King Fahd University of Petroleum and Minerals
Department of Mathematical Sciences
Math 301 Exam I
Semester I, 2006- (061)
Dr. Faisal Fairag

Serial NO:	
ID:	
Name:	FORM **A**

Q		Points
1		6
2		4
3		9
4		4
5		5
6		13
7		12
8		12
9		12
10		20
11		33
Total		130

Say a prayer & Good luck ☺

1) Find $L\left[f(t)\right]$ where

$$f(t) = t^2 - e^{-9t} + 5$$

2) Find the directional derivative of $f(x,y)=(xy+1)^2$ at the point (3,2) in the direction of (5,3).

3) Given that $F(x,y,z)=xi+yj+zk$ and $G(x,y,z)=yi+xk$

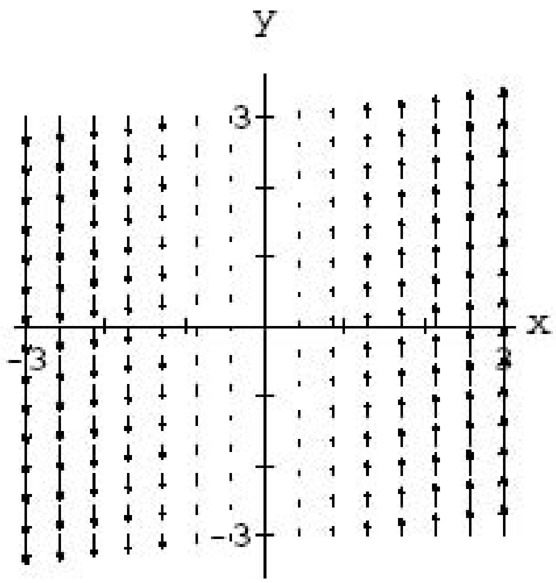
(a) Find $div(F\times G)=$

(b) Find $G\cdot curlF - F\cdot curlG =$

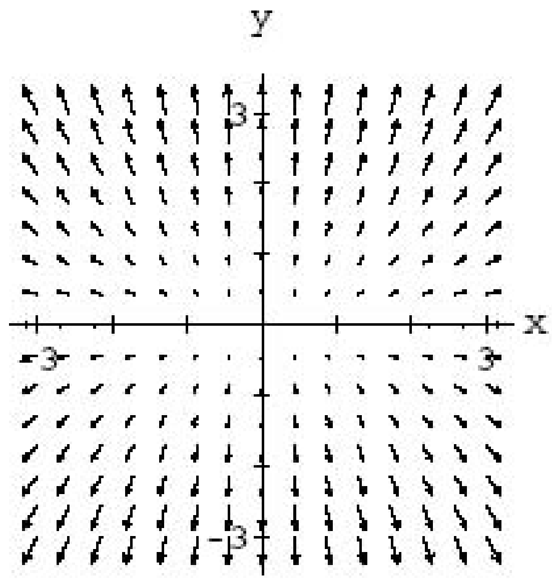
4) Find a vector that gives the direction in which the function $F(x,y,z)=x^2+4xz+2yz^2$ increases most rapidly at the point (1,0,-1) .

5) The graph of the vector field $F(x,y) = -xi + yj$ is

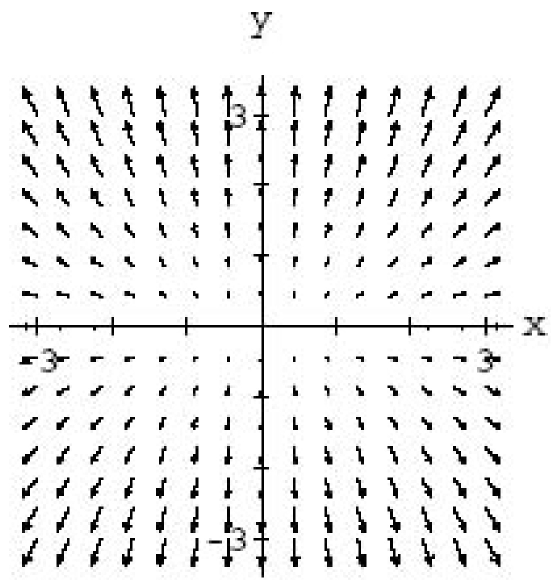
(a)



