

# Ans. Key

## Math 2551 A1-3 Exercise 13

Section:

Name:

Student Number:

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

False

(1)  $\nabla f$  gives a direction along which  $f$  decreases the fastest;

Actually  $-\nabla f$  gives a dir. along which  $f$  decreases the fastest.

True

(2) Let  $\mathbf{e} = -\nabla f / |\nabla f|$ . Then  $f'_e = \min \{f'_{\mathbf{e}_1} : |\mathbf{e}_1| = 1\}$ .

The directional derivative is the smallest along the  $-\nabla f / |\nabla f|$  direction.

False

(3)  $\nabla f$  gives a normal direction of the surface  $z = f(x, y)$ .

$\nabla f$  gives a normal direction to the level curve  $f(x, y) = C$ .

True

(4)  $-\nabla f$  gives a normal direction of the curve  $f(x, y) = 0$ .

Since  $\nabla f$  is normal to the level curve  $f(x, y) = 0$ , so is  $-\nabla f$ .