# Assignment 09 Notes

## Recall on indexed primitives

Indexed primitives are defined by two arrays: the **vertex array**, contains the definitions (the positions) of the different vertices, and the **index array**, which is used to specify triangles in a indirect way.

The vertex array is something like: `std::vector<float> vertices`. Each `float` element represent a coordinate (either x, y or z) of a point in space. Then we'll use the index array to draw triangles by referencing triplets of elements (one triplet makes up one point in the 3D space) belonging to the vertex array.

### Cube Example

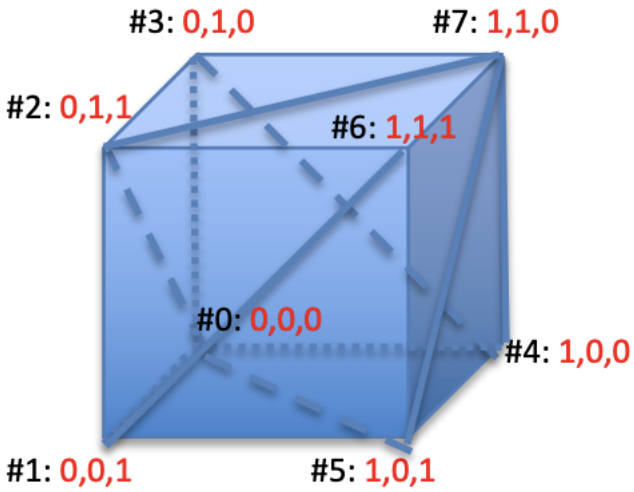


Figure 1: Cube Example

```
std::vector<float> vertices = {
    0, 0, 0,    // point #0
  0, 1, 1,  // point #2
    0, 1, 0,    // etc.
    1, 0, 0,
    1, 0, 1,
    1, 1, 1,
    1, 1, 0,
}
```

```
std::vector<float> indices = {
  1, 2, 3,  // #1, #2, #3, triangle of the left side face
  2, 3, 0,
  0, 3, 4,
  4, 3, 7,
    5, 6, 7,
  7, 4, 5,
    1, 6, 5,
  1, 2, 6,
    7, 6, 2,
  3, 2, 7,
    4, 5, 0,
  1, 0, 5
}
```

## Cylinder

Let's start off with the cylinder parametric equation:

$$\begin{cases} x(\theta, h) = x_0 + r\cos(\theta) \\ y(\theta, h) = y_0 + h \\ z(\theta, h) = z_0 + r\sin(\theta) \end{cases}$$

Where: * $\theta$ is the angle generated by the $x$ axis and the cylinder base circumference radius. Note that $\theta \in [0, 2 * \pi)$. * $r$ is the circumference radius. * $h$ is the z-coordinate of the center of the base circumference of the cylinder.

## Sphere

Any point on a sphere can be found by using the following equation:

$$(x, y, z) = (\rho\cos\theta\sin\phi, \rho\cos\phi, \rho\sin\theta\sin\phi)$$

where $\rho$ is the constant radius, $\theta \in [0, 2\pi)$ is the longitude and $\phi \in [0, \pi]$ is the colatitude.