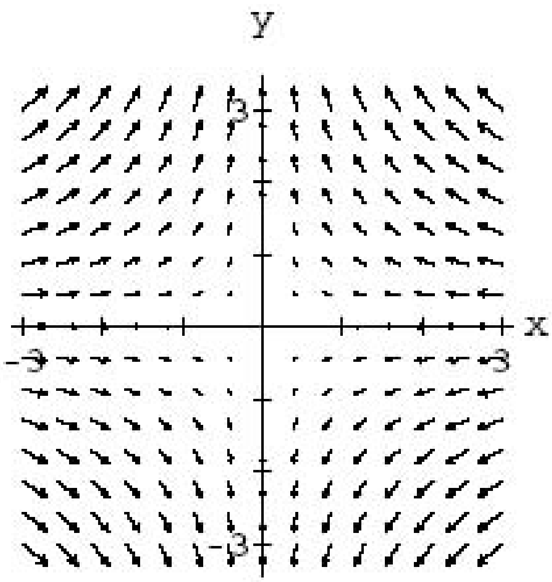
(b)



(c)



(d)



6) Given the force field F defined by $F(x,y,z)=(y-yz\sin x)i+(x+z\cos x)j+(y\cos x)k$

a) Show that F is a gradient field.

b) Find a potential function ϕ for F

c) Find the work done by F along the curve C traced by $r(t)=(2t)i+(1+\cos t)^2 j+(4\sin^3 t)k$ from $t=0$ to $t=\pi/2$

7) Use Green’s theorem to evaluate the line integral

$$\oint_C (x^4 - 2y^3)dx + (2x^3 - y^4)dy,$$

where C is the circle $x^2 + y^2 = 4.$

8) Use Green's theorem to evaluate the line integral

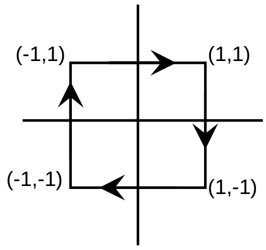
$$\oint_C xy\,dx + x^2\,dy,$$

where C is the boundary of the region determined by the graph of $x = 0, x^2 + y^2 = 1, x \geq 0.$
[**Hint:** use polar coordinate to evaluate the double integral]

9) Evaluate

$$\oint_C x^2 y^3 dx - xy^2 dy,$$

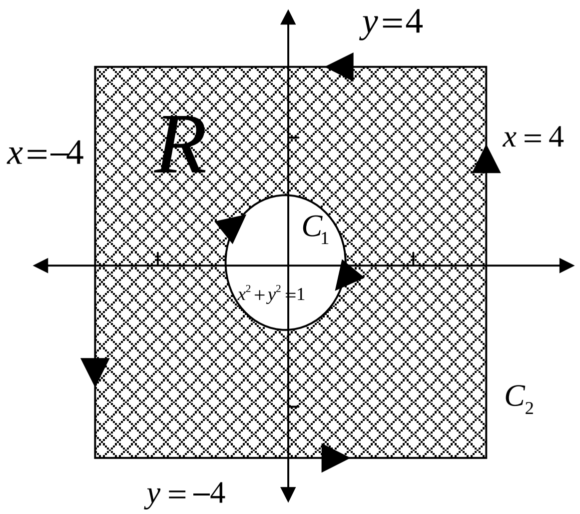
on the given curve C .



10) Evaluate

$$\oint_C \frac{x}{x^2+y^2-4}\,dx+\frac{y}{x^2+y^2-4}\,dy,$$

where $C=C_1\cup C_2$ is the boundary of the shaded region R.



11) Read the statement and decide if it is (True) or (False) and circle your answer.

A	The graph on the curve traced by $r(t) = ti + 2tj + \cos tk,\ \ t \geq 0$ is a helix.	**T** **F**
B	The curve C traced by $r(t) = (t^2 - 2t)i + (\frac{1}{3}t^3 - t)j,\ \ 0 \leq t \leq 5$ is a smooth curve.	**T** **F**
C	The length of the curve traced by $r(t) = (4t)i + 6j - (3t)k,\ \ 0 \leq t \leq 1$ is equal 5 .	**T** **F**
D	$\nabla F(-1,1,-1) = -i + j - k$ where $F(x, y, z) = xyz$.	**T** **F**
E	The maximum value of the directional derivative is $\lVert \nabla F \rVert$ and it occurs when u has the same direction as ∇F .	**T** **F**
F	$F(x, y, z) = xyz$. The minimum value of $D_u F(-1,1,-1)$ is $-\sqrt{3}$.	**T** **F**
G	$F(x, y, z) = (2x)i + j + (3x)k$ is not a vector field.	**T** **F**
H	The velocity vector field $F(x, y, z) = yi + xj + zk$ for a fluid is irrotational.	**T** **F**
I	The velocity vector field $F(x, y, z) = yi + xj + zk$ for a fluid is incompressible.	**T** **F**
J	The face field $F(x, y) = xi + yj$ is conservative.	**T** **F**
K	The function $\phi(x, y) = x^2 - y$ is a potential function for $F(x, y) = (2x)i + j$.	**T** **F**

Eid Mubarak ☺