Math 1553 Reading Day

Question 1	1 pts
If $\{u,v,w\}$ is a set of linearly dependent vectors, then w must be a linear combination of u and v .	
○ True	
○ False	

Question 2 1 pts

Find the value of k that makes the following vectors linearly dependent:

$$\begin{pmatrix} -3 \\ 0 \\ 3 \end{pmatrix} , \quad \begin{pmatrix} 3 \\ -3 \\ k \end{pmatrix} , \quad \begin{pmatrix} 3 \\ -1 \\ -1 \end{pmatrix}$$

Question 3 1 pts

If $\{u,v\}$ is a basis for a subspace W, then $\{u-v,u+v\}$ is also a basis for W.

- True

Question 4

1 pts

Which of the following are subspaces of \mathbb{R}^4 ?

(1) The set
$$W=\left\{egin{pmatrix}x\\y\\z\\w\end{pmatrix}\ ext{in }\mathbb{R}^4\ :\ 2x-y-z=0
ight\}.$$

- (2) The set of solutions to the equation $\begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 3 & 0 & -1 \end{pmatrix} x = \begin{pmatrix} 1 \\ 0 \end{pmatrix}$.
- both are subspaces
- oneither is a subspace
- (2) is a subspace but (1) is not a subspace
- (1) is a subspace but (2) is not a subspace

Question 5

1 pts

Let W be the set of vectors $egin{pmatrix} a \\ b \\ c \end{pmatrix}$ in \mathbb{R}^3 with abc=0. Then W is closed under addition, meaning that if v and w are in W, then v+w is in W.

- True
- False

Question 6 1 pts

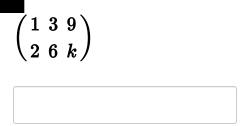
Match the transformations given below with their corresponding $\mathbf{2} \times \mathbf{2}$ matrix.

- A. $\begin{pmatrix} 0 & 1 \\ -1 & 0 \end{pmatrix}$
- B. $\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$
- C. $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$
- D. $\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$
- $\mathsf{E.} \ \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$

Counter-clockwise rotation by 90 degrees	[Choose]	
Reflection about the line y=x	[Choose]	~
Clockwise rotation by 90 degrees	[Choose]	~
Reflection across the x-axis	[Choose]	~
Reflection across the y-axis	[Choose]	~

Question 7 1 pts

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



Question 8 1 pts

Find the **nonzero** value of k that makes the following matrix not invertible.

$$egin{pmatrix} 1 & -1 & 0 \ k & k^2 & 0 \ -1 & 1 & 5 \end{pmatrix}$$

Enter an integer as your answer. Note that 0 is not the correct answer, since the question asks for a nonzero value of k.



Question 9 1 pts

Match the following definitions with the corresponding term describing a linear transformation $T: \mathbb{R}^m \to \mathbb{R}^n$.

Each definition should be used exactly once.

- A. For each y in \mathbb{R}^n there is at most one x in \mathbb{R}^m so that T(x)=y.
- B. For each y in \mathbb{R}^n there is at least one x in \mathbb{R}^m so that T(x)=y.
- C. For each y in \mathbb{R}^n there is exactly one x in \mathbb{R}^m so that T(x)=y.
- D. For each x in \mathbb{R}^m there is exactly one y in \mathbb{R}^n so that T(x)=y.

T is a transformation

[Choose]

T is one-to-one

[Choose]		
「is onto	[Choose]	~
Γ is one-to-one and onto	[Choose]	~

Question 10 1 pts Suppose A is a 4×6 matrix. Then the dimension of the null space of A is at most 2. \bigcirc True \bigcirc False

Question 11 1 pts

Complete the entries of the matrix A so that $\operatorname{Col}(A) = \operatorname{Span}\left\{\binom{1}{2}\right\}$ and $\operatorname{Nul}(A) = \operatorname{Span}\left\{\binom{1}{1}\right\}$. $A = \binom{r}{s} = \binom{1}{s}$, where $r = \binom{r}{s} = \binom{1}{s}$ and $s = \binom{r}{s} = \binom{r}{s}$

Question 12 1 pts

Suppose $T:\mathbb{R}^7 \to \mathbb{R}^9$ is a linear transformation with standard matrix A, and suppose that the range of T has a basis consisting of 3 vectors. What is the

dimension of the null space of A	4 ?				

