

UNIT 3

PART A

three Vertex (Point), Edge (Line),
primary Polygon (Face)
geometric
elements

Quadric Surface defined by second-degree equations

polygon table data structure storing lists of geometric and attribute data (to store connectivity information)

Plane equation $Ax+By+Cz+D=0$; $x,y,z \rightarrow$ components of normal vector
<0 inside; >0 outside

polygon meshes Triangle and Quadrilateral Meshes

spline defined by a set of polynomial functions

Plane Equations in Rendering Pipeline

Back-Face Culling: substitute viewport into plane equation (sign determines direction of plan for clipping)

Inside-Outside Testing & Depth: if a point is inside a polygon; calculate depth of any point

Meshes

Polygon Meshes made of triangles/quads

Quadratic (or Parametric) Surfaces equations/control points

Modelling Accuracy
Approximate, depends on number of polygons High precision, smooth surfaces

Resource Requirements
Needs more memory for high detail Compact representation, fewer parameters

Rendering Efficiency
Very efficient, directly supported by GPUs Not directly renderable, must be converted to meshes

Ray surface intersection

Advantages
fast; basic algebraic math; computation time predictable; universal for any shape exact representation; compact storage; analytical precision

Disadvantages
approximation error; memory performance trade-off computational cost; specialization required

Polygon meshes = standard for real-time rendering (fast, GPU-friendly)

Quadratic surfaces = better for design accuracy, but used as pre-processing before conversion to polygons

B-Spline and Bézier

B-Spline	Bézier
local control	global control
single compact representation	needs many separate curves

B-Splines are flexible, efficient (faster updates, less recomputation) and manageable.

Polygon tables

Geometric (Vertex) Table	Avoids duplication
Attribute Table	Stores properties (color, texture, reflectivity)
Surface (Polygon) Table	Stores faces using vertex indices (geometry + attributes)

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