



THE UNIVERSITY  
OF QUEENSLAND  
AUSTRALIA

CREATE CHANGE

# Blended learning in a large first year mathematics course

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The University of Queensland

First Year in Mathematics Workshop 8

Melbourne, 12<sup>th</sup> July 2019

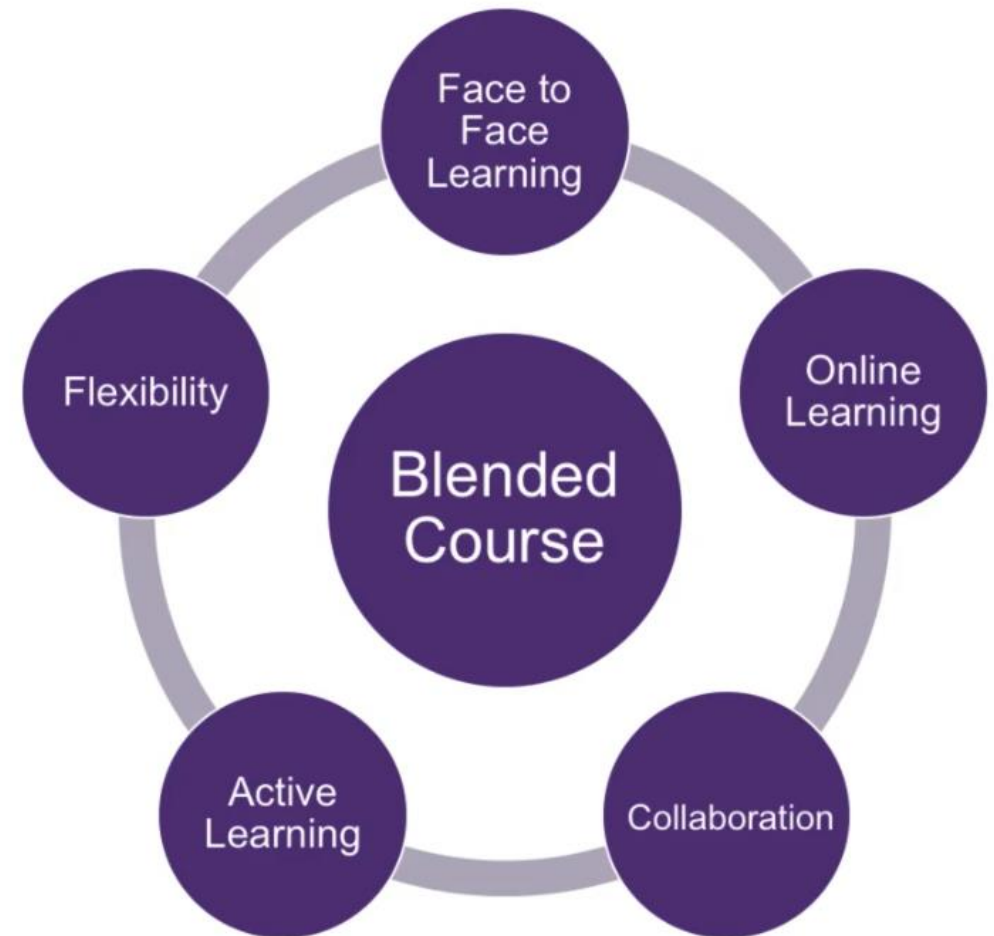
# UQ2U

- AIM: to redevelop UQ courses to deliver *more flexibility* and greater *active learning experiences*.
- The program began in 2018 with UQ's largest courses.
- “The online learning component provides students with the flexibility to learn at their own pace and in ways that suit their personal circumstances. On-line learning is focused on providing critical content without compromising on learning outcomes. Importantly, online modules are designed to be interactive and engaging, enabling both learning and collaboration across the course cohort.”
- “Active on-campus learning focuses on maximising face-to-face collaborative learning that is engaging, practical, and provides students with incremental feedback as they progress through the course.”

# Key Components of a Blended Learning Course

Blended learning is the thoughtful fusion of face-to-face and online learning experiences [Garrison & Vaughn, 2008 ].

Garrison, D., & Vaughan, N. (2008). Blended learning in higher education : Framework, principles, and guidelines (1st ed., Jossey-Bass higher and adult education series). San Francisco: Jossey-Bass.



# MATH1051: Calculus & Linear Algebra I

- First uni level maths course
- Provides the foundation in calculus & linear algebra for higher level maths courses.
- Services more than 45 different programs at UQ
- 70% engineers, 20% Science and 10 % others
- Sem 1: 900-1000 students; Sem 2: 600 – 700; Summer: 100
- High Failure rate ☹️

# MATH1051

## CALCULUS AND LINEAR ALGEBRA I

Semester 1, 2018  
Lecture Workbook

### How to use this workbook

This book should be taken to lectures, tutorials and lab sessions. There are exercises, definitions and examples in the workbook for you to fill in. These will be covered in lectures, and you should write down all the information given.

The completed workbook will act as a study guide to assist you in working through assignments and preparing for the the mid-semester and final exams. For this reason, it is very important to attend lectures.

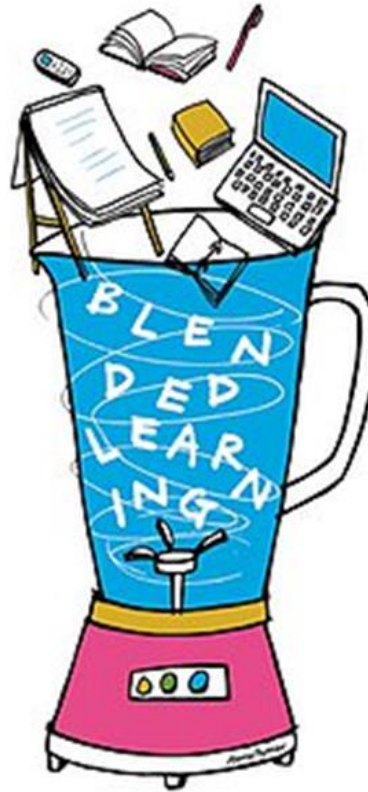
The text for the calculus part of the course is *Calculus* (8th edition) by James Stewart. We often refer to the text in this workbook, and many of the definitions, theorems, and examples come from the text. There is no set text for the linear algebra part of the course. *Elementary Linear Algebra* (11th edition) by Howard Anton covers the material well.

For further information about the course, please go to *Blackboard* at

<http://blackboard.elearning.uq.edu.au>

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Edited by Joseph Grotowski, Phil Isaac, Michael Jennings, Birgit Loch, Victor Scharaschkin, Mary Waterhouse, Poh Wah Hillock, 2018.

# Ma<sup>√</sup>th1051



Chapter 1: Complex Numbers



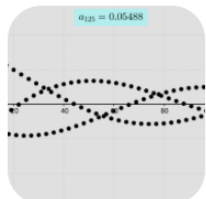
Chapter 2: Functions



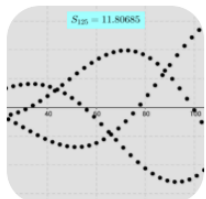
Chapter 3: Sequences



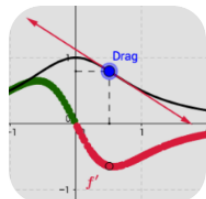
Chapter 4: Limits (Part I)



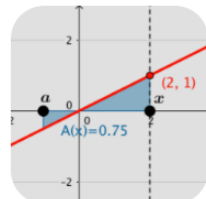
Sequences



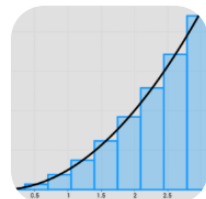
Series



Derivative



Fundamental  
Theorem of  
Calculus



Riemann sums

WBp108 (13:04)

