Practical Programming Exam
Exercise 20 and question 11.3

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1 Question 3 from lecture 11

Suppose you run the command make main *and it fails with diagnostics*

```
cc          main.c          -o main
main.c:1:19: fatal error: gsl_sf.h: No such file or directory
compilation terminated.
```

Explain the error and how to correct it.

The error occur because the header in main.c is wrong. The headerfile is #include<gsl_sf.h> when it should be #include<gsl/gsl_sf.h>. The reason for haveing gsl/... is because the gsl library files are installed in their own directory called gsl.

2 Exercise 20 - Numeric Arctan

This exercise require to calculate arctan as $\arctan(x) = \int_0^x \frac{1}{x^2+1} \mathrm{d}x$.
My arctan is calculated as seen in the file `numArctan.c`. Here the integrand is defined in the function *arctanInteg* and is used in the *gsl_function* to be used in *gsl_integration_qag* routine. To simplify the calculation I have reduced the argument in the following ways:

1. if $x = 0$ return $\arctan(x) = 0$
2. if $x < 0$ return $-\arctan(-x)$
3. if $x > 1$ return $\frac{\pi}{2} - \arctan(\frac{1}{x})$

My solution together with math.h's atan function is plotted as seen in Figure 1.

3 Exercise 32 - Minimization

$$\mathrm{f}(x) = \frac{1}{2}(x^2 - \frac{1}{2}x) \tag{1}$$

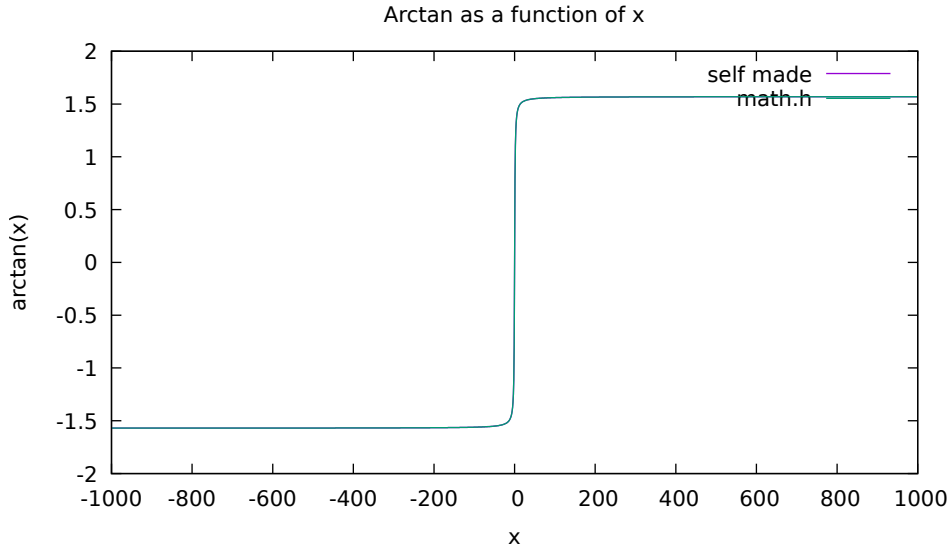

Figure 1: Self made arctan function plotted with math.h atan function. It can be seen that the two lines lie on top of each other.

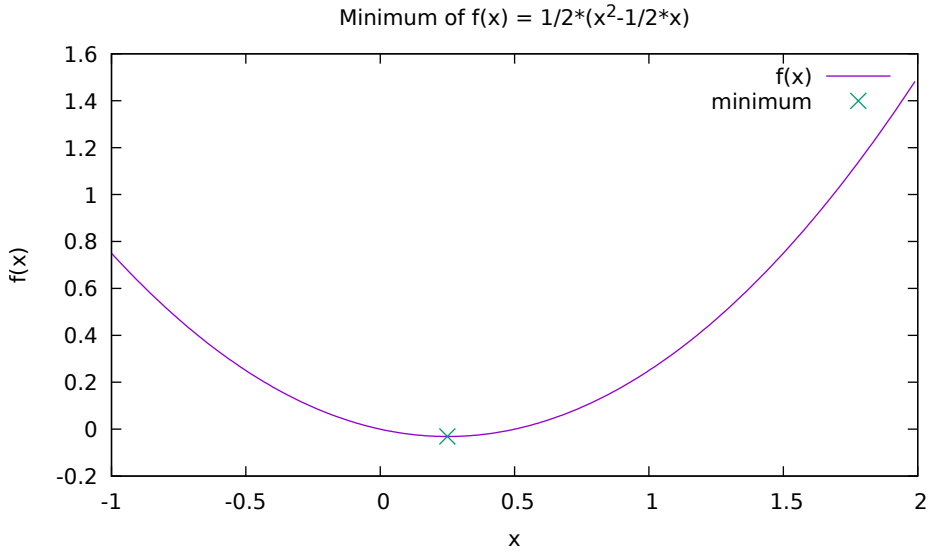

Figure 2: Plot of function (1) with a minima seen at $x = 0.25$.