You have minutes to complete the quiz. Please show all work, and then circle your answer.

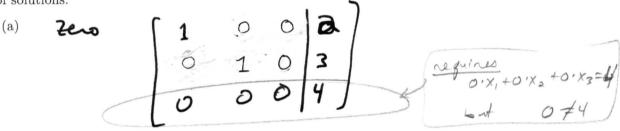
1. Fill in the blanks, to complete the statement of Theorem 2:

Theorem 2: The reduced echelon form of a linear system has three possible cases

(a) The system has zero solutions if it contains a row [0...0] it is consistent and has a pivot in every coeff. column.

it is consistent and (c) The system has <u>o-many</u> solutions if <u>if some</u> colf column does

2. For each of the cases above, write down an augmented matrix with the corresponding number of solutions.



(b) unique 
$$\begin{cases} 1 & 0 & 0 & | & 3 \\ 0 & 1 & 0 & | & 3 \\ 0 & 0 & 1 & | & 9 \end{cases}$$

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Section:

3. Write down the formal definition of  $\mathrm{Span}\{\vec{v}_1,\vec{v}_2,\vec{v}_3\}.$ 

the set of 
$$\vec{b}$$
 s.t.  $\vec{b} = c_1 \cdot \vec{V_1} + c_2 \cdot \vec{V_2} + c_3 \cdot \vec{V_3}$   
Box some  $c_1, c_2, c_3$  in  $\vec{R}$ 

4. What is the graphical meaning of  $\operatorname{Span}\{\vec{\mathbf{v}}_1, \vec{\mathbf{v}}_2, \vec{\mathbf{v}}_3\}$ ?

5. Fill in the blanks to state Theorem 4 in terms of pivots.

**Theorem 4:** The columns of an  $m \times n$  matrix A span  $\mathbb{R}^m$ 

6. Write down a  $3 \times 3$  matrix A whose columns span  $\mathbb{R}^3$ .

$$\begin{bmatrix}
1 & 2 & 0 \\
0 & 1 & 3 \\
0 & 0 & 1
\end{bmatrix}$$

7. Write down a  $3 \times 3$  matrix A whose columns do not span  $\mathbb{R}^3$ .

8. Can you write down a  $2 \times 3$  matrix A whose columns span  $\mathbb{R}^{2}$ ? Justify your answer.

9. Can you write down a  $3 \times 2$  matrix A whose columns span  $\mathbb{R}^3$ ? Justify your answer.

Name: \_\_\_\_\_

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10. Write down the formal definition of Linear **Dependence** of vectors  $\{\vec{\mathbf{v}}_1, \vec{\mathbf{v}}_2, \vec{\mathbf{v}}_3\}$ .

$$\{U_1, U_2, U_3\}$$
 is linearly Dependent  
If there are  $C_1, C_2, C_3$  in IR NOT ale O  
So that  
 $C_1 \cdot V_1 + C_2 \cdot V_2 + C_3 \cdot V_3 = 0$ 

11. Give an example of a non-trivial dependence relation between  $\vec{\mathbf{v}}_1, \vec{\mathbf{v}}_2, \vec{\mathbf{v}}_3$ .

Use this dependence relation to explain the graphical meaning of "Linear **Dependence**".

$$2\vec{V_1} + 6\vec{V_2} - \vec{V_3} = \vec{0}$$
  
solving for  $\vec{V_3} = 2\vec{V_1} + 6\vec{V_2}$   
shows that  $\vec{V_3}$  is in Span  $\{\vec{V_1}, \vec{V_2}\}$ .

12. What is the graphical meaning of the set  $\{\vec{\mathbf{v}}_1, \vec{\mathbf{v}}_2, \vec{\mathbf{v}}_3\}$  being Linearly **Independent**?

If there is NO Nontrivial dependence relation Then NO Vi is in the span of the other vector.

Section: \_

13. Suppose that  $x_1\vec{\mathbf{v}}_{\$} + x_2\vec{\mathbf{v}}_2 + x_3\vec{\mathbf{v}}_3 = \vec{\mathbf{0}}$  has a unique solution. Is  $\{\vec{\mathbf{v}}_1, \vec{\mathbf{v}}_2, \vec{\mathbf{v}}_3\}$  Linearly **Independent**?

per yes.

X1=X2=X3=0 is always a Solution

So the only dependence relation is the trivial one.

so the vectors are linearly independent

14. Suppose that  $x_1\vec{\mathbf{v}}_{\parallel} + x_2\vec{\mathbf{v}}_2 + x_3\vec{\mathbf{v}}_3 = \vec{\mathbf{0}}$  has infinitely many solutions. Is  $\{\vec{\mathbf{v}}_1, \vec{\mathbf{v}}_2, \vec{\mathbf{v}}_3\}$  Linearly Independent?

so-many solutions No.

=) has some wonthivial solution

=) there is a nontrivial dependence relation

15. Does  $x_1\vec{\mathbf{v}}_{\parallel} + x_2\vec{\mathbf{v}}_2 + x_3\vec{\mathbf{v}}_3 = \vec{\mathbf{0}}$  always have a solution? Why or why not?

yes. 
$$0.\vec{V}_1 + 0.\vec{V}_2 + 0.\vec{V}_3$$

= 0 + 5 +5

So \$x\_1=x\_2=x\_3=0 is always a solution.