

# Gauss Plane and Complex Function

## Graphics primitives

```
In[1]:= b[x__] := Map[{Re[#], Im[#]} &, x, {2}]
```

```
In[2]:= bl[x__] := Map[Line, b[x]]
```

```
In[3]:= c[x__] := Map[{Re[#], Im[#]} &, Transpose[x], {2}]
```

```
In[4]:= cl[x__] := Map[Line, c[x]]
```

## Set of Complex Numbers (Lattice on Gauss plane)

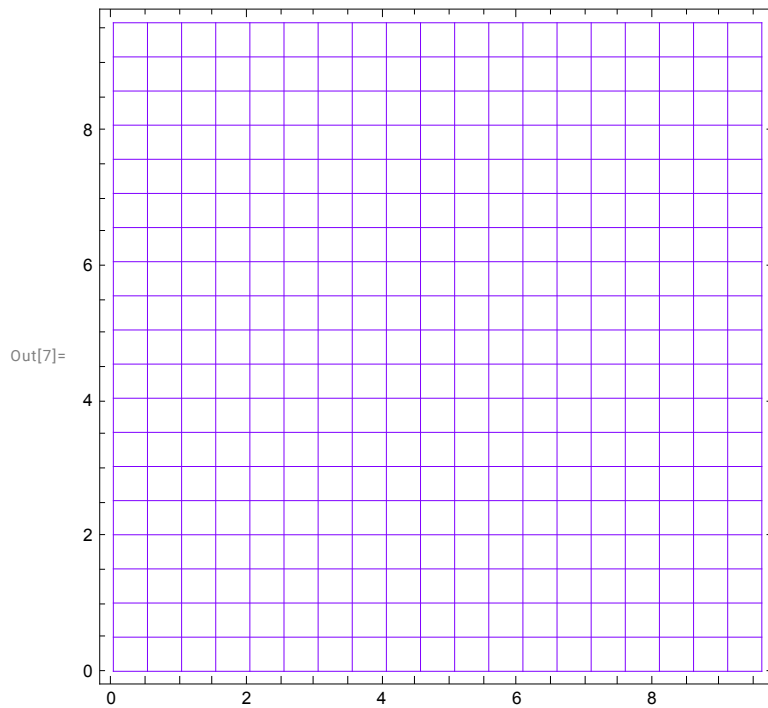
```
In[5]:= a = Table[N[i / 10] + I N[j / 10], (*I=Sqrt[-1]*)  
                {j, 0.1, 101, 10.1 / 2}, {i, 0.1, 101, 10.1 / 2}];
```

## Function, shows lattice

```
In[6]:= plt[clr_, x__] := Show[Graphics[{Hue[clr], bl[x]}],  
                               Graphics[{Hue[clr], cl[x]}], AspectRatio → Automatic, Frame → True]
```

