QUETION 1 A

In[1]:=
```
Qlist = {{q, 0, 0}, {-2 q, 0, 1}, {q, 1, 1}}
```

Out[1]=
```
{{q, 0, 0}, {-2 q, 0, 1}, {q, 1, 1}}
```

In[2]:=
```
Clear[x, y]
```

In[3]:=
```
V[x_, y_] :=
 Sum[Qlist[[i, 1]] / Sqrt[(x - Qlist[[i, 2]])^2 + (y - Qlist[[i, 3]])^2], {i, 1, 3}]
```

In[4]:=
```
EF4[x_, y_] := {D[V[x, y], x], D[V[x, y], y]}
```

In[25]:=
```
EF4[x, y]
```

Out[25]=

$$\left\{-\frac{-1+x}{\left((-1+x)^2+(-1+y)^2\right)^{3/2}}+\frac{2x}{\left(x^2+(-1+y)^2\right)^{3/2}}-\frac{x}{\left(x^2+y^2\right)^{3/2}},\right.$$
$$\left.-\frac{-1+y}{\left((-1+x)^2+(-1+y)^2\right)^{3/2}}+\frac{2(-1+y)}{\left(x^2+(-1+y)^2\right)^{3/2}}-\frac{y}{\left(x^2+y^2\right)^{3/2}}\right\}$$

In[39]:=
```
EF4[x, y] /. {{x → 1}, {y → 1}}
```

Out[39]=

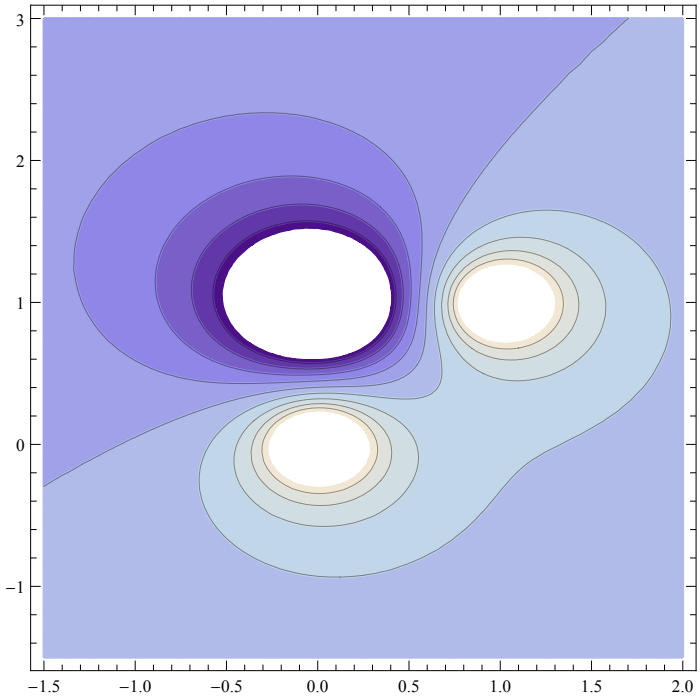
$$\left\{\left\{\frac{2}{\left(1+(-1+y)^2\right)^{3/2}}-\frac{1}{\left(1+y^2\right)^{3/2}},\ \frac{2(-1+y)}{\left(1+(-1+y)^2\right)^{3/2}}-\frac{-1+y}{\left((-1+y)^2\right)^{3/2}}-\frac{y}{\left(1+y^2\right)^{3/2}}\right\},\right.$$
$$\left.\left\{-\frac{-1+x}{\left((-1+x)^2\right)^{3/2}}+\frac{2x}{\left(x^2\right)^{3/2}}-\frac{x}{\left(1+x^2\right)^{3/2}},\ -\frac{1}{\left(1+x^2\right)^{3/2}}\right\}\right\}$$

