Section 16.6 - Parametric Surfaces & Their Areas

MVC

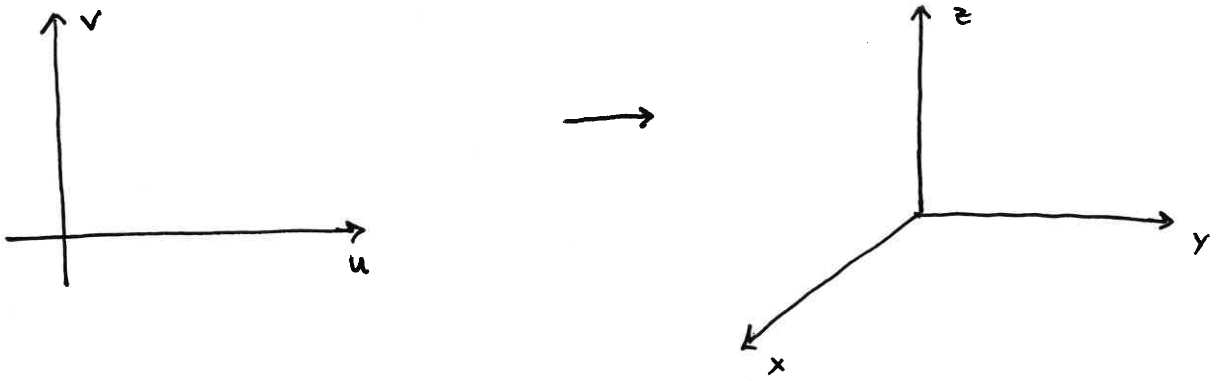
Chapter 12 - looked at special surfaces:

Chapter 14 - looked at surfaces from:

Want to describe more surfaces →

Chapter 13 - looked at:

- Parametric Surface:

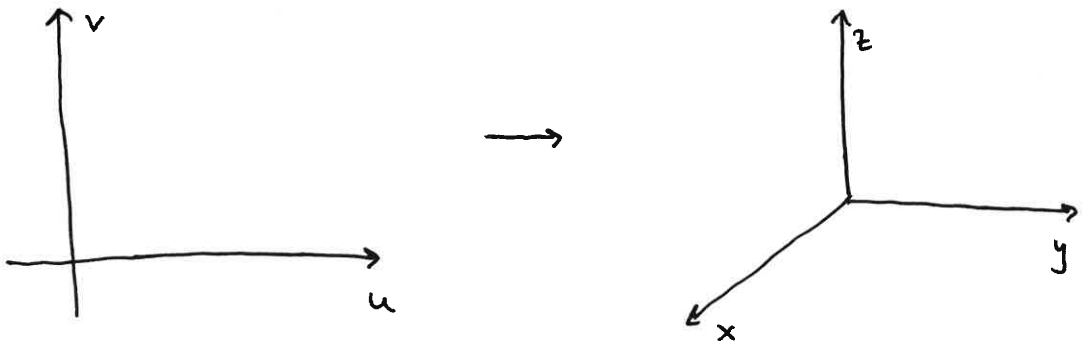


Example Identify and sketch the surface with vector equation:

$$\vec{r}(u,v) = \langle 2\cos u, v, 2\sin u \rangle$$

- Useful Family of curves:

Grid Curves -



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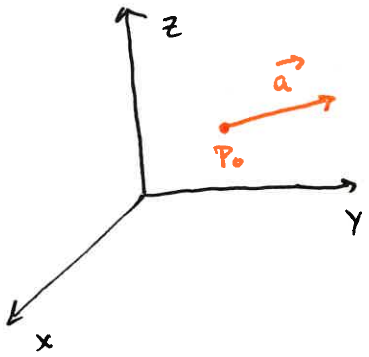
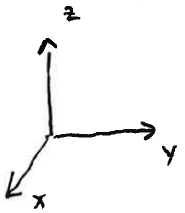
Recall: Parametrization of a Line with point r_0 and vector $\vec{a}$

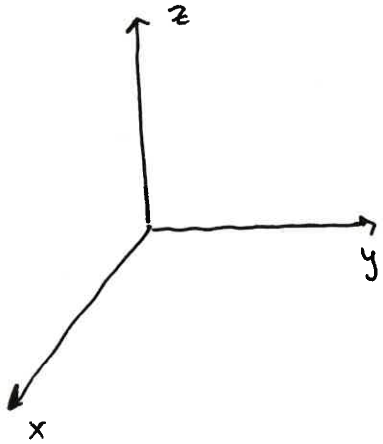


Example Find a vector function that represents the plane through the point P_0, containing two non parallel vectors $\vec{a}$ and $\vec{b}$



Example Find a parametric representation for the surface $z = 2\sqrt{x^2+y^2}$, that is the top half of the cone $z^2 = 4x^2 + 4y^2$.

