

Chapter 1

Vectors

1.1 Vectors in Two and Three Dimensions

1. Draw (or just construct) the points (1) (2) in the picture below.



2. Although more difficult for students to represent this on paper, the diagram should look something like the following. Note that the origin is not at a vertex of the triangle, but that it is at the tail of the three vectors.



In problems 3 and 4, you supply each student with a worksheet to provide an excellent initial perspective on being used.

3. Let $\vec{a} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$, $\vec{b} = \begin{bmatrix} -2 \\ 5 \end{bmatrix}$, $\vec{c} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$, $\vec{d} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$.
 then $\vec{a} + \vec{b} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} -2 \\ 5 \end{bmatrix} = \begin{bmatrix} 3-2 \\ 4+5 \end{bmatrix} = \begin{bmatrix} 1 \\ 9 \end{bmatrix}$, $\vec{a} + \vec{c} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 3 \\ 1 \end{bmatrix} = \begin{bmatrix} 3+3 \\ 4+1 \end{bmatrix} = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$,
 then $\vec{a} + \vec{d} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} = \begin{bmatrix} 3+4 \\ 4+3 \end{bmatrix} = \begin{bmatrix} 7 \\ 7 \end{bmatrix}$, $\vec{b} + \vec{c} = \begin{bmatrix} -2 \\ 5 \end{bmatrix} + \begin{bmatrix} 3 \\ 1 \end{bmatrix} = \begin{bmatrix} -2+3 \\ 5+1 \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \end{bmatrix}$,
 then $\vec{b} + \vec{d} = \begin{bmatrix} -2 \\ 5 \end{bmatrix} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} = \begin{bmatrix} -2+4 \\ 5+3 \end{bmatrix} = \begin{bmatrix} 2 \\ 8 \end{bmatrix}$, $\vec{c} + \vec{d} = \begin{bmatrix} 3 \\ 1 \end{bmatrix} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} = \begin{bmatrix} 3+4 \\ 1+3 \end{bmatrix} = \begin{bmatrix} 7 \\ 4 \end{bmatrix}$.
 4. Let $\vec{a} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}$, $\vec{b} = \begin{bmatrix} -2 \\ 5 \end{bmatrix}$, $\vec{c} = \begin{bmatrix} 3 \\ 1 \end{bmatrix}$, $\vec{d} = \begin{bmatrix} 4 \\ 3 \end{bmatrix}$.
 then $\vec{a} + \vec{b} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} -2 \\ 5 \end{bmatrix} = \begin{bmatrix} 3-2 \\ 4+5 \end{bmatrix} = \begin{bmatrix} 1 \\ 9 \end{bmatrix}$, $\vec{a} + \vec{c} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 3 \\ 1 \end{bmatrix} = \begin{bmatrix} 3+3 \\ 4+1 \end{bmatrix} = \begin{bmatrix} 6 \\ 5 \end{bmatrix}$,
 then $\vec{a} + \vec{d} = \begin{bmatrix} 3 \\ 4 \end{bmatrix} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} = \begin{bmatrix} 3+4 \\ 4+3 \end{bmatrix} = \begin{bmatrix} 7 \\ 7 \end{bmatrix}$, $\vec{b} + \vec{c} = \begin{bmatrix} -2 \\ 5 \end{bmatrix} + \begin{bmatrix} 3 \\ 1 \end{bmatrix} = \begin{bmatrix} -2+3 \\ 5+1 \end{bmatrix} = \begin{bmatrix} 1 \\ 6 \end{bmatrix}$,
 then $\vec{b} + \vec{d} = \begin{bmatrix} -2 \\ 5 \end{bmatrix} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} = \begin{bmatrix} -2+4 \\ 5+3 \end{bmatrix} = \begin{bmatrix} 2 \\ 8 \end{bmatrix}$, $\vec{c} + \vec{d} = \begin{bmatrix} 3 \\ 1 \end{bmatrix} + \begin{bmatrix} 4 \\ 3 \end{bmatrix} = \begin{bmatrix} 3+4 \\ 1+3 \end{bmatrix} = \begin{bmatrix} 7 \\ 4 \end{bmatrix}$.
 5. We start with the three vectors \vec{a} , \vec{b} , and \vec{c} . We then complete the parallelogram as in the figure on the left. The vector from the origin to this same vertex is the vector $\vec{a} + \vec{b}$. In the figure on the right we have translated vector \vec{b} so that its tail is the head of vector \vec{a} . The vector $\vec{a} + \vec{b}$ is the directed third side of this triangle.

Manual Vector Calculus

Susan Jane Colley



Manual Vector Calculus:

Vector Calculus Study Guide & Solutions Manual Karen Pao, Frederick Soon, 2003-08-22 Includes solutions to selected exercises and study hints

Vector Calculus Instructor's Manual Jerrold E. Marsden, 2003-08-29 *Student Solutions Manual [for] Vector Calculus* Susan Jane Colley, 2006

Vector Calculus Miroslav Lovric, 2007-01-03 This book gives a comprehensive and thorough introduction to ideas and major results of the theory of functions of several variables and of modern vector calculus in two and three dimensions Clear and easy to follow writing style carefully crafted examples wide spectrum of applications and numerous illustrations diagrams and graphs invite students to use the textbook actively helping them to both enforce their understanding of the material and to brush up on necessary technical and computational skills Particular attention has been given to the material that some students find challenging such as the chain rule Implicit Function Theorem parametrizations or the Change of Variables Theorem

Vector Calculus Instructor's Manual Jerrold E. Marsden, 1996-08-01 This instructor's manual accompanies the main text

Multivariate Calculus Barr, Thomas H. Barr, 1997-01-01

Vector Calculus Thomas H. Barr, 2001

Vector Calculus Miroslav Lovrić, 2007

Student solution manual for the second edition of vector calculus, linear algebra, and differential forms John H. Hubbard, Barbara Burke Hubbard, 2002-01-01 Contains worked out solutions to odd exercises in Vector Calculus Linear Algebra and Differential Forms A Unified Approach by John H Hubbard professor of mathematics at Cornell University and Barbara Burke Hubbard

Student Solutions Manual, Vector Calculus, Second Edition [by] Susan Jane Colley Daniel Howard Steinberg, 2002

An Illustrative Guide to Multivariable and Vector Calculus Stanley J. Miklavcic, 2020-02-17 This textbook focuses on one of the most valuable skills in multivariable and vector calculus visualization With over one hundred carefully drawn color images students who have long struggled picturing for example level sets or vector fields will find these abstract concepts rendered with clarity and ingenuity This illustrative approach to the material covered in standard multivariable and vector calculus textbooks will serve as a much needed and highly useful companion Emphasizing portability this book is an ideal complement to other references in the area It begins by exploring preliminary ideas such as vector algebra sets and coordinate systems before moving into the core areas of multivariable differentiation and integration and vector calculus Sections on the chain rule for second derivatives implicit functions PDEs and the method of least squares offer additional depth ample illustrations are woven throughout Mastery Checks engage students in material on the spot while longer exercise sets at the end of each chapter reinforce techniques An Illustrative Guide to Multivariable and Vector Calculus will appeal to multivariable and vector calculus students and instructors around the world who seek an accessible visual approach to this subject Higher level students called upon to apply these concepts across science and engineering will also find this a valuable and concise resource

Student Solutions Manual for Vector Calculus Susan Colley, 2012-03-14 This manual contains completely worked out solutions for all the odd numbered exercises in the text

Student Solution

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 Hubbard, 2007 Students Solutions Manual to Vector Calculus Lovric, 1999-08-01 **Instructor's Solutions Manual to**
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Calculus and Vectors, 2009

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