QUETION 1 B

In[10]:=
```
q = 1
```

Out[10]=
```
1
```

```
ContourPlot[V[x, y], {x, -1.5, 2}, {y, -1.5, 3}]
```



QUETION 1 C

```
NSolve[EF4[x, y] == 0, {x, y}]
```

```
{{x → 0.251258 + 1.11931 i, y → 0.258734 - 0.419234 i},
 {x → 0.251258 - 1.11931 i, y → 0.258734 + 0.419234 i},
 {x → 0.741266 + 0.419234 i, y → 0.748742 - 1.11931 i},
 {x → 0.741266 - 0.419234 i, y → 0.748742 + 1.11931 i},
 {x → 0.213624 + 0.487227 i, y → 0.786376 - 0.487227 i},
 {x → 0.213624 - 0.487227 i, y → 0.786376 + 0.487227 i},
 {x → 0.810361, y → 0.189639}, {x → 0.640595 + 0.453806 i, y → 1.07411 + 0.0314305 i},
 {x → 0.640595 - 0.453806 i, y → 1.07411 - 0.0314305 i},
 {x → -0.0741101 - 0.0314305 i, y → 0.359405 - 0.453806 i},
 {x → -0.0741101 + 0.0314305 i, y → 0.359405 + 0.453806 i}}
```

QUETION 1 D

```
Clear[q]
```

In[11]:=
```
q1 = -1
```

Out[11]= -1

In[23]:=
```
PE = q1 * V[1, 0]
```

Out[23]= $-2+\sqrt{2}$

In[40]:=
```
F = q1 * EF4[x, y] /. {{x → 1}, {y → 0}}
```

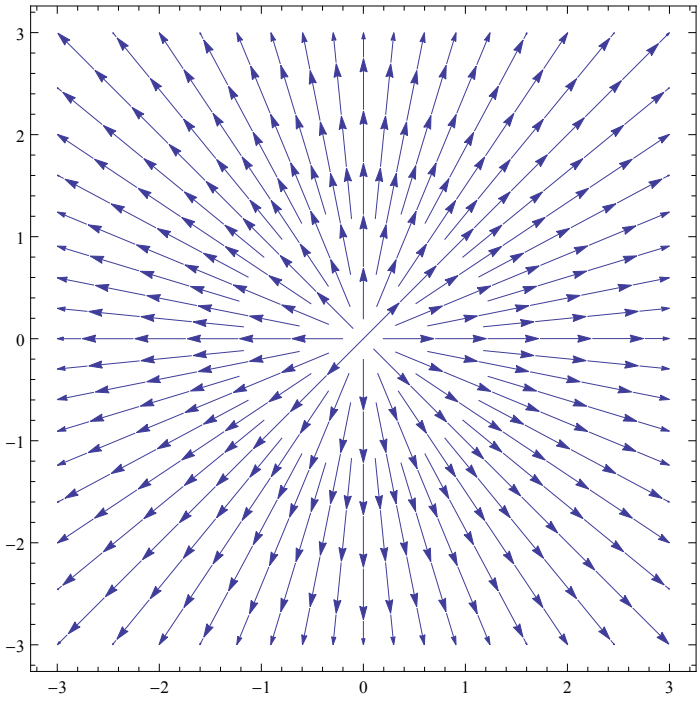
Out[40]=
$$\left\{\left\{-\frac{2}{(1+(-1+y)^2)^{3/2}}+\frac{1}{(1+y^2)^{3/2}},\ -\frac{2\,(-1+y)}{(1+(-1+y)^2)^{3/2}}+\frac{-1+y}{((-1+y)^2)^{3/2}}+\frac{y}{(1+y^2)^{3/2}}\right\},\right.$$
$$\left.\left\{\frac{-1+x}{(1+(-1+x)^2)^{3/2}}+\frac{x}{(x^2)^{3/2}}-\frac{2\,x}{(1+x^2)^{3/2}},\ -\frac{1}{(1+(-1+x)^2)^{3/2}}+\frac{2}{(1+x^2)^{3/2}}\right\}\right\}$$

QUETION 2 A

In[15]:=
```
EF[x_, y_] := {x / (x^2 + y^2) ^ (3 / 2), y / (x^2 + y^2) ^ (3 / 2)}
```

