

1. Find the Laurent expansion of the function  $f(z) = \frac{2z - 4}{z^2 - 4z + 3}$  in the annulus  $1 < |z| < 3$ .

2. Use the residue theorem to compute the integral  $\int_{-\infty}^{\infty} \frac{(x^2+1) dx}{x^4 + 5x^2 + 4}$  .

3. Determine the number of zeros in the first quarter  $\operatorname{Re}(z) > 0, \operatorname{Im}(z) > 0$  of the function  $f(z) = z^4 + z^3 + 15$ .

4. Find the number of zeros of the function  $f(z) = z^3 + z^2 + z - 2$  in the annulus  $1 < |z| < 2$

5. Find a Möbius transformation, which transforms the imaginary axis

$\operatorname{Re}(z) = 0$  onto the circle  $|z| = 1$ . Is such a transformation unique?

6. Check if the four points  $i$ ,  $1+i$ ,  $1-7i$ ,  $2-i$  lie on a circle (or line).