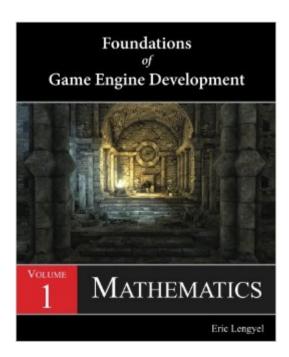
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# Foundations Of Game Engine Development, Volume 1: Mathematics





## Synopsis

The first volume of Foundations of Game Engine Development discusses the mathematics needed by engineers who work on games or other types of virtual simulations. The book begins with conventional treatments of topics such as linear algebra, transforms, and geometry. Then, it introduces Grassmann algebra and geometric algebra to provide a much deeper understanding of the subject matter and highlight the places where traditional arithmetic with vectors, matrices, quaternions, etc., isn't quite correct. Includes exercises.Chapter 1: Vectors and Matrices1.1 Vector Fundamentals1.2 Basic Vector Operations1.2.1 Magnitude and Scalar Multiplication1.2.2 Addition and Subtraction1.3 Matrix Fundamentals1.4 Basic Matrix Operations1.4.1 Addition, Subtraction, and Scalar Multiplication 1.4.2 Matrix Multiplication 1.5 Vector Multiplication 1.5.1 Dot Product1.5.2 Cross Product1.5.3 Scalar Triple Product1.6 Vector Projection1.7 Matrix Inversion 1.7.1 Identity Matrices 1.7.2 Determinants 1.7.3 Elementary Matrices 1.7.4 Inverse Calculation 1.7.5 Inverses of Small MatricesChapter 2: Transforms2.1 Coordinate Spaces2.1.1 Transformation Matrices 2.1.2 Orthogonal Transforms 2.1.3 Transform Composition 2.2 Rotations2.2.1 Rotation About a Coordinate Axis2.2.2 Rotation About an Arbitrary Axis2.3 Reflections2.4 Scales2.5 Skews2.6 Homogeneous Coordinates2.7 Quaternions2.7.1 Quaternion Fundamentals2.7.2 Rotations With QuaternionsChapter 3: Geometry3.1 Triangle Meshes3.2 Normal Vectors 3.2.1 Calculating Normal Vectors 3.2.2 Transforming Normal Vectors 3.3 Lines and Rays3.3.1 Parametric Lines3.3.2 Distance Between a Point and a Line3.3.3 Distance Between Two Lines3.4 Planes3.4.1 Implicit Planes3.4.2 Distance Between a Point and a Plane3.4.3 Reflection Through a Plane3.4.4 Intersection of a Line and a Plane3.4.5 Intersection of Three Planes3.4.6 Intersection of Two Planes3.4.7 Transforming Planes3.5 PlA cker Coordinates3.5.1 Implicit Lines3.5.2 Homogeneous Formulas3.5.3 Transforming LinesChapter 4: Advanced Algebra4.1 Grassmann Algebra4.1.1 Wedge Product4.1.2 Bivectors4.1.3 Trivectors4.1.4 Algebraic Structure4.1.5 Complements4.1.6 Antivectors4.1.7 Antiwedge Product4.2 Projective Geometry4.2.1 Lines4.2.2 Planes4.2.3 Join and Meet4.2.4 Line Crossing4.2.5 Plane Distance4.2.6 Summary and Implementation 4.3 Matrix Inverses 4.4 Geometric Algebra 4.4.1 Geometric Product 4.4.2 Vector Division4.4.3 Rotors4.5 Conclusion

### **Book Information**

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This volume is compact, but concise: contains the elementary linear math required for graphics. Really good print quality for a paperback.

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