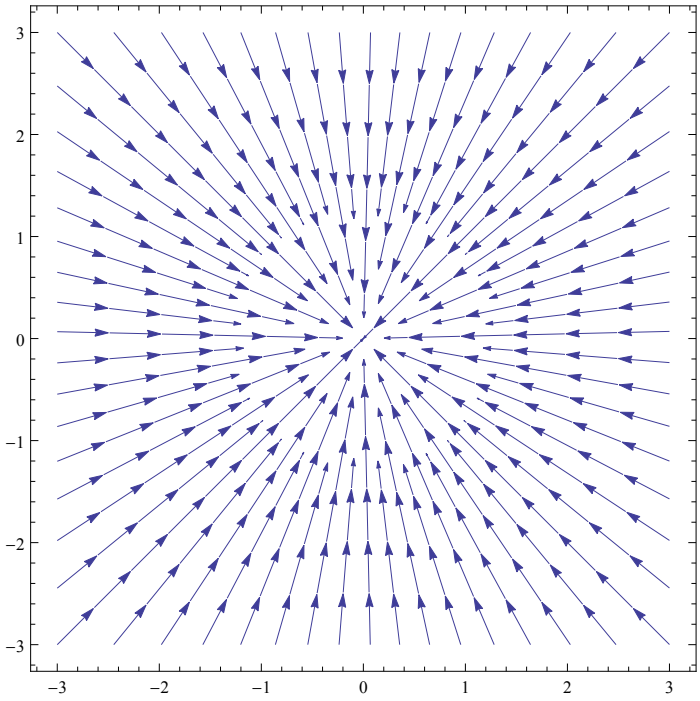
QUETION 2 B

```
StreamPlot[EF[x, y], {x, -3, 3}, {y, -3, 3}]
```



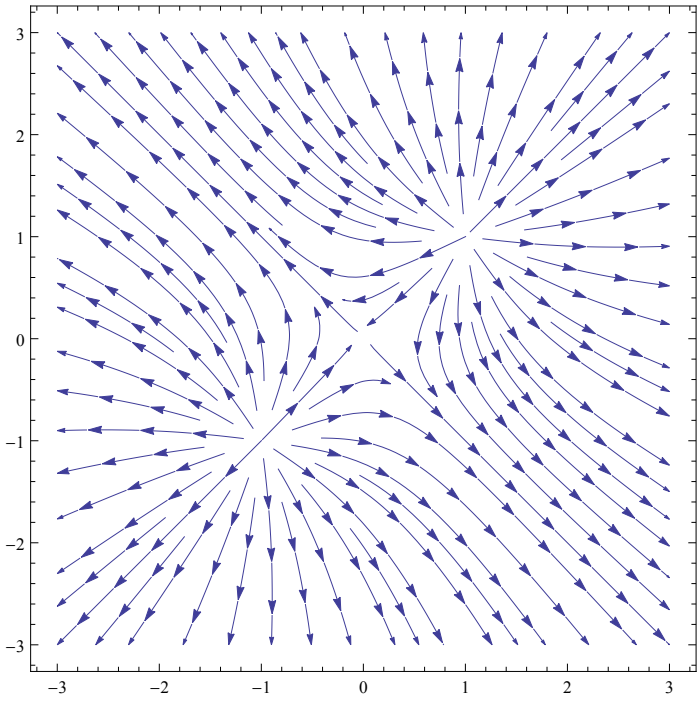
QUETION 2 C

```
StreamPlot[-EF[x, y], {x, -3, 3}, {y, -3, 3}]
```



