Math 227 Queen's University, Department of Mathematics

Vector Analysis, Homework 2 September 2014

1. Evaluate the double integral $\int\int_{\mathbf{D}} x\cos(y)dA$ where $\mathbf{D}$ is bounded by the lines $y = 0, x = 1$ and the curve $x = \sqrt{y}$. Evaluate this integral in two different ways by reversing the order of integration.

2. Using triple integrals, find the volume of the solid that lies under the plane $4x + 6y - 2z + 15 = 0$ and above the region

$$\mathbf{R} = \Big\{(x, y)|x^2 + y^2 \leq 2\Big\}$$

3. Using spherical coordinates or cylindrical coordinates calculate the volume of the ice cream cone shaped region between the surfaces $\phi = \frac{\pi}{3}$ (ϕ is the polar angle) and the sphere $\rho = \sqrt{3}$.

4. Consider the following donut shaped surface given by the equation

$$\left(\sqrt{x^2 + y^2} - a\right)^2 + z^2 = b^2, \quad a > b > 0$$

(a) Sketch the crossection of this surface with the planes $z = 0, z = \pm b$ and the planes $x = 0, y = 0$. Sketch the surface.

(b) By representing the top half of the surface as the graph of a function over a domain $\mathbf{D}$ in the x-y plane, determine the domain $\mathbf{D}$.

(c) Write a double integral for the surface area of this surface over the domain **D** (evaluation not necessary)