## Show Lattice .

In[7]:= `plt[.75, a]`

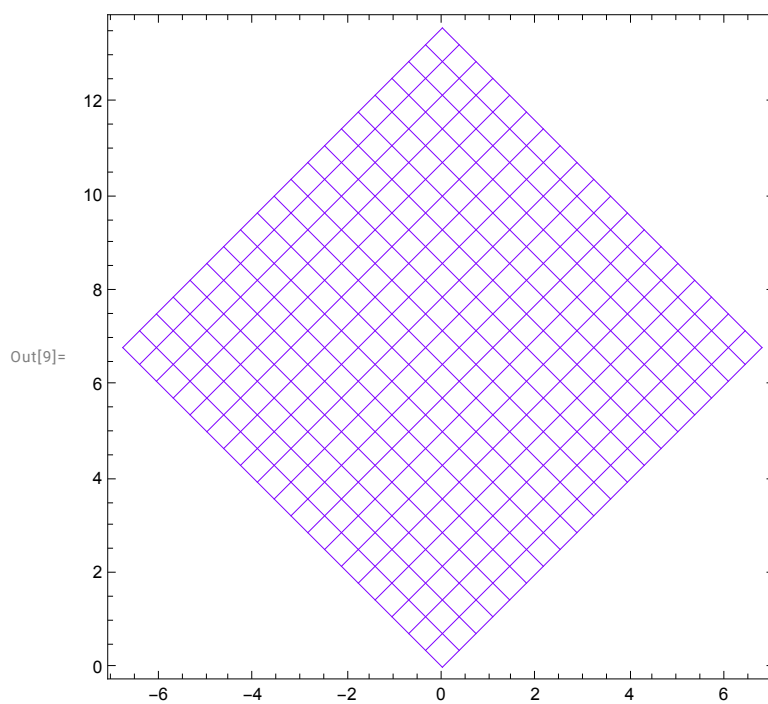


In[8]:= `r = Exp[I Pi * .25] (*I=Sqrt[-1]*)`

Out[8]= `0.707107 + 0.707107 i`

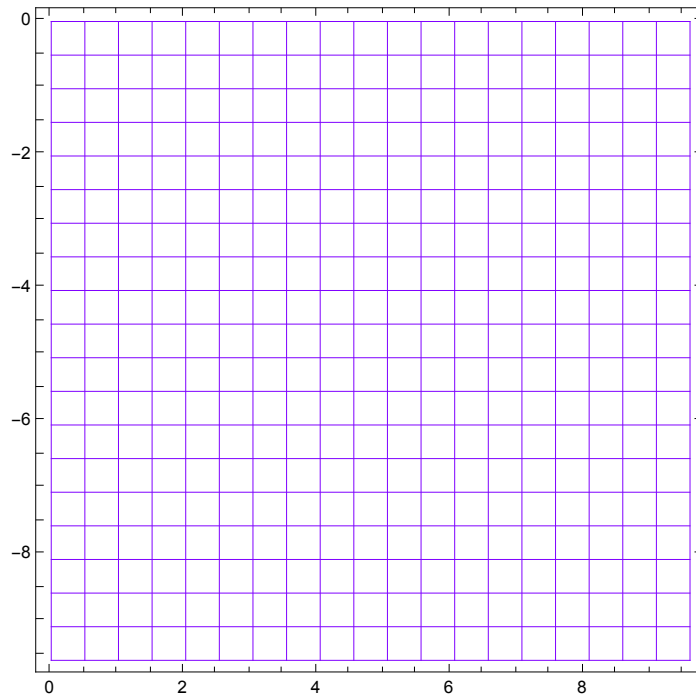
In[9]:= `plt[.75, r * a]`

`(*Rotate of Angle=Pi/4 around zero.r acts to each element of a*)`



```
In[10]:= plt[.75, Conjugate[a]]
(*Conjugate acts to each element of a*)
```

Out[10]=

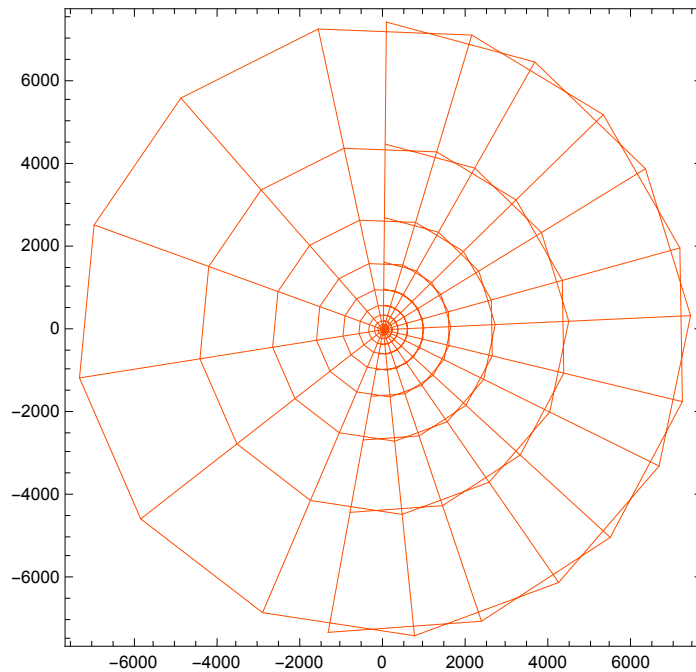


## Mapping Lattice

## Function acts to each element of List.

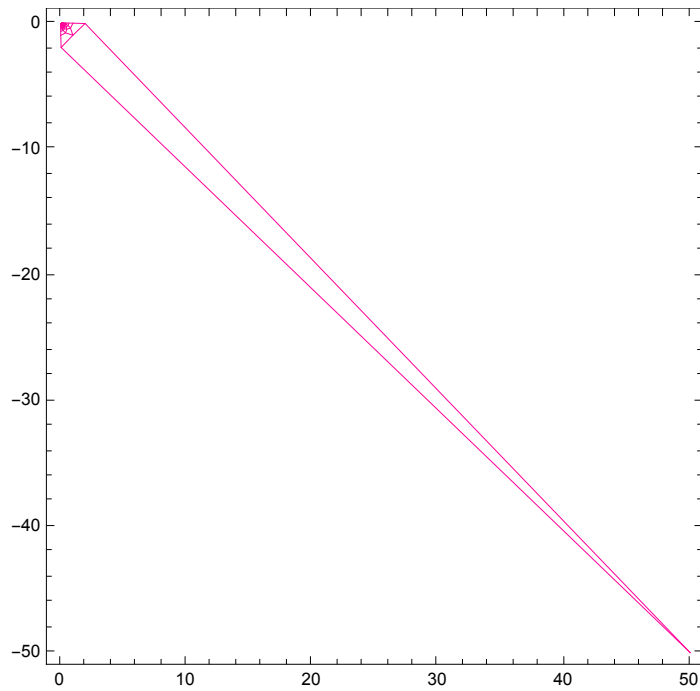
```
In[11]:= plt[.05, Sin[a]] (*sine function*)
```

