Practice Midterm 2

This is a preview of the published version of the quiz

Started: Oct 12 at 5:32pm

Quiz Instructions

Question 1 — 1 pts

Answer the following three true/false questions.

(a) There is a 5x4 matrix whose rank is 2 and whose nullity is 2.

[Select]

(b) There is a 4x6 matrix whose rank is 5 and whose nullity is 1.

[Select]

(c) If the column vectors of a 3x3 matrix *A* span R^3, then A has 3 pivots.

[Select]

Question 2 — 1 pts

Consider the subset $V = \{(x, y) \text{ in } \mathbb{R}^2 | \ |x| + |y| = 1\}$ of $\mathbb{R}^2$.

Does V contain the 0 vector? [Select]

Is V closed under addition? [Select]

Is V closed under scalar multiplication? [Select]

Is V a subspace of R^2? [Select]

Question 3

1 pts

Which of the following matrix transformations has as its range the xz-plane in $\mathbb{R}^3$?

- $\begin{pmatrix} 0 & 0 & 0 \\ 0 & 1 & 4 \\ 0 & 0 & 1 \end{pmatrix}$
- $\begin{pmatrix} 1 & 0 & 1 \\ 0 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
- $\begin{pmatrix} 1 & 3 & 0 \\ 3 & 4 & 0 \\ 1 & 5 & 0 \end{pmatrix}$
- $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$

Question 4

1 pts

Suppose that A is a 11x3 matrix, B is a 3x4 matrix, and C is a 4x11 matrix. Which of the following matrix multiplications is allowed? Select all that apply.

- ☐ AB

- [ ] AC
- [ ] BC
- [ ] CA

Question 5

1 pts

Which of the following statements are true *for all 2x2 matrices A and B.*

(a) AB=BA [Select]

(b) AB=0 (the zero matrix) implies that either A or B is 0.
[Select]

(c) A+B=B+A [Select]

Question 6

1 pts

Let $T : \mathbb{R}^2 \to \mathbb{R}^2$ be the transformation given by counterclockwise rotation by 30 degrees, and let A be the standard matrix for T.

Which of the following statements must be true about A?

- [ ] A is invertible
- [ ] A is not invertible
- [ ] rank(A)=1
- [ ] Nullity(A)=0

Question 7

1 pts

If u, v , and w form a basis of subspace W, then $u + v$, v, and w also form a basis for W.

- ◯ True
- ◯ False

Question 8

1 pts

Find the value of k so that the matrix transformation for the following matrix is not onto.

$$\begin{pmatrix} 2 & 3 & 4 \\ 6 & 9 & k \end{pmatrix}$$

Question 9

1 pts

Suppose that A is 10×9 matrix in row echelon form with 3 pivots. What is the dimension of $Nul(A)$?

Question 10

1 pts

Solve for the matrix X if $(AX+D)(BX+E)^{-1}=C$. Assume that all the matrices that arise in the solution are invertible.

- ○ $(A-CB)^{-1}(CE-D)$
- ○ $(A-BC)(CE-D)^{-1}$
- ○ $(A-B)^{-1}(C-D)$
- ○ $(CE-D)(A-BC)^{-1}$

Question 11

1 pts

Suppose that A and B are $n \times n$ matrices and AB is not invertible. Which of the following must be true?

- ○ B is not invertible
- ○ A is not invertible
- ○ Both A and B are not invertible
- ○ None of these must be true

Question 12

1 pts

Let $A=\begin{pmatrix}1&0&-3&5&0\\0&1&2&4&0\\0&0&0&0&1\end{pmatrix}$. Which of the following is a basis for $\mathbf{Nul}(A)$?

