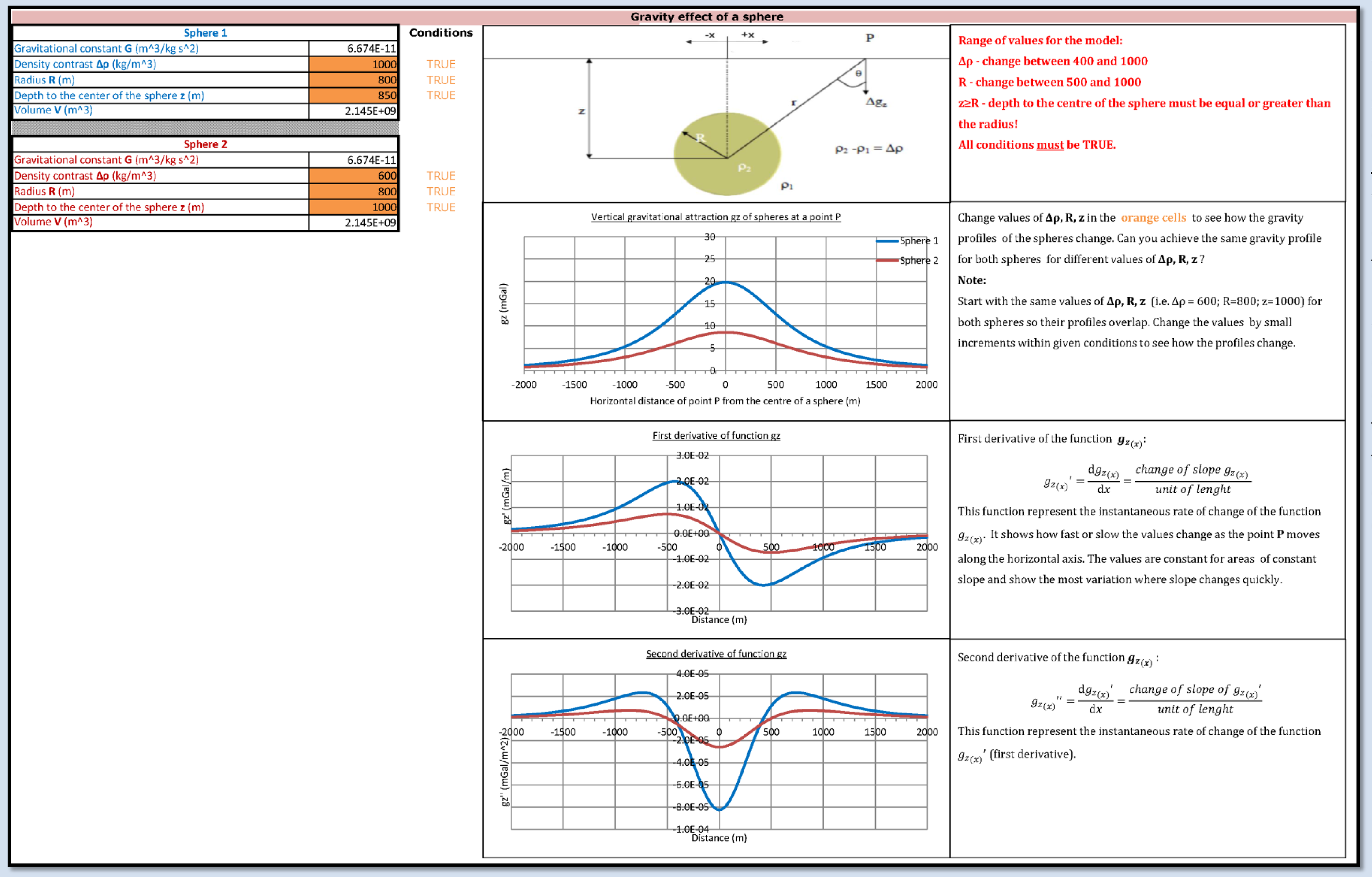
QAA Enhancement Theme – Introduction to Mathematical Concepts in Geophysics

