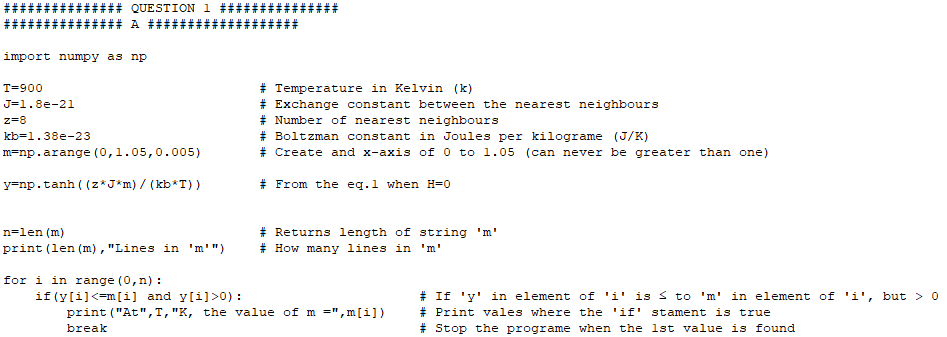
**Assignment 3**

**Question 1**





**Fig 1.1:** code to calculate a value of at temperature and what printed to the shell.



Fig 1 shows the value of magnetisation, at . Where there the applied field, (**Eq.1.1**)

Increasing or decreasing the temperature, yields different results for magnetisation, As can be seen below.

**Decreasing** the temperature yields:



**Increasing** the temperature yields:

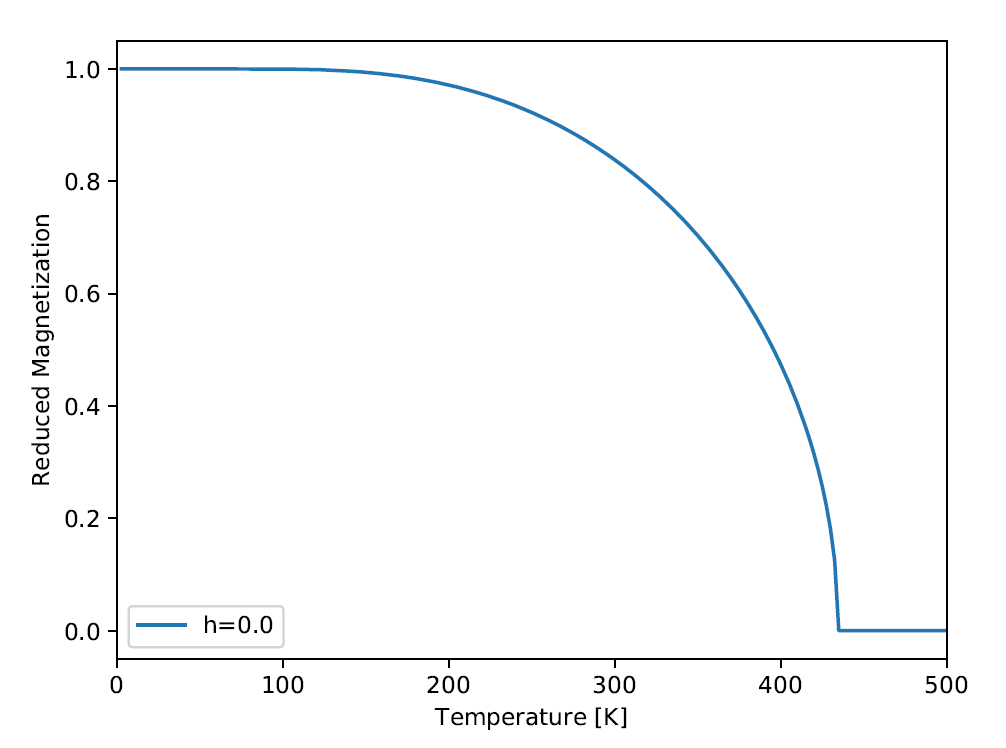


It can bee seen that the material performs better under lower temperatures. This is due to magnets preforming at their maximum magnetization when the magnetic moments are parallel (). These magnetic moments align more closely while at low temperatures.

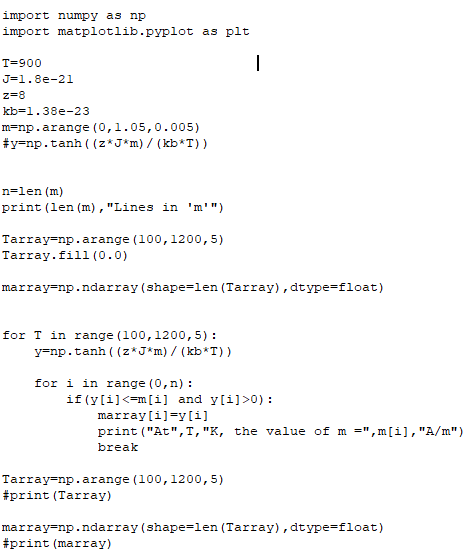
This code was used to find a value of magnetization, at temperature, . The next bit of code was written to see how vairies with without having to keep changing manually.

