SI Session: April 27th, 28th & 29th, 2009
Mondays: 4:50 PM – 6:20 PM
Tuesdays: 1:30 PM – 3:00 PM
Wednesdays: 4:50 PM – 6:20 PM
Room 1245 SNAD

Prof. Stockton : Calculus III
Spring 2009
SI Leader : Neil Jody

[1] Determine if the following vector field is conservative. If it is, find a potential function for the vector field.

(a) $\vec{F}(x,y) = \langle 2x - y^2, y^3 - 2xy \rangle$

(b) $\vec{F}(x,y,z) = e^z \left(y\hat{i} + x\hat{j} + \hat{k} \right)$

(c) $\vec{F}(x,y,z) = y^2 z^3 \hat{i} + 2xyz^3 \hat{j} + 3xy^2 z^2 \hat{k}$

(d) $\vec{F}(x,y,z) = \dfrac{x}{x^2+y^2}\hat{i} + \dfrac{y}{x^2+y^2}\hat{j} + \hat{k}$

[2] Find $\operatorname{curl} \vec{F}$ for the vector field at the given point.

(a) $\vec{F}(x,y,z) = x^2 z\hat{i} - 2xz\hat{j} + yz\hat{k}$, $(2,-1,3)$

(b) $\vec{F}(x,y,z) = e^{-xyz}\left(\hat{i} + \hat{j} + \hat{k} \right)$, $(3,2,0)$

[3] Find the divergence for the vector field $\vec{F}$.

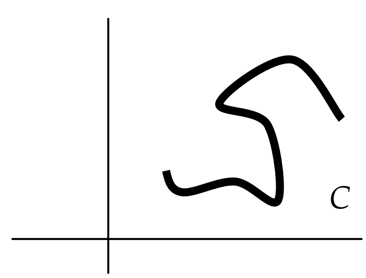
(a) $\vec{F}(x,y,z) = xe^x \hat{i} + ye^y \hat{j}$

(b) $\vec{F}(x,y,z) = \ln\left(x^2 + y^2\right)\hat{i} + xy\hat{j} + \ln\left(y^2 + z^2\right)\hat{k}$

[4] Let C be the curve in space parametrized by $\vec{r}(t) = \left(t, t^2, 1-t\right)$ for $t \in [0, 2]$. An object moving along C with the orientation prescribed by $\vec{r}$ is acted on by the force field $\vec{F}(x,y,z) = \langle x, x-z, 2y \rangle$. Calculate the work done by $\vec{F}$.

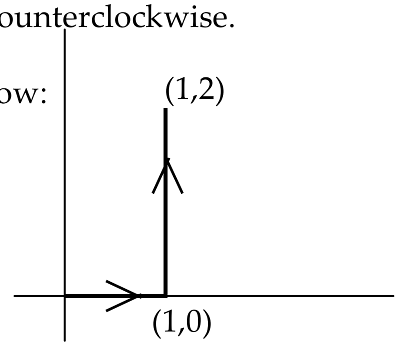
[5] A smooth curve C lying in the xy-plane begins at the point (1, 1) and ends at (3, 2) (see figure). Calculate the following line integral:

$$\int_C (2x - y^2)\,dx + (y^3 - 2xy)\,dy$$



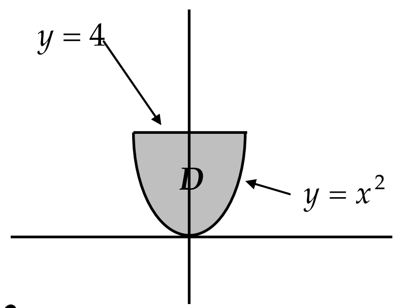
[6] Compute the following line integral: $\int_C (x^2 + y^2)dx - xydy$ where C is the upper arc of the circle $x^2 + y^2 = 4$, traversed counterclockwise.

[7] Evaluate $\int_C yds$ where C is the path shown below:



[8] Use Green's Theorem to calculate the following line integral:

$\int_C (x^2 + xy)dx + x^2y^3dy$ where C is the boundary of the region D shown below *traversed counterclockwise*.



[9] Use Green's Theorem to evaluate the line integral $\int_C y^2dx + 6xydy$ where C is the path from (0,0) to (1,0) along $y = 0$, from (1,0) to (1,1) along $x = 1$, and from (1,1) to (0,0) along $y = \sqrt{x}$

[10] Let S represent the portion of the plane $x + y + 2z = 4$ lying inside the cylinder $x^2 + z^2 = 1$.

(a) Give a parametrization of S.
(b) Calculate the surface area of S.
(c) Evaluate $\iint_S (4 - y)dS$