2.3 Primitives and attributes

OpenGL supports 2 types of primitives:

- Geometric primitives (vertices, line segments..) – they pass through the geometric pipeline

- Raster primitives (arrays of pixels) – passes through a separate pipeline to the frame buffer.

Line segments

![GL_LINES](image)

GL_LINE_STRIP
GL_LINE_LOOP

Polygons:

Object that has a border that can be described by a line loop & also has a well defined interior

Properties of polygon for it to be rendered correctly:

- Simple – No 2 edges of a polygon cross each other
- Convex – All points on the line segment between any 2 points inside the object, or on its boundary, are inside the object.
- Flat – All the vertices forming the polygon lie in the same plane. E.g. a triangle.

Polygon Issues

- User program can check if above true
  - OpenGL will produce output if these conditions are violated but it may not be what is desired
- Triangles satisfy all conditions
2.4 Approximating a sphere

- Fans and strips allow us to approximate curved surfaces in a simple way.
- E.g. – a unit sphere can be described by the following set of equations:
  \[
  \begin{align*}
  X(\Theta,\Phi) &= \sin \Theta \cos \Phi, \\
  Y(\Theta,\Phi) &= \cos \Theta \sin \Phi, \\
  Z(\Theta,\Phi) &= \sin \Phi
  \end{align*}
  \]

The sphere shown is constructed using quad strips.
A circle could be approximated using Quad strips.
The poles of the sphere are constructed using triangle fans as can be seen in the diagram.

Graphics Text:

A graphics application should also be able to provide textual display.
- There are 2 forms of text:
  - Stroke text – Like any other geometric object, vertices are used to define line segments & curves that form the outline of each character.
  - Raster text – Characters are defined as rectangles of bits called **bit blocks**.

**bit-block-transfer**: the entire block of bits can be moved to the frame buffer using a single function call.