Fall 2018

Name:		Er	ngineering Mathe
Multiple Choice Ques	tions (60 points)		
Q1 Under what condition of $(1, -1, 1)$ and $(2, 1, 0)$.	on can a vector (x, y, z)) be written as a	linear combination
(A) $x + y + z = 0$ (B) $3x + 2x + z = 0$	(C) $2x - y - z =$ (D) $x - 2y - 3z =$	$\begin{array}{c c} & 0 \\ = 0 \end{array} $ (E)	None
Q2 If $A = \begin{pmatrix} 3 & 1 & -5 \\ 0 & 1 & -5 \\ 0 & -2 & 10 \end{pmatrix}$). What is $rank(A)$?		
(A) 3 (B) 2	(C) 1	(D) 4	(E) None
Q3 For the augmented r parameters.	matrix $A = \begin{pmatrix} 1 & 2 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{pmatrix}$	$ \begin{array}{c c} 0 & 6 \\ 0 & 5 \\ 1 & -1 \end{array} \right), \text{ find} $	the number of free
(A) 0 (B) 1	(C) 2	(D) 3	(E) None
Q4 If the coefficient may unknowns is known to ha the general solution?	trix A in a homogene we $rank(A) = 5$, how	eous system of many free parar	12 equations in 16 neters are there in
(A) 2 (B) 3	(C) 7	(D) 11	(E) None
Q5 What is the product	$: \begin{pmatrix} 1 & 3 \\ 2 & 1 \end{pmatrix} \begin{pmatrix} 4 \\ 1 \end{pmatrix}.$		
(A) $(3,1)$	(C) $(2,6)$	(E)	None
(B) $(1,7)$	(D) $(7,9)$		

	$\begin{pmatrix} 2 & 1 \end{pmatrix} \begin{pmatrix} 1 \end{pmatrix}$	
(A) $(3,1)$	(C) (2,6)	(E) None
(B) $(1,7)$	(D) $(7,9)$	
Q6 The Span $\left\{ \begin{pmatrix} 1 \\ -2 \end{pmatrix}, \begin{pmatrix} 0 \\ 0 \end{pmatrix} \right\}$	$\binom{0}{0}$ is	
$(A) \ y = x + 1$	(C) $y = 4x$	(E) None
(B) $y = -2x$	(D) $y = 1$	
Q7 Find the value of p su	ich that the linear system	$\begin{cases} x - y = 3\\ x + py = p \end{cases}$ has no solution.
(A) $p = -1$	(C) $p = 1$	(E) None

