

## PROBLEM SET #7

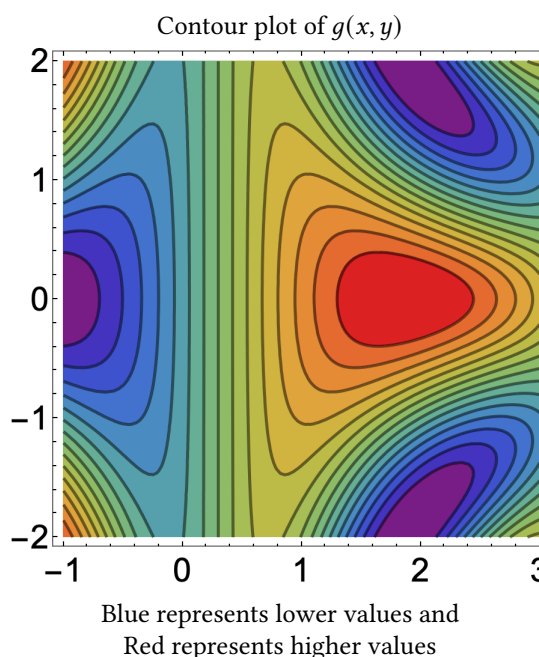
Due Friday, April 5, 2024 @ 12:30 pm  
Submit as single pdf file to Canvas

Remember to review the [Guidelines for WeBWorK and Problem Sets](#) on the course webpage when writing up your solutions. The rule of thumb is that you should give enough explanation so that you could hand your assignment to a student who took Calc II last semester and they could follow your solutions.

1. Let  $f(x, y) = x \cos(x^2 y)$ 
  - (a) Find  $f_x$ , the partial of  $f$  with respect to  $x$ , and  $f_y$ , the partial of  $f$  with respect to  $y$
  - (b) Is  $f(x, y)$  increasing or decreasing at the point  $(2, -1)$  in the positive  $x$ -direction? At what rate?
  - (c) Is  $f(x, y)$  increasing or decreasing at the point  $(2, -1)$  in the positive  $y$ -direction? At what rate?

2. Use the contour plot of  $g(x, y)$  to answer the following.

- (a) Is  $g_x(2, -1)$  positive, negative or zero? Explain.
- (b) Is  $g_y(2, -1)$  positive, negative or zero? Explain.
- (c) If you are standing at the point on the surface with  $(x, y) = (0, 0)$  and move northeast, i.e. in the  $\langle 1, 1 \rangle$  direction, will you be going uphill, downhill, or neither? Explain.
- (d) If you are standing at the point on the surface with  $(x, y) = (0, 0)$  and move due north, i.e. in the  $\langle 0, 1 \rangle$  direction, will you be going uphill, downhill, or neither? Explain.



3. If possible, find a function  $f(x, y)$  where

$$f_x(x, y) = -y \sin(xy) + \sec(y) + 4 \text{ and}$$

$$f_y(x, y) = -x \sin(xy) + x \tan(y) \sec(y) + 2 \cos(y)$$

4. Let  $\vec{v} = \langle 3, 2 \rangle$  and  $\vec{w} = \langle -1, 4 \rangle$ 
  - (a) What is the length of  $\vec{v}$ ?
  - (b) What is the unit vector that points in the same direction as  $\vec{v}$ ?
  - (c) What is the angle  $\theta$  between  $\vec{v}$  and  $\vec{w}$ ?