UCLA: Math 32B **Problem set 9** **Spring, 2020**

This week on the problem set you will get practice applying and understanding Green's theorem and Stokes' theorem.

Homework: The homework will be due on Friday 5 June. It will consist of questions $3, 4, 5$ below.
*Numbers in parentheses indicate the question has been taken from the textbook:

J. Rogawski, C. Adams, *Calculus, Multivariable*, 3rd Ed., W. H. Freeman & Company,

and refer to the section and question number in the textbook.

1. (Section 18.1) 3, 7, 8, 9, 12, 19, 20, 21, 23, 24 25, 29, 36*, 41, 45. (Use the following translations $4^{\text{th}} \mapsto 3^{\text{rd}}$ editions: $7 \mapsto 5$, $8 \mapsto 6$, $9 \mapsto 7$, $12 \mapsto 10$, $19 \mapsto 15$, $20 \mapsto 16$, $21 \mapsto 17$, $23 \mapsto 19$, $24 \mapsto 20$, $25 \mapsto 21$, $29 \mapsto 25$, $36 \mapsto 32$, $41 \mapsto 37$, $45 \mapsto 41$ otherwise the questions are the same).

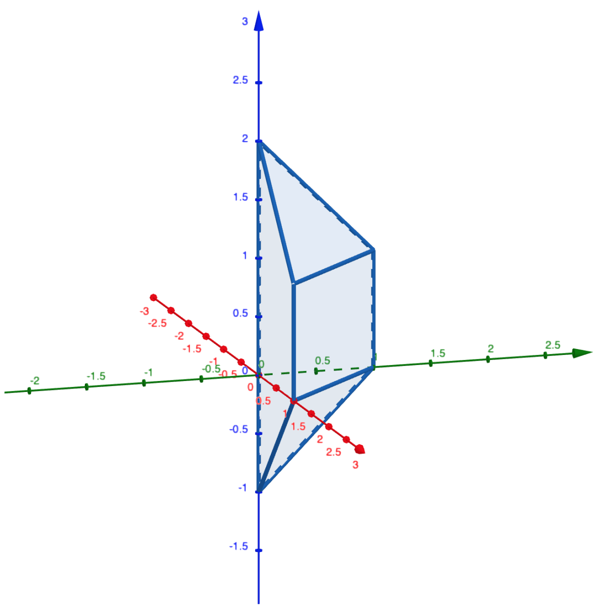
2. (Section 18.2) 5, 8, 9, 18, 19. (Use the following translations $4^{\text{th}} \mapsto 3^{\text{rd}}$ editions: $18 \mapsto 16$, $19 \mapsto 17$, otherwise the questions are the same).

3. Let $\mathbf{F}(x, y, z) = \langle x, x + y^3, x^2 + y^2 - z\rangle$ and let S be the surface $z = x^2 - y^2$ where $x^2 + y^2 \leq 1$ with upward orienation and boundary $\mathcal{C}$ (with the usual boundary orientation). Find $\displaystyle\int_{\mathcal{C}} \mathbf{F} \cdot d\mathbf{r}$.

4. Let $\mathbf{F} = \langle x, y, -2z + e^{x^4+y^2}\rangle$ and let S be the part of the hyperboloid $x^2 + y^2 = 1 + z^2$ where $z^2 \leq 3$ oriented so that at points with positive z values the z coordinate of the normal vector is negative (i.e. with outward pointing normal). What is $\displaystyle\iint_S \mathbf{F} \cdot dS$?

   Hint: Find a simpler surface with the same boundary.

5. Consider the 3 dimensional polyhedron pictured below with vertices



$(0, 0, 2)$
$(0, 0, -1)$
$(0, 1, 0)$
$(1, 0, 0)$
$(0, 1, 1)$
$(1, 0, 1)$

   with outward pointing orientation. Find the flux of $\mathbf{F} = \langle 2x^2 - 3xy^2, xz^2e^z + y^3, \sin(x^2 + y^2)\rangle$ through $\mathcal{S}$.

*The questions marked with an asterisk are more difficult or are of a form that would not appear on an exam. Nonetheless they are worth thinking about as they often test understanding at a deeper conceptual level.