$$\int \frac{1}{x^2+4} dx$$

Recall that  $\int \frac{1}{1+u^2} dx = \arctan u + c$

$$\int \frac{1}{x^2+4} dx = \int \frac{1}{4(1+\frac{x^2}{4})} dx$$

$$= \frac{1}{4} \int \frac{1}{1+(\frac{x}{2})^2} dx$$

Let  $u = \frac{x}{2}$

$$\frac{du}{dx} = \frac{1}{2} \Rightarrow dx = 2 du$$

$$\int \frac{1}{1+(\frac{x}{2})^2} dx = \int \frac{1}{1+u^2} 2 du$$

$$= 2 \int \frac{1}{1+u^2} du$$

$$= 2 \arctan(u) + C$$

$$= 2 \arctan\left(\frac{x}{2}\right) + C$$

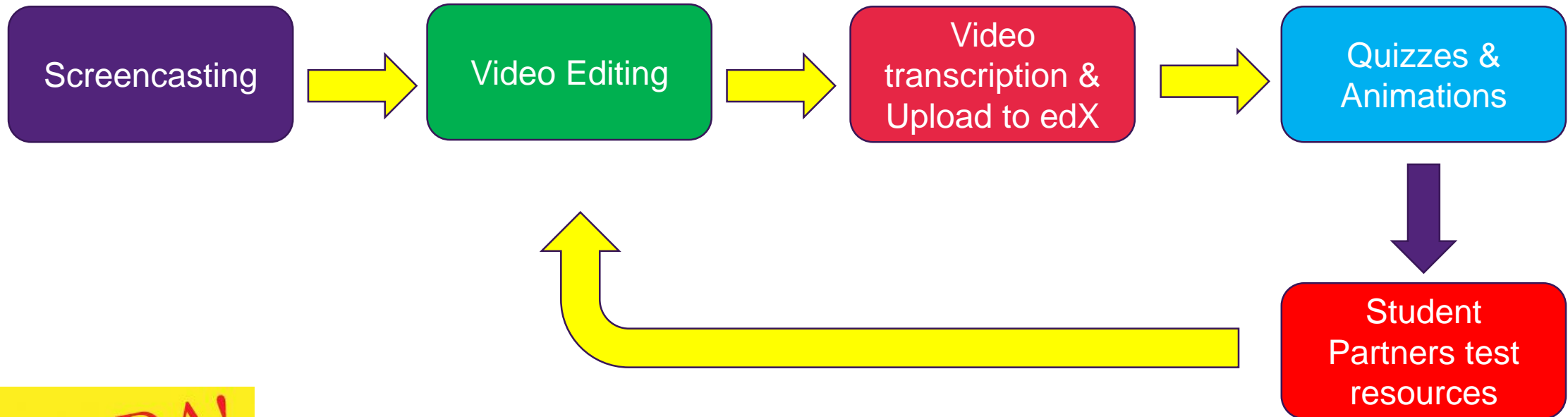
$$\int \frac{1}{x^2+4} dx = \frac{1}{4} \left( 2 \arctan\left(\frac{x}{2}\right) \right) + C$$

$$= \frac{1}{2} \arctan\left(\frac{x}{2}\right) + C$$

# MATH1051 UQ2U Journey

- Feb 2018: Initial Discussions with ITALI
- Mar 2018: Played around with various screencasting software: Kaltura capture space, screencast-o-matic, officemix; We went with Officemix (desktop recording). Decommissioned in May 2018 but still working on my computer! 😊
- April 2018: Made first sample video! Yay!
- May 2018: Sample module (video + quiz + animation) on edge.edX
- June to Dec 2018: More of the same!
- Nov 2018: Officemix mysteriously disappeared! Used Kaltura Capturespace.
- 12/12/18: Completed final video!!
- Jan 2019: Ready to go!

