

Math 221 202

(Take home) Quiz 6 Cover-sheet

Score

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Your name _____ Student #

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Due: Thursday, March 1st, 2001 at 10.00am.

Ground Rules:

- 1. Donot pick up a quiz for any other person.**
- 2. Please turn in the quiz in person as you enter the class (no later than 10.15 am).**

*3. Open book and notes. You may consult anyone you want, but you must write up your own solutions.**4. Show your work. Explain your solutions clearly.**5. When you submit the quiz back on Tuesday, please use this cover sheet as the first page.**6. The grader will choose two problems randomly (page 3) and grade them.**7. Maximum possible score will be 25. There will be 4 points for completion and 1 point for attaching this cover sheet. No points for turning in this cover sheet without the quiz.*

It would be nice if you use the space below and the back of this page to answer the problems (page 3).
It will minimize my/our contributions to global warming.

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¹ **Office hours:** Monday 1:30pm-3pm, 5pm-6pm, Wednesday 2:30pm-3:30pm, Thursday at 1:30pm-3:00pm, Friday 11:30am-12:30pm or by appointment.

Overview of Sections 3.1,3.2,3.3

1. **Vocabulary List:**

- (a) Determinant.
- (b) Cofactor.
- (c) Volume and Area.

2. **Key Concepts:**

- (a) Determinant.
- (b) Determinant of triangular matrix, A^T , AB .
- (c) expansion of determinant along any row and column.
- (d) Relationship between elementary rows and the determinant.
- (e) Relationship between invertibility and the determinant.
- (f) Relationship between volume/area and the determinant.

3. **Skills to Master:**

- (a) Computing the determinant of a matrix using cofactor expansion.
- (b) Computing the determinant of a matrix using elementary operations.
- (c) Computing the area and volume using determinant.

Homework Set no.	Date	Section	Problems
Homework Set 15	February 27th	4.1	12,13,14
		4.2	1,6,15,27
		4.3	5,11,13,19,23
Homework Set 16	March 1	4.4	3,7,9
		4.6	7,9,19,27

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Quiz 6 Questions

1. Section 3.1: 14,37
2. Section 3.2: 26,29,40E
3. Section 3.3: 23,31
4. Show that for a triple a, b, c with $a \neq b, a \neq c, b \neq c$ that

$$\det \begin{bmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{bmatrix} \neq 0$$

Such a matrix is called Vandermonde matrix. *Hint: Factor the resulting determinant*

5. Let

$$A = \begin{bmatrix} 1 & -1 \\ 1 & 3 \end{bmatrix}, I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}.$$

- (a) Let $p(\lambda) = \det(A - \lambda I)$. Show that $p(\lambda) = \lambda^2 - 4\lambda + 5$.
- (b) $p(\lambda) = 0$ has two solutions say λ_1, λ_2 . Find λ_1, λ_2 .
- (c) Using the values of λ_1, λ_2 that you found above, Describe a basis for the Null($A - \lambda_1 I$) and Null($A - \lambda_2 I$).

$p(\lambda)$ is called the characteristic polynomial of A . λ_1, λ_2 are called eigen-values of A and the vectors you found in (5c) are called their eigen-vectors.

6. Let $A = \begin{pmatrix} 2 & 0 \\ 0 & 0 \end{pmatrix}$. Let $b = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$. Verify $Ax=b$ is Inconsistent. Please solve $A^T A x = A^T b$. (You should get infinitely many solutions). Pick any solution and call it x^* , and let $v = Ax^*$. systems.

Prize Question: (*Need not turn in with the quiz*) What is the geometric significance of the vector v ? If anyone of you solves it, the whole class gets free candy.
Prize offer EXTENDED-March 1.

Hint: Try the same calculation with say $b = \begin{pmatrix} 8 \\ 1 \end{pmatrix}$.

Then try the same calculation with say $A = \begin{pmatrix} 2 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{pmatrix}$ and $b = \begin{pmatrix} 1 \\ 1 \\ 9 \end{pmatrix}$. Sketch in each of the above three cases: b, v , range-space(A)=col(A). Spot the significance.