Matlab – 10

Divergence, curl and their application

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DIVERGENCE, CURL AND THEIR APPLICATION

Experiment 10

Aim:

(1) Evaluate the divergence of the vector filed $f=xy^2i+x^2j$ and visualize it through matlab.
(2) Evaluate the divergence of the vector filed $f= -yx^2\ i+(x+y^3)\ j$ and visualize it through matlab.
(3) Evaluate the divergence of the vector filed $f=xy^2i+x^2j$and visualize it through matlab.
(4) Let us verify the Stoke's theorem. For this we will choose S to be portion of the hyperbolic paraboloid z = xy that is contained in the cylinder $x^2 + y^2 = 4$, oriented by the upward normal ***n***, and we will take F = zi + xj + yk.

For part (1):

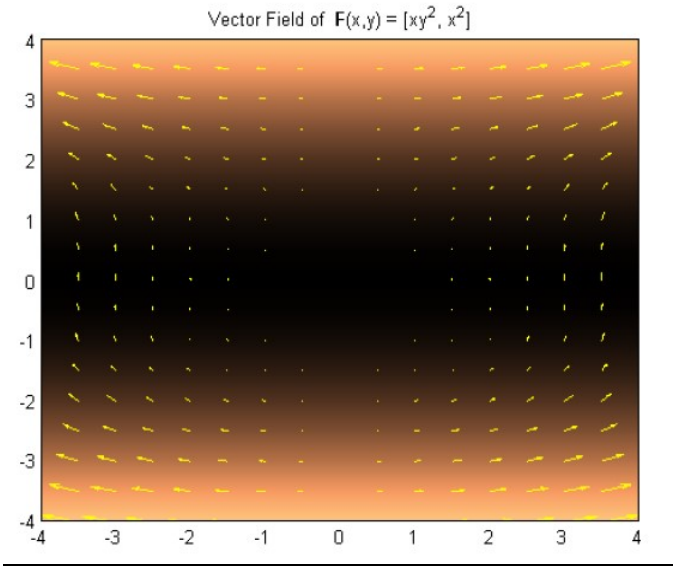
The code:

```
x = -4:0:5:4;
y = x;
[X, Y] = meshgrid(x,y);
div1 = divergence(X,Y,X.*(Y.^2),X.^2); %% INPUT IN THE CODE
figure
pcolour(X,Y,div1);
hold on;
quiver(X,Y,X.*Y.^2,X.^2,'Y');
hold off;
colormap copper
title('Vector Field of {\bf F}{x,y} = ');
```

Input:

The code itself contains the Input for the following program.

The graph:



For part (2):

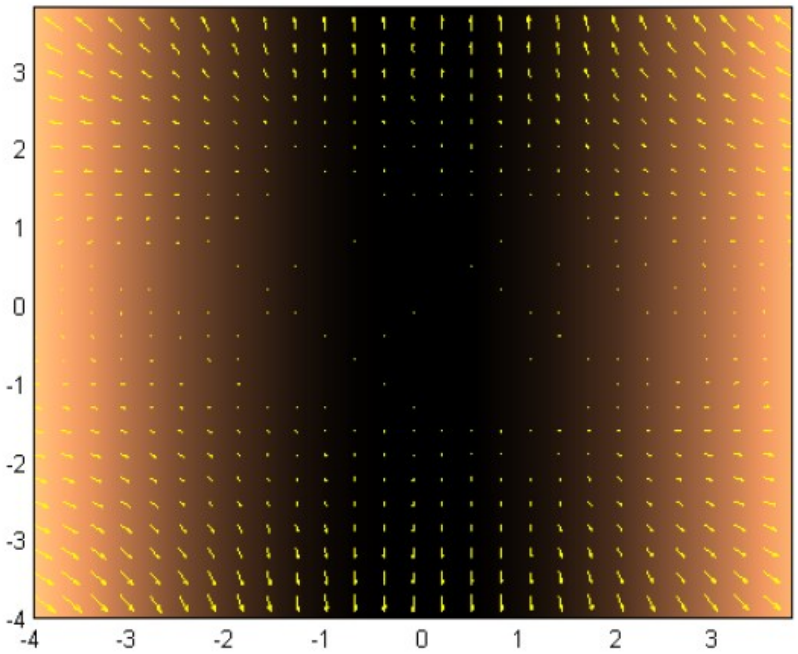
The code:

```
x = -4:0:5:4;
y = x;
[X, Y] = meshgrid(x,y);
div1 = divergence(X,Y,-Y.*X.^2,X+Y.^3); %% INPUT IN THE CODE
figure
pcolour(X,Y,div1);
hold on;
quiver(X,Y,-Y.*X.^2,X+Y.^3,'Y');
hold off;
colormap copper
title('Vector Field of {\bf F}{x,y} = ');
```

Input:

The code itself contains the Input for the following program.

