Name: _____

Instructor: _____

Math 20550. Exam 3
April 21, 2015

- 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

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Multiple Choice

1.(6 pts)Which of the following integrals computes $\bar{x}$ for the solid bounded by $x = 0$, $y = 0$, $z = 0$, and $2x + 2y + z = 2$ which has constant density $\rho(x, y, z) = k$, and mass equals $k/3$.

(a) $1/3 \int_0^1 \int_0^1 \int_0^{1-x-y} x \, dzdydx$

(b) $3 \int_0^1 \int_0^{1-x} \int_0^{2-2x-2y} dxdydz$

(c) $3 \int_0^1 \int_0^{1-x} \int_0^{2-2x-2y} x \, dzdydx$

(d) $3 \int_0^1 \int_0^1 \int_0^2 x \, dxdydx$

(e) $1/3 \int_0^1 \int_0^1 \int_0^{1-x-y} dxdydz$

2.(6 pts) Express the double integral $\iint_D (x+1) \, dA$, where D is the region in the upper half-plane (i.e. $y \geq 0$) between the circles $x^2 + y^2 = 4$ and $x^2 + y^2 = 9$, in polar coordinates.

(a) $\int_0^{2\pi} \int_2^3 (r^2 \cos\theta + r) \, drd\theta$

(b) $\int_0^{\pi} \int_2^3 (r \cos\theta + 1) \, drd\theta$

(c) $\int_0^{2\pi} \int_2^3 (r \cos\theta + 1) \, drd\theta$

(d) $\int_0^{\pi} \int_2^3 (r^2 \cos\theta + r) \, drd\theta$

(e) $\int_0^{\pi} \int_4^9 (r^2 \cos\theta + r) \, drd\theta$

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3.(6 pts) Find the surface area of the parametric surface $\mathbf{r}(u,v) = \langle u, uv, u \rangle$ with $0 \le u \le 1, 0 \le v \le 1$.

(a) $\frac{1}{2}$ (b) $\sqrt{2}$ (c) 2 (d) 1 (e) $\frac{\sqrt{2}}{2}$

Disregard !!!

4.(6 pts) Which of the following integrals computes $\iiint_E y\, dV$ in cylindrical coordinates, where E is the solid that lies between cylinders $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$, above the xy-plane and below the plane $z = x + 4$?

(a) $\int_0^{2\pi} \int_1^2 \int_0^{r\cos\theta+4} r^2 \sin\theta \, dz dr d\theta$

(b) $\int_0^{2\pi} \int_1^2 \int_0^{r\cos\theta+4} r \sin\theta \, dz \, dr \, d\theta$

(c) $\int_0^{2\pi} \int_1^2 \int_0^{r\sin\theta} (r\cos\theta + 4) \, dz dr d\theta$

(d) $\int_0^{2\pi} \int_1^2 \int_0^{r} r^2 \sin\theta \, dz dr d\theta$

(e) $\int_0^{2\pi} \int_1^2 \int_0^{r} r \sin\theta \, dz dr d\theta$

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5.(6 pts) Evaluate $\iiint_E (x^2+y^2+z^2)^{3/2} dV$, where E is the solid hemisphere enclosed by $x^2+y^2+z^2=1$ and above the plane $z=0$.

(a) 0 (b) $\frac{\pi}{3}$ (c) $\frac{1}{3}$ (d) $\frac{2\pi}{3}$ (e) π

6.(6 pts) Evaluate the line integral $\int_C (x+y+z)\, ds$ along the curve C given by $\mathbf{r}(t) = \langle \sin t, \cos t, t \rangle$, $0 \le t \le \pi$.

(a) $\sqrt{2}\pi^2$ (b) $\frac{1}{2}\pi^2$ (c) $\sqrt{2}(2+\frac{1}{2}\pi^2)$

(d) $\frac{\sqrt{2}}{2}\pi^2$ (e) $2+\frac{1}{2}\pi^2$

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7.(6 pts) Evaluate $\int_C \mathbf{F} \cdot d\mathbf{r}$, where $\mathbf{F}(x, y) = xy\mathbf{i} + e^x\mathbf{j}$ and C is the line segment from $(2, 0)$ to $(4, 0)$.

(a) 0 (b) 2 (c) -2 (d) 4 (e) -4

8.(6 pts) Use Fundamental Theorem of Line Integrals to compute $\int_C \nabla f \cdot d\mathbf{r}$ where $f(x, y, z) = xy^2 + ye^{5z}$ and C is the curve $\mathbf{r}(t) = \langle e^{3t}, \sqrt{1 + 3t^4}, 2\sin(\pi t)\rangle$, $0 \leq t \leq 1$.

(a) $4e^3$ (b) $4e^5$ (c) $2e^3$ (d) 0 (e) $2e^3 + 2$

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9.(6 pts)Evaluate $\oint_C (y^3+x^2)dx+(3y^2x+x)dy$ where C is the positively oriented boundary of the triangle with vertices $(0,0)$, $(0,4)$, and $(2,2)$

(a) -2 (b) 2 (c) -4 (d) 0 (e) 4

Disregard !!!

10.(6 pts)Find an equation for the tangent plane to the surface given by $\mathbf{r}(u,v) = \langle u, uv, u\rangle$ at the point $(1,0,1)$.

(a) $x+z=0$ (b) $-x+z=0$

(c) $x+y+z=0$ (d) $y=1$

(e) $x+z=2$

Disregard !!!

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Partial Credit

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

11.(12 pts.) (a) Find the Jacobian of the transformation

$$x = u^2 - v^2, \qquad y = uv.$$

(b)(Note this part is not related to part (a)) Use the transformation $x = u + \frac{v}{2}$, $y = \frac{v}{2}$ to compute $\iint_D 2dA$ where D is the region bounded by $x^2 - 2xy + 5y^2 = 1$.

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12.(12 pts.) For the integral $\int_0^1 \int_{4y}^4 e^{x^2}\, dx\, dy$

(a) Sketch the region of integration.

(b) Reverse the order of integration.

(c) Evaluate the integral .

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13.(12 pts.) Suppose the vector field $F = y\mathbf{i} + (x+z)\mathbf{j} + (y+2z)\mathbf{k}$ is conservative. Find a potential function of F.