BLT

In [1]:

```python
from sympy import *
def crossratio(x1,x2,x3,x4):
    return ((x1-x2)*(x3-x4))/((x2-x3)*(x4-x1))



z1, z2, z3, z4, w1, w2, w3, w4 = symbols("z1 z2 z3 z4 w1 w2 w3 w4")

z1 = Symbol('z')
z2 = 1
z3 = 1j
z4 = -1
crz = crossratio(z1,z2,z3,z4)

w1 = Symbol('w')
w2 = 1j
w3 = 0
w4 = -1j
crw = crossratio(w1,w2,w3,w4)
init_printing()
eqn = Eq(crw, crz)
solve(eqn)
```

Out[1]:

$$\left[\left\{w : \frac{z - iz - 1.0 - i}{-z + iz - 1.0 - i}\right\}\right]$$

Conformal mapping

Check if q = e^z is conformal or not

In [76]:

```python
import numpy as np
import matplotlib.pyplot as plt
from sympy import *
import cmath as cm
z = Symbol('z')
q = Symbol('q')
q = exp(z)
d = diff(q,z)
print ("derivative : " , d)
if(d!=0):
    print("conformal")
else:
    print("not conformal")
```

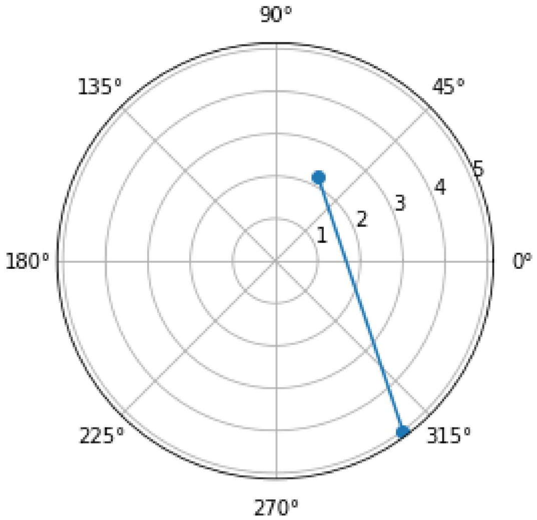
```
derivative :  exp(z)
conformal
```

Elementary Transformation

Reflexion

```
In [63]: from cmath import *
         import matplotlib.pyplot as plt
         z = 1+2j
         w = conjugate(c)

         plt.polar([phase(z), phase(w)],[abs(z), abs(w)],marker='o')
```

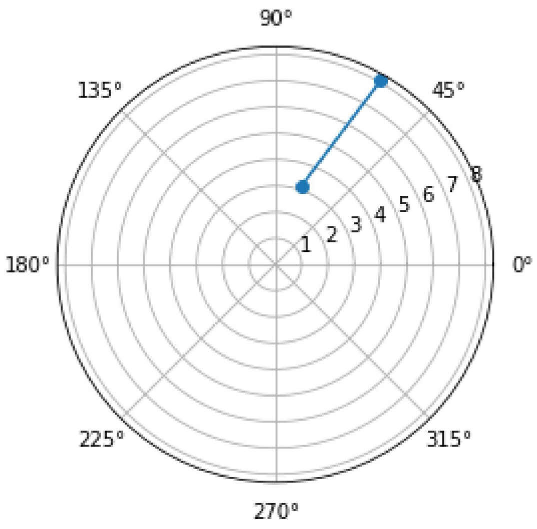
```
Out[63]: [<matplotlib.lines.Line2D at 0x93566f0>]
```



Translation

In [62]:
```
def translate(z, c):
    return z+c
z = 1+3j
c = 3+4j
w = translate(z,c)
values = [z,c,w]


plt.polar([phase(z),phase(w)],[abs(z),abs(w)], marker='o')
```