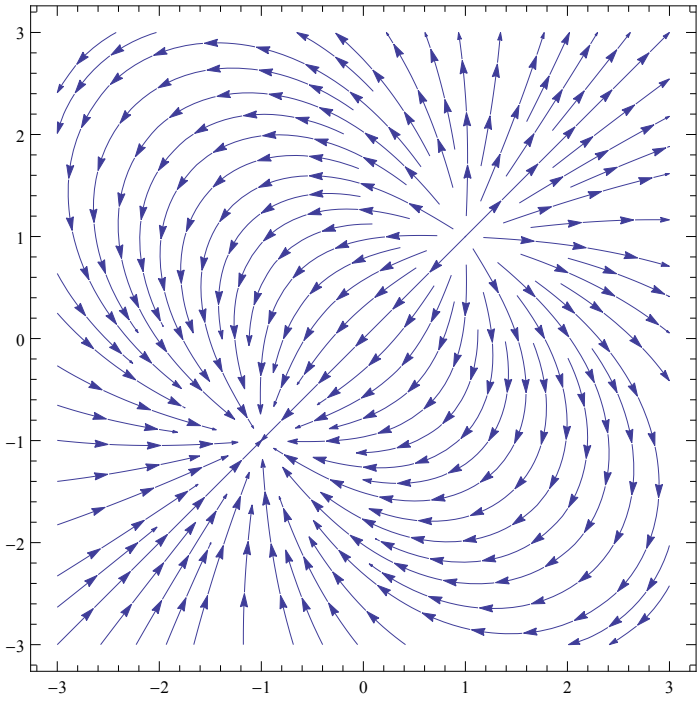
QUETION 2 D

```
StreamPlot[EF[x + 1, y + 1] + EF[x - 1, y - 1], {x, -3, 3}, {y, -3, 3}]
```



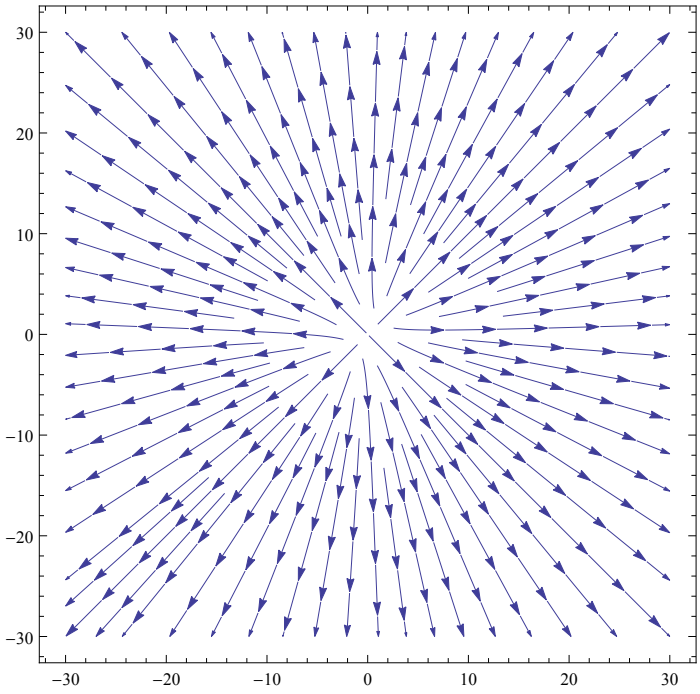
QUETION 2 E

```
StreamPlot[-EF[x + 1, y + 1] + EF[x - 1, y - 1], {x, -3, 3}, {y, -3, 3}]
```



QUETION 2 F (d)

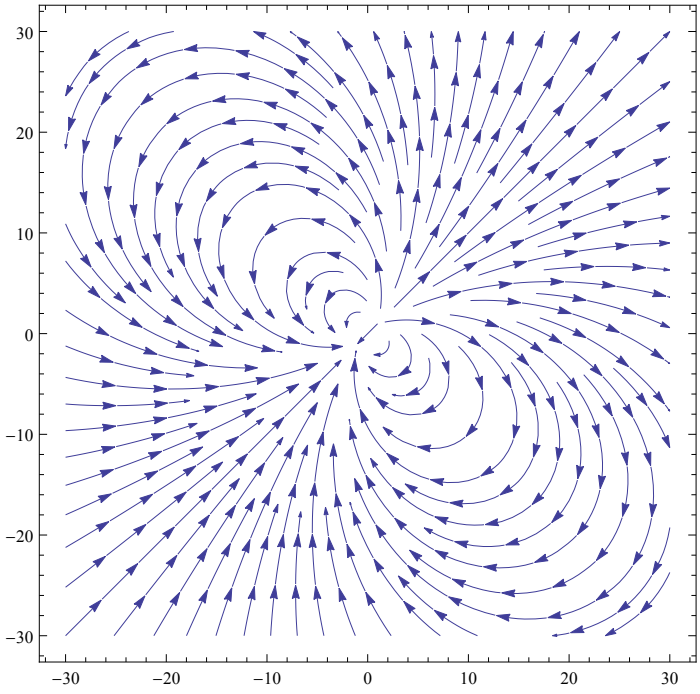
```
StreamPlot[EF[x + 1, y + 1] + EF[x - 1, y - 1], {x, -30, 30}, {y, -30, 30}]
```



Looks like a single point charge's field lines

QUETION 2 F (e)

```
StreamPlot[-EF[x + 1, y + 1] + EF[x - 1, y - 1], {x, -30, 30}, {y, -30, 30}]
```

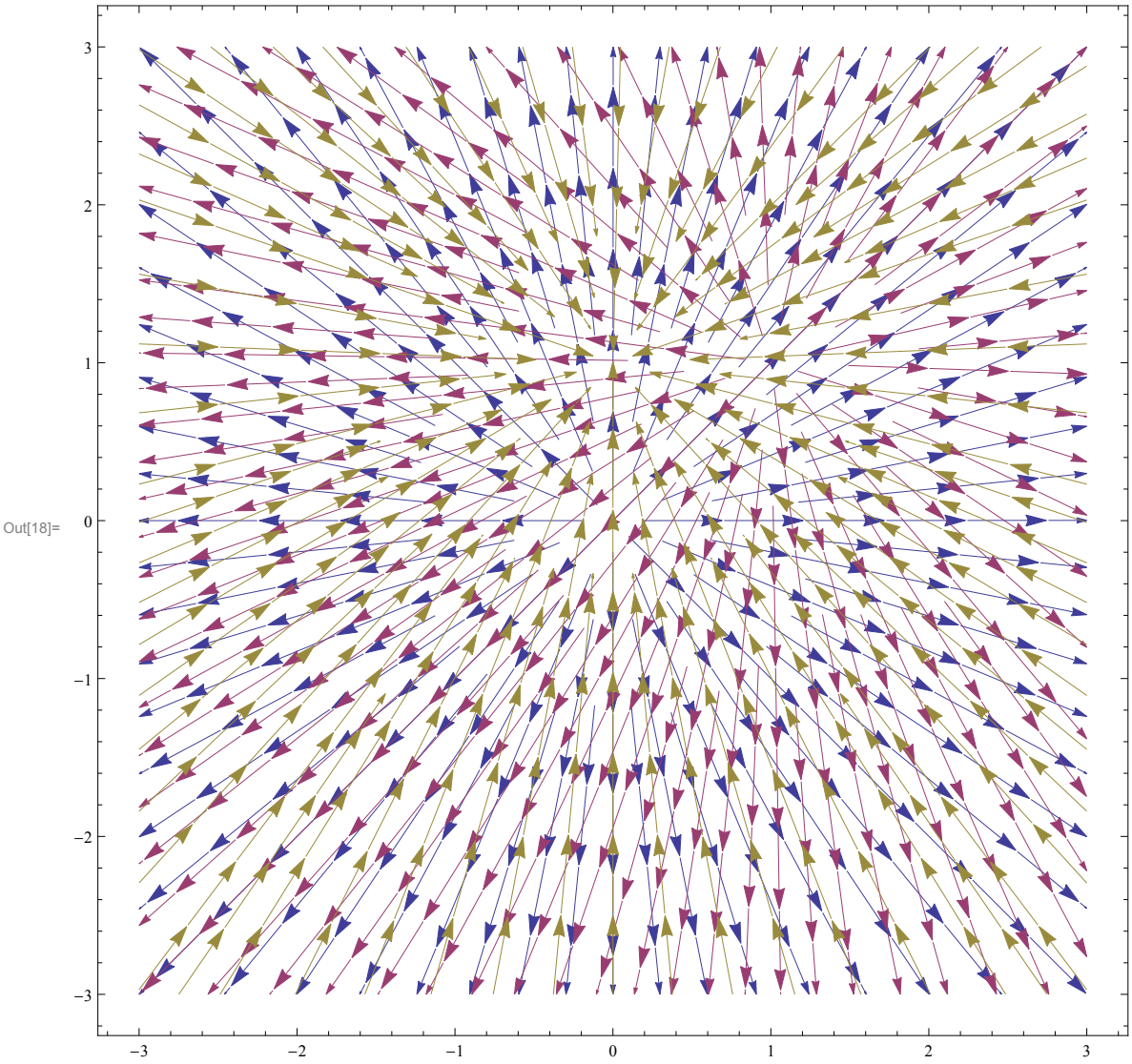


Looks like magnetic field lines

QUETION 2 G

In[17]:=
```
StreamPlot[{EF[x, y], EF[x - 1, y - 1], -2 * EF[x, y - 1]}, {x, -3, 3}, {y, -3, 3}]