- ○

$$\left\{\begin{pmatrix}-3\\2\\1\\0\\0\end{pmatrix},\begin{pmatrix}5\\4\\0\\1\\0\end{pmatrix}\right\}$$

- ○ $\left\{\begin{pmatrix}1\\0\\0\end{pmatrix},\begin{pmatrix}0\\1\\0\end{pmatrix},\begin{pmatrix}0\\0\\1\end{pmatrix}\right\}$
- ○ $\left\{\begin{pmatrix}3\\-2\\1\\0\\0\end{pmatrix},\begin{pmatrix}-5\\-4\\0\\1\\0\end{pmatrix}\right\}$
- ○ $\left\{\begin{pmatrix}-3\\2\\0\end{pmatrix},\begin{pmatrix}5\\4\\0\end{pmatrix}\right\}$

Question 13

1 pts

Suppose A is a 7×4 matrix such that the associated linear transformation $T : \mathbb{R}^4 \to \mathbb{R}^7$ is one-to-one. What is $\mathbf{rank}(A)$?

Question 14

1 pts

Which of the following linear transformations are invertible? Select all that apply.

- ☐ Projection onto the x-axis, followed by dilation by a factor of 2
- ☐ Rotation by -47 degrees, followed by reflection across the y-axis

- [ ] Dilation by a factor of -0.001
- [ ] Dilation by a factor of 3, followed by projection onto the line y = 2x

Question 15

1 pts

Consider the matrix

$$A = \begin{pmatrix} 3 & 3 & 2 & -8 \\ -1 & -1 & 5 & -3 \\ 0 & 0 & 1 & -1 \end{pmatrix},$$

which can be row reduced to the following matrix

$$\begin{pmatrix} 1 & 1 & 0 & -2 \\ 0 & 0 & 1 & -1 \\ 0 & 0 & 0 & 0 \end{pmatrix}.$$

(a) Is the vector $\begin{pmatrix} 5 \\ 4 \\ 1 \end{pmatrix}$ in $\mathbf{Nul}(A)$? [Select]

(b) Is the vector $\begin{pmatrix} 1 \\ 1 \\ 1 \\ 1 \end{pmatrix}$ in $\mathbf{Nul}(A)$? [Select]

Question 16

1 pts

Consider the matrix

$$A = \begin{pmatrix} 3 & 0 & -3 & 1 \\ 0 & -2 & 6 & 0 \\ 0 & 0 & 0 & 8 \end{pmatrix}.$$

Let T be the matrix transformation $T(v) = Av$.

The domain of T is $\mathbb{R}^n$, where $n =$ [ ]

The codomain of T is $\mathbb{R}^m$, where $m =$ [ ] .

The range of T has dimension [ ] .

Question 17

1 pts

For which of the following matrices A is the range of the associated matrix transformation $T : \mathbb{R}^n \to \mathbb{R}^m$ a line? Select all that apply.

- [ ] $A = \begin{pmatrix} 1 & 3 \\ 0 & 2 \end{pmatrix}$
- [ ] $A = \begin{pmatrix} 1 & -2 & 3 & -4 \\ 0 & 0 & 0 & 0 \end{pmatrix}$
- [ ] $A = \begin{pmatrix} -2 & 4 & 1 \\ 0 & -3 & 9 \\ 0 & 0 & 0 \end{pmatrix}$
- [ ] $A = \begin{pmatrix} 2 & -1 \\ 0 & 0 \\ 0 & 0 \end{pmatrix}$

Question 18

1 pts

Suppose that T is a linear transformation and

$$T\begin{pmatrix}1\\1\end{pmatrix}=\begin{pmatrix}1\\1\\1\end{pmatrix} \text{ and } T\begin{pmatrix}10\\11\end{pmatrix}=\begin{pmatrix}1\\1\\1\end{pmatrix}$$

What is $T\begin{pmatrix}12\\13\end{pmatrix}$?

Question 19

1 pts

Suppose that $T:\mathbb{R}^2\rightarrow\mathbb{R}^2$ is reflection about the line y=7x and A is the standard matrix. What is A^2?

Question 20

1 pts

Suppose that A is an *n x n* matrix and T(v)=Av. Answer the following three questions.

If the columns of A add up to 0, is it possible that T is onto?

[Select]

If the row echelon form of A has no row of zeros, is it possible for Ax=b to have infinitely many solutions? [Select]

If Ax=b is consistent for all b, can Ax=0 have infinitely many solutions?

[Select]

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