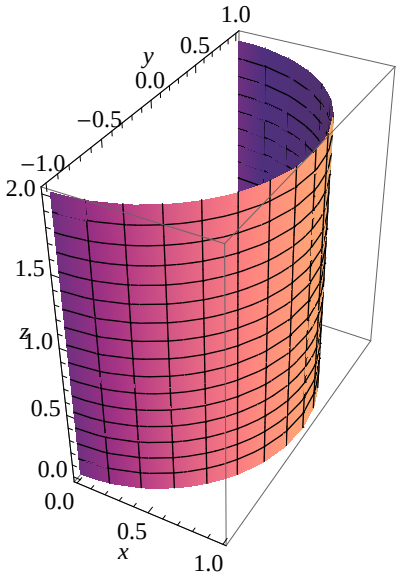
Exercises

Chapter 12.5 # 3

Chapter 12.6 # 8

Chapter 12.9 # 1

Problem A: Find a parameterization of the piece of cylinder shown below. Give both the formula and the range of values for u and v.



Problem B: Consider the parameterized surface

$$x = (2 + \cos(v))\cos(u)$$
$$y = (2 + \cos(v))\sin(u)$$
$$z = \sin(v)$$

What does this surface look like?

Compute the normal vector and tangent plane to the surface at the point $(\frac{4+\sqrt{2}}{2}, 0, \frac{\sqrt{2}}{2})$.

Problem C: For each of these functions defined on all of $\mathbb{R}^3$, decide if $\mathbf{F}$ is conservative. If so, find a potential function.

(a) $\mathbf{F} = 2x\mathbf{i} - 2y\mathbf{j} + 2z\mathbf{k}$.

(b) $\mathbf{F} = (\cos(x) + y\sin(x))\mathbf{i} + x\sin(xy)\mathbf{j} + \mathbf{k}$

(c) $\mathbf{F} = 3\mathbf{i} - \mathbf{j} + 2\mathbf{k}$.

(d) $\mathbf{F} = ye^{xy}\mathbf{i} + xe^{xy}\mathbf{j} + \mathbf{k}$.

Problem D: Let $\varphi(x, y, z) = \arctan(y/z)$. Compute $\mathbf{F} = \nabla\varphi$. What is the largest set D on which the formula for $\mathbf{F}$ makes sense? Find a simple closed curve C contained in D so that the line integral $\oint_C \mathbf{F} \cdot d\mathbf{R} \neq 0$.

Problem E: Let $f(x)$ be a differentiable function of one variable, and let $\mathbf{F} = f'(x)\mathbf{i} + f'(y)\mathbf{j} + f'(z)\mathbf{k}$. Is $\mathbf{F}$ conservative? If so, find φ so that $\mathbf{F} = \nabla\varphi$.