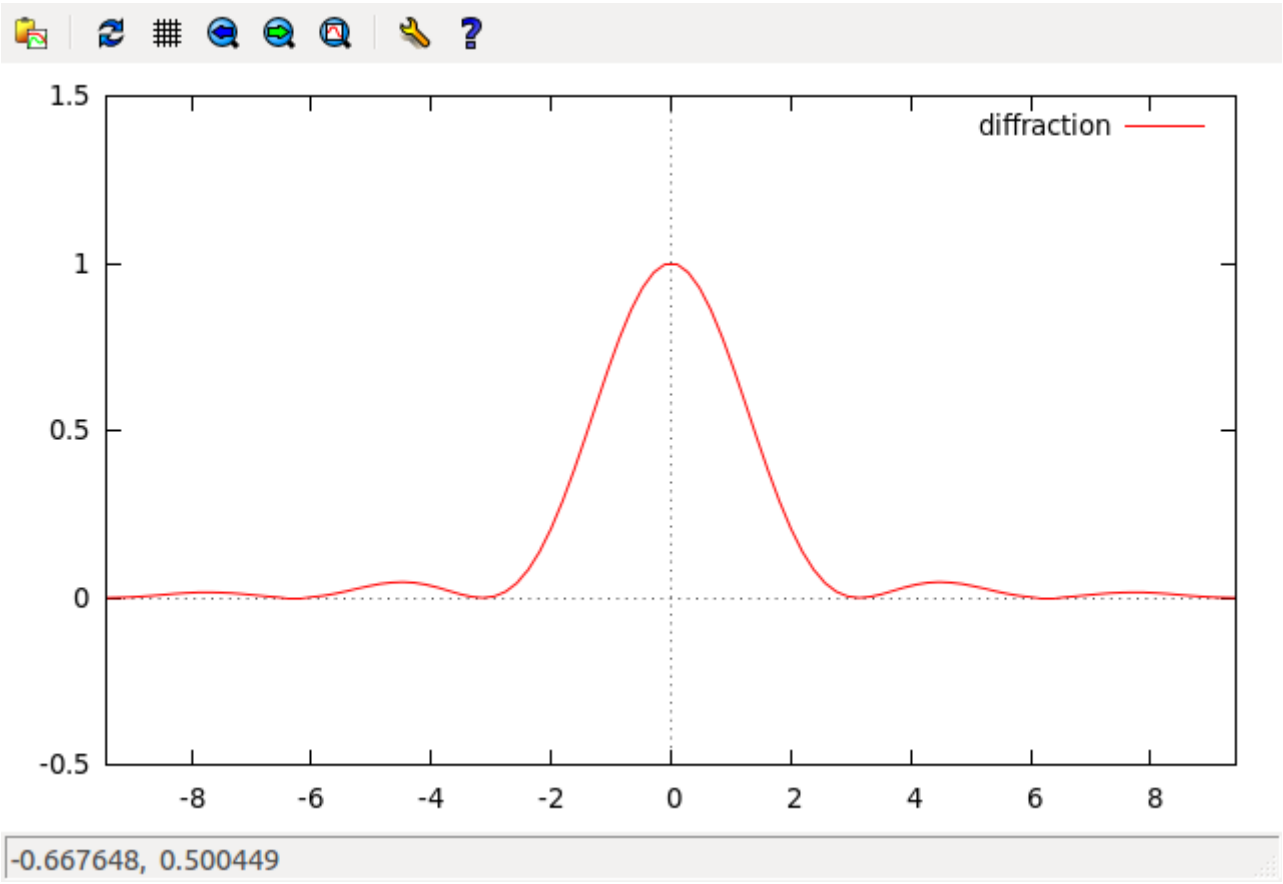
CS1101 Worksheet03

Login to the system. Open a terminal. Create a directory called **Worksheet03** under your home directory. Change to that directory and do all your work there. In particular open a file called **Worksheet03.txt** (using **gedit**) inside this directory where you will write down the answers to all questions asked in this worksheet. At the end of the class, archive the directory **Worksheet03** and upload to welearn. Open gnuplot in the interactive mode by typing **gnuplot** at the Linux prompt.

Warning : please strictly adhere to the instructions above – not doing so may affect your grades!

Q 1) Plot the function $\frac{a*\sin^2(x)}{x}$ where a=1.5 with x ranging from -5π to $+5\pi$ and y ranging from -1.5 to 1.5 . The graph should have both the X and Y axes (remember `set zeroaxis`) and the key should display the legend "diffraction".

For ease of understanding I have shown what the output should look like a function $\frac{\sin^2(x)}{x^2}$ with x ranging from -3π to $+3\pi$ and y ranging from -0.5 to 1.5 .



You have to export the graph in png format (call the file **graphQ1.png**) from within gnuplot (no screenshots allowed). Write down all the gnuplot commands that you have to use in the file **Worksheet03.txt** (including the commands that are needed to export the png file).

Q 2) In **gnuplot** define the function

$$f(x)=3x^3-2x^2-x+1$$

Plot this function along with the X and Y axes . A glance should tell you that the equation $f(x)=0$ has a root close to $x=0$. By zooming in to the graph try to find this root to 5 decimal places. Write down the root in **Worksheet03.txt**.

We will later learn how to solve complicated equations by writing programs in python. But if you are in a hurry, this is a quick way to find solutions, at least approximately.

Q 3) A function $q(x)$ is defined in **gnuplot** (gnuplot is case sensitive, so $Q(x)$ is different from $q(x)$) by the command

q(x) = x>3? 5*x : x>2? 5-2*x:x<0?5*x**2 : -5*x

In the file **Worksheet03.txt** write down the values of $f(4.5), f(3), f(1.5), f(-1)$ and $f(-2)$.

Q 4) In gnuplot, define a function

$$p(x)=\begin{cases} 4x \text{ for } x>0 \\ -2x \text{ for } -1<x\le 0 \\ 2x^2 \text{ for } x\le -1 \end{cases}$$

Plot the function $p(x)$ for x ranging from -2 to +2. The graph should have both axes and the key should be below the graph. Export the graph in png format.

Q 5) The speed of a body falling under rest from gravity, acted upon by an additional drag force of magnitude kv , is given by the expression.

$$v(t)=\frac{mg}{k}\left(1-e^{-mt/k}\right)$$

where m is the mass of the body, g is the acceleration due to gravity. Write a function in gnuplot to express this.(*Remember – in gnuplot the independent variable is always called* x *!*). Set g to the value 9.8, and m to a value of 1. Plot the velocity versus time variation for four different values, $k=0.8$, $k=0.7, k=0.6$ and $k=0.5$ in a single graph with t going from 0 to 8. The key should be placed above the graph, and each line in the key should be labelled by the "k=0.8" etc. Export the graph in png format.