



### Dr Seibu Mary Jacob

Senior Lecturer in Engineering  
Mathematics  
s.jacob@tees.ac.uk



Used my (Apple) iPad for note taking and accessing worksheets. The Desmos app was useful for plotting graphs to help understand mathematical problems.

1st Year Engineering student

## Engineering Mathematics Classroom - Teaching using Desmos Software

Engineering Mathematics (ENG 1005-N) is a core first year module for all first year Engineering students. The cohort is usually large consisting of about 200 students. The module deals with the concepts of functions and calculus to help seal the foundations for the engineering modules.

The module is taught using lectures and tutorial sessions in GPT rooms and typically includes demonstration of mathematical problems on the white board or using the visualiser. This was accompanied by the students trying out tutorial exercises on paper.

Graphing functions and analysing them is a crucial aspect involved in the journey of the student learning, but this was hampered due to the lack of lab facilities available for a cohort of this size. Hence the students did not have ready access to a graphing software during the regular lecture/tutorial sessions.

This of course posed a limitation to the learning experience especially in terms of analysis within the restricted class time.

### Approach

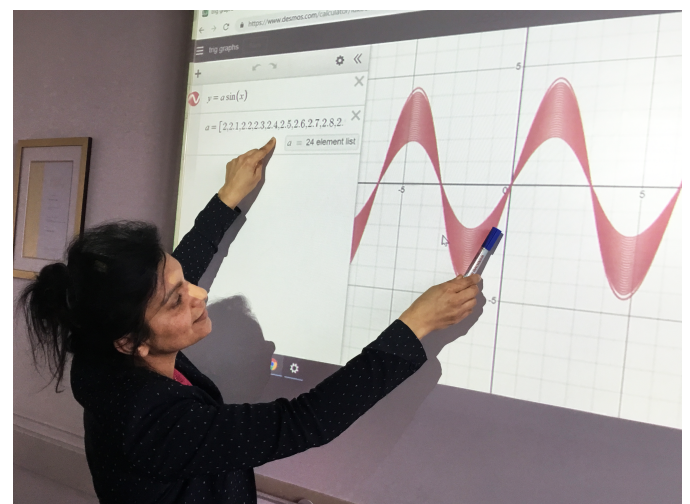
Desmos, is a free web based graphical calculator, available from <https://www.desmos.com/>. This has been explored in the previous years and sampled out on mobile phones but was deterred by the limited screen size.

With the introduction of Future Facing Learning, all first-year students receive an Apple iPad thus the idea of using a graphical calculator became easily accessible through the digital device in the student's hands.

Ideally, students should be able to view the graphs and apply the features with the graphing tool to analyse and experiment the output. The Apple iPads, on the other hand, made this vision of accessing a ready to use mathematical tool achievable in a normal GPT room.

During a typical activity I would demonstrate an example and ask students to plot the relevant graph to come up with analysis or interpretation of the scenario. Students access Desmos using a browser or the Desmos app on their Apple iPads, then plot it to view the shape and generic details. Then they embed/ copy the graph into their Microsoft OneNote Notebook.

Then the students and I together bring out the analysis quickly without needing to spend lots of time in graphing. Also, the solution of certain equations and generation of tables could easily be done using the Desmos calculator.



## Outcome

In short, the students were able to gain much more time to analyse the various perspectives, methods and solutions of practical problems very quickly thus boosting their analysis and synthesis skills.

The easy access and use of Desmos made the lectures very interactive and student focussed, with formative feedback on graphing and analysing functions naturally embedded into the regular sessions.

The time gained for deeper learning of the mathematical aspects made it interesting and engaging with better 'takeaways' from the learning session. In fact, the use of device enabled every student to have equal opportunity to explore the problem-solving aspects of the topics especially the complex problems, visually and analytically.

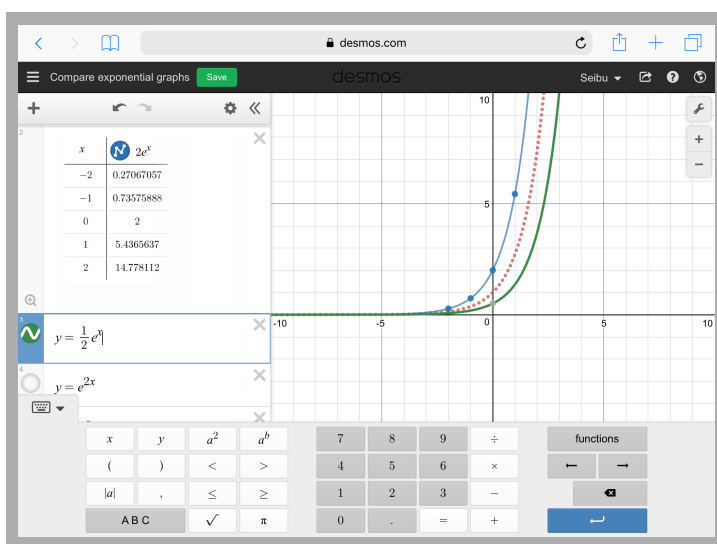
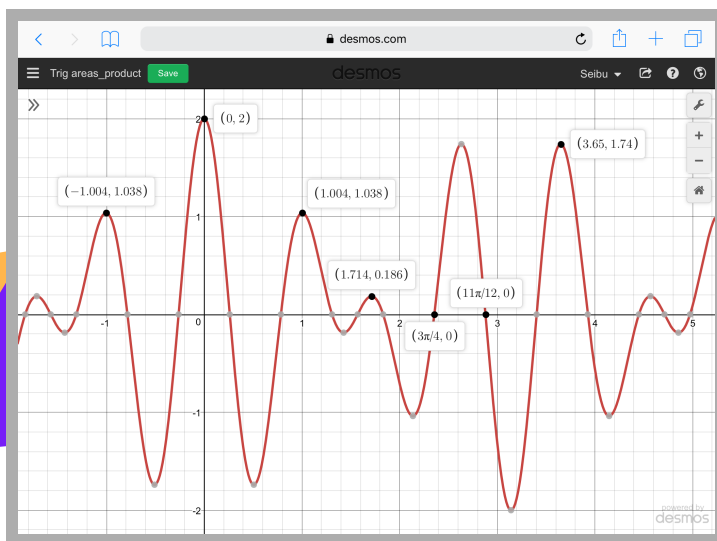
The usage of Desmos on the Apple iPads offer a pragmatic and sustainable framework to embed digital technology into the Mathematics classroom in a coherent and comfortable manner, thus making technology integration an effortless pedagogy in the day-to-day teaching.

The following are the key gains out of the activity:

- Time gained owing to the easy access to Desmos on the device
- Deeper learning and interest ensued through the interactive learning
- Opportunity for formative feedback achievable during lectures and tutorials through conversations/discussions through visual learning
- Equal opportunity afforded by every student in terms of access and usage of a valuable mathematical tool
- Easy capture of graphs into the student note through the usage of Microsoft OneNote enabled personal documentation of students' learning into a digital form

“ Felt using an (Apple) iPad was an invaluable asset throughout the module.

1st Year Engineering student



Screen shots of the Desmos graphical calculator in use

## Challenges & Next Steps

There was a clear challenge to embed the device as part of the learning culture in a maths classroom. Some students were quite forgetful in bringing the device to lectures since they were not actively using it in other modules / sessions. The perspective of maths being a set of problems done by pen and paper needed to be addressed by incorporating visual and dynamic learning styles in the learning process.

At present, the usage of Desmos was limited to the lecture slides or presentation during the learning session. But now, I am inspired to explore ways to incorporate the use Desmos more effectively in collaboration with Microsoft OneNote and Teams in my future modules / learning sessions.