

**Instructions.** Either print this three-page file and fill in your answers or use exactly three blank pages and answer your response following this format (gradescope will not accept more or fewer number of pages). Then attach your work as a PDF. Show all your work in order to receive full credit. You have a total a 45 minutes from the time you enter the assignment to the time you submit it. No outside help allowed.

1. (2 Points) Find equations for the contour of  $f(x, y) = x^2 + y^2$  and draw a contour diagram of  $f$ . Then draw the graph of  $f$ .

2. (2 Points) Show that

$$f(x, y) = \frac{x^2}{x^2 + y}, x^2 + y \neq 0$$

does not have a limit as  $(x, y) \rightarrow (0, 0)$ .

3. (2 Points) The Dubois formula relates a person's surface area,  $s$ , in  $m^2$ , to weight,  $w$ , in  $kg$ , and height,  $h$ , in  $cm$ , by

$$s = f(w, h) = 0.01w^{0.25}h^{0.75}.$$

Find  $f(66, 165)$ ,  $f_w(66, 165)$ , and  $f_h(66, 165)$ . Interpret your answers in terms of surface area, height, and weight.

4. (2 Points) Find the equation of the tangent plane to the surface  $z = x^2 + y^2$  at the point  $(3, 4)$ . Then find the local linearization at the point  $(3, 4)$ . Estimate  $f(2.9, 4.2)$  and  $f(2, 2)$  using the linearization and compare your answer to the true values.

5. (2 Points) Let  $w = x^2 e^y$ ,  $x = 4u$ , and  $y = 3u^2 - 2v$ . Compute  $\frac{\partial w}{\partial u}$  and  $\frac{\partial w}{\partial v}$ .