The graph:



For part (3):

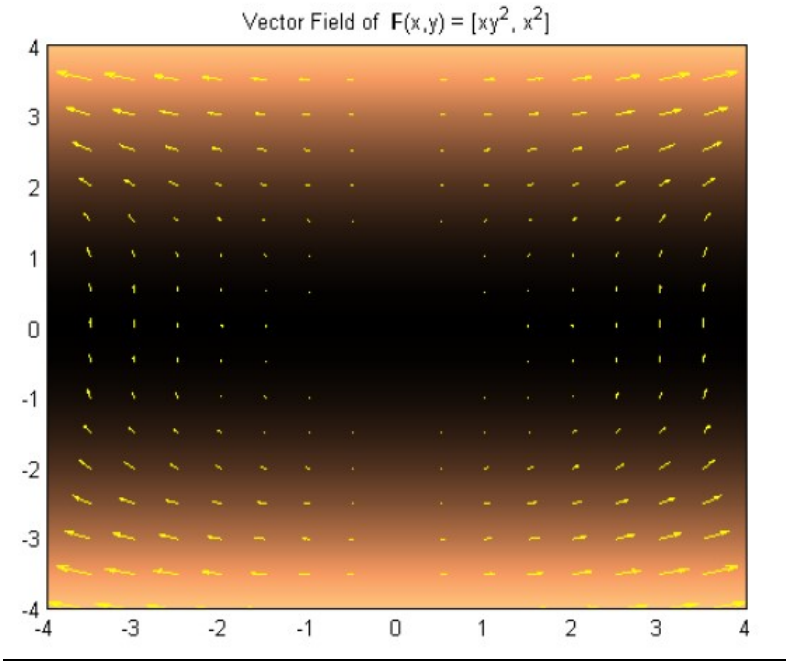
The code:

```
x = -4:0:5:4;
y = x;
[X, Y] = meshgrid(x,y);
div1 = divergence(X,Y,X.*(Y.^2),X.^2); %% INPUT IN THE CODE
figure
pcolour(X,Y,div1);
hold on;
quiver(X,Y,X.*Y.^2,X.^2,'Y');
hold off;
colormap copper
title('Vector Field of {\bf F}{x,y} = ');
```

Input:

The code itself contains the Input for the following program.

The graph:



For part (4):

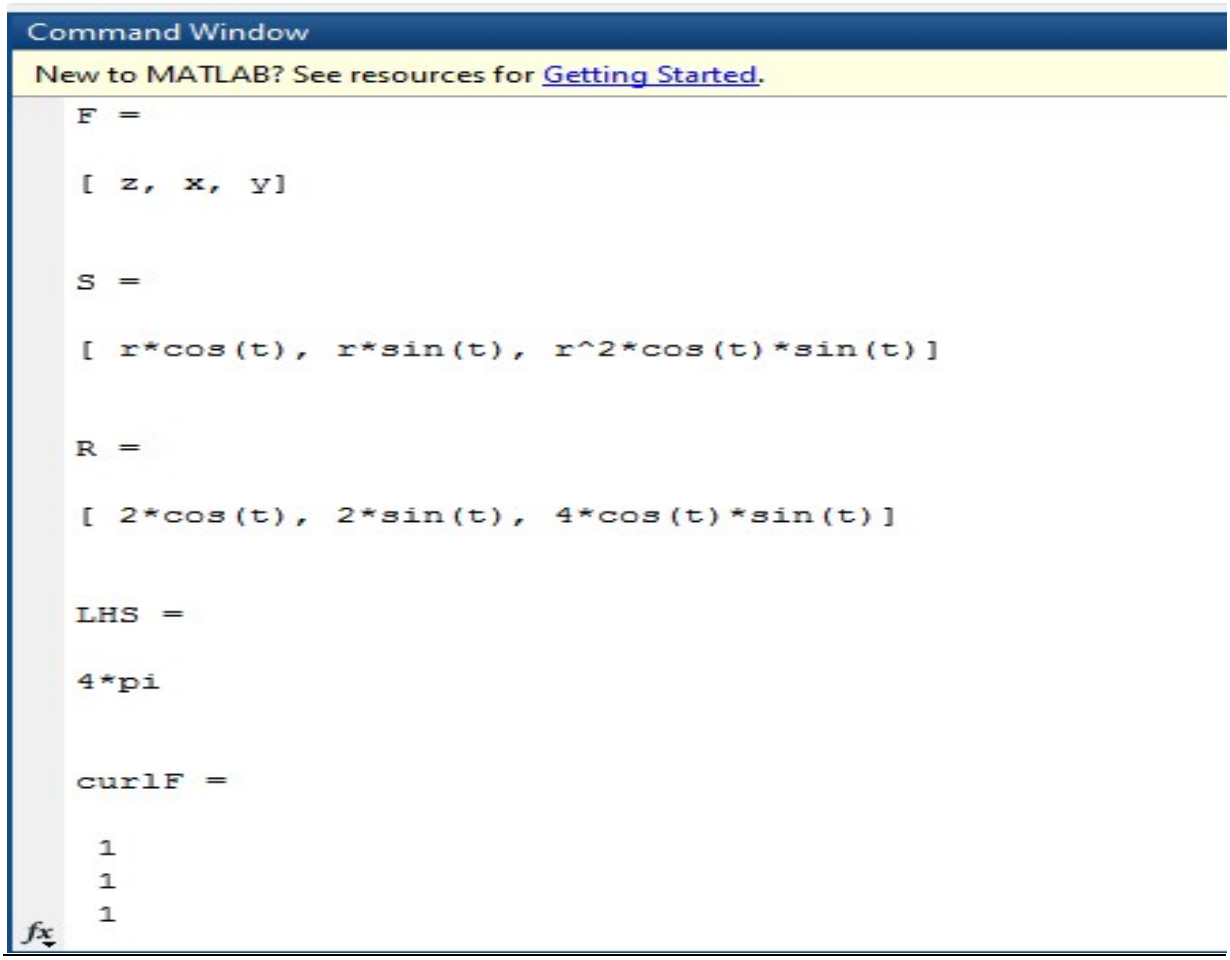
The code:

