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Problem 4.8

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Homework due Nov 14, 2020 19:00 EST

Problem 4.8

0.0/2.0 points (graded)

The point  $z_0$  is called a branch point for the complex (multiple) valued function  $f(z)$  if the value of  $f(z)$  does not return to its initial value as a closed curve around the point is traced (starting from some arbitrary point on the curve), in such away that  $f$  varies continuously as the path is traced. It is possible and sometimes useful to generalize this definition to the point  $z = \infty$ . The simplest way to do so is to first map  $z = \infty$  into a point on the finite complex plane and then apply to it the prior definition. This we can do using the inversion map: by introducing the new variable  $\zeta = 1/z$  and then applying a prior definition at  $\zeta = 0$ . Consider the following example.

Check all of the options below that correspond to the functions that have branch points at  $z = \infty$ .

☐  $f(z) = \ln z$

☐  $f(z) = \ln\left(\frac{z-1}{z+1}\right)$

☐  $f(z) = \ln(z^2 - 1)$

☐  $f(z) = \sqrt{z^2 - 1}$

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