CALCULUS 211-FINAL EXAM-DECEMBER 17, 2008

1)For the line and the plane given by $x = 3 - t$, $y = t + 1$, $z = 3t$ and $x + y - z = 1$

a)Determine the coordinates of the point of intersection of the line and the plane

b)Determine the cosine of the angle between the line and a line normal to the given plane

2)For the space curve $x = t + 1, y = \sqrt{2t + 1}, z = (t^2 - 4)$
a) Determine the equation of the line tangent to the curve at $t = 1$
b) Determine the acceleration vector at $t = 1$

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3)Find all the local relative and absolute extrema of the function
$f(x,y) = x^2 + 3y - 3xy$ bounded by the region $y = x$, $y = 0$, $x = 2$

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4)Using Lagrange multipliers find the maximum and minimum values of the function
$f(x,y) = xe^y$ subject to the constraint $x^2 + y^2 = 2$

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5)a)Determine the directional derivative of $f = e^{xy+z}$ at the point (1,-1,1)
in the direction from (1,3,1) to (1,6,-3)
b)Determine the equation of the plane tangent to the surface $e^{xy+z} = 1$
at the point (1,-1,1)

6)Evaluate, using cylindrical coordinates
$\iiint e^z dV$ for the region between $z = 0$ and $z = -\sqrt{4 - x^2 - y^2}$ and outside

the cylinder $x^2 + y^2 = 3$

7)Evaluate the line integral $\int_c xzds$ where C is the straight line
segment from (1,0,1) to (2,-2,2)

8)For the conservative vector field $\mathbf{F} = 2xy\mathbf{i} + (x^2 - 1)\mathbf{j}$
determine its potential $f(x,y)$ and evaluate the line integral $\int_{(1,0)}^{(3,1)} \mathbf{F} \cdot d\mathbf{r}$.

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9)Evaluate directly as a line intergral $\oint xdy$ for the closed cuve which encloses the region

formed by the curves $y = x^2$ *and* $y = 4$, oriented counterclockwise

10)Use Green's Theorem for the vector field $\mathbf{F} = (y^3 - \ln x)\mathbf{i} + (\sqrt{y^2 + 1} + 3x)\mathbf{j}$ to evaluate
the line integral $\oint \mathbf{F} \cdot d\mathbf{r}$ over the boundary of the region formed by the curves $x = y^2$ and $x = 4$,
as a double integral over this region, oriented counterclockwise