Practical Numerical Analysis: Sheet 3

1. Use the bisection, regula falsi, Illinois and Newton-Raphson methods to find the roots of the function $f(x) = \sin(x) + \sin(x^2)$ on the interval $[0, 3]$. Compare the number of iterations required for each method.

2. Compute the Newton fractal of the function $f(z) = z^3 - 1$ and check your picture looks like the one shown in lectures. Then compute a Newton fractal for a complex-valued function of your choice. We will look at the most beautiful in class so please email me the most impressive figures you generate. (You should colour points that did not converge in white. You may wish to shade the pictures according to how difficult it was for Newton's method to converge. You may also wish to use the damped Newton iteration rather than taking a full Newton step at each iteration.)

Further Reading

1. E. Süli and D. Mayers, *An Introduction to Numerical Analysis*, CUP, 2003.

2. http://stackoverflow.com/questions/470690/how-to-automatically-generate-n-distinct-colors (This discusses how to generate n distinct colours for Newton fractals. When there are only three roots, the obvious choice is to use red, blue and green, but the choice is less obvious for more roots.)