MA261 — FINAL EXAM — FALL 2014 — DECEMBER 16, 2014
TEST NUMBER 01– GREEN– USE GREEN SCANTRON
ENTER YOUR STUDENT ID NUMBER AND SECTION NUMBER CORRECTLY ON THE SCANTRON

INSTRUCTIONS:

1. **Do not open the exam booklet until you are instructed to do so.**
2. This exam has 20 problems in 14 different pages (including this cover page). Once you are allowed to open the exam, make sure you have a complete test.
3. Do any necessary work for each problem on the space provided or on the back of the pages of this test booklet. Circle your answers in this test booklet.
4. The number of points each problem is worth is stated next to it. The maximum total is 200 points. No partial credit.
5. The section numbers for each TA are listed on page # 2
6. Use a # 2 pencil to fill in the required information in your scantron and fill in the circles.
7. Use a # 2 pencil to fill in the answers on your scantron.
8. After you have finished the exam, hand in your scantron and your test booklet to your recitation instructor.

RULES REGARDING ACADEMIC DISHONESTY:

1. Do not leave the exam room during the first 20 minutes of the exam.
2. If you do not finish your exam in the first 110 minutes, you must wait until the end of the exam period to leave the room.
3. Do not seek or obtain any kind of help from anyone to answer questions on this exam. If you have questions, consult only your instructor.
4. Do not look at the exam of another student. You may not compare answers with anyone else or consult another student until after you have finished your exam, handed it in to your instructor and left the room.
5. Do not consult notes, books, calculators.
6. Do not handle phones or cameras, or any electronic device until after you have finished your exam, handed it in to your instructor and left the room.
7. After time is called, the students have to put down all writing instruments and remain in their seats, while the TAs will collect the scantrons and the exams.
8. Anyone who violates these instructions will have committed an act of academic dishonesty. Penalties for academic dishonesty can be very severe and may include an F in the course. All cases of academic dishonesty will be reported immediately to the Office of the Dean of Students.

I have read and understand the above statements regarding academic dishonesty:

STUDENT NAME: ____________________

STUDENT SIGNATURE: ____________________

STUDENT ID NUMBER: ____________________ SECTION NUMBER ____________________

RECITATION INSTRUCTOR: ____________________

MA261 Recitation Section Numbers Listed by TA– Enter the four numbers on your scantron:

Daniel Bath:
Section 0351 - 02:30pm
Section 0371 - 03:30pm
Section 0301 - 04:30pm

Jonathan Chavez–Casillas:
Section 0171 - 12:30pm
Section 0498 - 01:30pm
Section 0132 - 02:30pm

Binghe Chen:
Section 0507 - 02:30pm
Section 0508 - 03:30pm
Section 0509 - 04:30pm

Hee Jun Choi:
Section 0514 - 01:30pm
Section 0515 - 02:30pm
Section 0516 - 03:30pm

Monte Cooper:
Section 0491 - 11:30am
Section 0441 - 12:30pm
Section 0471 - 01:30pm

Jinwoo Hwang:
Section 0111 - 07:30am
Section 0191 - 08:30am
Section 0513 - 09:30am

Michael Kaminski:
Section 0510 - 02:30pm
Section 0511 - 03:30pm
Section 0512 - 04:30pm

Ngai Fung Ng:
Section 0495 - 01:30pm
Section 0501 - 02:30pm
Section 0506 - 03:30pm

Gayane Poghotanyan:
Section 0391 - 10:30am
Section 0381 - 11:30am
Section 0311 - 12:30pm

Andrew Ritchie:
Section 0421 - 07:30am
Section 0431 - 08:30am
Section 0452 - 09:30am

Alessio Sammartano:
Section 0401 - 07:30am
Section 0451 - 08:30am
Section 0461 - 09:30am

Partha Solapurkar:
Section 0494 - 07:30am
Section 0505 - 08:30am
Section 0493 - 09:30am

Jamie Weigandt
Section 0504 - 07:30am
Section 0321 - 08:30am
Section 0331 - 09:30am

Wei Zhang:
Section 0121 - 10:30am
Section 0181 - 11:30am
Section 0141 - 12:30pm

Jeffery Zylinski:
Section 0131 - 02:30pm
Section 0503- 03:30pm
Section 0101 - 04:30pm

1. **(10 points)** If $P = (6, 4, z)$ is on the plane that goes through $(1, 0, 1)$, $(0, 1, 0)$, and $(1, 1, 1)$, what must z equal?

A. 6

B. 7

C. 8

D. -8

E. 10

2. **(10 points)** If particle A moves on a path defined by $\langle t,\ t^2 \rangle$ and particle B moves on a path defined by $\langle t,\ t^3 \rangle$, at what positive time t do they have the same speed?