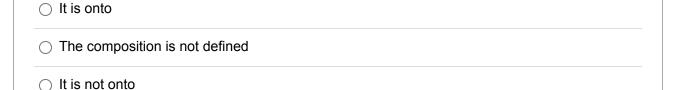
Question 131 ptsDefine a transformation $T: \mathbb{R}^3 \to \mathbb{R}^4$ by $T(x,y,z) = (0,\ x-y,\ y-x,\ z)$.Which one of the following statements is true?T is onto but not one-to-one.T is one-to-one but not onto.T is one-to-one and onto.T is neither one-to-one nor onto.

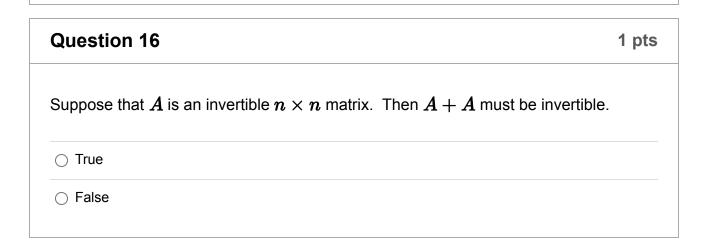
Suppose that A is a 7×5 matrix, and the null space of A is a line. Say that T is the matrix transformation T(v) = Av. Which of the following statements must be true about the range of T?

O It is a 4-dimensional subspace of \mathbb{R}^{5} O It is a 4-dimensional subspace of \mathbb{R}^{7} O It is a 6-dimensional subspace of \mathbb{R}^{7}

Question 15 1 pts

Say that $S:\mathbb{R}^2 o\mathbb{R}^3$ and $T:\mathbb{R}^3 o\mathbb{R}^4$ are linear transformations. Which	of the
following must be true about $T \circ S$?	





Question 171 ptsSuppose
$$A$$
 is a 3×3 matrix and the equation $Ax = \begin{pmatrix} -1 \\ 3 \\ 2 \end{pmatrix}$ has exactly one solution.Then A must be invertible. \bigcirc True \bigcirc False

O It is not one-to-one

	1 pts
Suppose that A and B are $n imes n$ matrices and AB is not invertible.	
Which one of of the following statements must be true?	
○ None of these	
○ B is not invertible	
At least one of the matrices A or B is not invertible	
○ A is not invertible	
Question 19	1 pts
Suppose A and B are 3×3 matrices, with $dot(A) = 3$ and $dot(B) = 6$	
Suppose A and B are $3 imes 3$ matrices, with $\det(A) = 3$ and $\det(B) = -6$. Find $\det(2A^{-1}B)$.	
	1 pts

Question 21

Suppose A is a square matrix and $\lambda = -1$ is an eigenvalue of A.

Which one of the following statements must be true?

- \bigcirc Nul $(A+I)=\{0\}$
- \bigcirc The columns of A + I are linearly independent.
- \bigcirc **A** is invertible.
- \bigcirc For some nonzero $m{x}$, the vectors $m{A}m{x}$ and $m{x}$ are linearly dependent.
- \bigcirc The equation \(Ax = x \\)has only the trivial solution.

Question 22 1 pts

Suppose A is a 4 x 4 matrix with characteristic polynomial $-(1-\lambda)^2(5-\lambda)\lambda$.

What is the rank of A?

Question 23		1 pt

Let $T:\mathbb{R}^2 o\mathbb{R}^2$ be the transformation that reflects across the line $x_2=2x_1$.

Find the value of k so that $A \begin{pmatrix} 2 \\ k \end{pmatrix} = \begin{pmatrix} 2 \\ k \end{pmatrix}$.



Suppose that A is a 5×5 matrix with characteristic polynomial $(1-\lambda)^3(2-\lambda)(3-\lambda)$ and also that A is diagonalizable. What is the dimension of the 1-eigenspace of A?

Question 26 1 pts

Find the value of t such that 3 is an eigenvalue of $\begin{pmatrix} 1 & t & 3 \\ 1 & 1 & 1 \\ 3 & 0 & 3 \end{pmatrix}$. Enter an integer answer below.

