Title: Green's Theorem

Aim: To find integrals using Green's Theorem

Question:

1. Evaluate $\oint_C \left(3y - e^{\sin(x)}\right)dx + \left(7x + \sqrt{y^4 + 1}\right)dy$, where C is the circle $x^2 + y^2 = 9$.
2. Evaluate $\oint_C (y^2)dx + (3xy)dy$, where C is the boundary of the semiannular region D in the upper –plane between the circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$.

Question 1:

MATLAB CODE

```
% Green's theorem for circular region
clc
clear all
syms x y r t
F=input('enter the F vector as i and j order in vector form: ')
integrand=diff(F(2),x)-diff(F(1),y) % Qx-Py
polarint=r*subs(integrand,[x,y],[r*cos(t),r*sin(t)]);
Value=int(int(polarint,r,0,3),t,0,2*pi)
P = inline(vectorize(F(1)), 'x', 'y');
Q = inline(vectorize(F(2)), 'x', 'y')
x = linspace(-3.2,3.2, 10);
y = x;
[X,Y] = meshgrid(x,y);
U = P(X,Y);
V = Q(X,Y);
quiver(X,Y,U,V)
hold on
fplot(3*cos(t),3*sin(t),[0,2*pi])
axis equal
hold off
```

Output:

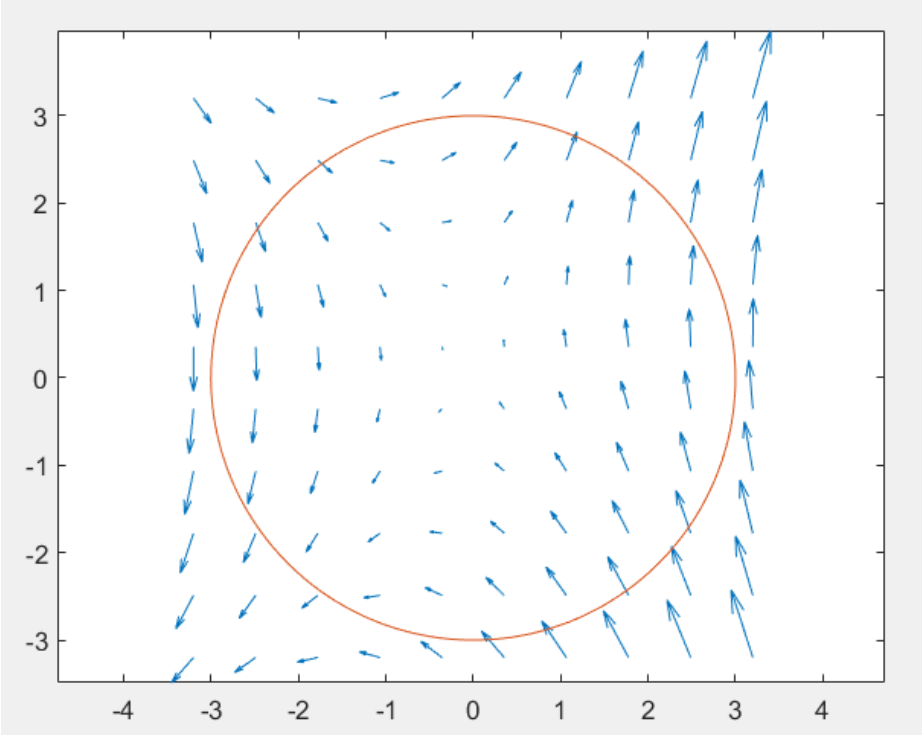
```
enter the F vector as i and j order in vector form: [3*y-exp(sin(x))
7*x+(y^4+1)^(1/2)]

F =
[3*y - exp(sin(x)), 7*x + (y^4 + 1)^(1/2)]

integrand =
4

Value =
36*pi

Q =
     Inline function:
     Q(x,y) = 7.*x + (y.^4 + 1).^(1./2)
```



Question 2:

MATLAB CODE

```
% Green's theorem for annular circular region
clc
clear all
syms x y r t
F=input('enter the F vector as i and j order in vector form: ')
integrand=diff(F(2),x)-diff(F(1),y) % Qx-Py
polarint=r*subs(integrand,[x,y],[r*cos(t),r*sin(t)]);
Value=int(int(polarint,r,1,2),t,0,pi)
P = inline(vectorize(F(1)), 'x', 'y');
Q = inline(vectorize(F(2)), 'x', 'y');
x = linspace(-3.2,3.2,10);
y = x;
[X,Y] = meshgrid(x,y);
U = P(X,Y);
V = Q(X,Y);
quiver(X,Y,U,V)
hold on
fplot(1*cos(t),1*sin(t),[0,pi])
fplot(2*cos(t),2*sin(t),[0,pi])
axis equal
hold off
```

Output:

```
enter the F vector as i and j order in vector form: [y^2 3*x*y]

F =
[y^2, 3*x*y]

integrand =
y
Value = 14/3
```