A. $\dfrac{\sqrt{2}}{2}$

B. 4

C. $\dfrac{\sqrt{3}}{2}$

D. $\dfrac{1}{2}$

E. $\dfrac{2}{3}$

3. **(10 points)** What is the length of the curve defined by $\langle 2t+1,\ \sin t,\ 2+\cos t\rangle$ on $[1,3]$?

A. $2\sqrt{2}$

B. $2\sqrt{3}$

C. $2\sqrt{5}$

D. $3\sqrt{5}$

E. $2\sqrt{10}$

4. **(10 points)** What is the y-coordinate of the point where the curve defined by $\langle t-1,\ 3t,\ 1\rangle$ intersects the cone $z^2 = x^2 + y^2$ for $t > 0$?

A. $\frac{3}{5}$

B. $\frac{5}{2}$

C. $\frac{3}{10}$

D. $\frac{8}{5}$

E. $\frac{3}{4}$

5. **(10 points)** The intersection of the quadric surfaces defined by $x^2 + y^2 + z^2 = 1$ and $-x^2 - y^2 + z^2 = 1$ is:

A. one point

B. two points

C. a straight line

D. a parabola

E. a circle

6. **(10 points)** If the point $(1, 1, k)$ lies on the tangent plane to the paraboloid $z = 5 - x^2 - y^2$ at $(1, 2, 0)$, then $k =$

A. 1

B. -2

C. 2

D. -3

E. 4

7. **(10 points)** Compute $\dfrac{\partial w}{\partial r}$ at $(r, s) = (2, 0)$, given that $w = x^2 - y^3$ with $x = \dfrac{1}{2}r^2 + rs^3$ and $y = r + se^{2s}$.

A. -4

B. -3

C. 4

D. 2

E. 7

8. **(10 points)** The rate of change of $f(x, y) = e^{xy} + y^2 - x^2 + 3$ at $(2, 0)$ in the direction from $(2, 0)$ to $(5, 4)$ is

A. $-\dfrac{3}{5}$

B. $-\dfrac{2}{5}$

C. -2

D. $-\dfrac{4}{5}$

E. -4

9. (10 points) Given that $(0,0)$ and $(1,1)$ are critical points of the differentiable function f and given that $f_x(x,y) = 3y - 3x^2$ and $f_y(x,y) = 3x - 3y^2$, then

A. $(0,0)$ is a saddle point; $(1,1)$ is a local minimum of f

B. $(0,0)$ is a local minimum of f; $(1,1)$ is a saddle point

C. $(0,0)$ is a local minimum of f; $(1,1)$ is a local maximum of f

D. $(0,0)$ is a saddle point; $(1,1)$ is a local maximum of f

E. $(0,0)$ is local maximum of f; $(1,1)$ is a saddle point

10. (10 points) If $y = y(x,z)$ is defined implicitly by the equation

$$xy + y^3 = 2zy - z^2 + 1$$

compute $\left.\dfrac{\partial y}{\partial z}\right|_{(x,y,z)=(3,0,1)}$

A. 3

B. 0

C. 1

D. 2

E. -2

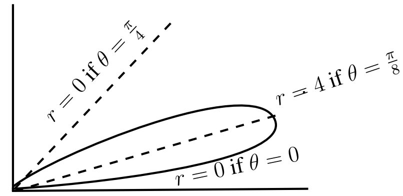

FIGURE 1. Figure for problem 11. One loop of an eight-leaved rose.

11. **(10 points)** The area inside one loop of the rose $r = 4\sin\ 4\theta$ (see figure above) is equal to (recall that $\cos^2\alpha = \dfrac{1}{2}(1+\cos 2\alpha)$ and $\sin^2\alpha = \dfrac{1}{2}(1-\cos 2\alpha)$)

A. π

B. $\dfrac{\pi}{2}$

C. $\dfrac{\pi}{4}$

D. $\dfrac{3\pi}{2}$

E. $\dfrac{3\pi}{4}$

12. **(10 points)** Evaluate $\displaystyle\iint_D y^2\, dydx$ where D is the triangle with vertices $(0,0)$, $(1,1)$, $(2,0)$.

