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Linear Equations in Linear Algebra

1.1 SOLUTIONS

Notes: The key exercises are 7 (or 11 or 12), 19–22, and 25. For brevity, the symbols $R1, R2, \dots$ stand for row 1 (or equation 1), row 2 (or equation 2), and so on. Additional notes are at the end of the section.

$$1. \quad \begin{aligned} x_1 + 5x_2 &= 7 \\ -2x_1 - 7x_2 &= -5 \end{aligned} \quad \begin{bmatrix} 1 & 5 & 7 \\ -2 & -7 & -5 \end{bmatrix}$$

Replace $R2$ by $R2 + (2)R1$ and obtain:

$$\begin{aligned} x_1 + 5x_2 &= 7 \\ 3x_2 &= 9 \end{aligned} \quad \begin{bmatrix} 1 & 5 & 7 \\ 0 & 3 & 9 \end{bmatrix}$$

Scale $R2$ by $1/3$:

$$\begin{aligned} x_1 + 5x_2 &= 7 \\ x_2 &= 3 \end{aligned} \quad \begin{bmatrix} 1 & 5 & 7 \\ 0 & 1 & 3 \end{bmatrix}$$

Replace $R1$ by $R1 + (-5)R2$:

$$\begin{aligned} x_1 &= -8 \\ x_2 &= 3 \end{aligned} \quad \begin{bmatrix} 1 & 0 & -8 \\ 0 & 1 & 3 \end{bmatrix}$$

The solution is $(x_1, x_2) = (-8, 3)$, or simply $(-8, 3)$.

$$2. \quad \begin{aligned} 2x_1 + 4x_2 &= -4 \\ 5x_1 + 7x_2 &= 11 \end{aligned} \quad \begin{bmatrix} 2 & 4 & -4 \\ 5 & 7 & 11 \end{bmatrix}$$

Scale $R1$ by $1/2$ and obtain:

$$\begin{aligned} x_1 + 2x_2 &= -2 \\ 5x_1 + 7x_2 &= 11 \end{aligned} \quad \begin{bmatrix} 1 & 2 & -2 \\ 5 & 7 & 11 \end{bmatrix}$$

Replace $R2$ by $R2 + (-5)R1$:

$$\begin{aligned} x_1 + 2x_2 &= -2 \\ -3x_2 &= 21 \end{aligned} \quad \begin{bmatrix} 1 & 2 & -2 \\ 0 & -3 & 21 \end{bmatrix}$$

Scale $R2$ by $-1/3$:

$$\begin{aligned} x_1 + 2x_2 &= -2 \\ x_2 &= -7 \end{aligned} \quad \begin{bmatrix} 1 & 2 & -2 \\ 0 & 1 & -7 \end{bmatrix}$$

Replace $R1$ by $R1 + (-2)R2$:

$$\begin{aligned} x_1 &= 12 \\ x_2 &= -7 \end{aligned} \quad \begin{bmatrix} 1 & 0 & 12 \\ 0 & 1 & -7 \end{bmatrix}$$

The solution is $(x_1, x_2) = (12, -7)$, or simply $(12, -7)$.

Linear Algebra 3rd Edition Lang Solution Manual

Rami Shakarchi



Linear Algebra 3rd Edition Lang Solution Manual:

Solutions Manual for Lang's Linear Algebra Rami Shakarchi, 2012-12-06 The present volume contains all the exercises and their solutions of Lang's Linear Algebra Solving problems being an essential part of the learning process my goal is to provide those learning and teaching linear algebra with a large number of worked out exercises Lang's textbook covers all the topics in linear algebra that are usually taught at the undergraduate level vector spaces matrices and linear maps including eigenvectors and eigenvalues determinants diagonalization of symmetric and hermitian maps unitary maps and matrices triangulation Jordan canonical form and convex sets Therefore this solutions manual can be helpful to anyone learning or teaching linear algebra at the college level As the understanding of the first chapters is essential to the comprehension of the later more involved chapters I encourage the reader to work through all of the problems of Chapters I II III and IV Often earlier exercises are useful in solving later problems For example Exercise 35.3 of Chapter II shows that a strictly upper triangular matrix is nilpotent and this result is then used in Exercise 7.1 of Chapter X To make the solutions concise I have included only the necessary arguments the reader may have to fill in the details to get complete proofs Finally I thank Serge Lang for giving me the opportunity to work on this solutions manual and I also thank my brother Karim and Steve Miller for their helpful comments and their support

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