Name (Last, First): ____________________

Student ID: ____________________

Circle your GSI and section:

Sparks	8am	105 Latimer
McIvor	9am	55 Evans
Hening	10am	7 Evans
Hening	11am	3113 Etcheverry
Sparks	12pm	285 Cory
Sparks	1pm	285 Cory
McIvor	2pm	3107 Etcheverry
McIvor	3pm	3107 Etcheverry
Tener	4pm	79 Dwinelle
Tener	5pm	81 Evans

If none of the above, please explain: ____________________

This is a closed book exam, no notes allowed. It consists of 6 problems, each worth 10 points, of which you must complete 5. **Choose one problem not to be graded by crossing it out in the box below.** You must justify every one of your answers unless otherwise directed.

Problem	Maximum Score	Your Score
1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
Total Possible	50	

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1. Inside of the vector space $\mathbb{R}^3$, consider the set of vectors

$$S = \{(1,2,3),(4,5,6),(7,8,9)\}$$

Find a basis for and the dimension of the span of S.

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2. Let $S = \{v_1, v_2, v_3, v_4\}$ be a set of vectors inside of the vector space $\mathbb{R}^3$. Suppose that the subset $\beta = \{v_1, v_2, v_3\}$ is a basis of $\mathbb{R}^3$. Prove that if v_4 is nonzero, there is a subset of S containing v_4 that is also a basis of $\mathbb{R}^3$. (Extra credit: Is your subset unique? How many such subsets are there?)

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3. State what it means for a vector space to be infinite-dimensional. Prove that the vector space $P(\mathbb{R})$ of real polynomials is infinite-dimensional.

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4. Decide if each of the following statements is TRUE or FALSE. If true, provide a proof. If false, provide a counterexample.

a) Inside of the vector space $\mathbb{R}^2$, if we set $W_1 = span\{(1,0)\}$ and have another subspace W_2 such that $\mathbb{R}^2 = W_1 \oplus W_2$, then W_2 contains the vector $(0,1)$.

b) Inside of the vector space $\mathbb{R}^3$, consider the subspaces $W_1 = span\{(1,1,0),(0,1,1)\}$ and $W_2 = span\{(1,1,1)\}$. Then we have $\mathbb{R}^3 = W_1 \oplus W_2$.

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5. Consider the vector space $P_3(\mathbb{R})$ of real polynomials of degree ≤ 3. For each of the following subsets, decide whether it is a subspace or not, and when it is a subspace calculate its dimension.

a) $W = \{p(x) \in P_3(\mathbb{R}) \,|\, p(0) = p(1)\}$

b) $W = \{p(x) \in P_3(\mathbb{R}) \,|\, p(x)^2 = p(1)^2 x^6\}$

6. State what it means for a field to have characteristic 2. Suppose F is a field and $a \in F$ is a nonzero element such that $a = -a$. Prove that the characteristic of F equals 2.