In[57]:=

```
(* Electric potential and electric intensity due to an electric QuadraPole *)
(* Potential Function *)
Pot[Q_, x0_, y0_, z0_] := Q / (4 Pi epsilon Sqrt[(x - x0)^2 + (y - y0)^2 + (z - z0)^2]);
(* Specify Quadrapole *)
q = {0.2, -1.2, 0.2, -0.2};
(* Specify Position *)
q1pos = {1, 0, 0}; q2pos = {-1, 0, 0}; q3pos = {0, 1, 0}; q4pos = {0, -1, 0};
(* Now use potential function for computing potential due to electric quadrapole *)
"Potential function for due to electric Quadrapole "
QuadPot = Pot[q[[1]], q1pos[[1]], q1pos[[2]], q1pos[[3]]] +
  Pot[q[[2]], q2pos[[1]], q2pos[[2]], q2pos[[3]]] +
  Pot[q[[3]], q3pos[[1]], q3pos[[2]], q3pos[[3]]] +
  Pot[q[[4]], q4pos[[1]], q4pos[[2]], q4pos[[3]]]
(* For 3D Plot in xy plane *)
QuadPot = QuadPot /. {epsilon → 1, z → 0}
"3D Plot in xy plane"
Plot3D[QuadPot, {x, -2, 2}, {y, -2, 2},
 PlotRange → {{-2, 2}, {-2, 2}, {-1, 1}}, PlotPoints → 100]
(* Now laod the package *)
<< VectorAnalysis`
(* Compute electric intensity *)
"Electric Intensity"
QuadInt = -Grad[QuadPot, Cartesian[x, y, z]]
(* Drawing electric field pattern of quadrapole *)
<< VectorFieldPlots`
"Electric Field pattern of QuadraPole"
VectorFieldPlot[{QuadInt[[1]], QuadInt[[2]]}, {x, -2, 2, 0.11}, {y, -2, 2, 0.11}]
(* Step size avoid the singularity step size
 should be such that it should not divided by 0 *)
```

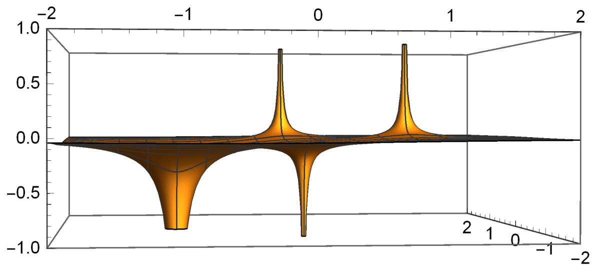
Out[60]= Potential function for due to electric Quadrapole

Out[61]=
$$\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(-1+y)^2+z^2}}+\frac{0.0159155}{\text{epsilon}\sqrt{(-1+x)^2+y^2+z^2}}-\frac{0.095493}{\text{epsilon}\sqrt{(1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(1+y)^2+z^2}}$$

Out[62]=
$$\frac{0.0159155}{\sqrt{x^2+(-1+y)^2}}+\frac{0.0159155}{\sqrt{(-1+x)^2+y^2}}-\frac{0.095493}{\sqrt{(1+x)^2+y^2}}-\frac{0.0159155}{\sqrt{x^2+(1+y)^2}}$$

Out[63]= 3D Plot in xy plane

Out[64]=




General: VectorAnalysis` is now obsolete. The legacy version being loaded may conflict with current functionality. See the Compatibility Guide for updating information.

