Calculus III
Homework on Lecture 19

1. (a) Derive the formula for the surface area of the sphere with radius R.
   (b) Find the surface area of a torus with major radius R and minor radius r, $r < R$.
2. Find the flux of the field $\mathbf{F}$ through the surface $\mathcal{S}$.
   (a) $\mathbf{F} = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$, $\mathcal{S}$ is the hemisphere, oriented upwards, with radius 1, whose axis is the z-axis and whose base lies in the x, y-plane.
   (b) $\mathbf{F} = x^2\mathbf{i}$, where $\mathcal{S}$ is the part of the paraboloid with equation $z = 1 - x^2 - y^2$ that lies above the x, y-plane. $\mathcal{S}$ is oriented upwards.