

LINEAR ALGEBRA ESSENTIALS

A WORKBOOK FOR UNDERGRADUATES

SUHAILA ABD HALIM · SITI SALMAH YASIRAN

MOHD RAHIMIE MD NOOR

NOR HILALIYAH MOHD JAMIL · NORMI ABDUL HADI

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Preface

Linear Algebra Essentials: A Workbook for Undergraduates provides notes, samples of questions and solutions, and tutorials for six chapters. This workbook is designed to support and enhance the understanding of linear algebra fundamentals at the undergraduate level. It also offers a comprehensive approach in solving questions related to linear algebra. In addition, the use of Python is introduced at the end of the book.

The section in each chapter consists of:

1. Concise notes: The key concepts are presented in a clear and concise manner to assist in quick understanding. The notes serve as a quick reference for revising the fundamental ideas.
2. Sample questions and solutions: Examples are provided to illustrate the applications of concepts in solving problems in linear algebra. It has all the topics in each chapter. Detailed solutions are also provided in each sample problem.
3. Tutorials: The tutorials are designed to guide students through problems to enhance their analytical skills and conceptual understanding.

The goal of this workbook is to make linear algebra accessible and engaging. Regular practice and engagement with the content will help develop students' confidence and proficiency in linear algebra. In addition, using Python for solving linear algebra problems provides students with valuable computational skills that are essential in today's data-driven world.

We hope this workbook becomes an important resource for students in their mathematical journey.

Let's learn together!

Chapter 1

MATRICES

NOTES

INTRODUCTION TO MATRICES

Matrix

A matrix is a rectangular arrangement of m by n numbers that is enclosed within a bracket.

The numbers in a matrix are called its **elements** or **entries**. The entries or elements of the matrix are denoted by a_{ij} with the i^{th} rows and j^{th} column. In general, an $m \times n$ matrix A can be written as follows.

$$A = \begin{pmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{pmatrix} = (a_{ij})_{m \times n}$$

Transpose of a Matrix

For an $m \times n$ matrix A , its transpose, which is the matrix of $n \times m$ is

$$A^T = \begin{pmatrix} a_{11} & a_{21} & \cdots & a_{m1} \\ a_{12} & a_{22} & \cdots & a_{m2} \\ \vdots & \vdots & \ddots & \vdots \\ a_{1n} & a_{2n} & \cdots & a_{nm} \end{pmatrix}$$

Linear Algebra Essentials: A Workbook for Undergraduates is designed to make learning linear algebra enjoyable. It provides easy-to-understand notes, practical sample questions with step-by-step solutions, and helpful tutorials to build problem-solving skills. The workbook also introduces Python for elementary linear algebra problems while giving students valuable computational experiences. The workbook features interactive exercises and visual aids to enhance understanding. It also offers guidelines and strategies for effective studying. The aim is to boost confidence and proficiency in linear algebra through practice and engagement, making it accessible and relevant to students' future careers. This comprehensive approach ensures that students grasp the fundamental concepts and appreciate the practical significance of elementary linear algebra.

SUHAILA ABD HALIM



Ts. Dr. Suhaila Abd Halim is an Associate Professor at the Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA (UiTM) Shah Alam. She was appointed as a lecturer at UiTM in 2007. She is a Professional Technologist (Ts-MBOT) and also a Senior Member of IEEE. She has been supervising students at undergraduate and postgraduate levels, besides she is one of the editors for the Malaysian Journal of Computing (MJoC). In addition, her research interests include image processing, computational mathematics, applications of neural networks, and numerical methods.

SITI SALMAH YASIRAN



Dr. Siti Salmah Yasiran is a Malaysian academic with a Ph.D. in Mathematics from Universiti Teknologi Malaysia (UTM). She currently holds the position of senior lecturer at Universiti Teknologi MARA (UiTM) Shah Alam, where she has been contributing since 2010. Her research interests include machine learning, algorithm development, and image processing.

MOHD RAHIMIE MD NOOR



Mohd Rahimie Md Noor graduated with a Master's degree in Mathematics from Universiti Kebangsaan Malaysia (UKM). He began his career as a lecturer at Universiti Teknologi MARA (UiTM), Perak branch, from 2009 to 2013. He is currently serving as a senior lecturer at UiTM Kelantan branch from 2013 to the present.

NOR HILALIYAH MOHD JAMIL



Nor Hilaliyah Mohd Jamil is a mathematics lecturer with over eight (8) years of teaching experiences. She is currently teaching at Universiti Teknologi MARA (UiTM), Negeri Sembilan Branch, Seremban Campus. She holds a Master's degree in Applied Mathematics from UiTM Shah Alam. Nor Hilaliyah is passionate about teaching and enjoys helping students understand mathematics better. This book reflects her dedication to education and her love for the subject.

NORMI ABDUL HADI



Ts. Dr. Normi Abdul Hadi is an Associate Professor at Universiti Teknologi MARA (UiTM), specialising in computer-aided geometric design, image processing, and high-performance computing. She holds a PhD in Mathematics from UiTM and completed postdoctoral research in parallel computing at Universiti Teknologi Malaysia (UTM). Her work has earned multiple research grants, academic awards, and recognition for innovative teaching tools. She has supervised numerous postgraduate students and served as an examiner, reviewer, and invited speaker at international conferences.