Mathematics for Game Developers

Downey Unified School District
Publisher

Mathematics for Game Developers fully meets accessibility standards.
https://OER4CTE.ORG

Mathematics for Game Developers

Downey Unified School District, Publisher

Downey Unified School District (DUSD) Team

DUSD Vision
All students graduate with a 21st Century education that ensures they are college and career ready, globally competitive, and citizens of strong character.

DUSD Mission
Downey Unified School District is committed to developing all students to be self-motivated learners and productive, responsible, and compassionate members of an ever-changing global society. Our highly qualified staff foster meaningful relationships with students, parents, and the community while providing a relevant and rigorous curriculum in facilities that advance teaching and learning.

DUSD Administration
Superintendent John A. Garcia, Jr., Ph.D.
Assistant Superintendent Roger Brossmer, Ed.D.
Director, College and Career Readiness John M. Harris

DUSD Board of Education
D. Mark Morris, President and Trustee Area 6
Barbara R. Samperi, Vice President and Trustee Area 7
Martha E. Sodetani, Clerk and Trustee Area 1
Giovanna Perez-Saab, Trustee Area 3
Jose J. Rodriguez, Trustee Area 2
Linda Salomon Saldaña, Trustee Area 4
Nancy A. Swenson, Trustee Area 5

Additional Support
California Community College K12 Strong Workforce Program Round 3 award: Open-Source Downey taps into DUSD's existing ecosystem and builds a culture of open education resources (OER) and industry collaborative work-based learning to be shared with high schools across the state.

Open Education Resources (OER) Team

Denny Burzynski, Author
Kelly Cooper, Project Manager
Veronika Focht, Book Designer, Technical Editor
June Bayha, Thought Partner
Muhammad Awais, Technical Reviewer

About the Author

Denny Burzynski has a Master's Degree in Mathematics from the California State University, Long Beach, and has taught mathematics at California and Nevada community colleges for 45 years. His programming experience started when Fortran IV was popular and used line numbers and punch cards. With some of his friends, Denny authored six college mathematics textbooks from basic arithmetic, elementary and intermediate algebra, college algebra, to applied calculus. Denny presented at many mathematics conferences all over the country, spent a semester interning as a program director at the National Science Foundation in Washington, D.C., and served as president of both the California Mathematics Council Community Colleges and the Nevada Mathematical Association of Community Colleges.

Introduction

Are you reading this note because you want to develop computer games or write computer programs that perform particular tasks or create whimsical illusions? How is your background in mathematics? Good? Okay? Not sure? To design and program fun and adventurous games, you may not need deep knowledge of mathematics to understand what programming commands do and how to use them to your advantage. In this book, we focus on a few of the mathematical instruments used in programming languages such as C# and C++. Programming languages have libraries of commands that you can use to write programs, and their commands come from mathematical instruments. In Mathematics for Game Developers, we explore the basic ideas of how mathematical instruments control action and motion in the games you develop. And, we introduce technology that performs all the mathematical calculations you might need. How awesome is that!

We clearly define four mathematical instruments: vectors, matrices, and the sine and cosine functions and describe what they do. We intend to add practical insight to your programming experience. Programmers use commands to direct computers to perform specific tasks. Commands commonly used in C# and C++ include mathematical instruments such as the Quaternion, the Euler angle, and the rotation matrix that have been around a long time. Quaternions were developed in 1843 by the Irish Mathematician William Rowan Hamilton and matrices in 1850 by the English mathematician James Sylvester. Hipparchus of Nicea (ancient Greece), who lived from 180-125 BCE, likely compiled the first trigonometric table.

Directing your computer to rotate an object or move it vertically or horizontally uses a command born from one or more of these instruments. Can you imagine what Hamilton, Euler, and Hipparchus would think if they knew what you are planning to do with their mathematics!