**Newton Iteration**

Newton's method is a simple method for finding approximations of roots of non-linear real functions. The goal is to develop a generic framework for this that can be instantiated for particular functions and connecting it with Isabelle's existing packages for interval arithmetic and Taylor models.

Advisor: [Manuel Eberl](https://www21.in.tum.de/~eberlm)

20.10 Reading IIA until mid-chapter 6.

Review on proofs in other proof assistants

https://math.stackexchange.com/questions/2963302/finding-libraries-of-formalized-mathematics

21.10 Reading IIA until chapter 8. page 116.

Questions for meeting.

1. Do you know the proof archives of other systems? (connection with math.stack.exchange)

2. to develop a generic framework for this that can be instantiated for particular functions

2.1 this implies building an interval analysis framework (examples in Isabelle)

2.2 particular functions (given by Isabelle libraries)

2.3 and then proving theorems (essentially theorem and lemma 8.1)

**Mail Immler (18/10)**  
Resources for interval arithmetic:

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| theory Decision\_Procs.Approximation |
| <http://home.in.tum.de/~hoelzl/> |
| Proving Real-Valued Inequalities by Computation in Isabelle/HOL |
| Proving Inequalities over Reals with Computation in Isabelle/HOL |
| Introduction to Interval Analysis:  http://www-sbras.nsc.ru/interval/Library/InteBooks/IntroIntervAn.pdf |

Proposed directions:

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| 1. a one-dimensional (using the library) |
| 2. extend it to vectors and matrices (interval arithmetic library isn't really well developed, and  there might be some useful things in the Affine\_Arithmetic) |