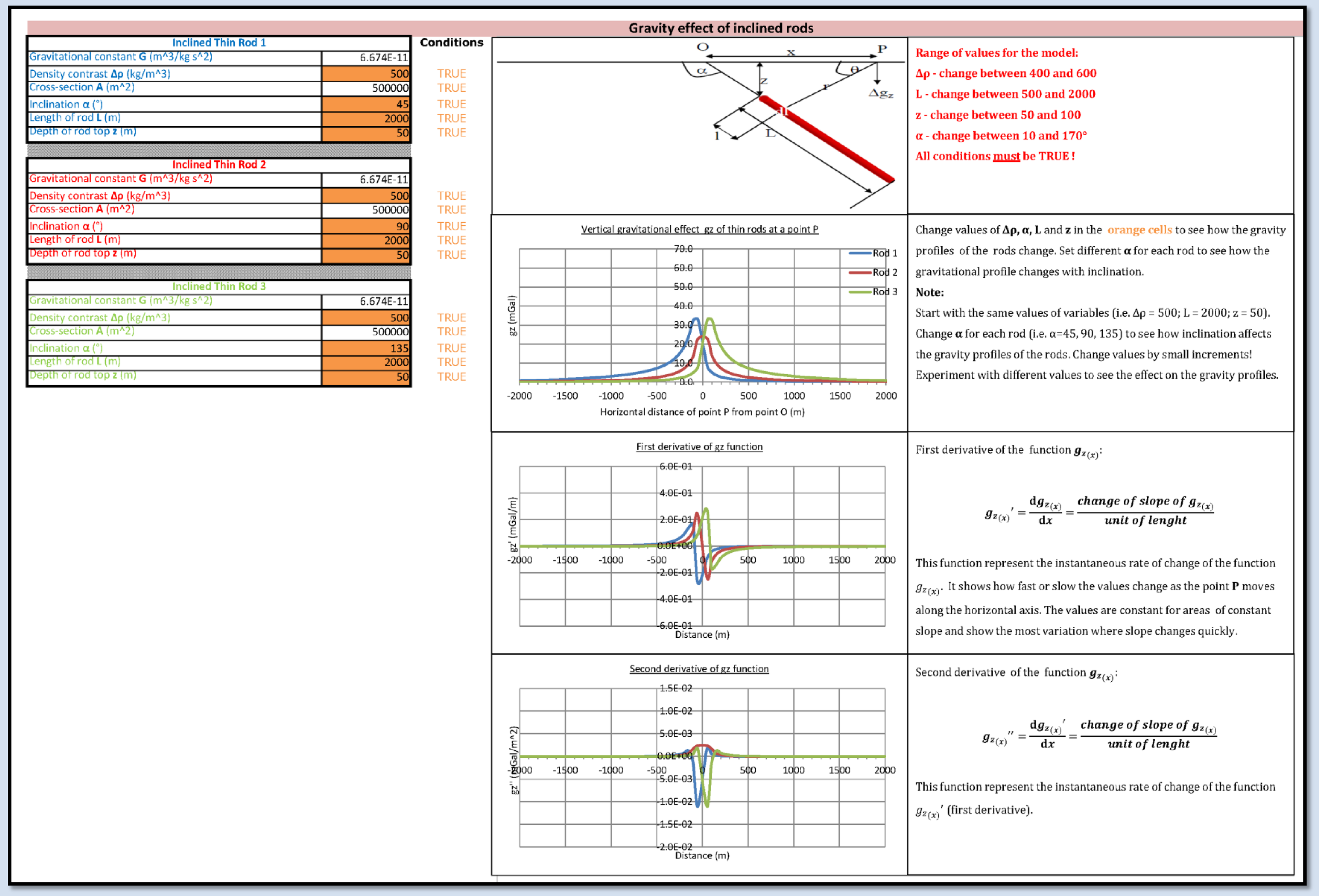
Introduction

We teach GL2511 “Introduction to Geophysics” to Level 2 Geology students, many of whom have a poor to non-existent background in basic mathematics and physics. Nevertheless, we find it imperative that some understanding of the mathematical formulation of principles essential to geophysics be achieved in this course. This is a major challenge for some students. Many students do not have the tools for us to get the message across of how mathematics can be used to formulate a problem with a solution that provides (geo)physical insights. We think that with an opportunity to refresh skills in basic mathematics many students will derive a much enhanced appreciation of the geophysical materials covered in lectures and exercises. In some cases we even expect that the recognition of the simple elegance of some of the geophysical concepts as applied could stimulate some students to adopt a more quantitative approach in their future geological studies. Ad hoc feedback from students in this year’s cohort suggests that there is an interest and willingness among them to engage in web-based learning modules designed specifically around course materials were these available.



