EE/RPPF

For first assessment in 2018

International Baccalaureate®
Baccalauréat International
Bachillerato Internacional

Candidate personal code:

Extended essay - Reflections on planning and progress form

Candidate: *This form is to be completed by the candidate during the course and completion of their EE. This document records reflections on your planning and progress, and the nature of your discussions with your supervisor. You must undertake three formal reflection sessions with your supervisor: The first formal reflection session should focus on your initial ideas and how you plan to undertake your research; the interim reflection session is once a significant amount of your research has been completed, and the final session will be in the form of a viva voce once you have completed and handed in your EE. This document acts as a record in supporting the authenticity of your work. The three reflections combined must amount to no more than 500 words.*

The completion of this form is a mandatory requirement of the EE for first assessment May 2018. It must be submitted together with the completed EE for assessment under Criterion E.

Supervisor: *You must have three reflection sessions with each candidate, one early on in the process, an interim meeting and then the final viva voce. Other check-in sessions are permitted but do not need to be recorded on this sheet. After each reflection session candidates must record their reflections and as the supervisor you must sign and date this form.*

First reflection session

Candidate comments:

As an astronomy enthusiast, I wanted to write my EE on spherical geometry. However, while conducting preliminary research, the use of great circles as equivalents of straight lines in spherical geometry intrigued me. Researching this, I discovered “geodesics” and it made me wonder if it could be mathematically proven that a straight line is a geodesic on a plane. This led me to the Euler-Lagrange Equation, which I had previously encountered in Physics. Surprised, I went into my first interaction curious about these connections between geometry, calculus, and physics. Knowing that I wanted to explore “geodesics” and having an idea of its difficulty level helped me decide the research question, “What is the shortest distance between two points on Earth?” I chose Earth as it is an oblate spheroid, and I hope to develop from planes to spheres to spheroids in my essay. One goal I have is to emphasise intuition.

Date: July 2021

Supervisor initials:

Interim reflection

Candidate comments:

During my research, I felt that intuition behind the final Euler-Lagrange Equation was lost in the standard derivation employed in most Calculus of Variations textbooks. So, I sought other derivations with deeper insights. I eventually discovered elegant alternatives in an introductory textbook and a blog. While researching, I studied the notations and conventions employed in mathematical writing. For example, noting how discrete values are represented with a subscript helped me plan diagrams to communicate the derivation more visually and intuitively.
The integral for the sphere geodesic was especially challenging. Even online solvers could not solve it analytically. I started listing and ruling out methods and soon discovered I could solve them through successive trigonometric and linear substitutions. Afterwards, I was unable to obtain expressions for the constants. After weeks of unsuccessful attempts, I consulted my supervisor and decided to proceed as not finding these expressions would not hamper the development of ideas in my essay. Instead, I took the opportunity to approach the constants from a visual perspective. I learnt to use Wolfram Cloud to graph solutions for different values of the constants and to figure out how they affect the solutions.

Date: September 2021 Supervisor initials:

Final reflection - Viva voce

Candidate comments:

The geodesic problem of the ellipsoid was significantly more complicated. It involved reducing the problem to an auxiliary sphere and then transforming the solution back to the ellipsoid. Though I managed to explore it, it wasn't possible to fit into the EE's word limit. Consequently, I altered my research question and concluded my EE with the shortest path on the sphere. Nonetheless, I will certainly revisit it in the future.
This EE has given me the opportunity to explore concepts I have always wanted to. Ideas like the definition of "straightness" made me realise how abstract mathematics can get. I have gained an appreciation for mathematics communicators and how clearly ideas even in my IB mathematics textbook are developed. I also learned LaTeX, which I will definitely continue using. Nonetheless, in the future, I would document my research on paper first before typing it out on LaTeX as it's much easier to write mathematics than type it.

Date: January 2022 Supervisor initials:

Supervisor comments: