

Tuesday, November 13 ** Surface Parameterpalooza

1. Let S be the portion of the plane $x + y + z = 1$ which lies in the positive octant.
 - (a) Draw a picture of S .
 - (b) Find a parameterization $\mathbf{r}: D \rightarrow S$, being sure to clearly indicate the domain D . Check your answer with the instructor.
 - (c) Use your answer in (b) to compute the area of S via an integral over D .
 - (d) Check your answer in (c) using only things you learned in the first few weeks of this class.
2. Consider the surface S which is the part of $z + x^2 + y^2 = 1$ where $z \geq 0$.
 - (a) Draw a picture of S .
 - (b) Find a parameterization $\mathbf{r}: D \rightarrow S$. Check your answer with the instructor.
3. Let S be the surface given by the following parameterization. Let $D = [-1, 1] \times [0, 2\pi]$ and define
$$\mathbf{r}(u, v) = (u \cos v, u \sin v, v).$$
 - (a) Consider the vertical line segment $L = \{u = 0\}$ in D . Describe geometrically the image of L under \mathbf{r} .
 - (b) Repeat for the vertical segments where $u = -1$ and $u = 1$.
 - (c) Use your answers in (a) and (b) to make a sketch of S .
4. Consider the ellipsoid E given by $\frac{x^2}{9} + \frac{y^2}{4} + z^2 = 1$.
 - (a) Draw a picture of E .
 - (b) Find a parameterization of E . Hint: Find a transformation $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ which takes the unit sphere S to E , and combine that with our existing parameterization of the plain sphere S .