

Solutions I.N. Herstein- Second Edition

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Problem 0.1. In the following determine whether the systems described are groups. If they are not, point out which of the group axioms fail to hold.

(a). $G =$ set of integers, $a.b \equiv a - b$.

(b). $G =$ set of all positive integers, $a.b = ab$, the usual product of integers.

(c). $G = a_0, a_1, \dots, a_6$ where,

$$\begin{aligned} a_i.a_j &= a_{i+j} & \text{if } i+j < 7, \\ a_i.a_j &= a_{i+j-7} & \text{if } i+j \geq 7 \end{aligned}$$

(for instance, $a_5.a_4 = a_{5+4-7} = a_2$, since $5+4=9 > 7$).

(d). $G =$ set of all rational numbers with odd denominators, $a.b \equiv a + b$, the usual addition of rational numbers.

Proof. (a). $G =$ set of integers, $a.b \equiv a - b$.

We note G is not a group as there exists no identity in G .

(b). $G =$ set of all positive integers, $a.b = ab$, the usual product of integers.

We note G is not a group as the inverses do not belong in G for all elements of G . For example, inverse of 2 is $\frac{1}{2} \in \mathbb{Z}^+$.

(c). $G = a_0, a_1, \dots, a_6$ where,

$$\begin{aligned} a_i.a_j &= a_{i+j} & \text{if } i+j < 7, \\ a_i.a_j &= a_{i+j-7} & \text{if } i+j \geq 7 \end{aligned}$$

(for instance, $a_5.a_4 = a_{5+4-7} = a_2$, since $5+4=9 > 7$).

We note G has closure by definition.

We claim a_0 is the identity of G . This is because $a_0.a_i = a_i.a_0 = a_{0+i} = a_i \forall i = 1, 2, 3, 4, 5, 6$.

Next we claim the associative law holds in G .

– $i+j < 7, j+k < 7, i+j+k < 7$

Then $(a_i.a_j).a_k = a_{i+j}.a_k = a_{i+j+k}$ and $a_i.(a_j.a_k) = a_i.a_{j+k} = a_{i+j+k}$.

– $i+j < 7, j+k < 7, i+j+k \geq 7$

Then $(a_i.a_j).a_k = a_{i+j}.a_k = a_{i+j+k-7}$ and $a_i.(a_j.a_k) = a_i.a_{j+k} = a_{i+j+k-7}$.

Algebra Herstein Solutions Second Edition

David A Cox, John Little, Donal O'Shea



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Abstract Algebra Manual Ayman Badawi, 2004 This is the most current textbook in teaching the basic concepts of abstract algebra The author finds that there are many students who just memorise a theorem without having the ability to apply it to a given problem Therefore this is a hands on manual where many typical algebraic problems are provided for students to be able to apply the theorems and to actually practice the methods they have learned Each chapter begins with a statement of a major result in Group and Ring Theory followed by problems and solutions Contents Tools and Major Results of Groups Problems in Group Theory Tools and Major Results of Ring Theory Problems in Ring Theory Index Basic Abstract Algebra: Exercises And Solutions Mohammed Hichem Mortad, 2022-02-10 This book is mainly intended for first year University students who undertake a basic abstract algebra course as well as instructors It contains the basic notions of abstract algebra through solved exercises as well as a True or False section in each chapter Each chapter also contains an essential background section which makes the book easier to use Course In Linear Algebra With Applications, A (2nd Edition) Derek J S Robinson, 2006-08-15 This is the second edition of the best selling introduction to linear algebra Presupposing no knowledge beyond calculus it provides a thorough treatment of all the basic concepts such as vector space linear transformation and inner product The concept of a quotient space is introduced and related to solutions of linear system of equations and a simplified treatment of Jordan normal form is given Numerous applications of linear algebra are described including systems of linear recurrence relations systems of linear differential equations Markov processes and the Method of Least Squares An entirely new chapter on linear programming introduces the reader to the simplex algorithm with emphasis on understanding the theory behind it The book is addressed to students who wish to learn linear algebra as well as to professionals who need to use the methods of the subject in their own fields **Algebra** Louis Halle Rowen, Uzi Vishne, 2025-02-21 Algebra is a subject we have become acquainted with during most of our mathematical education often in connection with the solution of equations Algebra Groups Rings and Fields Second Edition deals with developments related to their solutions The principle at the heart of abstract algebra a subject that enables one to deduce sweeping conclusions from elementary premises is that the process of abstraction enables us to solve a variety of such problems with economy of effort This leads to the glorious world of mathematical discovery This second edition follows the original three pronged approach the theory of finite groups number theory and Galois amazing theory of field extensions tying solvability of equations to group theory As algebra has branched out in many directions the authors strive to keep the text manageable while at the same time introducing the student to exciting new paths In order to support this approach the authors broadened the first edition giving monoids a greater role and relying more on matrices Hundreds of new exercises were added A course in abstract algebra properly presented could treat mathematics as an art as well as a science In this exposition we try to present underlying ideas as well as the results they yield *Harmonic Analysis for Engineers and*