Question 27 1 pts

Say that A is a 2×2 matrix with characteristic polynomial $(1 - \lambda)(2 - \lambda)$. What is the characteristic polynomial of A^2 ?

- $\bigcirc \ (1-\lambda)^2(2-\lambda)^2$
- $\bigcirc \ (1-\lambda^2)(2-\lambda^2)$
- $\bigcirc (1-\lambda^2)(4-\lambda^2)$
- $\bigcirc (1-\lambda)(2-\lambda)$
- $\bigcirc (1-\lambda)(4-\lambda)$

Question 28 1 pts

Suppose that a vector x is an eigenvector of A with eigenvalue 3 and that x is also an eigenvector of B with eigenvalue 4. Which of the following is true about the matrix 2A - B and x:

- $\bigcirc x$ is an eigenvector of 2A-B with eigenvalue 3
- $\bigcirc x$ is an eigenvector of 2A-B with eigenvalue 2
- $\bigcirc \ m{x}$ is an eigenvector of $m{2A-B}$ with eigenvalue 1
- $\bigcirc ~ m{x}$ is an eigenvector of $m{2A} m{B}$ with eigenvalue 4
- O None of these

Question 29 1 pts

Suppose that A is a 4×4 matrix with eigenvalues 0, 1, and 2, where the eigenvalue 1 has algebraic multiplicity two.

Which of the following must be true?

(1) $m{A}$ is not diagonalizable

(2)	A	is	not	inve	rtible	е
\ <u> </u>	,	.0	1100			٠

- O Both (1) and (2) must be true
- O Neither statement is necessarily true
- (2) must be true but (1) might not be true
- \bigcirc (1) must be true but (2) might not be true

Question 30

1 pts

 ${\tt Suppose} A$ is a 5×5 matrix whose entries are real numbers. Then A must have at least one real eigenvalue.

- True

Question 31

1 pts

Suppose A is a positive stochastic matrix and $A \begin{pmatrix} 3/5 \\ 2/5 \end{pmatrix} = \begin{pmatrix} 3/5 \\ 2/5 \end{pmatrix}$. Let

$$v = \binom{5}{95}$$

As n gets very large, $A^n v$ approaches the vector $egin{pmatrix} r \\ s \end{pmatrix}$, where:

$$r =$$
 and $s =$

Question 32

Suppose that A is a 4×4 matrix of rank 2. Which one of the following statements must be true?

- \bigcirc $m{A}$ cannot have four distinct eigenvalues
- \bigcirc $m{A}$ is not diagonalizable
- none of these
- \bigcirc $m{A}$ is diagonalizable
- A must have four distinct eigenvalues

Question 33 1 pts

Suppose A is a 2×2 matrix whose entries are real numbers, and suppose A has eigenvalue 1+i with corresponding eigenvector $\begin{pmatrix} 2 \\ 1+i \end{pmatrix}$.

Which of the following must be true?

- ${}^{\bigcirc}$ igar must have eigenvalue 1-i with corresponding eigenvector ${2 \choose 1+i}$
- igcirc $m{A}$ must have eigenvalue $m{1}-m{i}$ with corresponding eigenvector $egin{pmatrix} m{2} \ m{1}-m{i} \end{pmatrix}$
- None of these
- ${}^{\bigcirc}$ $\emph{ extit{A}}$ must have eigenvalue 1+i with corresponding eigenvector $egin{pmatrix} 2 \ 1-i \end{pmatrix}$

Question 34

Let $T:\mathbb{R}^2 \to \mathbb{R}^2$ be the linear transformation that rotates the plane clockwise by 45 degrees, and let A be the standard matrix for T.

Which one of the following statements is true?

\cap A has one complex ϵ	eigenvalue with algebraic multiplicity two
	ue with algebraic multiplicity two
•	
\bigcirc A has two distinct co	mplex eigenvalues.

Question 35 1 pts

Suppose ${\pmb u}$ and ${\pmb v}$ are orthogonal unit vectors (to say that a vector is a unit vector means that it has length 1). Find the dot product

$$(3u-8v)\cdot 4u$$
.