It was then necessary to plot as a function of . This should look like the **Fig 1.12** Below

**Fig 1.12:** How the magnetization, should vary with at temperature increases.



I was unsuccessful in plotting the curve. However, I was able to gather the date required with the following code (**Fig 1.13**)

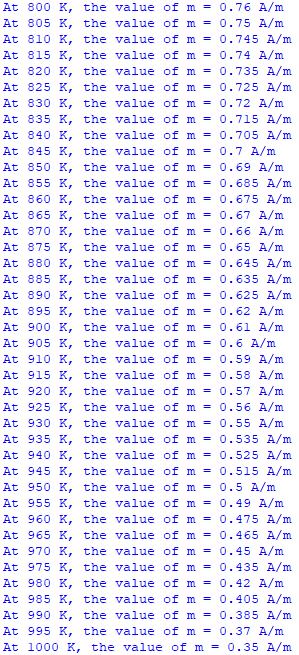


**Fig 1.13:** Code to see how magnetization, varies with temperature increases.

The shell prints out a long list of variables, but we will focus on a small sample, show below (**Fig1.14**)

Here we can see that at the temperature, increases the magnetization, decreases.

I picked this sample because it agrees with our solution for the first bit of code (**Fig 1.1**) where at

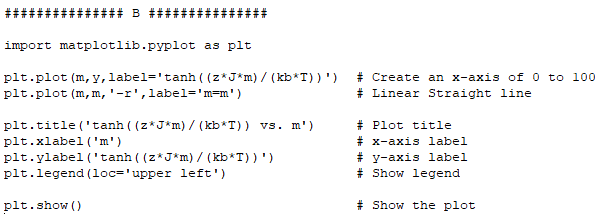


**Fig 1.14:** Small sample of what printed to the shell using code from **Fig 1.13.**

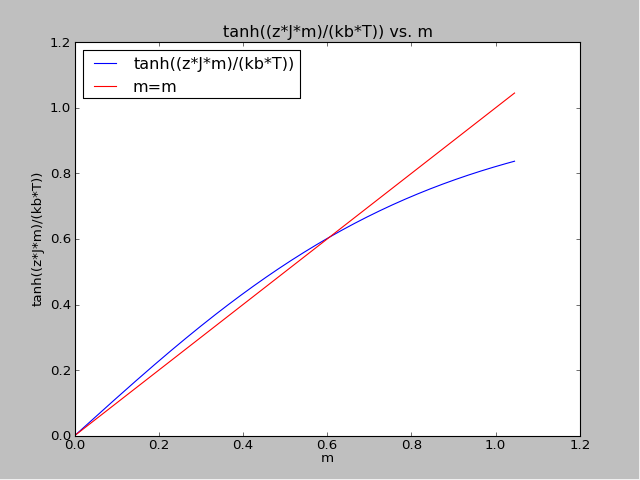
It also agrees with the values for when and which we found previously.



**Fig 1.12:** Code to plot solution to 2b from **Fig1.1**



**Fig 1.2:** Plot of solution to 1a. Where



The two lines cross at and .

**Question 2**



(1.1)

