Fachbereich Mathematik der Universität Hamburg **SoSe 2023**
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Complex functions for Engineering Students

Exercise class 7

Exercise 1:

For the following functions

a) $f(z) = \dfrac{z^2 + z - 2}{z^3 - 2z^2}$,

b) $f(z) = \dfrac{1 + z - \exp(z)}{z^4}$,

c) $f(z) = \cosh\dfrac{1}{z} - \sinh\dfrac{1}{z}$,

d) $f(z) = \dfrac{z - \pi}{\sin z}$

one determine:

position and type of the (finite) singularities, the corresponding residuals and the first four (non-vanishing) addends of the Laurent series around $z = 0$, converging for large z.

Exercise 2:

Let the function

$$f(z) = \frac{32}{z^4 + 4z^3 + 8z^2 + 16z + 16}$$

be given.

a) Determine the partial fraction decomposition of f with the help of Laurent series expansion.

b) Compute with the help of the residue theorem the integral

$$\oint_c f(z)\,dz$$

for the circumference $c:\ |z + 2 - 2i| = 3$.

Dates of classes: 3.7.-7.7.