

MA/PHY507 Spring 2019
Problem Set 3
DUE: Wednesday, 6 February 2019

1. By using a simple change of variables from (x, y) to (R, θ) , where $r^2 = x^2 + y^2$ and $\theta = \tan^{-1}(y/x)$, show that the Cauchy-Riemann equations in polar coordinates are:

$$\frac{\partial u}{\partial r} = \frac{1}{r} \frac{\partial v}{\partial \theta} \quad \frac{\partial v}{\partial r} = -\frac{1}{r} \frac{\partial u}{\partial \theta}.$$

2. Do the following contour integrals using the simplest method you can think of and state if either integral is path dependent:

(a)

$$\int_{\gamma} z^2 dz, \quad \gamma(t) = e^{it} \sin^3 t, \quad 0 \leq t \leq \pi/2.$$

(b)

$$\int_{\gamma} y dz,$$

where γ joins 0 to i and then i to $i + 2$.

3. Arfken, section 11.2, page 477, problem 11.2.10 a).
4. Arfken, section 11.3, page 485, problems 11.3.4, 11.3.6, and 11.3.7.