Homework Assignment for Week 08

1. Section 14.5: Problems 9, 15, 19, 25, 27, 29, 35, 36, 40 (See page 850).

2. Section 14.5: Let $f_1(x, y) = \sqrt{x^2 + y^2}^{\frac{1}{2}} = (x^2 + y^2)^{\frac{1}{4}}$,

   $f_2(x, y) = 2x + 3y + 4 + \sqrt{x^2 + y^2}^{\frac{3}{2}} = 2x + 3y + 4 + (x^2 + y^2)^{\frac{3}{4}}$ and

   $f_3(x, y) = \dfrac{x^3}{x^2 + y^2}$ for $(x, y) \neq (0, 0)$, $f_3(0, 0) = 0$.

   (a) Are f_i continuous at $(0, 0)$?

   (b) Do $\partial_x f_i$ and $\partial_y f_i$ exist at $(0, 0)$?

   (c) Use the definition of directional derivative to evaluate $\dfrac{df_i}{ds}\Big|_{(0,0),(\cos\theta,\sin\theta)}$, i.e. the directional derivative of f_i at $(x_0, y_0) = (0, 0)$ in the direction $(\cos\theta, \sin\theta)$, if it exists.

   (d) Are f_i differentiable at $(0, 0)$?