Practice 2.2

Practice sheets are not assessed. The intention is to use material from lectures in preparation for Competence tests and Assignments.

Here's some data to be used in this Practice sheet.

```
xdata = [-4.00, -3.11, -2.22, -1.33, -0.44, 0.44, 1.33, 2.22, 3.11, 4.00]
ydata = [9.37, 7.38, 4.36, 6.76, 7.17, 10.58, 18.31, 21.45, 30.99, 41.44]
```

Interpolation [EASY]

Create an interpolating function based on the data.

Plot this interpolating function and the data.

Curve fitting [EASY]

Find the best fit parameters a, b, c in the equation $y = ax^2 + bx + c$ given the above data.

Plot this fitted function and the data.

Integrating [MEDIUM]

Integrate the interpolating function from -4 to $+4$.

Newton's method for complex arguments [HARD]

```
def newton(f, x0, fprime=None, tol=1e-6, maxiter=50):
    if fprime is None:
        def fprime(x):
            h = 1e-6
            return (f(x+h)-f(x))/h
    x = x0
    for n in range(maxiter):
        x -= f(x)/fprime(x)
        if abs(f(x)) < tol:
            return x
    return x
```

Using the above implementation of Newton's method, find the solution to which Newton's method converges, for a starting point in the *complex* plane $z = x + iy$: equation $z^3 - z^2 - 1$; interval $-2 < x < 2$ and $-2 < y < +2$; at least 500×500 points. Plot this using `plt.pcolormesh`, an example of which is given below:

```
def f(x,y):
    return np.exp(-x**2/10-y**2+x*y/2)

x = np.linspace(-4,4,101)
y = np.linspace(-3,3,101)

N, M = len(x), len(y)
A = np.zeros((N,M))
for n,xi in enumerate(x):
    for m, yi in enumerate(y):
        A[n,m] = f(xi,yi)

plt.pcolormesh(x,y,A.transpose())
plt.axis('equal'); plt.xlabel('x'); plt.ylabel('y'); plt.title('2D Gaussian')
plt.savefig('figs/pcolormesh.png'); plt.close('all')
```