

Phys 2920, Spring 2013
Problem Set #9

1. Use a computer program which does “3D graphics”, make a plot of the function

$$f(x, y) = 5 \sin(2x) \sin(5y)$$

for the range $0 \leq x \leq 2\pi$, $0 \leq y \leq 2\pi$.

Hint: In Maple, you can learn how the procedure `plot3d` is used. You may also want to change the option `numpoints` or `grid` to get a better picture.

2. Using a computer program produce (any way you can) a plot of the function

$$f(\rho, \phi) = 5 \sin(\rho^2/3) \cos(\phi) e^{-\rho^2/10}$$

for the range $-5 \leq x \leq 5$, $-5 \leq y \leq 5$

3. Find $\cos(-2 + 5i)$, using both your calculator and demonstrating the result using only a real-variable (\$10) calculator.

4. Evaluate $\cos^{-1}(10)$; get the decimal value from your calculator and show how this value comes about using the definition of $\cos^{-1}(z)$ and real-variable math.

5. (CV 3.44) Prove that $\frac{d}{dz}(z^2 z^*)$ does not exist anywhere.
(If it were analytic, the C–R equations would have to be satisfied...)

6. (CV 3.47) Verify that the real and imaginary parts of the following functions satisfy the Cauchy–Riemann equations and thus deduce the analyticity of each function:

$$(a) \quad f(z) = z^2 + 5iz + 3 - i, \quad (b) \quad f(z) = ze^{-z}, \quad (c) \quad f(z) = \sin 2z$$

In other words, use $z = x + iy$, find $u(x, y)$ and $v(x, y)$ and test the C–R equations.

7. (CV 3.78) Evaluate

$$(a) \quad \lim_{z \rightarrow 2i} \frac{z^2 + 4}{2z^2 + (3 - 4i)z - 6i} \quad (b) \quad \lim_{z \rightarrow e^{\pi i/3}} (z - e^{\pi i/3}) \left(\frac{z}{z^3 + 1} \right) \quad (c) \quad \lim_{z \rightarrow i} \frac{z^2 - 2iz - 1}{z^4 + 2z^2 + 1}$$

(A little practice with l’Hopital’s rule and derivatives.)