Your Preferred Name

Student ID #

- Do not open this quiz until you are told to begin. You will have 30 minutes for the quiz.
- Check that you have a complete quiz. There are 3 questions for a total of 29 points.
- You are allowed to have one index card of handwritten notes (both sides). Only basic non-graphing scientific calculators are allowed, though you should not need one.
- Cheating will result in a zero and be reported to the Dean's Academic Conduct Committee.
- **Show all your work**. Unless explicitly stated otherwise in a particular question, if there is no work supporting your answer, you will not receive credit for the problem. If you need more space to answer a question, continue on the back of the page, and indicate that you have done so.

Question	Points	Score
1	9	
2	10	
3	10	
Total:	29	

1. (9 points) Below is a list of definitions or equivalent conditions. Clearly write the number of the corresponding definition or equivalent condition next to each given term. Some numbers will not be used.

   (a) ____________ dimension

   (b) ____________ basis

   (c) ____________ subspace

   (d) ____________ row space

   (e) ____________ invertible

   (f) ____________ kernel

   (g) ____________ column space

   (h) ____________ range

   (i) ____________ nullity

   1. a subset of $\mathbb{R}^n$ which contains $\vec{0}$ and is closed under linear combinations
   2. a linearly independent spanning set
   3. $\{\vec{x} \in \mathbb{R}^n : T(\vec{x}) = \vec{0}\}$
   4. $\{\vec{x} \in \mathbb{R}^n : A\vec{x} = \vec{0}\}$
   5. $\{A\vec{x} : \vec{x} \in \mathbb{R}^n\}$
   6. $\{T(\vec{x}) : \vec{x} \in \mathbb{R}^n\}$
   7. $\text{span}\{\vec{v}_1, \ldots, \vec{v}_n\}$ where $\vec{v}_i$ is the ith row of A
   8. $\det(A) \neq 0$
   9. the number of vectors in a basis for a subspace
   10. the number of vectors in a basis for the row space
   11. the number of vectors in a basis for the null space

2. Consider the following matrix:

$$A = \begin{pmatrix} 1 & 2 & -1 & -2 \\ 2 & 4 & -3 & -5 \\ -1 & -2 & 0 & 1 \end{pmatrix}$$

(a) (4 points) Give a basis for null(A).

(b) (3 points) Give a basis for row(A).

(c) (3 points) Give a basis for col(A).

3. (a) (3 points) Compute

$$\det \begin{pmatrix} 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 1 & 0 & 0 & -1 \\ 0 & 1 & -1 & -1 \end{pmatrix}$$

(b) (2 points) Give an example of a non-invertible matrix of rank 2. You do not need to justify why your example works.

(c) (2 points) Suppose A and B are $n \times n$ matrices where $A = (I + B)(I - B)^{-1}$. Solve for B in terms of A; assume any inverses you encounter exist.

(d) (3 points) Give an example of a linear transformation $T \colon \mathbb{R}^2 \to \mathbb{R}^2$ with one-dimensional range. You do not need to justify why your example works. What must the dimension of the kernel be?