PROJECT I - MATH 800
SPRING 2018

(1) Problem 19/page 23;
(2) Problem 29/page 24;
(3) Problem 34/page 25;
(4) Problem 47/page 26;
   Hint: For $f = u + iv$, write $\ln(|f|) = \frac{1}{2}\ln(u^2 + v^2)$. Take derivatives and use the Cauchy-Riemann for u, v.
(5) Show that the functions

$$f(x, y) = \frac{y}{x^2 + y^2}; g(x, y) = -\frac{x}{x^2 + y^2}$$

satisfy $f_y = g_x$ for each $\mathbf{R}^2 \setminus \{0\}$, but on the other hand **there is no** C^2 funtion h on $\{(x, y) : 0 < x^2 + y^2 < 1\}$ so that

$$h_x = f, h_y = g.$$

Explain why this does not contradict the generalized version of Theorem 1.5.1 that we have established in class.
Hint: To show the non-existence of h argue by contradiction, by considering the path integral

$$\int_{x^2+y^2=1} f(x, y)dx + g(x, y)dy.$$

(6) Problem 55/page 27 without the counterexample.
(7) Problem 4 a), c)/page 60;
(8) Problem 29/page 65;
(9) Problem 37/page 66;
(10) Problem 39/page 66;