Diffracting **Eq.1.1** with respect to ,

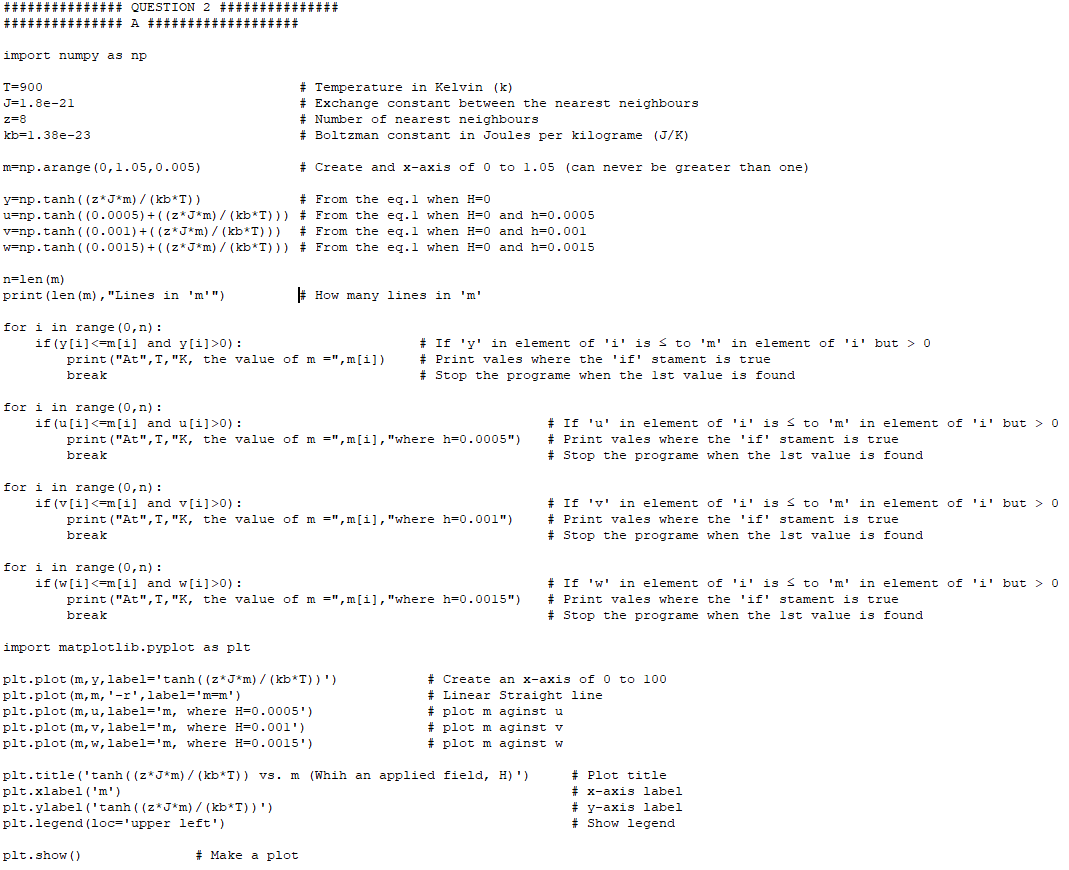
For LHS,

For RHS,

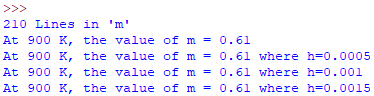
Subbing in and and combining the LHS and RHS we have that,

Hence, we can rearrange so say that



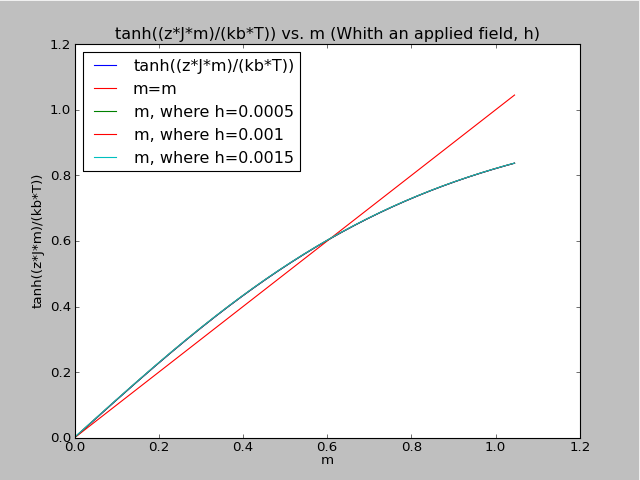


**Fig 2.1:** Written code for question 2b.



**Fig 2.2:** What was printed to the shell from **Fig 2.1.**

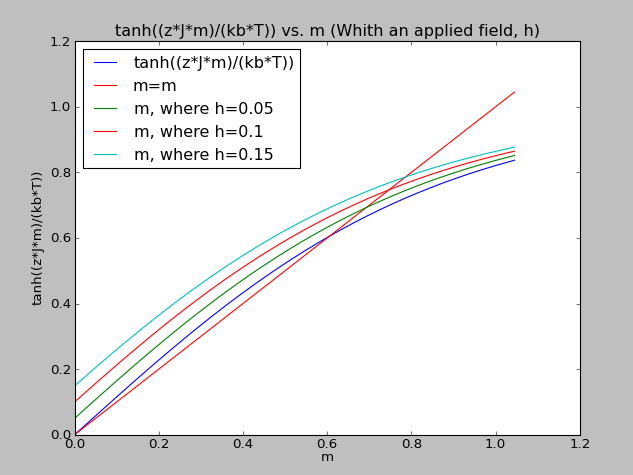
With the given values for the applied field, . It can be seen that the magnetisation remains unchanged as per what was printed into the shell. We can see this visually shown in the plot below (**Fig2.3**)



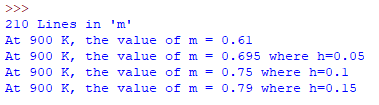
**Fig 2.3:** Plot of solutions to 2b.

However if we were to increase each value of of by two factors of . The graph yeilds difrrent results (**Fig.2.4**)

**Fig 2.4:** Plot of solutions to 2b. When has been increased.



The shell also printed new values for . Shown below.



**Fig 2.5:** What was printed to the shell when was increased by 2 factors of 10.



The magnetisation increased as the applied field, . did also. This means you could increase the magnetization of a material with an applied field, when the material is of a higher temperature.