21BDS0340

Abhinav Dinesh Srivatsa

Course Code: BMAT101L

Course Number: VL2021220106765

Course Slot: L9, L10

Digital Lab Assignment 5

Problem 1

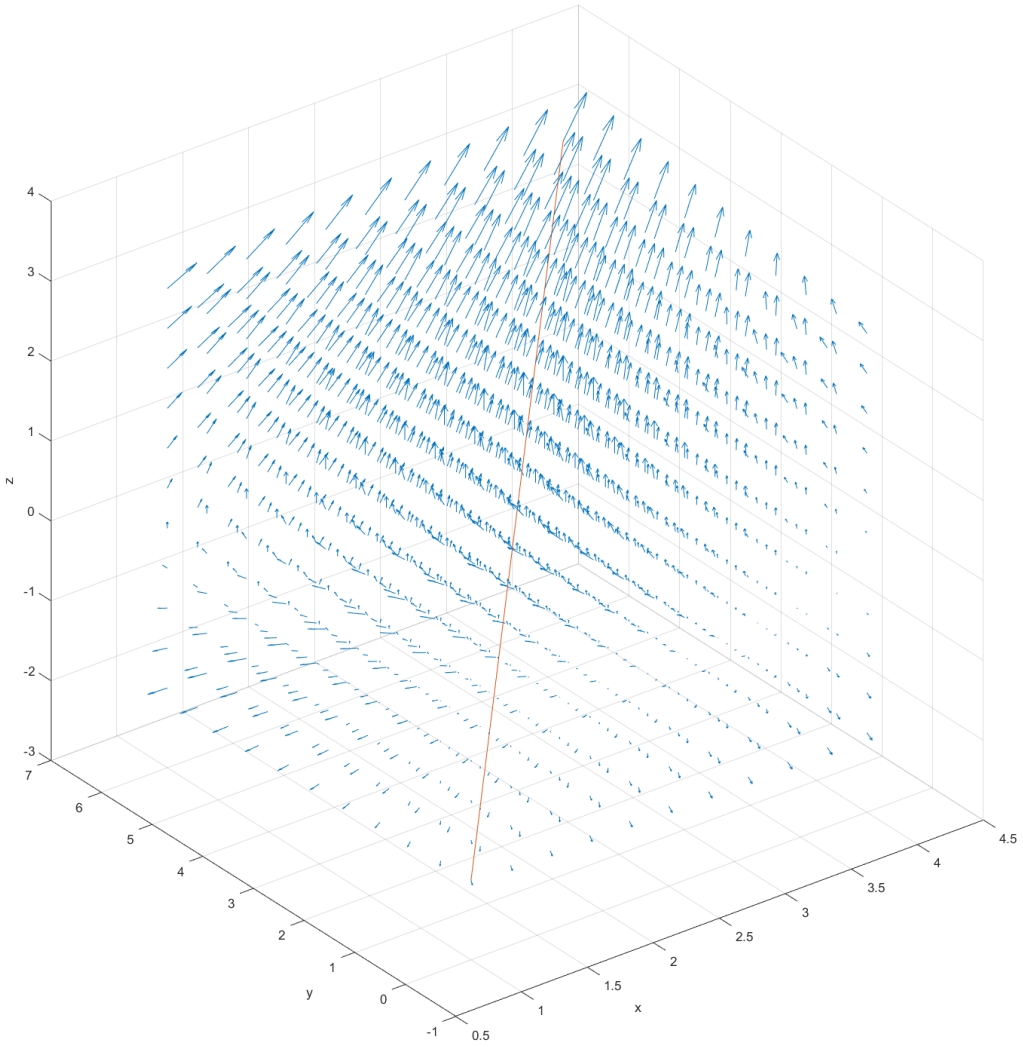
Find the work done for the force $F = yzi + xzj + (xy + 2z)k$ along the line segment from (1,0,-2) to (4,6,3).

Code:

```
syms x y z t
f = [y*z, x*z, x*y + 2*z];
P1 = [1, 0, -2]; P2 = [4, 6, 3];
P(x, y, z) = f(1); Q(x, y, z) = f(2); R(x, y, z) = f(3);
r = (P2 - P1) * t + P1; % parameterisation
lim = [0, 1];
F = subs(f, {x, y, z}, r);
dr = diff(r, t);
F1 = sum(F.*dr);
W = int(F1, t, lim(1), lim(2))

% graphing for visualisation
xlin = linspace(P1(1), P2(1), 11); ylin = linspace(P1(2),
P2(2), 11); zlin = linspace(P1(3), P2(3), 11);
[X, Y, Z] = meshgrid(xlin, ylin, zlin);
quiver3(X, Y, Z, P(X, Y, Z), Q(X, Y, Z), R(X, Y, Z))
hold on
a = linspace(0, 1, 11);
plot3(subs(r(1), a), subs(r(2), a), subs(r(3), a))
xlabel('x'); ylabel('y'); zlabel('z');
```

Output:

```
>> Question1

W =

77
```


z
4
3
2
1
0
-1
-2
-3
y
7
6
5
4
3
2
1
0
-1
x
0.5
1
1.5
2
2.5
3
3.5
4
4.5

Problem 2

Verify Green's theorem for the vector field $F = (x^2 - y^3)i + (x^3 + y^2)j$, over the ellipse $C: x^2 + 4y^2 = 64$.

Code:

```
syms x y t
f = [x^2 - y^3, x^3 + y^2];
M(x, y) = f(1); N(x, y) = f(2);
r = [8*cos(t), 4*sin(t)];
dr = diff(r, t);
F = subs(f, {x, y}, r);
F1 = sum(F.*dr);
T = [0, 2*pi];
LHS = int(F1, t, T(1), T(2));

ylim = [-sqrt(16 - (x/2)^2), sqrt(16 - (x/2)^2)];
xlim = [-8, 8];
F2 = diff(N, x) - diff(M, y);
RHS = int(int(F2, y, ylim(1), ylim(2)), x, xlim(1),
xlim(2));

if LHS == RHS
    disp('LHS = ')
    disp(LHS)
    disp('RHS = ')
    disp(RHS)
    disp('Therefore Greens theorem is verified')
end
```

Output:

```
LHS =
1920*pi

RHS =
1920*pi

Therefore Greens theorem is verified
```