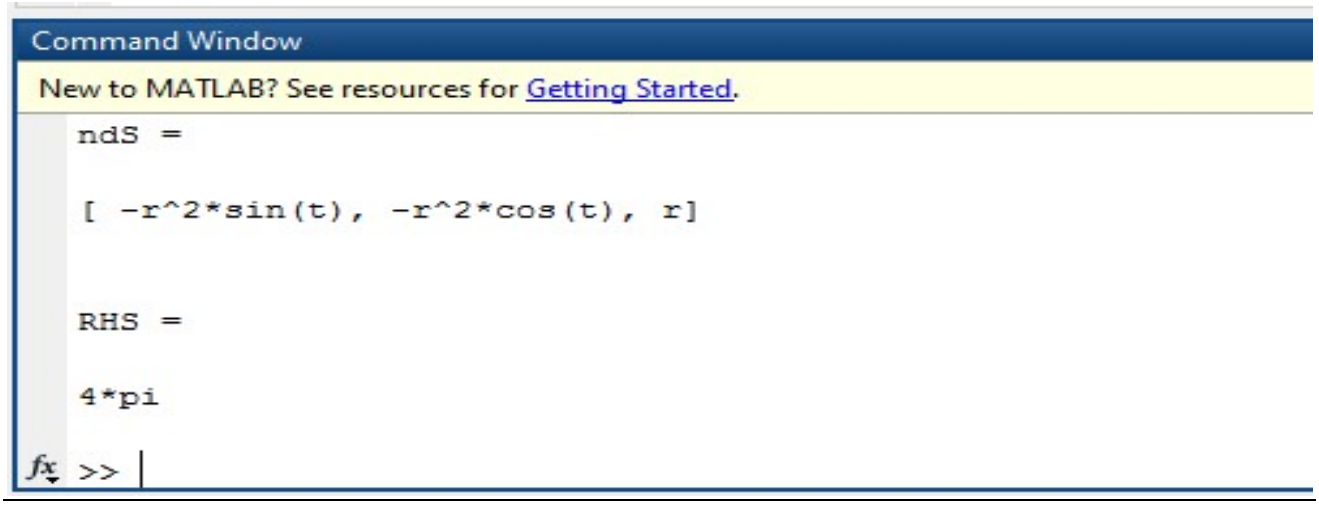
```
clc
clearvars
syms x y z r t
F=[z x y]
S=[r*cos(t) r*sin(t) r^2*cos(t)*sin(t)]
R=subs(S,r,2)
Ft=subs(F,[x,y,z],R);
drt=diff(R,t);
Fdr=dot(Ft,drt);
LHS=int(Fdr,t,0,2*pi)
curlF=curl(F,[x,y,z])
ndS=simplify(cross(diff(S,r),diff(S,t)))
RHS=int(int(dot(curlF,ndS),r,0,2),t,0,2*pi)
```

Input:

The code itself contains the Input for the following program.

Output:




Command Window
New to MATLAB? See resources for Getting Started.
ndS =
[-r^2*sin(t), -r^2*cos(t), r]
RHS =
4*pi
>>