

## Complex Numbers – Check your understanding

- Can you explain where De Moivre's formula comes from? Can you use this formula to for instance find  $\cos(n\theta)$  in terms of  $\cos(\theta)$  and  $\sin(\theta)$ ?
- Can you list all of the multi-valued functions we discussed in class?
- Can you use the definitions of cosine and sine to show that  $\cos^2(z) + \sin^2(z) = 1$ ?
- Given the formula for  $\ln(z)$ , can you show that  $e^{\ln(z)} = z$ ? Is  $\ln(e^z)$  equal to  $z$ ? Why or why not?
- Does the formula  $\ln(4) = \ln(4) + 2ip\pi$  mean that  $p = 0$ ?
- Can you explain where the Cauchy-Riemann equations come from? Can you show how they are derived?
- Do you know the difference between the following statements: " $f$  is differentiable at  $z = z_0$ ", " $f$  is analytic at  $z = z_0$ ", " $f$  is entire"?
- Can you give an example of a function which is not entire? Can you give an example of a function which is not analytic at  $z = 0$ , but analytic elsewhere?
- Can you give an example of a function which is not analytic at  $z = i$ , but analytic elsewhere?
- If  $f$  is analytic, what can you say about the contours of the real and imaginary parts of  $f$ ? Why?
- If  $f$  is entire, what can you say about the modulus of  $f$ ? Why?
- Can you explain why the real and imaginary parts of an analytic function satisfy Laplace's equation?
- Can you say what the periods of  $e^z$ ,  $\cos(z)$ ,  $\sin(z)$ ,  $\cosh(z)$ ,  $\sinh(z)$ , are?
- What happens on a branch cut of the logarithm?
- Review the concept tests we did in class.