```

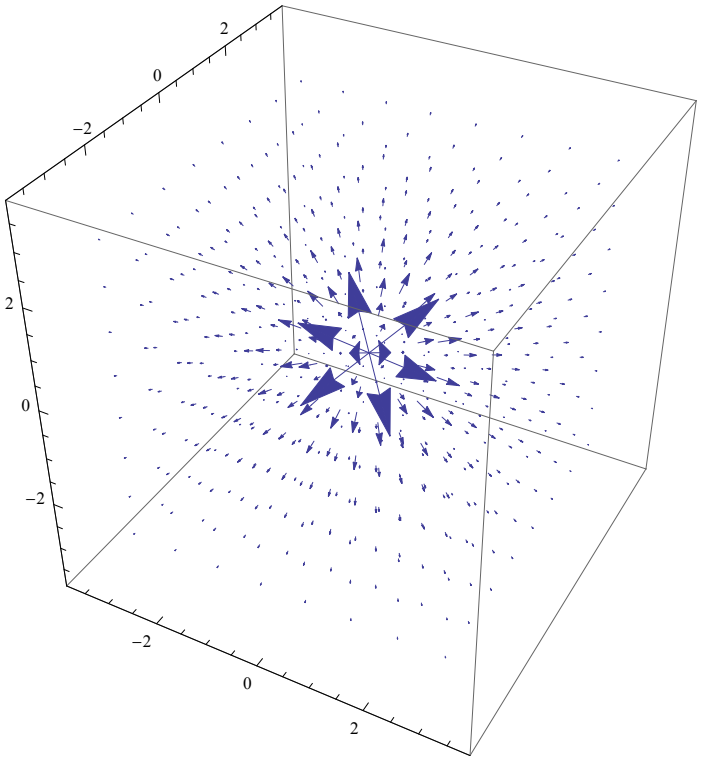
Out[18]=



QUETION 2 H (I)

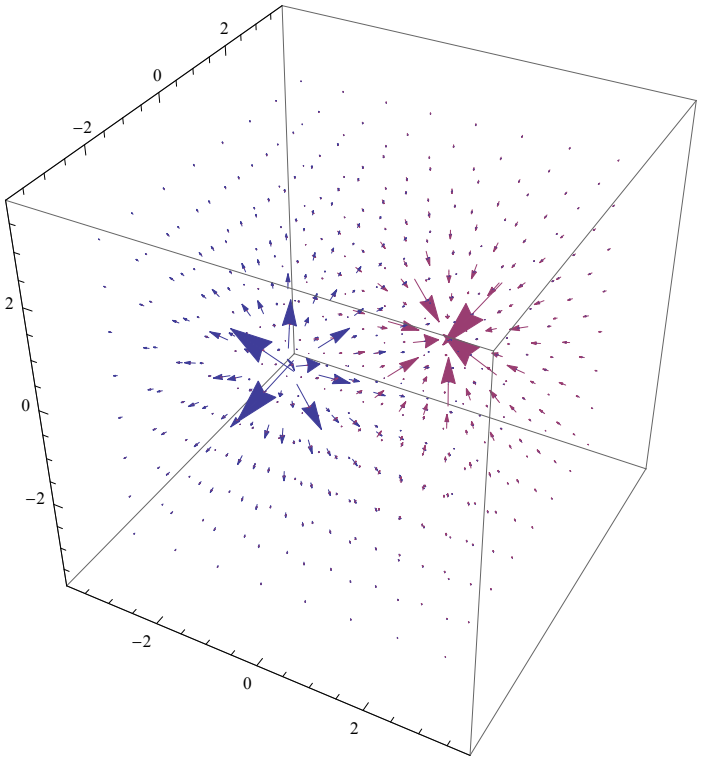
```
EF[x_, y_, z_] := {x / (x^2 + y^2 + z^2) ^ (3 / 2),
  y / (x^2 + y^2 + z^2) ^ (3 / 2), z / (x^2 + y^2 + z^2) ^ (3 / 2)}
```

```
VectorPlot3D[{EF[x, y, z]}, {x, -3, 3}, {y, -3, 3}, {z, -3, 3}]
```



