

Example question

This question takes as its starting point the calculus material of MATH1010. The first three parts are standard module material, designed to get students going; the latter two are extension material that builds on the module material in a natural way. Students should think through this for themselves and then demonstrate their understanding.

The rubric would be based on the programme learning outcomes for the appropriate level, which include mentions of concepts and practical competencies, logical structure, comprehension, problem solving and written communication. Some of these factors would form the mark scheme.

Question

We may ask you to explain your answer in an interview, so make sure you present your own understanding; if you need to use a fact but cannot explain why the fact itself is true, you can quote the fact itself with a reference.

Note that the clarity of your written communication, which is a learning outcome of your programme, will form a part of the marking.

Root-finding

- i. Using an example of your own devising, explain the meaning of the Intermediate Value Theorem.
- ii. Apply the Intermediate Value Theorem to explain why a root for $x \exp x = 2$ exists somewhere between $x = 0$ and $x = 1$.
- iii. Using the Intermediate Value Theorem and interval bisection, find the solution to $x \exp x = 2$, to 3 decimal places.
- iv. *Newton's method* uses the first derivative to compute numerical solutions to equations; you can read about it at <https://www.math.ubc.ca/~anstee/math104/newtonmethod.pdf>. In your own words, write an explanation of how to apply the method to a given equation.
- v. Apply Newton's method to the equation in part iii, to find the solution, again to 3 decimal places. Compare your calculation with the earlier one in terms of speed of getting to the answer.