

Project Solutions for Chapter 1

1 Graphing Linear Equations

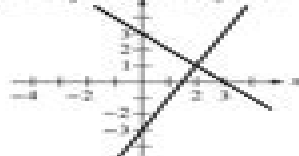
$$1. \begin{bmatrix} 2 & -1 & 3 \\ a & b & 6 \end{bmatrix} \Rightarrow \begin{bmatrix} 1 & -\frac{1}{2} & \frac{3}{2} \\ 0 & b + \frac{1}{2}a & 6 - \frac{1}{2}a \end{bmatrix}$$

(a) Unique solution if $b + \frac{1}{2}a \neq 0$. For instance, $a = b = 2$.

(b) Infinite number of solutions if $b + \frac{1}{2}a = 6 - \frac{1}{2}a = 0 \Rightarrow a = 4$ and $b = -2$.

(c) No solution if $b + \frac{1}{2}a = 0$ and $6 - \frac{1}{2}a \neq 0 \Rightarrow a \neq 4$ and $b = -\frac{1}{2}a$. For instance, $a = 2$, $b = -1$.

(d) $2x + 2y = 6$, $2x - y = 3$



$$\begin{aligned} (a) \quad & 2x - y = 3 \\ & 2x + 2y = 6 \end{aligned}$$

(The answers are not unique.)



$$\begin{aligned} (b) \quad & 2x - y = 3 \\ & 4x - 2y = 6 \end{aligned}$$



$$\begin{aligned} (c) \quad & 2x - y = 3 \\ & 2x - y = 6 \end{aligned}$$

$$\begin{aligned} 2. (a) \quad & x + y + z = 0 \\ & x + y + z = 0 \\ & x - y - z = 0 \end{aligned}$$

(The answers are not unique.)

$$\begin{aligned} (b) \quad & x + y + z = 0 \\ & y + z = 1 \\ & z = 2 \end{aligned}$$

$$\begin{aligned} (c) \quad & x + y + z = 0 \\ & x + y + z = 1 \\ & x - y - z = 0 \end{aligned}$$

There are other configurations, such as three mutually parallel planes or three planes that intersect pairwise in lines.

2 Underdetermined and Overdetermined Systems of Equations

1. Yes, $x + y = 2$ is a consistent underdetermined system.

2. Yes,

$$\begin{aligned} x + y &= 2 \\ 2x + 2y &= 4 \\ 3x + 3y &= 6 \end{aligned}$$

is a consistent, overdetermined system.

3. Yes,

$$\begin{aligned} x + y + z &= 1 \\ x + y + z &= 2 \end{aligned}$$

is an inconsistent underdetermined system.

4. Yes,

$$\begin{aligned} x + y &= 1 \\ x + y &= 2 \\ x + y &= 3 \end{aligned}$$

is an inconsistent underdetermined system.

5. In general, a linear system with more equations than variables would probably be inconsistent. Here is an intuitive reason: Each variable represents a degree of freedom, while each equation gives a condition that in general reduces number of degrees of freedom by one. If there are more equations (conditions) than variables (degrees of freedom), then there are too many conditions for the system to be consistent. So you expect such a system to be inconsistent in general. But, as Exercise 2 shows, this is not always true.

6. In general, a linear system with more variables than equations would probably be consistent. As in Exercise 5, the intuitive explanation is as follows. Each variable represents a degree of freedom, and each equation represents a condition that takes away one degree of freedom. If there are more variables than equations, in general, you would expect a solution. But, as Exercise 3 shows, this is not always true.

Linear Algebra 7th Larson Answers

Padhraic Smyth



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Instructor's Solutions Manual for Larson/Falvo's Elementary Linear Algebra, 7th, 2012-04-03 *Challenges and Strategies in Teaching Linear Algebra* Sepideh Stewart, Christine Andrews-Larson, Avi Berman, Michelle Zandieh, 2018-02-01 This book originated from a Discussion Group Teaching Linear Algebra that was held at the 13th International Conference on Mathematics Education ICME 13 The aim was to consider and highlight current efforts regarding research and instruction on teaching and learning linear algebra from around the world and to spark new collaborations As the outcome of the two day discussion at ICME 13 this book focuses on the pedagogy of linear algebra with a particular emphasis on tasks that are productive for learning The main themes addressed include theoretical perspectives on the teaching and learning of linear algebra empirical analyses related to learning particular content in linear algebra the use of technology and dynamic geometry software and pedagogical discussions of challenging linear algebra tasks Drawing on the expertise of mathematics education researchers and research mathematicians with experience in teaching linear algebra this book gathers work from nine countries Austria Germany Israel Ireland Mexico Slovenia Turkey the USA and Zimbabwe *Explorations of Mathematical Models in Biology with MATLAB* Mazen Shahin, 2013-12-24 Explore and analyze the solutions of mathematical models from diverse disciplines As biology increasingly depends on data algorithms and models it has become necessary to use a computing language such as the user friendly MATLAB to focus more on building and analyzing models as opposed to configuring tedious calculations *Explorations of Mathematical Models in Biology with MATLAB* provides an introduction to model creation using MATLAB followed by the translation analysis interpretation and observation of the models With an integrated and interdisciplinary approach that embeds mathematical modeling into biological applications the book illustrates numerous applications of mathematical techniques within biology ecology and environmental sciences Featuring a quantitative computational and mathematical approach the book includes Examples of real world applications such as population dynamics genetics drug administration interacting species and the spread of contagious diseases to showcase the relevancy and wide applicability of abstract mathematical techniques Discussion of various mathematical concepts such as Markov chains matrix algebra eigenvalues eigenvectors first order linear difference equations and nonlinear first order difference equations Coverage of difference equations to model a wide range of real life discrete time situations in diverse areas as well as discussions on matrices to model linear problems Solutions to selected exercises and additional MATLAB codes *Explorations of Mathematical Models in Biology with MATLAB* is an ideal textbook for upper undergraduate courses in mathematical models in biology theoretical ecology bioeconomics forensic science applied mathematics and environmental science The book is also an excellent reference for biologists ecologists mathematicians biomathematicians and environmental and resource economists *Stochastic Models, Information Theory, and Lie Groups, Volume 1* Gregory S. Chirikjian, 2009-09-02 This unique two volume set presents the subjects of stochastic processes information theory and Lie

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