

Name _____ ID _____

MATH 311
Section 200

Exam 1

Fall 2002
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1	/15	4	/15
2	/15	5	/20
3	/15	6	/20

1. (15 points) Compute

$$\det \begin{pmatrix} 2 & 5 & 4 & -1 & 4 \\ 0 & 1 & -2 & 1 & 2 \\ 1 & 3 & 0 & -2 & 1 \\ 2 & 6 & 3 & -4 & -1 \\ -2 & -6 & -3 & 0 & 1 \end{pmatrix}$$

2. (15 points) Use row operations on the augmented matrix to solve the system of equations

$$2u + 4v - 2w - 2x + 2y - 4z = 4$$

$$u + 2v - 2w - 3x + y - 3z = -3$$

$$3u + 6v - 2w - x + 3y - 5z = b$$

a. For what value(s) of b do there exist solutions.

$$b =$$

b. For those value(s) of b write the set of all solutions in parametric form.

$$u =$$

$$x =$$

$$v =$$

$$y =$$

$$w =$$

$$z =$$

c. Interpret the solution set as a k -plane in \mathbb{R}^n for some k and n .

3. (15 points) Find the equation of the plane tangent to the graph of the function

$$f(x,y) = 3x \sin y - 2y \cos x \quad \text{at the point } (x,y) = \left(0, \frac{\pi}{2}\right).$$

4. (15 points) Find the equation of the line perpendicular to the surface

$$F(x,y,z) = x^2y + y^3z + z^4x = 29 \quad \text{at the point } P = (x,y,z) = (3, 2, 1).$$

5. (20 points) Consider the matrix $A = \begin{pmatrix} -2 & -5 & 1 \\ 1 & 3 & -1 \\ 3 & 7 & -1 \end{pmatrix}$.

a. Find A^{-1} or show it does not exist.

b. Consider the equations $AX = \mathbf{0}$, i.e.

$$-2x - 5y + z = 0$$

$$x + 3y - z = 0$$

$$3x + 7y - z = 0$$

How many solutions are there?

Circle one: (Do not solve the equations.)

No Solutions

Unique Solution

∞ -Many Solutions

Explain why:

6. (20 points) Consider the matrix $A = \begin{pmatrix} -2 & -5 & 1 \\ 1 & 3 & -1 \\ 3 & 7 & 0 \end{pmatrix}$.

a. Find A^{-1} or show it does not exist.

b. Consider the equations $AX = \hat{j}$, i.e.

$$-2x - 5y + z = 0$$

$$x + 3y - z = 1$$

$$3x + 7y = 0$$

How many solutions are there?

Circle one:

No Solutions

Unique Solution

∞ -Many Solutions

Find all solutions if there are any.