(D) p = 2

$\begin{pmatrix} 1 & 0 & 0 & & 5 \\ 0 & 1 & 1 & & -2 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & & 0 \end{pmatrix}$ then the solution to system is $\begin{pmatrix} A & (5, -3, 1) & & (C) & (0, 0, 0) & & (E) \text{ None} \\ \end{pmatrix}$ $\begin{pmatrix} A & (5, -3, 1) & & (C) & (0, 0, 0) & & (E) \text{ None} \\ \end{pmatrix}$ $\begin{pmatrix} A & (5, -3, 1) & & (C) & (0, 0, 0) & & (E) \text{ None} \\ \end{pmatrix}$ $\begin{pmatrix} P & P & P & P & P \\ P & P & P & P \\ P & P &$	Q8 If the augmented n	matrix $[A b]$ of a system $Ax = b$ is row equivalent to		
(A) $(5, -3, 1)$ (C) $(0, 0, 0)$ (E) None(B) $(3, -4, 5)$ (D) $(5, -2, 1)$ (E) None(Q9) Let $A = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$. Which of the following is the correct geometric interpretation of the associated linear transformation?(A) shear(A) shear(C) projection(E) None(B) reflection(D) rotation(E) None(B) reflection(D) rotation(E) None(A) the triangle of the transformation?(A) the triangle of the transformation?(A) shear(C) projection(E) None(B) reflection(D) rotation(E) None(B) tet $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear mappting, satisfying $T(1, 2) = (2, 0, 1)$ at $T(2, 3) = (0, 1, 2)$. Find $T(1, 0)$.(A) $(1, 2, 3)$ (A) $(1, 2, 3)$ (C) $(2, 0, 1)$ (E) None(B) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None(B) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None(C) 2(20pts)The following is the reduced row-echelon form of the augmented matrix of a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & 8 \\ 0 & 1 & 1 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 & 5 & -5 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$ (I. How many equations does the system have?I. How many equations does the system have?	$ \begin{pmatrix} 1 & 0 & 0 & & 5 \\ 0 & 1 & 1 & & -2 \\ 0 & 0 & 1 & & 1 \\ 0 & 0 & 0 & & 0 \end{pmatrix} $ then the	solution to system is		
(B) $(3, -4, 5)$ (D) $(5, -2, 1)$ (D) $(2, -2, 1)$ (D) $(2, -1, -2, -1)$ (D) $(2, -1, -2, -1)$ (E) None (E) None (E) reflection (D) rotation (E) None (E) None (E) reflection (D) rotation (E) None (E) $(2, 0, 1)$ (E) None (E) $(2, 0, 1)$ (E) None (E) $(-1, -6, 2)$ (C) $(2, 0, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (D) $(-6, 2, 1)$ (E) None (E) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (D) $($	(A) $(5, -3, 1)$	(C) $(0,0,0)$ (E) None		
Q9Let $A = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$. Which of the following is the correct geometric interpretation of the associated linear transformation?(A) shear(C) projection(E) None(B) reflection(D) rotation(E) NoneQ10Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear mappting, satisfying $T(1,2) = (2,0,1)$ at $T(2,3) = (0,1,2)$. Find $T(1,0)$.(A) $(1,2,3)$ (C) $(2,0,1)$ (E) None(A) $(1,2,3)$ (C) $(2,0,1)$ (E) None(D) $(-6,2,1)$ (E) None(B) $(-1,-6,2)$ (D) $(-6,2,1)$ (E) None(Classical Problems: Show all work. No work=No credit(40 pts)Q2(20pts)The following is the reduced row-echelon form of the augmented matrixof a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & 8 \\ 0 & 1 & 1 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 & 5 & -5 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix}$ 1. How many equations does the system have?	(B) $(3, -4, 5)$	(D) $(5, -2, 1)$		
(A) shear(C) projection(E) None(B) reflection(D) rotation(E) NoneQ10Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear mappting, satisfying $T(1,2) = (2,0,1)$ a $T(2,3) = (0,1,2)$. Find $T(1,0)$.(C) $(2,0,1)$ (E) None(A) $(1,2,3)$ (C) $(2,0,1)$ (E) None(B) $(-1,-6,2)$ (D) $(-6,2,1)$ (E) NoneClassical Problems: Show all work. No work=No credit(40 pts)Q2(20pts)The following is the reduced row-echelon form of the augmented matherof a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & & 8 \\ 0 & 1 & 1 & 0 & 2 & 0 \\ 0 & 0 & 0 & 1 & 5 & -5 \\ 0 & 0 & 0 & 0 & 0 & & 0 \end{pmatrix}$ 1. How many equations does the system have?	Q9 Let $A = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$. Which of the following is the correct geometric interpretation of the associated linear transformation?			
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Q10 Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear mappting, satisfying $T(1,2) = (2,0,1)$ at $T(2,3) = (0,1,2)$. Find $T(1,0)$. (A) $(1,2,3)$ (C) $(2,0,1)$ (E) None (B) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ (E) None Q2(20pts) The following is the reduced row-echelon form of the augmented matrix of a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & & 8 \\ 0 & 1 & 1 & 0 & 2 & & 0 \\ 0 & 0 & 0 & 1 & 5 & & -5 \\ 0 & 0 & 0 & 0 & & 0 \\ 0 & 0 & 0 & 0 & & 0 \end{pmatrix}$ 1. How many equations does the system have?	(B) reflection	(D) rotation		
(A) $(1,2,3)$ (C) $(2,0,1)$ (E) None (B) $(-1,-6,2)$ (D) $(-6,2,1)$ (E) None Classical Problems: Show all work. No work=No credit(40 pts) Q2(20pts) The following is the reduced row-echelon form of the augmented matrix of a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & & 8 \\ 0 & 1 & 1 & 0 & 2 & & 0 \\ 0 & 0 & 0 & 1 & 5 & & -5 \\ 0 & 0 & 0 & 0 & 0 & & 0 \\ 0 & 0 & 0 & 0 & 0 & & 0 \end{pmatrix}$ 1. How many equations does the system have?	Q10 Let $T : \mathbb{R}^2 \to \mathbb{R}^3$ be a linear mapping, satisfying $T(1,2) = (2,0,1)$ and $T(2,3) = (0,1,2)$. Find $T(1,0)$.			
(B) $(-1, -6, 2)$ (D) $(-6, 2, 1)$ Classical Problems: Show all work. No work=No credit(40 pts) Q2(20pts) The following is the reduced row-echelon form of the augmented matrix of a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & & 8 \\ 0 & 1 & 1 & 0 & 2 & & 0 \\ 0 & 0 & 0 & 1 & 5 & & -5 \\ 0 & 0 & 0 & 0 & 0 & & 0 \\ 0 & 0 & 0 & 0 & 0 & & 0 \end{pmatrix}$ 1. How many equations does the system have?	(A) $(1,2,3)$	(C) $(2,0,1)$ (E) None		
Classical Problems: Show all work. No work=No credit(40 pts) Q2(20pts) The following is the reduced row-echelon form of the augmented matrix of a system of linear equations. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & & 8 \\ 0 & 1 & 1 & 0 & 2 & & 0 \\ 0 & 0 & 0 & 1 & 5 & & -5 \\ 0 & 0 & 0 & 0 & 0 & & 0 \\ 0 & 0 & 0 & 0 & 0 & & 0 \end{pmatrix}$ 1. How many equations does the system have?	(B) $(-1, -6, 2)$	(D) $(-6, 2, 1)$		
Q2(20pts) The following is the reduced row-echelon form of the augmented matrix of a system of linear equations.	Classical Problems: Show all work. No work=No credit(40 pts)			
1. How many equations does the system have?	Q2(20pts) The following to f a system of linear equat	is the reduced row-echelon form of the augmented matrix ions. $\begin{pmatrix} 1 & 0 & -3 & 0 & 6 & & 8 \\ 0 & 1 & 1 & 0 & 2 & & 0 \\ 0 & 0 & 0 & 1 & 5 & & -5 \\ 0 & 0 & 0 & 0 & 0 & & 0 \\ 0 & 0 & 0 & 0 & 0 & & 0 \end{pmatrix}$		
	1. How many equations	does the system have?		