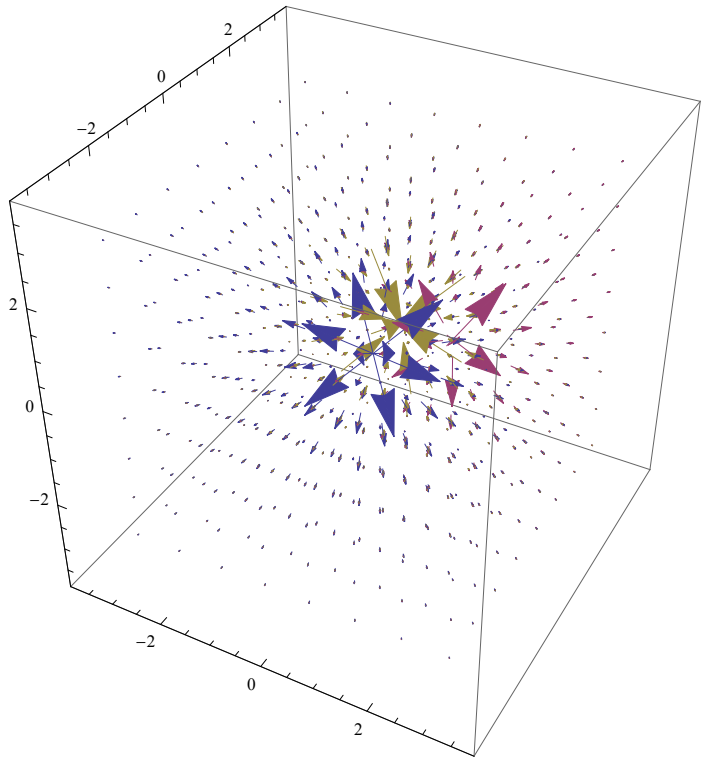
QUETION 2 H (II)

```
VectorPlot3D[{EF[x + 1, y + 1, z], -EF[x - 1, y - 1, z]},
 {x, -3, 3}, {y, -3, 3}, {z, -3, 3}]
```



QUETION 2 H (III)

```
VectorPlot3D[{EF[x, y, z], EF[x - 1, y - 1, z], -2 * EF[x, y - 1, z]},
 {x, -3, 3}, {y, -3, 3}, {z, -3, 3}]
```



QUETION 2 H (IV)

In[19]:=
```
R = 1 * Cos[45 * Pi / 180]
```

Out[19]= $\frac{1}{\sqrt{2}}$

In[20]:=
```
EF[x_, y_, z_] := {x / (x^2 + y^2 + z^2) ^ (3 / 2),
  y / (x^2 + y^2 + z^2) ^ (3 / 2), z / (x^2 + y^2 + z^2) ^ (3 / 2)}
```

In[22]:=
```
VectorPlot3D[{EF[x - 1, y, z], EF[x + 1, y, z],
  EF[x, y - 1, z], EF[x, y + 1, z], EF[x + R, y + R, z], EF[x - R, y - R, z],
  EF[x + R, y - R, z], EF[x - R, y + R, z]}, {x, -3, 3}, {y, -3, 3}, {z, -3, 3}]
```

Out[22]=