Surfaces of Revolution

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CSE 557
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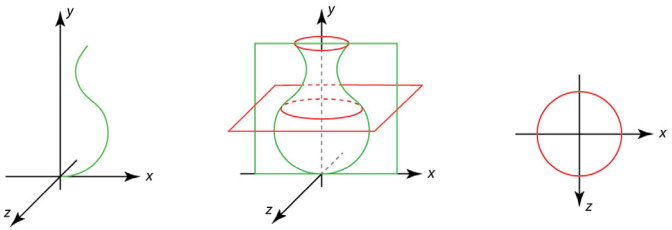
Surfaces of revolution

Idea: rotate a 2D **profile curve** around an axis.

What kinds of shapes can you model this way?

Constructing surfaces of revolution



Given: A curve $C(u)$ in the xy-plane:

$$C(u) = \begin{bmatrix} c_x(u) \\ c_y(u) \\ 0 \\ 1 \end{bmatrix}$$

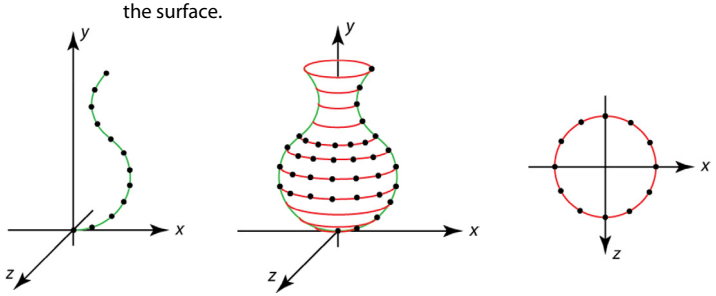
Let $R_y(\theta)$ be a rotation about the y-axis.

Find: A surface $S(u,v)$ which is $C(u)$ rotated about the y-axis, where $u, v \in [0, 1]$.

Solution:

Constructing surfaces of revolution

We can sample in u and v to get a grid of points over the surface.



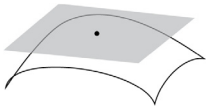
Suppose we sample:

- in u, to give $C[m]$ where $m \in [0..M\text{-}1]$
- in v, to give rotation angle $q[n] = 2\pi n/N$ where $n \in [0..N\text{-}1]$

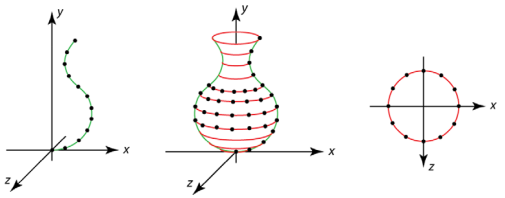
We can now write the surface as:

How would we turn this into a mesh of triangles?
How do we assign per-vertex normals?

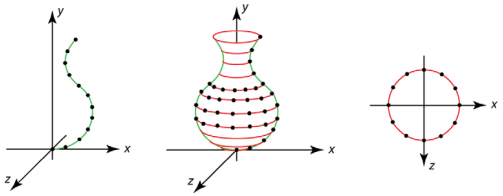
Tangent vectors and tangent planes



Normals on a surface of revolution



Texture coordinates on a surface of revolution



Triangle meshes

How should we generally represent triangle meshes?