Not to be handed in

1. Suppose that $\mathbf{0} = (0,0)$, $r > 0$ and $f = (f_1, f_2)$ mapping $B_r(\mathbf{0})$ into $\mathbb{R}^2$ is C^1. Prove that if $df_\mathbf{0}$ is invertible and $f^{-1} = (g_1, g_2)$ is the local inverse, then

$$D_1(g_1)(f(\mathbf{0})) = \frac{D_2(f_2)(\mathbf{0})}{Jf_\mathbf{0}}, \qquad D_2(g_1)(f(\mathbf{0})) = \frac{-D_2(f_1)(\mathbf{0})}{Jf_\mathbf{0}},$$

and

$$D_1(g_2)(f(\mathbf{0})) = \frac{-D_1(f_2)(\mathbf{0})}{Jf_\mathbf{0}}, \qquad D_2(g_2)(f(\mathbf{0})) = \frac{D_1(f_1)(\mathbf{0})}{Jf_\mathbf{0}}.$$