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Part 1:

Reference for Part 1: Advance Engineering Mathematics,1Oth edition, Erwin Kreyszig, Page 661,Cauchy integral formula.

Part 3:

I have used formula = |calculated value – absolute value | / | absolute value|

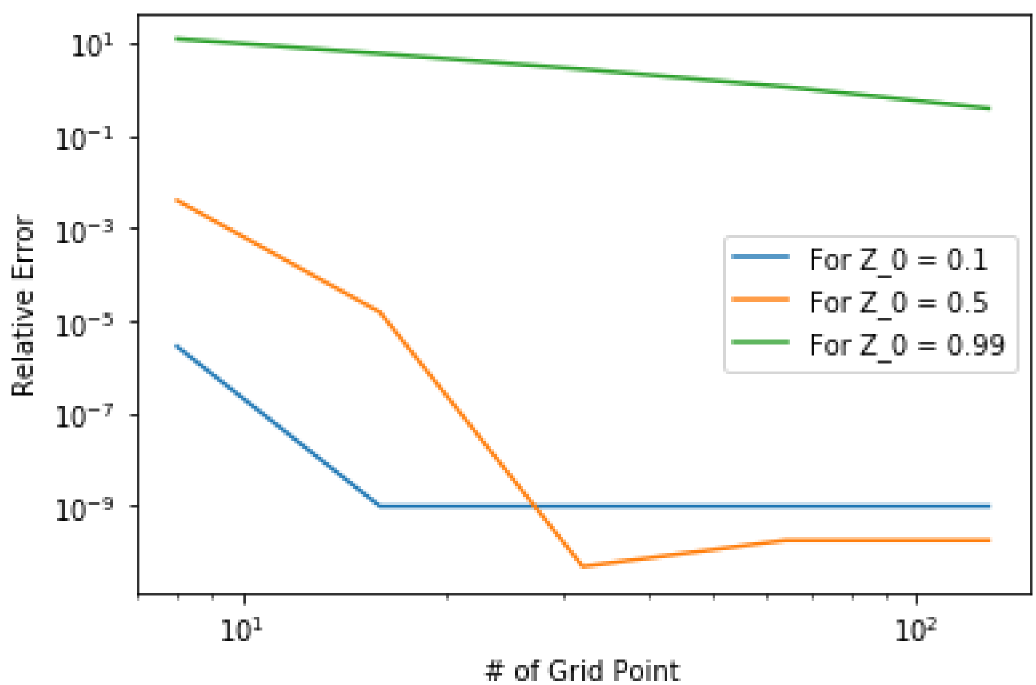
(Reference)

https://www.google.com/search?q=relative+error+formula&rlz=1C1CHBF_enUS896US896&oq=relat&aqs=chrome.0.69i59j69i57j0l3j69i60l3.3066j0j7&sourceid=chrome&ie=UTF-8

The error table:

```
array([[2.76908259e-06, 9.96661854e-10, 9.96664773e-10, 9.96664495e-10,
        9.96664634e-10],
       [3.92443591e-03, 1.52588388e-05, 4.97817262e-11, 1.83048633e-10,
        1.83048865e-10],
       [1.19440979e+01, 5.73209227e+00, 2.63610360e+00, 1.10791018e+00,
        3.81695750e-01]])
```

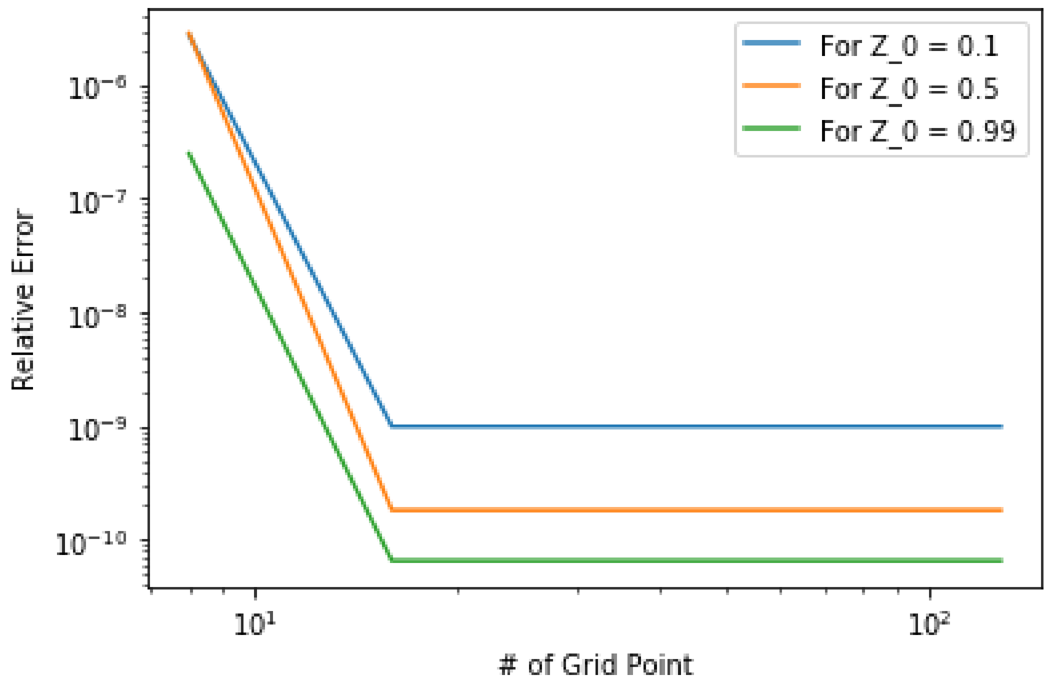
The Plot:



Z_0 = 0.1 converges way faster than as compared to z_0 = 0.99. Also the convergence for z_0 = 0.1 is faster as compared to convergence for z_0 = 0.5, and it achieve convergence for only <10 grid points. But with increase in #of grid point the relative error become better for Z_0 = 0.5.

Part 4:

```
array([[2.75908256e-06, 9.96662132e-10, 9.96664773e-10, 9.96664495e-10,
         9.96665051e-10],
        [2.85608821e-06, 1.83045739e-10, 1.83048865e-10, 1.83048633e-10,
         1.83048633e-10],
        [2.49806728e-07, 6.56303351e-11, 6.56311319e-11, 6.56308663e-11,
         6.56303351e-11]])
```



After Dividing by integral it make the convergence for all z_0 fast, also the z_0 = 0.99 converges faster as compared to rest of the two. The convergence becomes stable. We observe that for the first method point near to singularity will be converged faster and stable, but as we moved away towards the boundary the convergence would get slow and become less stable. But after Dividing with integral the point far away from singularity will converge faster and convergence is stable for all the point enclosed in domain.