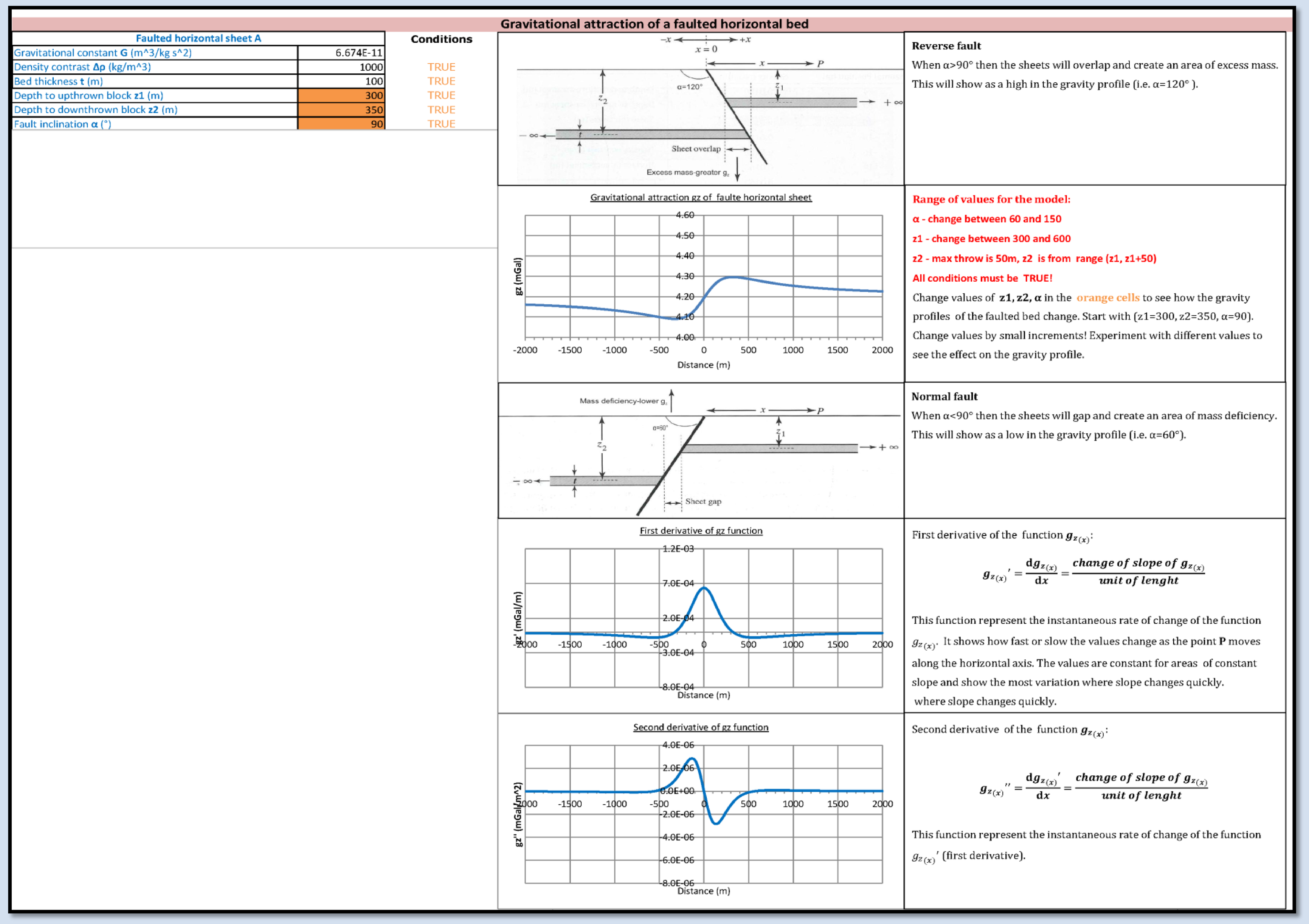
Discussion

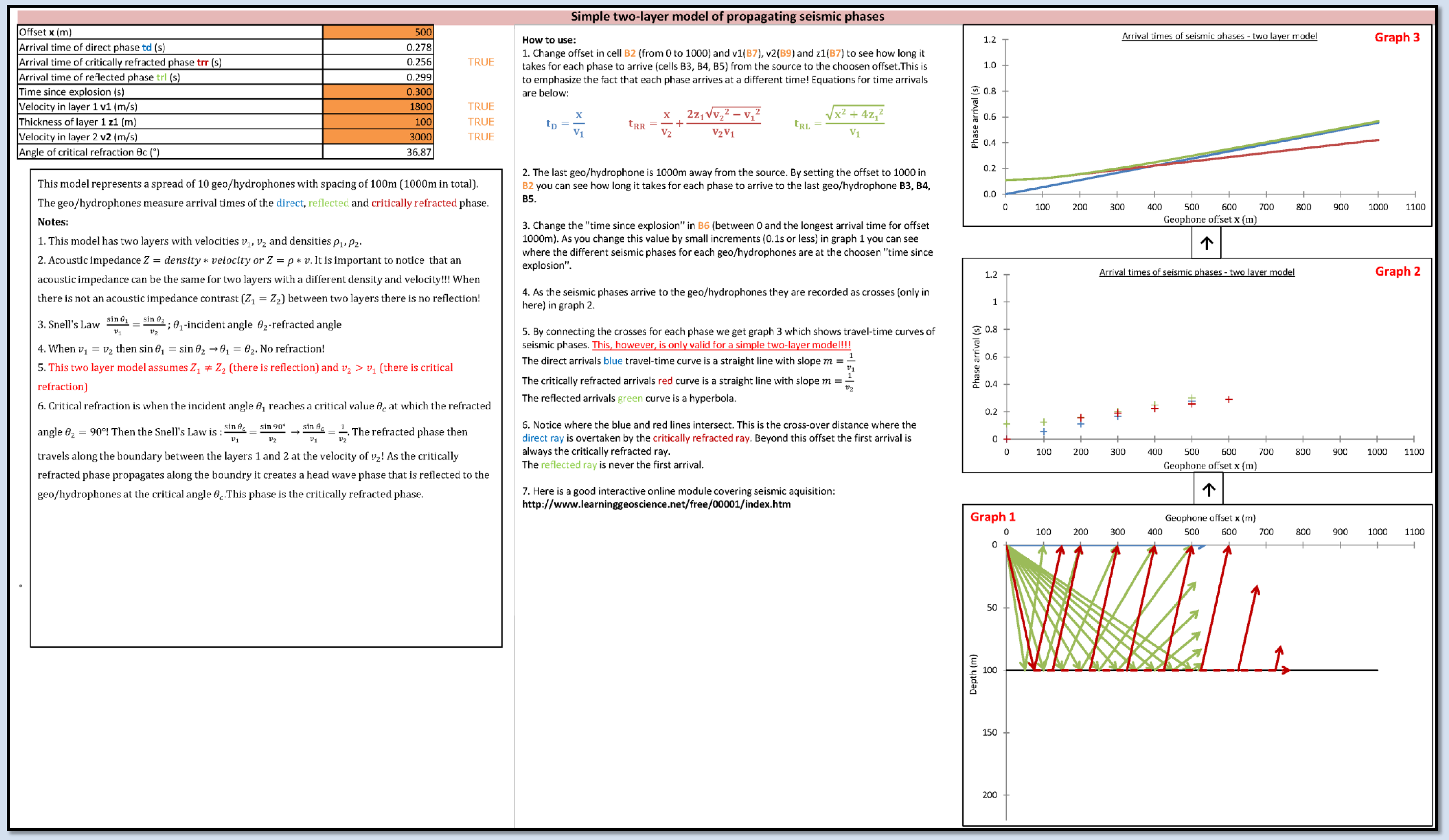
We will carry out a baseline survey/assessment of our students at the outset of the GL2511 course (which begins in January 2014), the development of which will be part of the project, and again at the end of the course (May 2014). Over a longer term, we expect that the enhanced mathematical skills of our Level 2 students will be evident in most (geology) courses delivered in levels 3 and 4 and we will establish a mechanism within those courses to track performance in selected modules in them as next year’s (2013-2014) Level 2 cohort progresses through them, as compared with results mined from course records in academic years 2011-2012, 2012-2013 and 2013-2014.



Aims and Objectives

We envision a set of MyAberdeen-based, self-learning Excel modules for our students to access, covering some elementary mathematical concepts and applications, corresponding with the material being dealt with in the course. These would comprise simple, illustrated (mainly graphs) exercises, with drag and drop answers (or otherwise, as appropriate), with prompts and customised feedback as “leading questions” for incorrect answers. Topics to be covered (and relevant course topics) include (i) trigonometric functions and simple planar geometry (seismic ray-paths in the Earth); (ii) 1-D functions, equations of lines and curves, pla(seismic phase travel-time curves); (iii) basics of differentiation and integration; derivatives and second derivatives of simple functions in 1-D.





Projects Outcomes

Initially, we will compile statistical information on student participation, augmented by (non-assessed) online quizzes. The eventual outcome, which will be driven by the success of the project as based on initial feedback, will be to streamline and iteratively enhance the presentation of the quantitative geophysical and continuum mechanics course materials, providing a more rounded theoretical basis for those materials and, accordingly, an enhanced understanding of their usefulness and general applicability. We expect that enhanced modal skill level of our students will propagate into subsequent teaching years in geology.
The course in 2013-2014 will have some 100+ students; we expect that the vast majority of these will make use of the enhancement if available.

Project timeline

The main work will be undertaken in the summer of 2013 and the new materials are to be ready for use and evaluation with the commencement of the second term in 2013-2014 academic year.