 & 2 \end{bmatrix}$ then the dimension of the Null space of A is

- (a) 0 (b) 1 (c) 2 (d) 3

6. If $x = p \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + q \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ is the general solution to the homogeneous system of equations $Ax = 0$ and

$\begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}$ is a solution to the equation $Ax = b$ then the general solution to the equation $Ax = b$ is

- (a) $x = p \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + q \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} + \begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}$ (b) $\begin{pmatrix} 2 \\ 3 \\ 0 \end{pmatrix}$ (c) $x = p \begin{pmatrix} 1 \\ 1 \\ 0 \end{pmatrix} + q \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix}$ (d) $\begin{pmatrix} 3 \\ 4 \\ 0 \end{pmatrix}$

7. The matrix $A = \begin{pmatrix} 1 & 1 \\ k & 1 \end{pmatrix}$ is not invertible if

- (a) $k \neq 1$ (b) $k = 1$ (c) $k \neq 0$ (d) $k = 0$

8. If $A = P \cdot \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} \cdot P^{-1}$ then A^5 is

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(a) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 2^5 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$ (c) $P \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 2^5 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} P^{-1}$ (d) $P \begin{pmatrix} 1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix} P^{-1}$

9. If $A = \begin{pmatrix} a & b & c \\ d & e & f \\ g & h & j \end{pmatrix}$ and $B = \begin{pmatrix} -a & -b & -c \\ d+2g & e+2h & f+2j \\ g & h & j \end{pmatrix}$ such that $\det(A) = 5$ then $\det(B)$ is
 (a) -10 (b) -5 (c) 5 (d) 10

10. If A and B are 5x5 matrices such that $\det(A)=5$ and $\det(B)=3$ then $\det(3AB)$ is
 (a) 15 (b) 45 (c) 3645 (d) 10125

11. If $\det \begin{pmatrix} 1 & 2 & -1 \\ 2 & -1 & 3 \\ 4 & 3 & -2 \end{pmatrix} = 15$ the find the value of z which solves the system of equations

$$\begin{cases} x + 2y - z = 4 \\ 2x - y + 3 = 3 \\ 4x + 3y - 2z = 5 \end{cases}$$

(a) 2 (b) 0 (c) 3 (d) 30

12. Suppose $\underline{u} = (1,4,2,1)$ and $\underline{v} = (2,1,0,3)$ then the projection of u on v is
 (a) $9/14 (2,1,0,3)$ (b) $14/9 (1,4,2,1)$ (c) $9/22 (2,1,0,3)$ (d) $22/9 (1,4,2,1)$

13. Suppose $T \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} x \\ x+y \\ x-y \end{pmatrix}$ then

(a) T is one-to-one and onto. (b) T is one-to-one but not onto.
 (c) T is onto but not one-to-one. (d) T is neither one-to-one nor onto.

14. Suppose $H = \left\{ \begin{pmatrix} x \\ x+y \\ x-y \end{pmatrix} \mid x, y, z \in R \right\}$ then a basis for H is

(a) $\{(1,0),(1,1),(1,-1)\}$ (b) $\{(1,0),(1,-1)\}$ (c) $\{(1,1,1),\{0,1,0\},\{0,0,-1\}\}$ (d) $\{(1,1,1),(0,1,-1)\}$

15. What are the eigenvalues of the matrix $A = \begin{bmatrix} 1 & 0 & 3 \\ 0 & 2 & 1 \\ 0 & 3 & 2 \end{bmatrix}$

(a) 1, 2, 2 (b) 1, 2, 3 (c) $1, 2 + \sqrt{3}$ (d) $1, 2 + \sqrt{3}, 2 - \sqrt{3}$

16. If A is a 3x3 matrix with eigenvalues $\lambda = 0,3$ then which of the following could be the characteristic equation?

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- (a) $\lambda(\lambda + 3)$ (b) $\lambda(\lambda + 3)^2$ (c) $\lambda(\lambda - 3)^2$ (d) $\lambda(\lambda - 3)$

17. Which of the following matrices is in reduced row echelon form?

- (a) $\begin{pmatrix} 1 & 2 & 3 \\ 0 & 2 & 1 \end{pmatrix}$ (b) $\begin{pmatrix} 1 & 2 & 3 \\ 0 & 0 & 1 \end{pmatrix}$ (c) $\begin{pmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ (d) $\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \end{pmatrix}$

18. What are the eigenvalue(s) of the matrix $A = \begin{pmatrix} 1 & 2 \\ -2 & 1 \end{pmatrix}$?

- (a) 1 (b) 2i (c) 1+2i (d) 1±2i

19. For what values of k does $\begin{pmatrix} 1 & 1 & 1 \\ 0 & k & 1 \end{pmatrix}$ represent a consistent system?

- (a) k=0 (b) k≠0 (c) k=1 (d) k≠1

20. What is the length from the point (1,2,3) to the line through the origin and the point (1,1,1)?

- (a) $\sqrt{2}$ (b) $\sqrt{3}$ (c) $\sqrt{14}$ (d) $\sqrt{5}$

21. Given the set of vectors $\left\{ \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \right\}$ which of the following vectors, when added to the set,

would create an orthogonal basis for \mathbb{R}^3 ?

- (a) (1,0,0) (b) (0,1,0) (c) (0,0,1) (d) none of the above

22. Given the subspace defined by $S = \text{span} \left\{ \begin{pmatrix} 1 \\ 0 \\ -1 \end{pmatrix}, \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} \right\}$ and $\underline{x} = \begin{pmatrix} 3 \\ 2 \\ 1 \end{pmatrix}$ is in S, then which of the

following is a coordinate vector of x with respect to S?

- (a) (2,1) (b) (1,2) (c) (3,2,1) (d) (1,3)

23. What is the eigenvector of the matrix $\begin{bmatrix} 1 & 4 \\ 1 & 1 \end{bmatrix}$ for the eigenvalue $\lambda = 3$

- (a) (-2,1) (b) (2,1) (c) (-2,2) (d) (1,1)

24. Which of the following are the eigenvalues of the matrix $\begin{bmatrix} 1 & 4 \\ -4 & 1 \end{bmatrix}$?

- (a) 1±2i (b) 1±4i (c) 1±16i (d) 3,-1

Solutions

1. (c) 2. (b) 3. (b) 4. (d) 5. (b) 6. (a) 7. (b) 8. (c) 9. (b) 10. (c) 11. (a) 12. (a)
13. (b) 14. (d) 15. (d) 16. (c) 17. (c) 18. (d) 19. (b) 20. (a) 21. (d) 22. (b) 23. (b) 24. (b)