2. How many variables does the system have?

Ans: 5

3. Is this system homogeneous or non-homogeneous?

Ans:non-homogeneous

4. Find the pivot columns.

(B) p = 0

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Ans: col1, col2, col3

5. Find the basic variables.

Ans: x_1, x_2, x_4

6. Find the free variables.

Ans: x_3 and x_5 are free variables

7. What is the rank of this matrix?

Ans: 3

8. How many parameters (if any) do we need for the general solution?

Ans: 2

9. What is the system of equations corresponding to this matrix?

Ans: The corresponding system of linear equations is

 $x_1 - 3x_3 + 6x_5 = 8$ $x_2 + x_3 + 2x_5 = 0$ $x_4 + 5x_5 = -5$

10. What is the general solution?

Ans:

$$\begin{array}{rcl}
x_1 = 3x_3 - 6x_5 + 8 \\
x_2 = & -x_3 - 2x_5 \\
x_3 = & x_3 \\
x_4 = & -5x_5 - 5 \\
x_5 = & t
\end{array}$$

Let $x_3 = s$ and $x_5 = t$ then

$$x_1 = 3s - 6t + 8$$
$$x_2 = -s - 2t$$
$$x_3 = s$$
$$x_4 = -5t - 5$$
$$x_5 = t$$

Q1(20pts) Find all values of k so that the system: $\begin{aligned} x - 2y + & 3z = 1\\ 2x + ky + & 6z = 6\\ -x + 3y + (k - 3)z = 0 \end{aligned}$

has

- **1.** no solutions
- **2.** a unique solution
- **3.** infinitely many solutions

Solution: Solution: First, we convert this linear system to an augmented matrix

(1)	-2	3	$ 1\rangle$	
2	k	6	6	
$\setminus -1$	3	k-3	0/	

and apply row operations: $R_2\to -2R_1+R_2$ $R_3\to R_1+R_3$ $R_3\to R_2$ $R_2\to R_3$ $R_3=-(4+k)R_2+R_3$ we get

$$\begin{pmatrix} 1 & -2 & 3 & | & 1 \\ 0 & 1 & k & | & 1 \\ 0 & 0 & -k(k+4) & | & -k \\ 0 & 0 & 0 & | & 0 \end{pmatrix}$$

Case1: k = 0. Then the system is

/1	-2	3	1
0	1	0	1
0	0	0	0
$\setminus 0$	0	0	0/

and it's consistent. There is a col without a pivot (the third) so there are infinitely many solutions.

Case2: k = -4. Then the system is

 $\begin{pmatrix} 1 & -2 & 3 & 1 \\ 0 & 1 & -4 & 1 \\ 0 & 0 & 0 & 4 \\ 0 & 0 & 0 & 0 \end{pmatrix}$

and is inconsistent. Case 3: $k \neq 0,4.$ Then the system is

 $\begin{pmatrix} 1 & -2 & 3 & | & 1 \\ 0 & 1 & k & | & 1 \\ 0 & 0 & nonzero & | & 0-k \\ 0 & 0 & 0 & | & 0 \end{pmatrix}$

and there is unique solution.