

University of Birmingham
School of Mathematics
Vectors, Geometry and Linear Algebra
VGLA

Feedback on Exam

Model Solutions

GENERAL COMMENTS

Most students showed good understanding of vectors (the first subject in the course). Mostly the complex numbers related questions were well understood. Students struggled with the complex numbers/conics question Q3 (i).

On the whole linear equations posed no severe problems. The Gaussian Elimination method was mostly mastered. Also questions related to determinants were well handled.

The questions focussed on vector spaces split the class between those that could answer the questions and those that couldn't. Mastering vector spaces is important in the course and it was plain that some students struggled.

GENERAL COMMENTS ABOUT THE QUESTIONS

- Question One (a) This one was very well answered.
(b) This was very well done. Some solutions demonstrated some confusion with the principal value of the argument.
(c) Again this was for the most part well done.
- Question Two (a) This was well done. The first part is just a matter of reducing the matrix to diagonal form using the standard row reduction techniques and then reading of the determinant as the product of the diagonal entries.
The second part uses the standard row-reduction method for finding inverse. Some students tried to use the adjoint method. This caused more elementary errors.
For part 3, you need to remember rules about determinants (or have to do lots of calculations). The nicest solution remembers that $\det(XY) = \det X \det Y$, $\det X^{-1} = \frac{1}{\det X}$ and $\det(X^T) = \det X$. (Here X is an $n \times n$ matrix.)
(b) This was also well attempted. Key points to remember. a) The subspace test. This includes showing that the set which you want to check is a subspace is non-empty. b) The definition of a basis. c) The definition of the dimension of a subspace.
- Question Three (a) I already mentioned this before. Here people sometimes forgot the definition of focus, vertex and the standard form of a parabola.
(b) This was less well done. It is conceptually harder than the other parts of the question. It was plain some people were guessing.
(c) Part (iii) was a place where people had remembered the rules and could write down the answer. This was well done.
(d) Not many people got this solution. The point is that $\mathbf{A} \operatorname{adj}(\mathbf{A}) = (\det \mathbf{A}) \mathbf{I}_n$. Now take the determinant of both sides noting that $\det((\det \mathbf{A}) \mathbf{I}_n) = (\det \mathbf{A})^n$
- Question 4 (a) This just demands you keep calm. Lots of this question was unseen. Use the subspace test, remember the definitions related to linear transformations. Most people struggled with this question.
(b) Most people who remembered the definition of a linear transformation could do the first part of this question. After that, it was clear some people had not revised this part of the course adequately.

WHERE STUDENTS TYPICALLY DID WELL

Very good understanding of determinants, vector calculations and complex numbers was displayed.

TYPICAL AREAS FOR IMPROVEMENT

Revising all aspects related to vector spaces will pay you back hugely in the compulsory second year linear algebra course no matter how well you do on the exam.