

1. (a) Determine all solutions of each of the equations given by  $z^5 = -1$  and  $z^4 = 16$ . (b) Show your solutions as a plot in the complex plane

2. Consider the two functions given by  $f(z) = |z^2| = zz^*$  and  $f(z) = \sin z$ . Determine the analyticity of these two functions.

3. Find the Laurent series of the function given by

$$f(z) = \frac{1}{z(z-2)^3}$$

about the singularities  $z = 0$  and  $z = 2$  separately. Verify that  $z = 0$  is a pole of order 1 and  $z = 2$  is a pole of order 3.

4. Write the real and imaginary parts  $u$  and  $v$  of the complex functions given by

$$(a) f(z) = z^2 \sin z \text{ and } (b) f(z) = \frac{1}{1+z}.$$

(c) Are the Cauchy-Riemann relations satisfied?

5. (a) Find the Laurent series about the singularity  $z = 1$  for the function given by

$$f(z) = \frac{e^z}{(z-1)^2}.$$

(b) Identify the order of any poles and state the region of convergence for the function.