Out[11]=



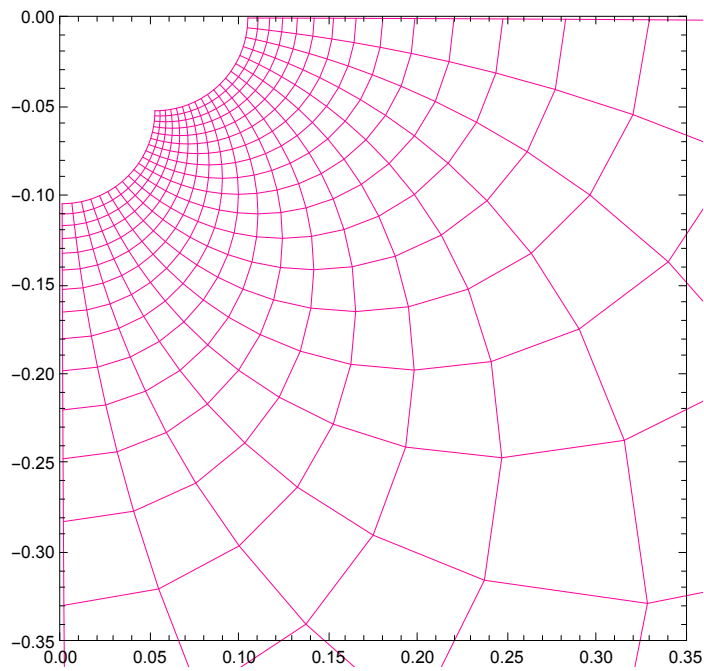
```
In[23]:= g1 = plt[.9, 1/a] (*1/a is inverse of each element of a*)
```

Out[23]=



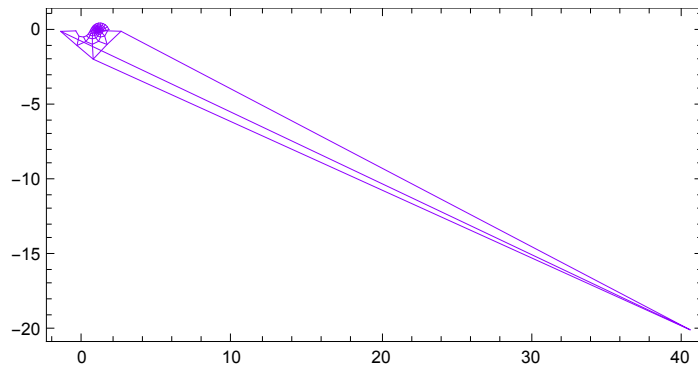
```
In[24]:= Show[g1, PlotRange -> {{0, 0.35}, {-0.35, 0}}]
```

Out[24]=



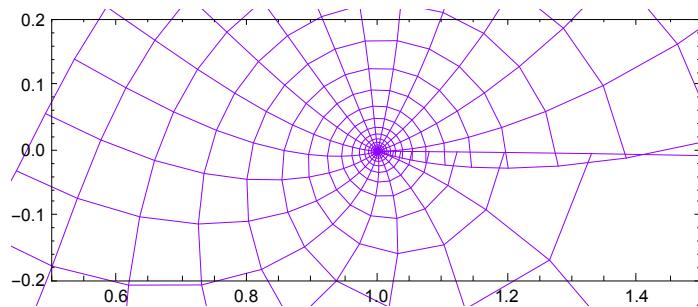
In[25]:= `g2 = Plot[.76, Zeta[a]]` (\*Riemann's Zeta function\*)

Out[25]=



In[27]:= `Show[g2, PlotRange -> {{0.5, 1.5}, {-0.2, 0.2}}]`

Out[27]=



In[15]:= `? BesselJ`

Out[15]=

Symbol

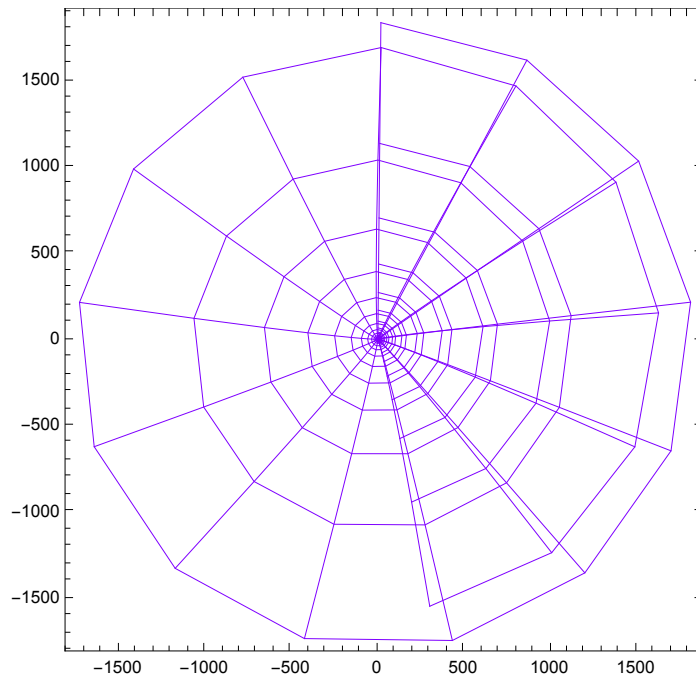


BesselJ[n, z] gives the Bessel function of the first kind  $J_n(z)$ .



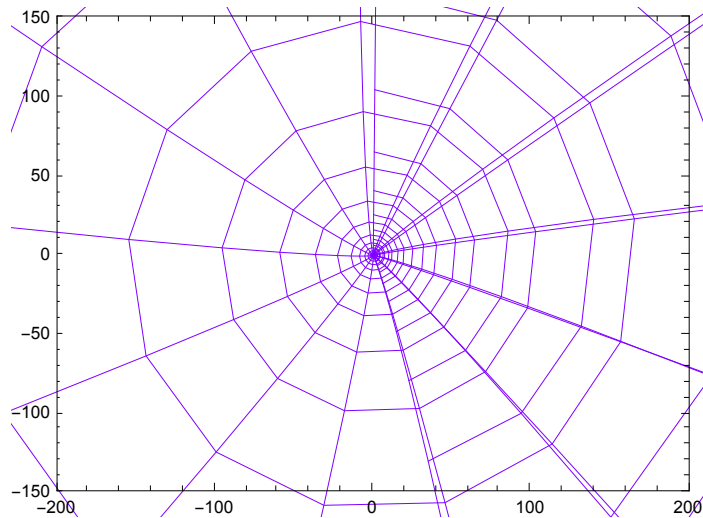
In[28]:= **g3 = plt[.75, BesselJ[1, a]]**

Out[28]=



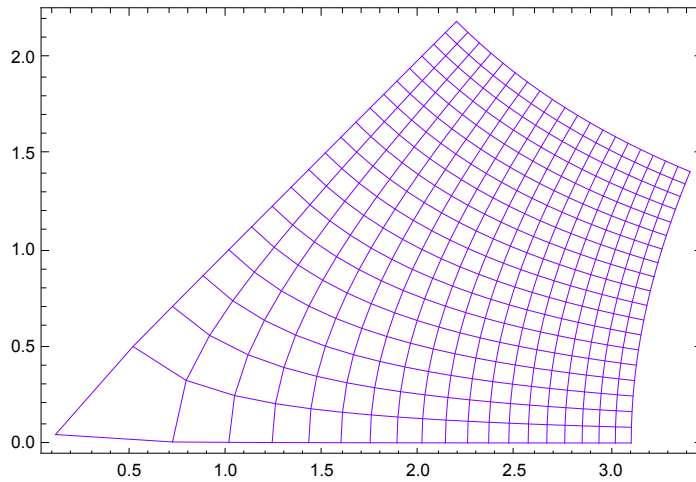
In[29]:= **Show[g3, PlotRange → {{-200, 200}, {-0150, 150}}]**