Out[62]:
```
[<matplotlib.lines.Line2D at 0x8f25c70>]
```



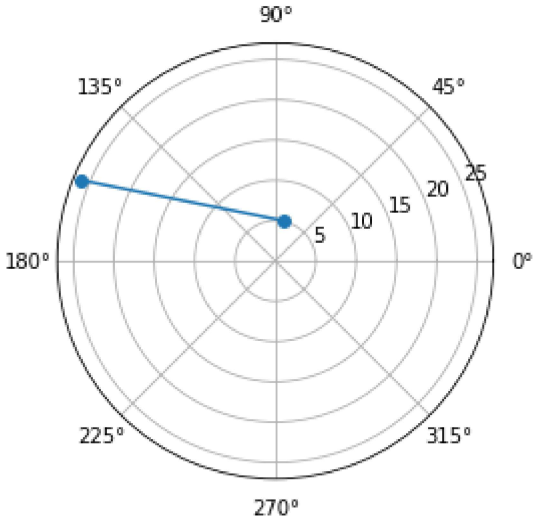
Magnificat and Rotation

In [61]:

```
z = 1 + 5j
r,theta = polar(z)
#z1 = r + (theta)*1j
a = 1 + 5j

#r1,theta1 = polar(a)
#a1 = r1 + (theta1)*1j

w = z*a
#r2,theta2 = polar(w)
#w1 = r2 + (theta)*2j

#values = [z1,w1]


plt.polar([phase(z),phase(w)],[abs(z),abs(w)], marker='o')
```

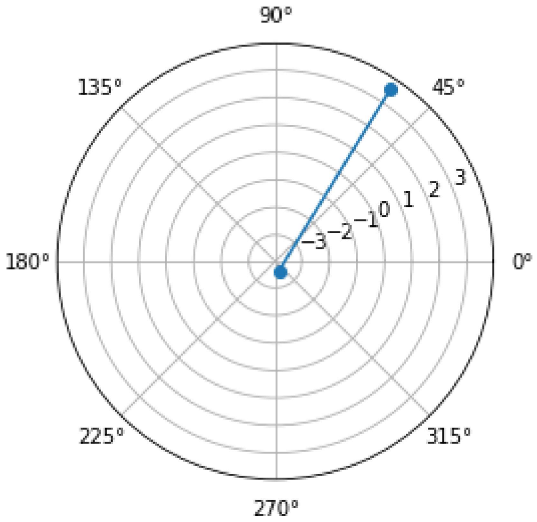
Out[61]:

```
[<matplotlib.lines.Line2D at 0x8f2f950>]
```



Inversion

```
In [58]: z = 2+3j
         r,theta = polar(z)

         A = 5
         #w = A/r + (-theta)*1j

         #values = [z,w]

         plt.polar([phase(z),A/phase(z)],[abs(z), -abs(z)], marker='o')

Out[58]: [<matplotlib.lines.Line2D at 0x92a66b0>]
```



question paper

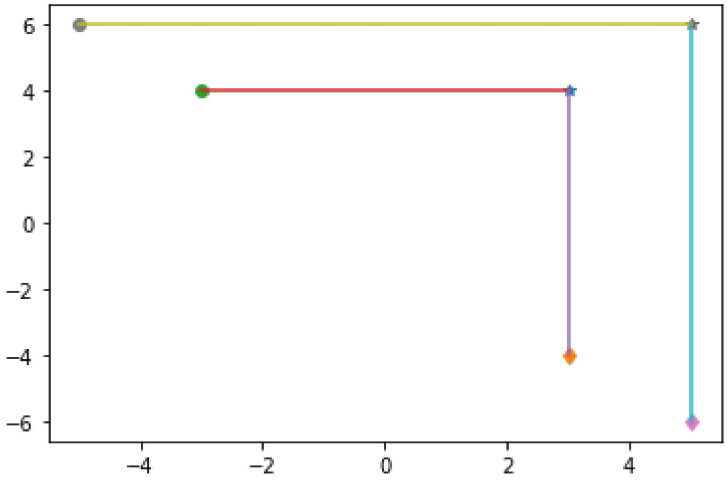
reflexion of the point (3,4) and (5,6) in both x plane and y plane

In [54]:

```
#(3,4)
x = 3
y = 4
plt.plot(x,y,"*" , x,-y,"d" , -x,y,"o")

xr = [-3,3]
yr = [4,4]
plt.plot(xr,yr)

xr1 = [3,3]
yr1 = [-4,4]
plt.plot(xr1,yr1)

#(5,6)
u = 5
v  = 6
plt.plot(u,v,"*" , u,-v,"d" , -u,v,"o")


ur = [-5,5]
vr = [6,6]
plt.plot(ur,vr)

ur1 = [5,5]
vr1 = [-6,6]
plt.plot(ur1,vr1)
```

Out[54]:

```
[<matplotlib.lines.Line2D at 0x91a6530>]
```


6
4
2
0
−2
−4
−6
−4
−2
0
2
4