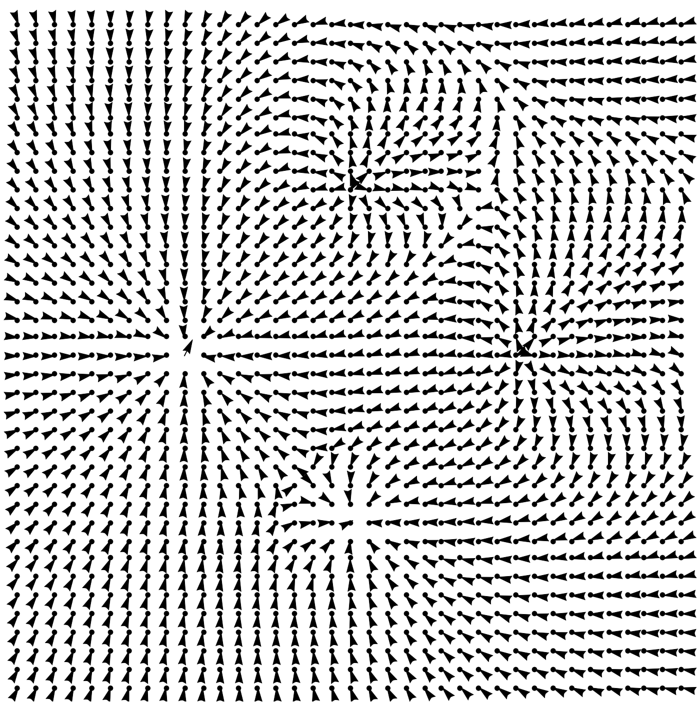
Out[66]= Electric Intensity

Out[67]=
$$\left\{\frac{0.0159155\,x}{\left(x^2+(-1+y)^2\right)^{3/2}}+\frac{0.0159155\,(-1+x)}{\left((-1+x)^2+y^2\right)^{3/2}}-\frac{0.095493\,(1+x)}{\left((1+x)^2+y^2\right)^{3/2}}-\frac{0.0159155\,x}{\left(x^2+(1+y)^2\right)^{3/2}},\right.$$
$$\left.\frac{0.0159155\,(-1+y)}{\left(x^2+(-1+y)^2\right)^{3/2}}+\frac{0.0159155\,y}{\left((-1+x)^2+y^2\right)^{3/2}}-\frac{0.095493\,y}{\left((1+x)^2+y^2\right)^{3/2}}-\frac{0.0159155\,(1+y)}{\left(x^2+(1+y)^2\right)^{3/2}},\ 0\right\}$$

General: VectorFieldPlots` is now obsolete. The legacy version being loaded may conflict with current functionality. See the Compatibility Guide for updating information.

Out[69]= Electric Field pattern of QuadraPole

Out[70]=



In[99]:=
```
(* Problem:Compute and Plot Electric potential of above quadrapole on *)
(* x-axis *)
Pot[Q_, x0_, y0_, z0_] := Q/(4 Pi epsilon Sqrt[(x - x0)^2 + (y - y0)^2 + (z - z0)^2]);
(* Specify Quadrapole *)
q = {0.2, -0.2, 0.2, -0.2};
(* Specify Position *)
q1pos = {1, 0, 0}; q2pos = {-1, 0, 0}; q3pos = {0, 1, 0}; q4pos = {0, -1, 0};
(* Now use potential function for computing potential due to electric quadrapole *)
"Potential function for due to electric Quadrapole"
QuadPot = Pot[q[[1]], q1pos[[1]], q1pos[[2]], q1pos[[3]]] +
  Pot[q[[2]], q2pos[[1]], q2pos[[2]], q2pos[[3]]] +
  Pot[q[[3]], q3pos[[1]], q3pos[[2]], q3pos[[3]]] +
  Pot[q[[4]], q4pos[[1]], q4pos[[2]], q4pos[[3]]]

(* For 3D Plot in x plane *)
QuadPot = QuadPot /. {epsilon → 1, z → 0, y → 0}
"3D Plot in xy plane"
Plot3D[QuadPot, {x, -2, 2}, {y, -2, 2},
 PlotRange → {{-2, 2}, {-2, 2}, {-0.2, 0.2}}, PlotPoints → 100]
"Electric Intensity"
QuadInt = -Grad[QuadPot, Cartesian[x, y, z]]
(* Drawing electric field pattern of quadrapole *)
<< VectorFieldPlots`
"Electric Field pattern of QuadraPole"
? VectorFieldPlot
VectorFieldPlot[{QuadInt[[1]], QuadInt[[2]]}, {x, -2, 2, 0.11}, {y, -2, 2, 0.11}]
```

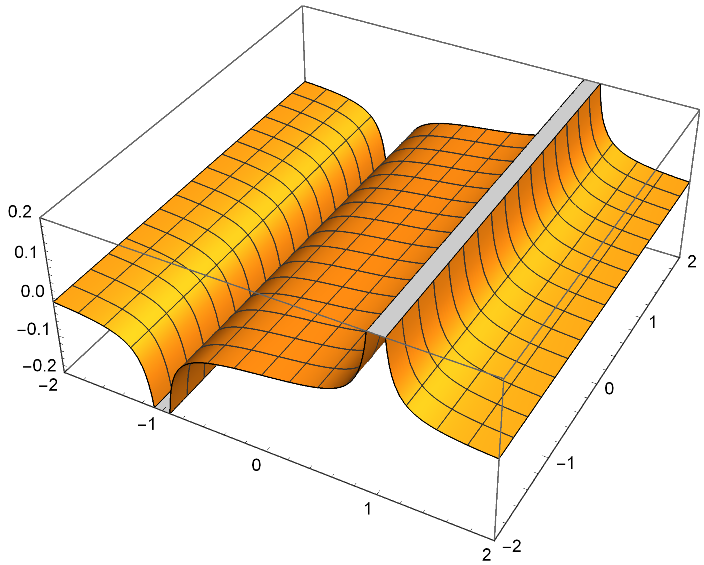
Out[102]= Potential function for due to electric Quadrapole

Out[103]=
$$\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(-1+y)^2+z^2}}+\frac{0.0159155}{\text{epsilon}\sqrt{(-1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{(1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(1+y)^2+z^2}}$$

Out[104]=
$$0.+\frac{0.0159155}{\sqrt{(-1+x)^2}}-\frac{0.0159155}{\sqrt{(1+x)^2}}$$

Out[105]= 3D Plot in xy plane

Out[106]=




Out[107]= Electric Intensity

Out[108]= $\left\{\frac{0.0159155\ (-1+x)}{\left((-1+x)^2\right)^{3/2}} - \frac{0.0159155\ (1+x)}{\left((1+x)^2\right)^{3/2}},\ 0,\ 0\right\}$

... General: VectorFieldPlots` is now obsolete. The legacy version being loaded may conflict with current functionality. See the Compatibility Guide for updating information.

Out[110]= Electric Field pattern of QuadraPole

Out[111]=

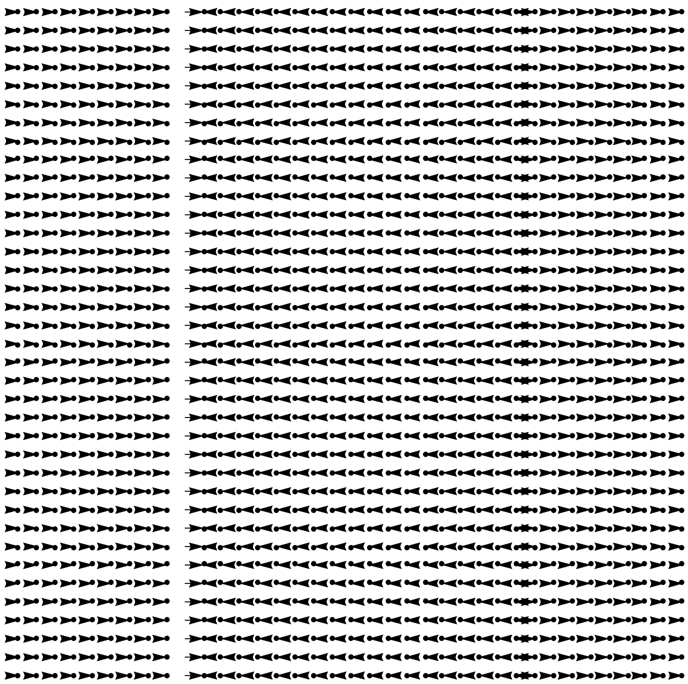
Symbol

VectorFieldPlot[{$f_x$, $f_y$}, {$x$, $x_{min}$, $x_{max}$}, {$y$, $y_{min}$, $y_{max}$}] generates a plot of

the vector field given by the vector valued function {$f_x$, $f_y$} as a function of $x$ and $y$.

VectorFieldPlot[{$f_x$, $f_y$}, {$x$, $x_{min}$, $x_{max}$, $dx$}, {$y$, $y_{min}$, $y_{max}$, $dy$}] uses steps $dx$ in variable $x$, and steps $dy$ in variable $y$.

Out[112]=



In[113]:=

```
(* y-axis *)
(* For 3D Plot in x plane *)
Pot[Q_, x0_, y0_, z0_] := Q / (4 Pi epsilon Sqrt[(x - x0)^2 + (y - y0)^2 + (z - z0)^2]);
(* Specify Quadrapole *)
q = {0.2, -0.2, 0.2, -0.2};
(* Specify Position *)
q1pos = {1, 0, 0}; q2pos = {-1, 0, 0}; q3pos = {0, 1, 0}; q4pos = {0, -1, 0};
(* Now use potential function for computing potential due to electric quadrapole *)
"Potential function for due to electric Quadrapole "
QuadPot = Pot[q[[1]], q1pos[[1]], q1pos[[2]], q1pos[[3]]] +
  Pot[q[[2]], q2pos[[1]], q2pos[[2]], q2pos[[3]]] +
  Pot[q[[3]], q3pos[[1]], q3pos[[2]], q3pos[[3]]] +
  Pot[q[[4]], q4pos[[1]], q4pos[[2]], q4pos[[3]]]

QuadPot = QuadPot /. {epsilon → 1, z → 0, x → 0}
"3D Plot in y plane"
Plot3D[QuadPot, {x, -2, 2}, {y, -2, 2},
 PlotRange → {{-2, 2}, {-2, 2}, {-1, 1}}, PlotPoints → 100]
"Electric Intensity"
QuadInt = -Grad[QuadPot, Cartesian[x, y, z]]
(* Drawing electric field pattern of quadrapole *)
<< VectorFieldPlots`
"Electric Field pattern of QuadraPole"
VectorFieldPlot[{QuadInt[[1]], QuadInt[[2]]}, {x, -2, 2, 0.11}, {y, -2, 2, 0.11}]
```

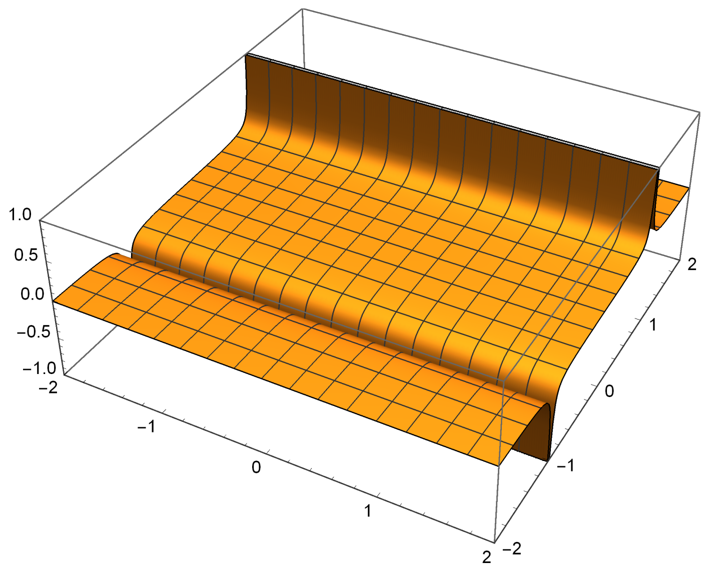
Out[116]= Potential function for due to electric Quadrapole

Out[117]= $$\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(-1+y)^2+z^2}}+\frac{0.0159155}{\text{epsilon}\sqrt{(-1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{(1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(1+y)^2+z^2}}$$

Out[118]= $$0.+\frac{0.0159155}{\sqrt{(-1+y)^2}}-\frac{0.0159155}{\sqrt{(1+y)^2}}$$

Out[119]= 3D Plot in y plane

Out[120]=



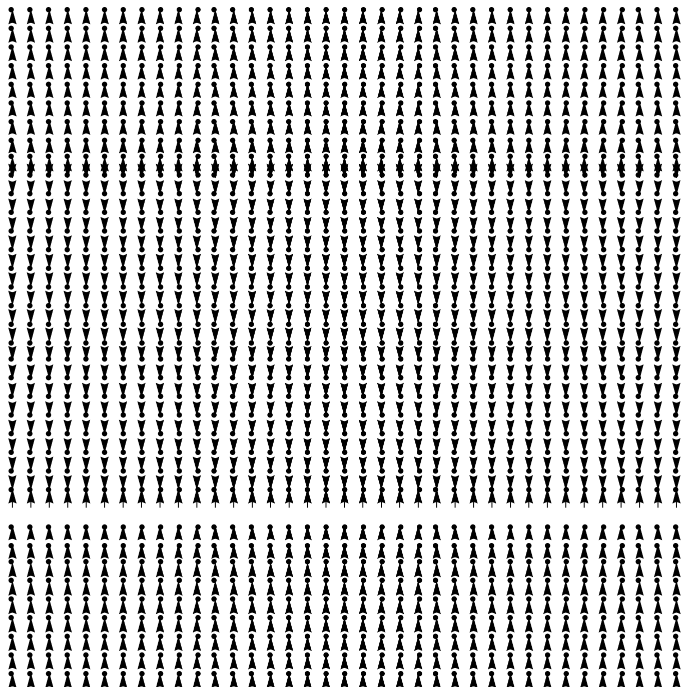

Out[121]= Electric Intensity

Out[122]= $$\left\{0, \frac{0.0159155\,(-1+y)}{\left((-1+y)^2\right)^{3/2}}-\frac{0.0159155\,(1+y)}{\left((1+y)^2\right)^{3/2}}, 0\right\}$$

General: VectorFieldPlots` is now obsolete. The legacy version being loaded may conflict with current functionality. See the Compatibility Guide for updating information.

Out[124]= Electric Field pattern of QuadraPole

Out[125]=



In[126]:=

```
(* on an ellipse x^2/9+y^2/16=1 *)
(* For 3D Plot in x plane *)
Pot[Q_, x0_, y0_, z0_] := Q/(4 Pi epsilon Sqrt[(x - x0)^2 + (y - y0)^2 + (z - z0)^2]);
(* Specify Quadrapole *)
q = {0.2, -0.2, 0.2, -0.2};
(* Specify Position *)
q1pos = {1, 0, 0}; q2pos = {-1, 0, 0}; q3pos = {0, 1, 0}; q4pos = {0, -1, 0};
(*Now use potential function for computing potential due to electric quadrapole*)
"Potential function for due to electric Quadrapole"
QuadPot = Pot[q[[1]], q1pos[[1]], q1pos[[2]], q1pos[[3]]] +
  Pot[q[[2]], q2pos[[1]], q2pos[[2]], q2pos[[3]]] +
  Pot[q[[3]], q3pos[[1]], q3pos[[2]], q3pos[[3]]] +
  Pot[q[[4]], q4pos[[1]], q4pos[[2]], q4pos[[3]]]
w = Solve[x^2/9 + y^2/16 == 1, x]
c = x /. w[[1]]
QuadPot = QuadPot /. {epsilon → 1, z → 0, y → c}
"3D Plot in y plane"
Plot3D[QuadPot, {x, -5, 5}, {y, -5, 5},
 PlotRange → {{-5, 5}, {-5, 5}, {0, 0.5}}, PlotPoints → 100]
"Electric Intensity"
QuadInt = -Grad[QuadPot, Cartesian[x, y, z]]
(* Drawing electric field pattern of quadrapole *)
<< VectorFieldPlots`
"Electric Field pattern of QuadraPole"
VectorFieldPlot[{QuadInt[[1]], QuadInt[[2]]}, {x, -2, 2, 0.11}, {y, -2, 2, 0.11}]
```

Out[129]= Potential function for due to electric Quadrapole

Out[130]= $$\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(-1+y)^2+z^2}}+\frac{0.0159155}{\text{epsilon}\sqrt{(-1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{(1+x)^2+y^2+z^2}}-\frac{0.0159155}{\text{epsilon}\sqrt{x^2+(1+y)^2+z^2}}$$

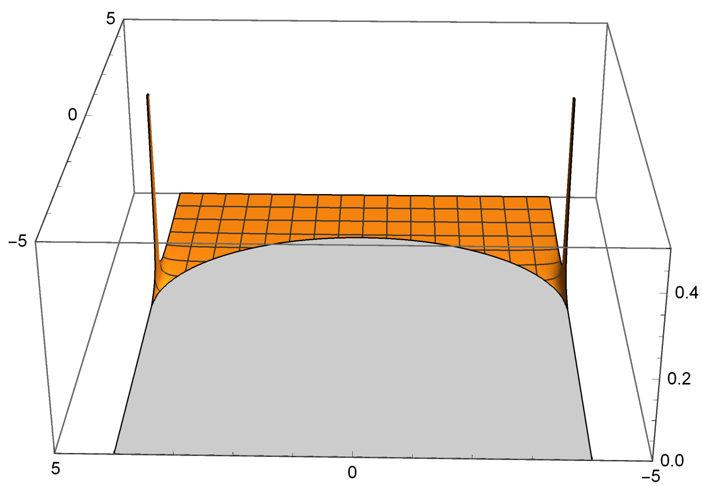
Out[131]= $$\left\{\left\{x\to-\frac{3}{4}\sqrt{16-y^2}\right\},\left\{x\to\frac{3\sqrt{16-y^2}}{4}\right\}\right\}$$

Out[132]= $$-\frac{3}{4}\sqrt{16-y^2}$$

Out[133]= $$\frac{0.0159155}{\sqrt{(-1+x)^2+\frac{9}{16}(16-y^2)}}-\frac{0.0159155}{\sqrt{(1+x)^2+\frac{9}{16}(16-y^2)}}+\frac{0.0159155}{\sqrt{x^2+\left(-1-\frac{3\sqrt{16-y^2}}{4}\right)^2}}-\frac{0.0159155}{\sqrt{x^2+\left(1-\frac{3\sqrt{16-y^2}}{4}\right)^2}}$$

Out[134]= `3D Plot in y plane`

Out[135]=




Out[136]= `Electric Intensity`

Out[137]= $$\left\{\frac{0.0159155\,(-1+x)}{\left((-1+x)^2+\frac{9}{16}(16-y^2)\right)^{3/2}}-\frac{0.0159155\,(1+x)}{\left((1+x)^2+\frac{9}{16}(16-y^2)\right)^{3/2}}+\frac{0.0159155\,x}{\left(x^2+\left(-1-\frac{3\sqrt{16-y^2}}{4}\right)^2\right)^{3/2}}-\frac{0.0159155\,x}{\left(x^2+\left(1-\frac{3\sqrt{16-y^2}}{4}\right)^2\right)^{3/2}},\ -\frac{0.00895247\,y}{\left((-1+x)^2+\frac{9}{16}(16-y^2)\right)^{3/2}}+\frac{0.00895247\,y}{\left((1+x)^2+\frac{9}{16}(16-y^2)\right)^{3/2}}+\frac{0.0119366\,y\left(-1-\frac{3\sqrt{16-y^2}}{4}\right)}{\sqrt{16-y^2}\left(x^2+\left(-1-\frac{3\sqrt{16-y^2}}{4}\right)^2\right)^{3/2}}-\frac{0.0119366\,y\left(1-\frac{3\sqrt{16-y^2}}{4}\right)}{\sqrt{16-y^2}\left(x^2+\left(1-\frac{3\sqrt{16-y^2}}{4}\right)^2\right)^{3/2}},\ 0\right\}$$

General: VectorFieldPlots` is now obsolete. The legacy version being loaded may conflict with current functionality. See the Compatibility Guide for updating information.

Out[139]= Electric Field pattern of QuadraPole

Out[140]=