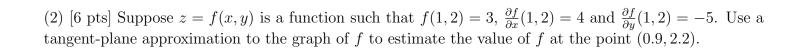
NAME:							CIRCLE: Turi Zwech				Zweck 4pm			
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MATH 2415 Final Exam, Fall 2014

No books or notes! You may use a scientific calculator provided it does not allow for access to the internet. Show all work and give complete explanations. Don't spend too much time on any one problem. This 2 hours 45 mins exam is worth 100 points.

- (1) [6 pts]
- (a) Find the area of the triangle with vertices (1,2,3), (2,0,3), and (0,2,0).

(b) Find a so that the line $\mathbf{r}(t) = (2 - t, 2 + at, 4 + 3t)$ is perpendicular to the plane 2x + 3y - 6z = 1.



(3) [6 pts] Suppose that $(x, y, z) = \mathbf{r}(t)$ is a parametrized curve whose speed is constant. Show that the acceleration vector of the curve is always perpendicular to the velocity vector of the curve.

(4) [12 pts] Find the absolute maximum and absolute minimum of the function f(x,y) = x + y - xy on the triangle in the xy-plane with vertices (0,0), (4,0), and (0,2).

(5) [12 pts] The intersection of the surfaces $x^2 + z^2 = 1$	and $y^2 + z^2 = 1$ is a pair of curves.
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(a) Find a parametrization for one of these curves.

(b) Show that the curve you found in (a) lies in a plane.

(c) Make a single sketch in three-dimensional space which shows the surface $y^2 + z^2 = 1$, the curve you found in (a), and the plane you found in (b).

(6) [10 pts] Let E be the solid region bounded by the surfaces $x=0, y=0, z=0, y=1-x^2$, and x+y+z=5. Find a function g(x) and numbers a and b so that $\iiint_E x \, dV = \int_a^b g(x) \, dx$.

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(a) Let C be the line segment from (1,0,0) to (4,1,2) and let $\mathbf{F}(x,y,z)=z^2\mathbf{i}+y^2\mathbf{k}$. Calculate $\int_C \mathbf{F} \cdot d\mathbf{r}$.

(b) Let C be the circle of radius 3, center (0,0), oriented clockwise and let $\mathbf{F}(x,y)=y^3\mathbf{i}-x^3\mathbf{j}$. Use Green's Theorem to calculate $\int_C \mathbf{F} \cdot d\mathbf{r}$.

(8) [8 pts] Use the Change of Variables Theorem to find the area of the ellipse $(\frac{x}{a})^2 + \frac{y}{b})^2 = 1$. Hint: Let (x,y) = (au,bv).

(9) [6 pts] Evaluate $\iiint_E z \, dV$, where E is the solid hemisphere $x^2 + y^2 + z^2 \le 4$, $z \ge 0$.

1	10)	[$T \cup C$	1	parametrized	C			2
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(a) Find a function f so that S is the graph of z = f(x, y).

(b) Sketch the surface S together with the curve on S where u=1 and the curve on S where $v=\pi/4$.

(c) Find a parametrization of the tangent plane to S at the point where $(u,v)=(1,\pi/4).$

(11) [7 pts] Let S be the part of the plane x+y+z=4 in the first octant (i.e., where $x>0,\ y>0,$ and z>0). Calculate $\iint z\,dS$.

(12) [8 pts] Let \mathbf{r} be the position vector field, $\mathbf{r}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z\mathbf{k}$.

(a) Calculate $\nabla \cdot \mathbf{r}$

(b) Calculate $\nabla \times \mathbf{r}$

(c) Let $r = |\mathbf{r}|$. Calculate $\nabla \cdot (\nabla r^2)$.

Pledge: I have neither given nor received aid on this exam

Signature: