Math 3214: Homework 8 (Due Friday 4/4, 5pm)

To obtain (full) credit, show all reasoning and work.

No calculator or other electronic devices for HWs.

1. Section 7.4: 9.

   Problems 2-6 require 1) a good sketch of S AND D.

   2) a comment on whether $\mathbf{\Phi}$ is regular at a finite number of points.

   You do not need to check if $\mathbf{\Phi}$ is one-to-one.

2. Review exercises for Ch. 7 (p. 424): 15.
3. 7.6: 3a. The book answer misses a factor 3, I think.
4. 7.6: 5. Take S to be oriented by the normal pointing away from the y-axis.
5. Let S be the surface given by $x = y^2$ with $0 \leq y \leq 1$ and $1 \leq z \leq 3$.
   (a) Compute $\iint_S y \, dS$ using a parametrization with $y = u$ and $z = v$.
   (b) Explain what $\iint_S y \, dS$ would be if S is parametrized using $y = v$ and $z = u$.
   (c) Compute the flow rate through the surface S using a parametrization with $y = u$ and $z = v$. The velocity is $\boldsymbol{v}(x, y, z) = (x,\ y,\ z)$.
   (d) Explain what the flow rate through the surface S would be when S is parametrized using $y = v$ and $z = u$. The velocity is $\boldsymbol{v}(x, y, z) = (x,\ y,\ z)$.
6. Consider the surface S given by $y = x^2 + z^2$ with $x^2 + z^2 \leq 2$.
   (a) Use a single parametrization to set up a double integral for the mass of S. The density is $\delta(x, y, z) = y$.
   (b) Use a single parametrization to set up a double integral for the flowrate through S. The velocity is $\boldsymbol{v} = (xy, 2, 0)$ and S is oriented according to the upward pointing normal.

   Note: A setup includes computing a cross product, dot product, and magnitude.

   Only evaluating integrals can be skipped.