PID: _

Last Name, First Name:

Section: ____

Midterm I Math 20E, UCSD, Winter 2018 Thursday, February 1st, 3:30pm-4:50pm Instructor: Eddie Aamari

- Write your PID, Name and Section in the spaces provided above.
- <u>Do not</u> unstaple the pages.
- Write your solutions clearly in the spaces provided.
- Answers written outside the answer boxes will not be graded.
- No calculators or other electronic devices are allowed during this exam.
- Put away (and silence!) your cell phone and other devices that can be used for communication or can access the Internet.
- Show all of your work; no credit will be given for unsupported answers.

DO NOT TURN PAGE UNTIL INSTRUCTED TO DO SO

Exercise	Ι	II	III	IV	V	Total
Points	5	5	5	5	5	25

Exercise I (5 points)

Let $f: \mathbb{R}^2 \to \mathbb{R}$ be the function defined for any (x; y) in \mathbb{R}^2 by

 $f(x,y) = e^{-xy}\cos(y).$

Find the second order Taylor polynomial of f at (0,0).



Exercise II (5 points)

Let $f: \mathbb{R}^2 \to \mathbb{R}^2$ and $g: \mathbb{R}^2 \to \mathbb{R}^2$ be the functions defined by

$$f(u,v) = \left(\sin(u^2 + v^2), \cos(u^2 - v^2)\right)$$

$$g(x,y) = (x + y, x - y).$$

Find the differential matrix Dh(x, y) of the function $h = f \circ g$ at $(x, y) \in \mathbb{R}^2$.



Exercise III (5 points)

Evaluate the iterated integral

$$\int_0^2 \int_{y/2}^1 \sin(x^2) \mathrm{d}x \mathrm{d}y$$

by changing the order of integration. Be sure to clearly sketch the region of integration and indicate how you found the new limits of integration.



Exercise IV (5 points)

Let D be the region bounded by the lines:

$$x + y = 0;$$
 $x + y = 2;$ $x - y = 0;$ $x - y = 2.$

Evaluate

$$\iint_D (x+y)e^{x^2-y^2} \mathrm{d}x \mathrm{d}y$$

using the change of variables u = x + y, v = x - y.



Exercise V (5 points)

Let H be the upper unit hemisphere given by $x^2 + y^2 + z^2 \le 1$ and $z \ge 0$. Calculate

$$\iiint_{H} z^2 dV.$$

Be sure to clearly sketch the region of integration and indicate how you found the limits of integration.

