Calculus III (Math 241)

1. Evaluate the iterated integral by converting to polar coordinates:

   a.
   $$\int_0^a \int_{-\sqrt{a^2-y^2}}^{\sqrt{a^2-y^2}} (2x+y)\, dx\, dy.$$

   b.
   $$\int_0^2 \int_0^{\sqrt{2x-x^2}} \sqrt{x^2+y^2}\, dy\, dx.$$

2. **(From a previous final)**

   Consider the solid K in $\mathbb{R}^3$ defined by
   $$K = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 \le z \le 1 + x\}.$$

   (a) Show that K is compact (that is, closed and bounded).

   (b) Determine the volume $\mathrm{vol}(K)$.

   Hint: Show that the projection of K onto the x-y plane is a disk, and use polar coordinates relative to the center of this disk.

   (c) Explain how to compute the surface area $\mathrm{vol}_2(\partial K)$.

   Note: An explicit formula for $\mathrm{vol}_2(\partial K)$ is not required, but you should simplify the task of computing the surface area as far as possible.