Out[29]=



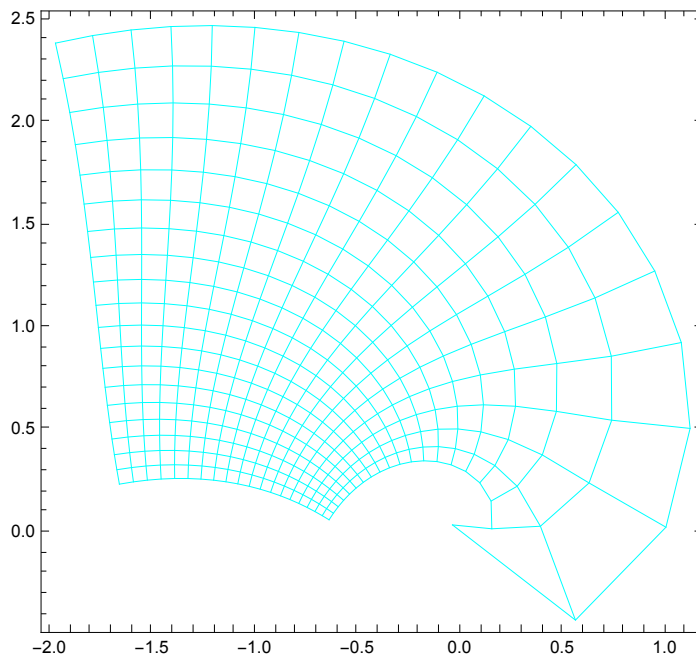
```
In[16]:= plt[.75, Sqrt[a]]
(*Square Root of each element of a*)
```

Out[16]=



```
In[17]:= plt[.5, a^(.5+I)] (*Power by "1/2 + Sqrt[-1]"*)
```

Out[17]=



```
In[18]:= ? AiryAi
```

Out[18]=

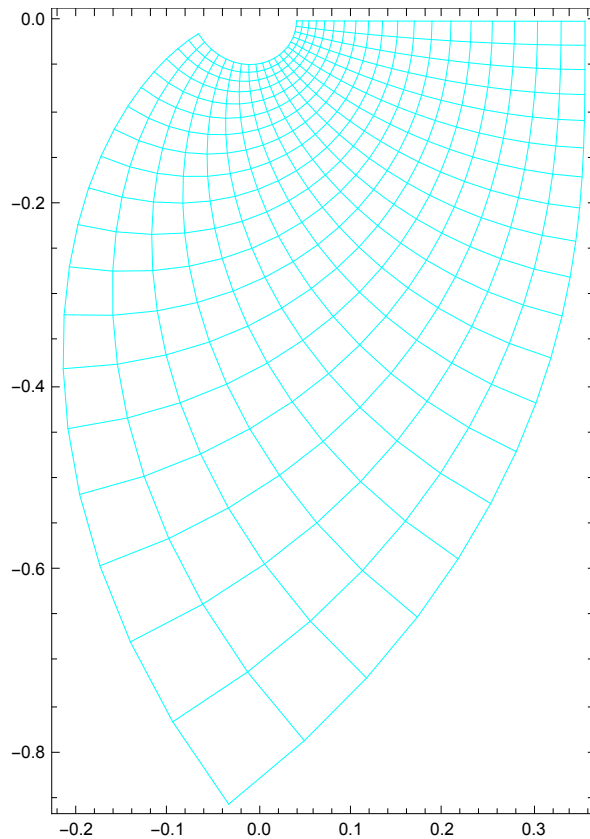
Symbol i

AiryAi[z] gives the Airy function Ai(z).

▼

```
In[19]:= plt[.5, AiryAi[Evaluate[a / 5]]]
```

```
Out[19]=
```



```
In[20]:= a1 = 4 + 4 I
```

```
Out[20]=
```

```
4 + 4 i
```

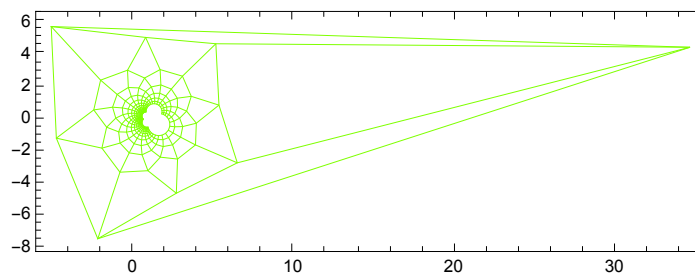
```
In[21]:= a2 = 6 + 7 I
```

```
Out[21]=
```

```
6 + 7 i
```

```
In[22]:= plt[.25, (a - a1) / (a - a2)]
```

```
Out[22]=
```



## Bibliography

Programming in Mathematica Second Edition, R. Maeder,  
Addison - Wesley, 1991