DEPARTMENT OF MATHEMATICS
UNIVERSITY OF KANSAS

Practice Final Exam

MATH 122 Spring 2014

Your Name: ______________________

KUID Number: ______________________

1	(10)	________
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15	(30)	________
Total	(350)	________

Some Useful Formulas

0.

Multiple Choice Questions (10 points each)

(1) Find a unit vector orthogonal to both $\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $-\mathbf{i} + \mathbf{k}$.
(A) $\frac{1}{\sqrt{11}} < -1, 3, -1 >$
(B) $\frac{1}{\sqrt{11}} < -1, -3, -1 >$
(C) $\frac{1}{\sqrt{11}} < 1, 3, -1 >$
(D) $\frac{1}{\sqrt{11}} < -1, 3, 1 >$

(2) Find the volume of the parallelepiped spanned by the vectors $< 1, 1, -2 >, < 3, -2, 1 >, < 0, 1, -5 >$.
(A) 18
(B) 7
(C) 4
(D) 23

(3) Find the acceleration vector of a particle with position function $\vec{r}(t) =< t\ln(t), t, e^{-t} >$ at $t = 1$.
(A) $< 0, 0, e^{-1} >$
(B) $< 1, 0, e >$
(C) $< 1, 0, e^{-1} >$
(D) $< 0, 1, e^{-1} >$

(4) Find the equation of the tangent plane to the surface $xy + yz + zx = 3$ at the point $(1, 1, 1)$.
(A) $x + y + z = 1$
(B) $x + yz + z = 3$
(C) $x + y + z = 3$
(D) $2x + 2y + 2z = 3$

(5) (A)
(B) 1.07
(C)
(D) 1.04

"Show Your Work" Questions (30 points each)

(6) Find the plane that contains the line $x = 1 + t, y = 2 - t, z = 4 - 3t$ and is parallel to the plane $3x - 7z = 12$.

(7) An athlete throws a shot at an angle of 45^o at an initial speed of $v_0 = 43ft/sec$. It leaves his hand at $7ft$ above the ground. How high does the shot go? How far is the shot landing? Assume that $g = 33ft/sec^2$.

(8) Let C be the curve with equations $x = 2 - t^3, y = 2t - 1, z = \ln(t)$.

- Find the point where C intersects the xz plane.
- Find the equations of the tangent line at the point $(1, 1, 0)$.
- Find the equation of the normal plane at the point $(1, 1, 0)$.

(9) Find the extreme values of the function $f(x, y) = 2x^2 + 3y^2 - 4x - 5$ on the region $D : x^2 + y^2 \leq 16$.

(10) Let $u(x, y) = f(x^2 + 1/y)$. Show that u satisfies

$$u_x + 2xy^2 u_y = 0.$$

(11) For the function $f(x, y, z) = x^2 e^{yz^2}$, compute the gradient. When is the directional derivative of f at the point $< 1, 1, 1 >$ a maximum? When is it a minimum?

(12) Compute

$$\int_D \cos(y^2)dxdy,$$

where $D = \{(x, y) : 0 \leq x \leq 1, x \leq y \leq 1\}$.

(13) Find the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $z = 0$ and $y + z = 3$.

(14) Lamina occupies the part of the disk $x^2 + y^2 \leq 1$ in the first quadrant. Find its center of mass, if the density is proportional to the square of its distance from the origin.

(15) Evaluate

$$\int\int\int_E x^2 dxdydz,$$

where E is the region bounded by the hemispheres $y = \sqrt{9 - x^2 - z^2}$ and $y = \sqrt{16 - x^2 - z^2}$.