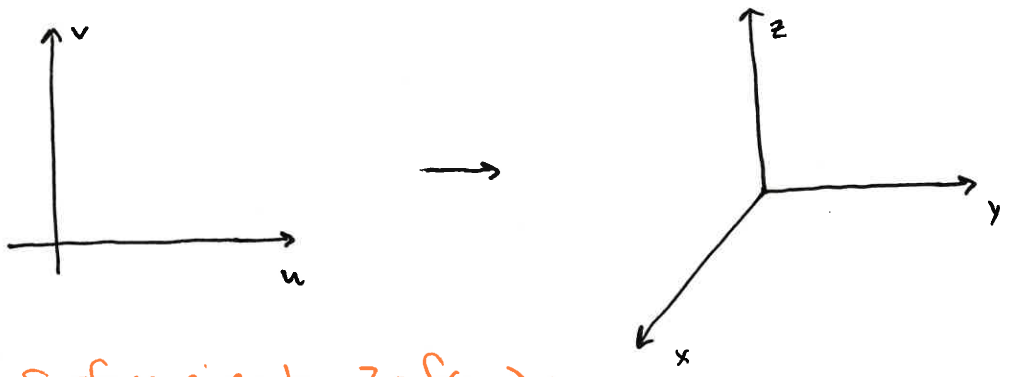
- Surfaces of Revolution:



Example Find a parametrization for the surface obtained by rotating one period of $y = \sin(z)$ about the z-axis.

- Tangent Planes: Given a surface S: $\vec{r}(u,v) = \langle x(u,v), y(u,v), z(u,v) \rangle$

Recall: For Equation of a plane need:



For a surface given by $z = f(x,y)$:

tangent plane at (x_0, y_0, z_0):

Example Find the tangent plane to the surface with parametric equations $x = u^2$, $y = v^2$, $z = u + 2v$ at the point $(1,1,3)$.

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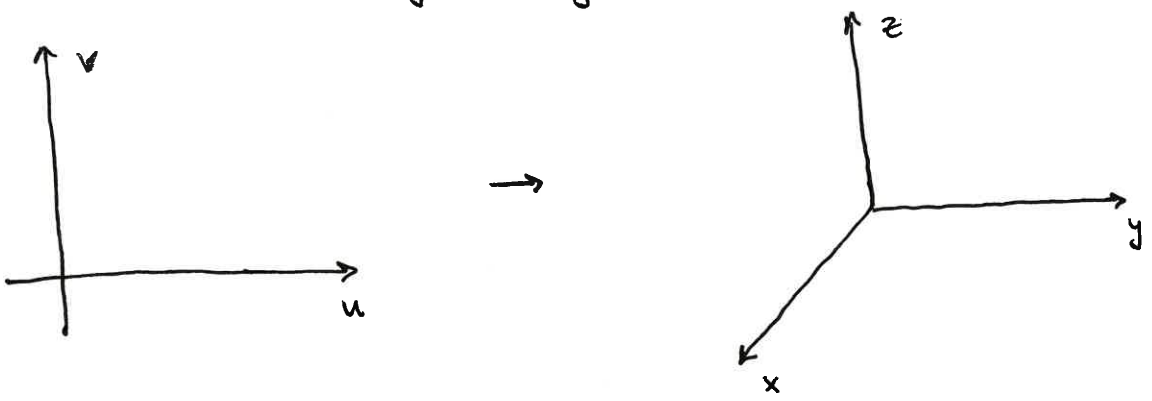
- Surface Area: Smooth S: $\vec{r}(u,v) = \langle x, y, z \rangle$ for $(u,v) \in D$ covering S only once.



Area of Rectangle $\approx$

Surface Area of S:

Example Find the surface area of a sphere of radius a.

- Surface Area of the graph of a function (Review): $z = f(x,y)$

Parametrization:

$A(S) =$

Example Find the area of the part of the paraboloid $z = x^2 + y^2$ that lies under the plane $z = 9$.