Reflection Activity

Submit responses to the following questions to the `1` slot on D2L by 11:59 pm on Monday, September 16. Any cogent response will earn you 5 points on the exam; you can earn the other 95 points on the exam itself.

1. (Required.) Explain in language accessible to a student who has taken calculus but not linear algebra (not even Linear I) what vector spaces and linear operators are and how they interact.

2. (Required.) What have you found most difficult or confusing in the course so far? Write it down explicitly. Then think hard about this concept for at least half an hour—go back over your notes, the daily log, and the textbook and reread and rework material related to this sticky topic. How do you feel now?

3. (Optional.) What would you like to discuss during our review in class on Wednesday, September 18? Please be as specific as possible and, if you can, point to numbered items in the daily log, problems from problem sets, or content in the textbook.

4. (Optional.) What, if anything, do you want to change about how you are working in and approaching this course? How can I help?

Exam Content

The exam will cover material discussed in class on Days 1 through 14. Specifically, the exam will test your ability to do the following.

1. Give the precise definition of any concept appearing in the "Vocabulary from today" boxes in the daily log for Days 1 through 14 and provide examples and/or nonexamples as appropriate. Vocabulary questions will be similar in style (if not content) to the ones from Vocabulary Quiz 1. Note that Days 3 and 11 have some more words in their boxes than appeared on Quiz 1.

2. Determine if a set of ordered pairs is or is not a function; if it is, specify the domain, codomain, and range and determine the image of a subset of the domain.

3. Be familiar with the notation $\mathbb{F}^n$, $\mathbb{F}^{m\times n}$, $\mathbb{R}^\infty$, and $\mathcal{C}^r(I)$ for special vector spaces in this course. I will remind on the exam you of what any other forms of idiosyncratic vector space notation mean (e.g., the idiosyncratic polynomial space $\mathbb{P}(\mathbb{F})$ or the space ℓ^∞ of bounded sequences).

4. Determine if a subset of a vector space is a subspace. If it is not, explain every way in which it fails to be a subspace.

5. Determine if a map between vector spaces is a linear operator or explain every way in which it fails to be a linear operator. You should know what the zero and identity operators are. You should be able to use both parts of the fundamental theorem of calculus to prove things about derivative and integral operators. You should be able to perform matrix-vector

multiplication and prove that it is linear. You should be comfortable manipulating sequences (e.g., via shift operators).

6. Determine if a scalar λ is an eigenvalue of a linear operator and find corresponding eigenvalues. Find all eigenvalues of a linear operator.

7. Determine the range and kernel of a linear operator.

8. Calculate the composition of two linear operators and determine if they commute or not.

9. Determine if a linear operator is surjective or injective and if two vector spaces are isomorphic or not.

10. You should be able to prove the following results from the daily log (some proofs are given in the book as well, some are given *only* in the book): Theorem 7.6 Theorem 11.3, Theorem 11.5, Theorem 11.8, Theorem 11.11, Theorem 12.2, Theorem 13.4, and Theorem 13.5

A natural question is how many problems will be on the exam. A numerical answer to this question that does not also discuss the length and difficulty of each problem (which would, more or less, require disclosing the content of each problem) will tell you very little. I expect that most students will need the full allotted time to complete an exam. There is definitely nothing wrong with you if the exam takes you all of the available time.

How to Prepare

Here are some questions for your consideration.

1. Have you completed all of the problems in the lecture notes corresponding to the material above?

2. Have you completed every problem set and checked your solutions carefully?

3. Have you completed every recommended problem from the problem sets?

4. Can you do all these problems with minimal reference to your notes, my notes, the textbook, or any other source?

5. Are you comfortable following the preparation instructions for Vocabulary Quiz 1 for all of the vocabulary covered on this exam?