A. $\dfrac{1}{3}$

B. $\dfrac{1}{6}$

C. $\dfrac{1}{2}$

D. $\dfrac{2}{3}$

E. $\dfrac{5}{6}$

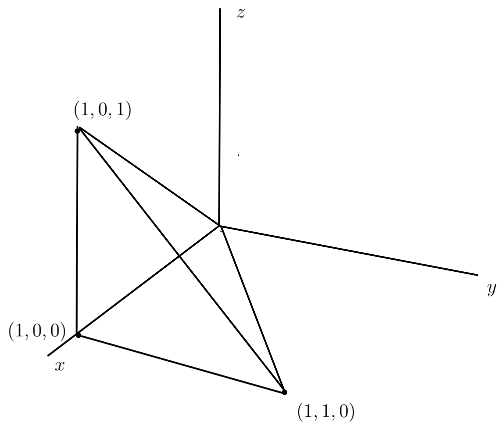

FIGURE 2. Figure for problem 13

13. (**10 points**) $\iiint_T xyz\ dV = \int_0^1 \int_0^a \int_0^b xyz\ dzdydx$, where T is the solid bounded by the planes $x = 1$, $y = 0$, $z = 0$ and $z - x + y = 0$, see figure above. Then a and b are

A. $a = x$ and $b = y + x$

B. $a = y$ and $b = x - y$

C. $a = x$ and $b = x - y$

D. $a = y$ and $b = y - x$

E. $a = x$ and $b = \frac{1}{2}(x - y)$

14. **(10 points)** Evaluate

$$\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{1-x^2-y^2} (x^2+y^2)\, dz dy dx$$

A. $\dfrac{\pi}{48}$

B. $\dfrac{\pi}{24}$

C. $\dfrac{\pi}{12}$

D. $\dfrac{\pi}{6}$

E. $\dfrac{\pi}{15}$

15. **(10 points)** Evaluate $\displaystyle\int_C (x^2+y^2+z^2)ds$ where

$$C\colon x=\sqrt{8}t,\ y=\cos t,\ z=\sin t,\quad 0\le t\le 1.$$

A. 3

B. 5

C. 7

D. 9

E. 11

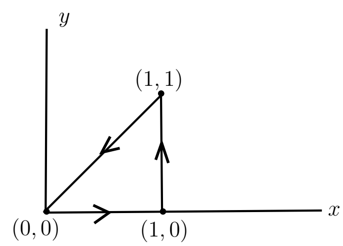

FIGURE 3. Figure for Problem 16

16. **(10 points)** Use Green's theorem to compute the line integral $\oint_C -x^2y\ dx + (e^{y^2} + x^3)\ dy$, where C is counterclockwise around the triangle with vertices $(0,0)$, $(1,0)$ and $(1,1)$, see figure above.

A. 1

B. $\frac{1}{2}$

C. $\frac{3}{2}$

D. $\frac{5}{3}$

E. $\frac{2}{3}$

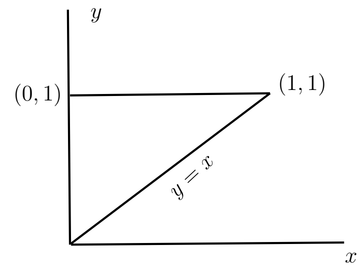

FIGURE 4. Figure for problem 17

17. **(10 points)** Evaluate $\int\int_D 6xe^{y^3}\, dydx$ where D is the region of the plane bounded by $x = 0$, $y = x$ and $y = 1$, see figure above.

A. $3e - 2$

B. $2e - 1$

C. $4e - 2$

D. $2e - 2$

E. $e - 1$

18. **(10 points)** Compute the surface integral $\int\int_S \boldsymbol{F} \cdot \, d\boldsymbol{S}$, where

$$\boldsymbol{F}(x, y, z) = \vec{i} + y^2\vec{j} - (1 - z - x)^2\vec{k}$$

and S is the part of the plane $x + y + z = 1$ where $x^2 + y^2 \leq 1$, oriented upward.

A. 3π

B. 5π

C. 4π

D. π

E. 2π

19. **(10 points)** Compute $\int\int_S \operatorname{curl} \boldsymbol{F} \cdot \, d\boldsymbol{S}$, where S is the surface $z = 4 - x^2 - y^2$, $z \geq 0$ oriented upward, and

$$\boldsymbol{F} = -y\vec{i} + 2xz\vec{j} + xy\vec{k}.$$

Recall that $\cos^2 \alpha = \frac{1}{2}(1 + \cos 2\alpha)$ and $\sin^2 \alpha = \frac{1}{2}(1 - \cos 2\alpha)$.

A. π

B. 2π

C. 8π

D. 3π

E. 4π

20. (10 points) Compute $\displaystyle\int\int_S \boldsymbol{F} \cdot \, d\boldsymbol{S}$, where S is the surface of the solid cube $0 \leq x \leq 2$, $0 \leq y \leq 2$, $0 \leq z \leq 2$, oriented outward, and

$$\boldsymbol{F}(x, y, z) = y^3 z^2 \vec{i} + x^4 e^{z^4} \vec{j} + \frac{1}{4}(z^2 - y^3 x^7)\vec{k}.$$

A. 1

B. 4

C. 8

D. 3

E. 6