Applied Scientists Gregory S. Chirikjian, Alexander B. Kyatkin, 2016-07-20 Although the Fourier transform is among engineering's most widely used mathematical tools few engineers realize that the extension of harmonic analysis to functions on groups holds great potential for solving problems in robotics image analysis mechanics and other areas This self contained approach geared toward readers with a standard background in engineering mathematics explores the widest possible range of applications to fields such as robotics mechanics tomography sensor calibration estimation and control liquid crystal analysis and conformational statistics of macromolecules Harmonic analysis is explored in terms of particular Lie groups and the text deals with only a limited number of proofs focusing instead on specific applications and fundamental mathematical results Forming a bridge between pure mathematics and the challenges of modern engineering this updated and expanded volume offers a concrete accessible treatment that places the general theory in the context of specific groups

Geometry of the Quintic Jerry Michael Shurman, 1997-01-31 This book helps students at the advanced undergraduate and beginning graduate levels to develop connections between the algebra geometry and analysis that they know and to better appreciate the totality of what they have learned The text demonstrates the use of general concepts by applying theorems from various areas in the context of one problem solving the quintic The problem is approached from two directions the first is Felix Klein's nineteenth century approach using the icosahedron The second approach presents recent works of Peter Doyle and Curt McMullen which update Klein's use of transcendental functions to a solution through pure iteration

Computer Graphics and Geometric Modelling Max K. Agoston, 2005-01-04 Possibly the most comprehensive overview of computer graphics as seen in the context of geometric modeling this two volume work covers implementation and theory in a thorough and systematic fashion It covers the computer graphics part of the field of geometric modeling and includes all the standard computer graphics topics The CD ROM features two companion programs

Ideals, Varieties, and Algorithms David A Cox, John Little, Donal O'Shea, 2008-07-31 This book details the heart and soul of modern commutative and algebraic geometry It covers such topics as the Hilbert Basis Theorem the Nullstellensatz invariant theory projective geometry and dimension theory In addition to enhancing the text of the second edition with over 200 pages reflecting changes to enhance clarity and correctness this third edition of *Ideals Varieties and Algorithms* includes a significantly updated section on Maple updated information on AXIOM CoCoA Macaulay 2 Magma Mathematica and SINGULAR and presents a shorter proof of the Extension Theorem

Primes of the Form $x^2 + ny^2$: Fermat, Class Field Theory, and Complex Multiplication. Third Edition with Solutions David A. Cox, 2022-11-16 This book studies when a prime p can be written in the form $x^2 + ny^2$ It begins at an elementary level with results of Fermat and Euler and then discusses the work of Lagrange Legendre and Gauss on quadratic reciprocity and the genus theory of quadratic forms After exploring cubic and biquadratic reciprocity the pace quickens with the introduction of algebraic number fields and class field theory This leads to the concept of ring class field and a complete but abstract solution of $p = x^2 + ny^2$ To make things more concrete the book introduces complex multiplication

and modular functions to give a constructive solution The book ends with a discussion of elliptic curves and Shimura reciprocity Along the way the reader will encounter some compelling history and marvelous formulas together with a complete solution of the class number one problem for imaginary quadratic fields The book is accessible to readers with modest backgrounds in number theory In the third edition the numerous exercises have been thoroughly checked and revised and as a special feature complete solutions are included This makes the book especially attractive to readers who want to get an active knowledge of this wonderful part of mathematics

A Course in Algebra Ernest Borisovich Vinberg, 2003 Great book The author's teaching experience shows in every chapter Efim Zelmanov University of California San Diego Vinberg has written an algebra book that is excellent both as a classroom text or for self study It is plain that years of teaching abstract algebra have enabled him to say the right thing at the right time Irving Kaplansky MSRI This is a comprehensive text on modern algebra written for advanced undergraduate and basic graduate algebra classes The book is based on courses taught by the author at the Mechanics and Mathematics Department of Moscow State University and at the Mathematical College of the Independent University of Moscow The unique feature of the book is that it contains almost no technically difficult proofs Following his point of view on mathematics the author tried whenever possible to replace calculations and difficult deductions with conceptual proofs and to associate geometric images to algebraic objects Another important feature is that the book presents most of the topics on several levels allowing the student to move smoothly from initial acquaintance to thorough study and deeper understanding of the subject Presented are basic topics in algebra such as algebraic structures linear algebra polynomials groups as well as more advanced topics like affine and projective spaces tensor algebra Galois theory Lie groups associative algebras and their representations Some applications of linear algebra and group theory to physics are discussed Written with extreme care and supplied with more than 200 exercises and 70 figures the book is also an excellent text for independent study

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