

Name: _____

Instructor: _____

Math 20550, Last Year Exam 3
November 16, 2017

- The Honor Code is in effect for this examination. All work is to be your own.
- No calculators.
- The exam lasts for 1 hour and 15 minutes
- Be sure that your name is on every page in case pages become detached.
- Be sure that you have all 9 pages of the test.
- Each multiple choice question is 6 points. Each partial credit problem is 12 points.
You will receive 4 extra points.

PLEASE MARK YOUR ANSWERS WITH AN X, not a circle!					
1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
.....					
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
.....					
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)
.....					
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)
.....					
9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)

Please do NOT write in this box.

Multiple Choice _____

11. _____

12. _____

13. _____

Extra Points. 4 _____

Total: _____

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Multiple Choice

1.(6 pts) Use cylindrical coordinates to evaluate $\iiint_E (x^2 + y^2) dV$, where

$$E = \{(x, y, z) \mid \sqrt{x^2 + y^2} \leq z \leq 2\}.$$

- (a) $\frac{3\pi}{4}$ (b) $\frac{\pi}{4}$ (c) $\frac{4\pi}{9}$ (d) $\frac{16\pi}{5}$ (e) $\frac{4\pi}{3}$

2.(6 pts) Evaluate $\int_C xy ds$, where C is given by $\vec{r}(t) = \langle 4 \cos t, 4 \sin t, 3t \rangle$ for $0 \leq t \leq \frac{\pi}{2}$.

- (a) 10 (b) 40 (c) 5 (d) 0 (e) -40

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3.(6 pts) Find the total mass of the laminated (i.e., thin) region D having density $\rho(x, y) = \sqrt{x^2 + y^2}$, where

$$D = \{(x, y) \mid x^2 + y^2 \leq 4, y \geq 0\}.$$

- (a) $\frac{4\pi}{3}$ (b) $\frac{8\pi}{3}$ (c) $\frac{3\pi}{2}$ (d) $\frac{4}{3}$ (e) $\frac{2\pi}{3}$

4.(6 pts) Use spherical coordinates to evaluate $\iiint_E e^{(x^2+y^2+z^2)^{3/2}} dV$, where

$$E = \{(x, y, z) \mid y \geq 0, z \geq 0, x^2 + y^2 + z^2 \leq 1\}.$$

- (a) $4\pi e$ (b) 0 (c) $\frac{\pi}{3}e$ (d) $\frac{\pi}{3}(e - 1)$ (e) $\frac{4\pi}{3}(e - 1)$

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5.(6 pts) Let $\vec{F} = \langle xz, xyz, -y^2 \rangle$. Compute $\text{curl } \vec{F}$.

- (a) $\langle -y(2+x), x, yz \rangle$ (b) 0 (c) $z + xy$
(d) $\langle x, -y(2+x), yz \rangle$ (e) $\langle -y(2+x), -x, yz \rangle$

Disregard

6.(6 pts) Use a double integral to find the area enclosed by one loop of the four-leaved rose $r = \sin(2\theta)$. The region inside the loop is described in polar coordinates by $0 \leq \theta \leq \frac{\pi}{2}$ and $0 \leq r \leq \sin(2\theta)$.

- (a) $\frac{\pi}{2}$ (b) 0 (c) $-\frac{\pi}{2}$ (d) $\frac{\pi}{8}$ (e) $\frac{\pi}{4}$

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7.(6 pts) Find the work $\int_C \vec{F} \cdot d\vec{r}$ done by the force field $\vec{F} = \langle xy, yz, zx \rangle$ in moving a particle along the curve C given by $\vec{r}(t) = \langle t, t^2, t^3 \rangle$ for $-1 \leq t \leq 1$.

(a) $\frac{1}{4}$

(b) $\frac{5}{7}$

(c) $\frac{1}{2}$

(d) $\frac{10}{7}$

(e) $\frac{27}{28}$

8.(6 pts) Use Green's theorem to evaluate $\int_C \left((3y - e^{x^2})dx + (7x + \sqrt{y^{99} + y + 100})dy \right)$ where C is the circle $x^2 + y^2 = 9$ with the counter-clockwise orientation.

(a) 3π

(b) 36π

(c) 0

(d) -36π

(e) 7π

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9.(6 pts) Let $x = 2u$ and $y = -3v$. Then $\int_{-3}^3 \int_{-2}^2 f(x, y) dx dy$ can be written as:

(a) $\frac{1}{6} \int_{-1}^1 \int_{-1}^1 f(2u, -3v) du dv$

(b) $6 \int_{-3}^3 \int_{-2}^2 f(2u, -3v) du dv$

(c) $6 \int_{-1}^1 \int_{-1}^1 f(2u, -3v) du dv$

(d) $-4 \int_{-1}^1 \int_{-1}^1 f(2u, -3v) du dv$

(e) $-6 \int_{-1}^1 \int_{-1}^1 f(2u, -3v) du dv$

10.(6 pts) Which of the following vector fields cannot be written as $\text{curl } \vec{F}$?

(a) $\langle -x - y + 1, xy - 1, -xz + y + z \rangle$

(b) $\langle -y, -z, -x \rangle$

(c) $\langle -y \cos(z), -z \cos(x), -x \cos(y) \rangle$

(d) $\langle 2yz, xyz, 3xy \rangle$

(e) $\langle 1 - 2z, 1 - 2x, 1 - 2y \rangle$

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Partial Credit

You must show your work on the partial credit problems to receive credit!

11.(12 pts.) Let $\vec{F} = \langle y^2 + 1, 2xy + 2y + e^{3z}, 3ye^{3z} + 3z^2 \rangle$.

(a) Find f such that $\nabla f = \vec{F}$.

(b) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ where C is any smooth curve beginning at $(1, 0, 0)$ and ending at $(0, 1, 0)$.

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12.(12 pts.) Let E be the tetrahedron enclosed by the coordinate planes $x = 0$, $y = 0$, $z = 0$ and the plane $2x + y + z = 2$. Assume the density function is $\rho(x, y, z) = 1$. Write an iterated integral (with limits) for the moment of the solid E about the yz -plane. (You do NOT need to compute this iterated integral.)

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13.(12 pts.) Use the transformation $x = \sqrt{3}u - v$, $y = \sqrt{3}u + v$ to evaluate the integral $\iint_R (x^2 - xy + y^2)dA$, where R is the region bounded by the ellipse $x^2 - xy + y^2 = 3$.