Question 36 1 pts

Find the value of k that makes the following pair of vectors orthogonal.

$$egin{pmatrix} 2 \ k \ 1 \end{pmatrix}$$
 and $egin{pmatrix} k \ 1 \ -6 \end{pmatrix}$

Your answer should be an integer.

Question 37 1 pts

If W is a subspace of \mathbb{R}^{100} and v is a vector in W^\perp then the orthogonal projection of v to W must be the 0 vector.

○ True			
○ False			

Question 38 1 pts

Suppose W is a subspace of \mathbb{R}^n . If x is a vector and x_W is the orthogonal projection of x onto W, then $x \cdot x_W$ must be 0.

True

False

 Question 39
 1 pts

 Suppose that A is a 3×3 invertible matrix. What is the dot product between the second row of A and third column of A^{-1} equal to?

 \bigcirc 1

 \bigcirc Not Enough Information is Given

 \bigcirc 2

 \bigcirc -2

 \bigcirc -1

 \bigcirc 0

Question 40 1 pts

Find the orthogonal projection of $\binom{0}{1}$ onto $\operatorname{\mathbf{Span}}\left\{\binom{1}{2}\right\}$.

The orthogonal projection is $\begin{pmatrix} a \\ b \end{pmatrix}$, where: $a = \begin{pmatrix} a \\ b \end{pmatrix}$

$$\begin{pmatrix} a \\ h \end{pmatrix}$$
, where: a

and b =

Enter integers or fractions as your entries.

Question 41

1 pts

Compute the orthogonal projection of the vector igg(5) to the plane spanned by the

vectors $\begin{pmatrix} 0 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 1 \\ 0 \end{pmatrix}$. What is the first coordinate of the projection? Your

answer should be an integer.

Question 42

1 pts

Suppose B is the standard matrix for the transformation $T:\mathbb{R}^3 o \mathbb{R}^3$ of orthogonal projection onto the subspace $W = \left\{ \left(egin{array}{c} x \ y \end{array}
ight) \ ext{in } \mathbb{R}^3 \ \left| \ x+y+2z=0
ight\}.$

What is the dimension of the 1-eigenspace of B?



Question 43

Let W be the subspace of \mathbb{R}^4 given by all vectors $egin{pmatrix} x \ y \ z \ w \end{pmatrix}$ such that $x-y+z+w=0.$ Find dimension of the orthogonal complement $W^\perp.$				
Question 44	pts			
If $m{b}$ is in the column space of the matrix $m{A}$ then every solution to $m{A}m{x}=m{b}$ is a least squares solution.				
○ True				
○ False				
Question 45	pts			

If A is an m imes n matrix, b is in \mathbb{R}^m , and \hat{x} is a least squares solution to Ax = b, then \hat{x} is the point in $\mathrm{Col}(A)$ that is closest to b.

Question 46 1 pts

Find the least squares solution $\hat{m{x}}$ to the linear system

$$\begin{pmatrix} 6 \\ -2 \\ -2 \end{pmatrix} x = \begin{pmatrix} 14 \\ -2 \\ 0 \end{pmatrix}.$$

If your answer is an integer, enter an integer.

If your answer is not an integer, enter a fraction.

Question 47	1	1 pts

Find the best fit line y= x+ for the data points

(-7, -22), (0, -2), and (7, 6) using the method of least squares. Your answers should both be integers.

Question 48 1 pts

Let
$$A=egin{pmatrix} 4 & 1 \ 5 & 2 \end{pmatrix} egin{pmatrix} -3 & 0 \ 0 & -1 \end{pmatrix} egin{pmatrix} 4 & 1 \ 5 & 2 \end{pmatrix}^{-1}.$$

Find r and s so that $A^3 \begin{pmatrix} 1 \\ 2 \end{pmatrix} = \begin{pmatrix} r \\ s \end{pmatrix}$.

Question 49 1 pts

If $m{A}$ is a diagonalizable $m{6} imes m{6}$ matrix, then $m{A}$ has $m{6}$ distinct eigenvalues.	
○ True	
○ False	

Question 50 1 pts

Find the eigenvalues of the matrix $A=egin{pmatrix}1&4\cr4&7\end{pmatrix}$ and write them in increasing order.

The smaller eigenvalue is λ_1 =

The larger eigenvalue is λ_2 =

Not saved

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