

VECTOR FIELD and GRADIENT

Aim:

- To write Matlab codes to visualize the vector field of 2-Dimension as well as 3-Dimension.
- To find the gradient vector and visualize it with contour curves.

Mathematical form:

- Draw the two dimensional vector field for the vector $\vec{F} = \vec{f}_1(x, y) + \vec{f}_2(x, y)$
- Draw the three dimensional vector field for the vector $\vec{F} = \vec{f}_1(x, y, z) + \vec{f}_2(x, y, z) + \vec{f}_3(x, y, z)$
- Find the gradient vector for the following function $F(x, y)$ at the point (x_1, y_1) .
let the given function be $f(x, y)$. $\text{grad}(f) = (\partial f / \partial x)\vec{i} + (\partial f / \partial y)\vec{j}$. Then $[\text{grad}(f)]$ at (a, b) is $(\partial f / \partial x)_{(a, b)}\vec{i} + (\partial f / \partial y)_{(a, b)}\vec{j}$.

1. 2D Vector Field

```
clc
clear all
syms x y
F = input('enter the vector as i and j order in a vector form:');
P = inline(vectorize(F(1)), 'x', 'y');
Q = inline(vectorize(F(2)), 'x', 'y');
x = linspace(0, 1, 10);
y = x;
[X, Y] = meshgrid(x, y);
U = P(X, Y);
V = Q(X, Y);
quiver(X, Y, U, V)
axis on
xlabel('x')
ylabel('y')
```

2. 3D VECTOR FIELD:

```
clc

clear all

syms x y z

F = input( 'enter the vector as i, j and k order in a vector form:')

P = inline(vectorize(F(1)), 'x', 'y', 'z');
Q = inline(vectorize(F(2)), 'x', 'y', 'z');
R = inline(vectorize(F(3)), 'x', 'y', 'z');

x = linspace(-1, 1, 5);

y = x;

z=x;

[X,Y,Z] = meshgrid(x,y,z);

U = P(X,Y,Z);
V = Q(X,Y,Z);
W = R(X,Y,Z);

quiver3(X,Y,Z,U,V,W)

axis on

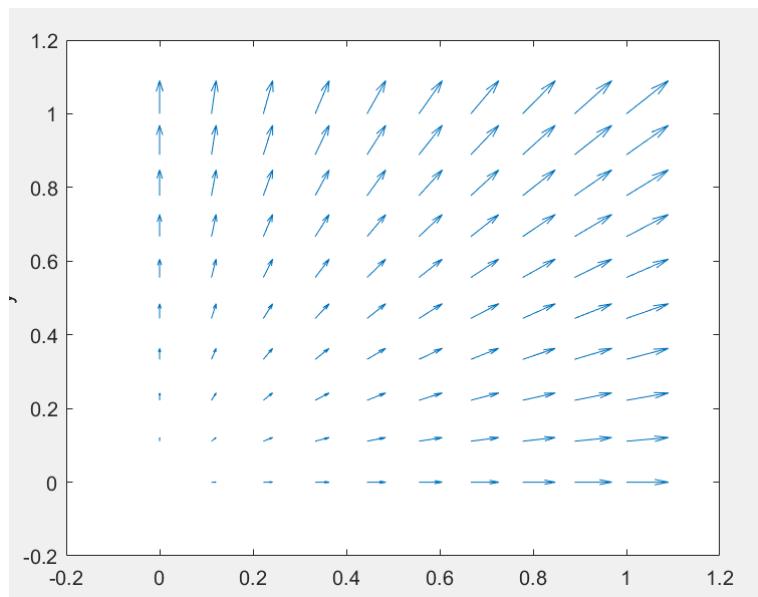
xlabel('x')
ylabel('y')
zlabel('z')
```

OUTPUT WINDOW:

Example 1:

Draw the two dimensional vector field for the vector $x\vec{i} + y\vec{j}$

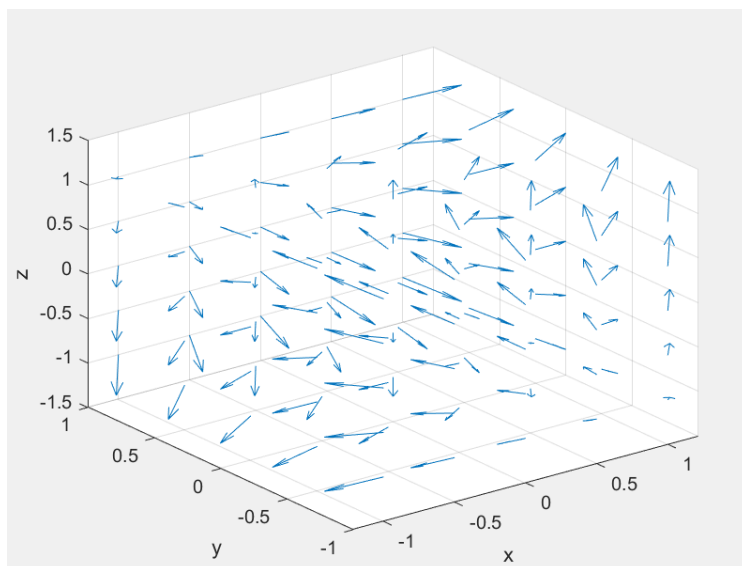
enter the vector as i and j
order in a vector form: [x y]



Example 2:

Draw the three dimensional vector field for the vector $x\vec{i} - y\vec{j} + z\vec{k}$

enter the vector as i, j and k order
in a vector form: [x -y z]

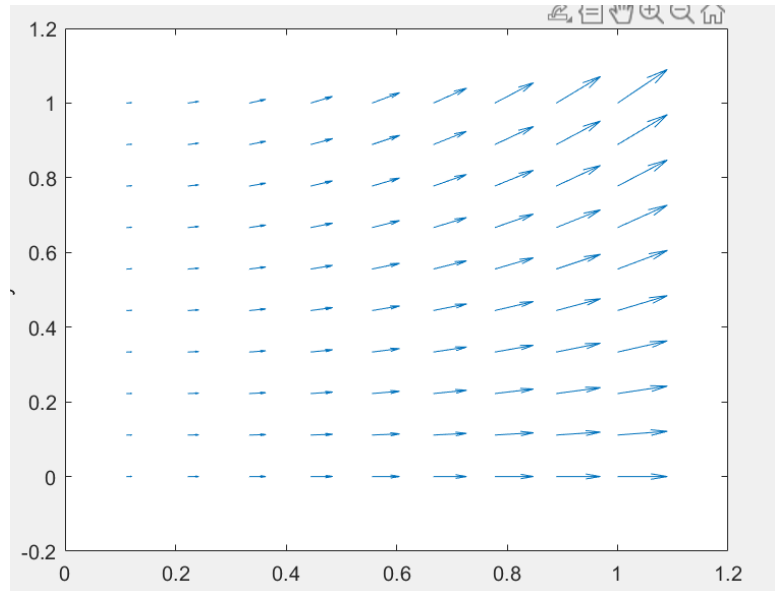


Practice Problems:

- 1) Write a MATLAB code to visualize the two dimensional vector $x\vec{i} + x^2y\vec{j}$
- 2) Write a MATLAB code to visualize the three dimensional vector $x\vec{i} + y\vec{j} + z\vec{k}$

enter the vector as i and j order in a vector

form: [x x^2*y]



enter the vector as i, j and k order in a vector

form: [x y z]

