Name: _____

Instructor: _____

Math 20550, Exam 2
March 17, 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) Find the absolute maximum and minimum of $f(x, y) = 4y + x^2 - 2x + 1$ on the closed triangular region with vertices $(0, 0)$, $(2, 0)$ and $(0, 2)$.

(a) maximum value = 9, minimum value = 0

(b) maximum value = 10, minimum value = -1

(c) maximum value = 8, minimum value = 1

(d) maximum value = 4, minimum value = 0

(e) maximum value = 1, minimum value = 0

2.(6 pts) Find the equation of the tangent plane to the surface $xz + \ln(2x + y) = 5$ at the point $(-1, 3, -5)$.

(a) $-3x + y - z - 11 = 0$

(b) $4x - y + z + 12 = 0$

(c) $5x - y + z + 13 = 0$

(d) $3x + y - z - 5 = 0$

(e) $-4x + y - z - 4 = 0$

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3.(6 pts) If $z = f(x, y)$, where f is differentiable, and $x = g(t), y = h(t)$, $g(1) = 3$, $h(1) = 4$, $g'(1) = -2$, $h'(1) = 5$, $f_x(3, 4) = 7$ and $f_y(3, 4) = 6$. Find dz/dt when $t = 1$.

(a) 16 (b) 23 (c) 44 (d) 32 (e) 13

4.(6 pts) Find the directional derivative of the function $f(x, y) = x^2 + y^3$ at the point $(2, 1)$ in the direction $< 1, 1 >$

(a) $\dfrac{7}{\sqrt{2}}$

(b) 7

(c) $\dfrac{3}{\sqrt{2}}$

(d) 3

(e) None of the above

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5.(6 pts) For a function $f(x, y)$, suppose that $f_{xx} = x^2$ and $D(x, y) = f_{xx}f_{yy} - f_{xy}^2 = x^2y^2 - 2$. Which is true for the points $P(1, 1)$ and $Q(1, 2)$ where P and Q are critical points of f.

(a) P is a saddle point and Q is a local min.

(b) P is a saddle point and Q is a local max.

(c) P is a local min and Q is a local max.

(d) P is a local max and Q is a local min.

(e) None of the above

6.(6 pts) What is the equation of the tangent line to the curve of intersection between the two surfaces defined by $z = x^2 + y^2$ and $x^2 + 2y^2 + z^2 = 7$ at the point $(-1, 1, 2)$.

(a) $\langle x, y, z\rangle = \langle -1, 1, 2\rangle + t\langle 12, 10, -4\rangle$

(b) $\langle x, y, z\rangle = \langle -1, 1, 2\rangle + t\langle -2, 2, 1\rangle$

(c) $\langle x, y, z\rangle = \langle -1, 1, 2\rangle + t\langle -2, 4, 4\rangle$

(d) $\langle x, y, z\rangle = \langle -1, 1, 2\rangle + t\langle 1, 2, 1\rangle$

(e) None of the above

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7.(6 pts) Find the maximum rate of change of $f(x, y) = 3e^{xy}$ at the point $(2, 0)$ and the direction in which it occurs.

(a) Rate of change $= 6$ in the direction $\langle 0, 1\rangle$

(b) Rate of change $= 3$ in the direction $\langle 1, 1\rangle$

(c) Rate of change $= \sqrt{3}$ in the direction $\langle 1, 0\rangle$

(d) Rate of change $= \sqrt{6}$ in the direction $\langle 1, -1\rangle$

(e) Rate of change $= 36$ in the direction $\langle -1, 0\rangle$

8.(6 pts) Find absolute maximum and minimum of $3x - y - 3z$ subject to the constraints $x + y - z = 0$ and $x^2 + 2z^2 = 6$.

(a) Max=12, Min=-12 (b) Max=15, Min=5 (c) Max=$3\sqrt{5}$, Min=0

(d) Max=5, Min=$-3\sqrt{5}$ (e) Max=6, Min=-1

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9.(6 pts) Evaluate the iterated integral

$$\int_0^2 \int_y^{2y} 2xy\, dx\, dy.$$

(a) 12 (b) 3 (c) 4 (d) 5 (e) 2

10.(6 pts) Which integral represents the volume of the solid below the plane $x+y+z=3$ and over the rectangle $[0,2]\times[0,1]$.

(a) $\int_0^2 \int_0^1 3-x-y\, dydx$ (b) $\int_0^1 \int_0^2 3-x-y\, dydx$

(c) $\int_0^2 \int_0^1 x+y+z\, dydx$ (d) $\int_0^1 \int_0^2 x+y+z\, dydx$

(e) $\int_0^2 \int_0^1 1\, dydx$

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Partial Credit

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

11.(12 pts) Find all critical points of of $f(x, y) = x^3 - xy + y^2/2$ and classify them using the second derivative test.

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12.(12 pts) Use Lagrange Multipliers to find extrema values of the funciton $f(x, y) = 2x^3 - y^3$ subject to the contraint $x^2 + y^2 = 5$.

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13.(12 pts) Find the volume of the solid that lies under the graph of $f(x, y) = xe^{xy}$ and above the rectangle $R = \{(x, y) \mid 0 \leq x \leq 1, 0 \leq y \leq 1\}$.