Exercise 1. Consider the complex number $w = 2i$. Do the following:

i) Convert w to polar form.

ii) Compute w^2, you may leave your answer in either polar or cartesian form.

iii) Now compute the number $z = \frac{w}{1+w^2}$ and leave it in cartesian form.

iv) What is the real part of z?

v) What is the complex absolute value of z?

Exercise 2. Consider the conservation law $ty(t^2+y^2)=2$.

i) What is the multivariable function f in the conservation law?

ii) Find the partial derivatives of f with respect to t and y.

iii) Build an exact differential equation by multiplying your results by dt and dy and then dividing by dt the whole equation.

iv) Suppose your exact differential equation comes with an initial condition $y(1)=1$. Write the initial value problem in this case.

v) Solve the initial value problem you just wrote as follows:

    (a) First multiply out dt throughout the whole equation.

    (b) Identify the functions multiplied by the differentials as the partial derivatives of a function.

    (c) Integrate either of the partial derivatives to obtain a function f.

    (d) Differentiate it again to obtain a C function with respect to your other variable and compare with your other derivative to find C.

    (e) Apply the initial value in question. If done correctly you should return to the equation in the statement.