

# Ans. Key

## Math 2551 Exercise 13

Section:

Name:

Student ID:

Let  $f(x, y)$  be a differentiable function. Mark "true" or "false" for each of the following statements.

True

(1)  $f(x, y)$  is approximately equal to  $f(1, 2) + f_x(1, 2)(x - 1) + f_y(1, 2)(y - 2)$  at any  $(x, y)$  near  $(1, 2)$ .

Because  $f(x, y)$  can be approximated by its linearization at  $(1, 2)$  for any  $(x, y)$  near  $(1, 2)$ .

False

(2) If  $f_x(1, 2) = f_y(1, 2) = 0$ , then  $f(x, y)$  must have a local maximum or minimum value at  $(1, 2)$ .

$f$  could have a ~~sep~~ saddle pt at  $(1, 2)$ .

True

(3) Let  $(x, y)$  change from  $(1, 2)$  by small numbers  $dx$  and  $dy$  respectively, then the change of  $f$  is approximately equal to the differential of  $f$  at  $(1, 2)$ .

$$f(1+dx, 2+dy) - f(1, 2) \approx f_x(1, 2) dx + f_y(1, 2) dy$$

for small  $dx$  &  $dy$ .

True

(4) Let  $(x, y)$  change from  $(1, 2)$  by  $dx$  and  $dy$  respectively, then the change of the linearization of  $f$  at  $(1, 2)$  is equal to the differential of  $f$  at  $(1, 2)$ .

Let  $L(x, y) = f(1, 2) + f_x(1, 2) \frac{(x-1)}{1} + f_y(1, 2) \frac{(y-2)}{1}$ , the linearization of  $f$  at  $(1, 2)$ .

Then  $L(1+dx, 2+dy) - L(1, 2) = f_x(1, 2) dx + f_y(1, 2) dy = df|_{(1, 2)}$