# UQ2U: creating videos



[MATH1051 Edge.edx](https://math1051.uq.edu.au)

# Implementation in Semester 1, 2019

## Old

- 3 f2f lectures:
  - 2 f2f Streams. By week 3, both streams could be accommodated in one lecture theatre.
- 1-hour tutorial
- 1-hour Matlab session

## New

- Lectures:
  - ✓ f2f lecture stream or online stream (edge.edx)
  - ✓ f2f stream: 1 main lecture stream and 1 overflow stream; overflow stream closed after week 3.
- 2-hour workshops
- 1-hour Matlab session



# Math 1051 F2F Lectures

- Flipped lectures in the first few weeks.
  - Students were overwhelmed.
  - Lectures were back to back
  - Students who chose the F2F stream wanted the “traditional” lectures
- Half-flipped lectures
  - Flipped revision topics (e.g. Numbers, Functions, Vectors & Matrices)
  - “Traditional” for the rest of the chapters
  - Edge.edx videos were useful for optional content as well as for catch up purposes (public holiday lectures).
  - Active learning tools: UQPoll & UQ wordcloud

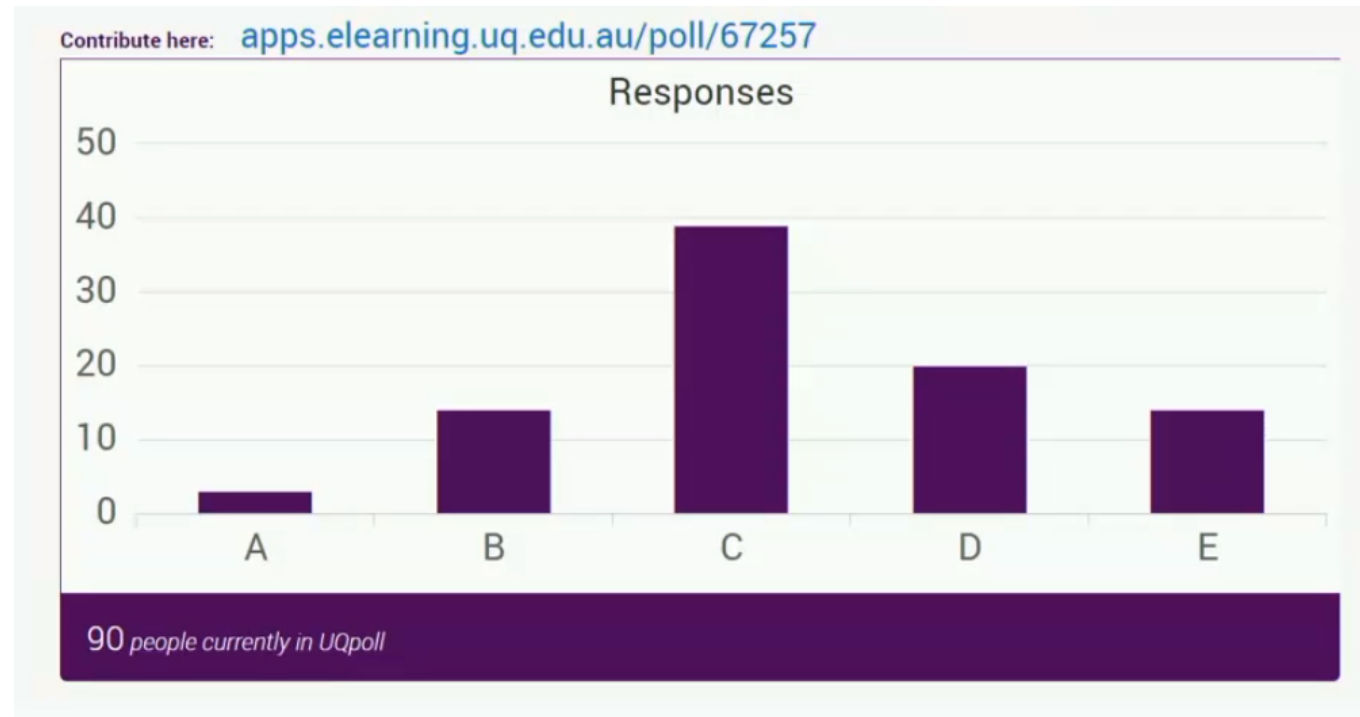
Wgfn1021

Math 1021

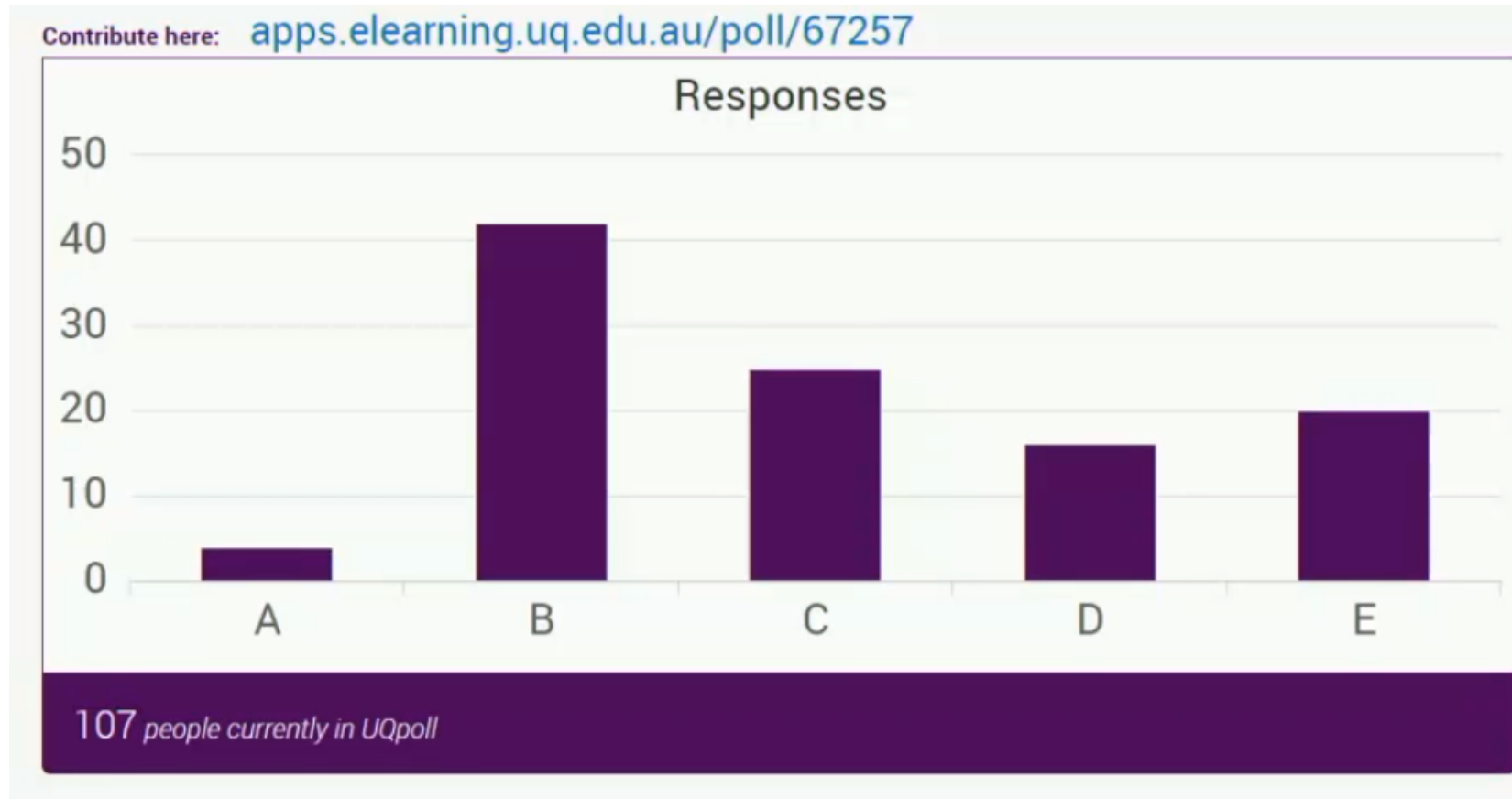
## 6.8 MVT

The Mean Value Theorem guarantees the existence of a special point on the graph of  $y = \sqrt{x}$  between  $(0,0)$  and  $(4,2)$ . What are the coordinates of this point?

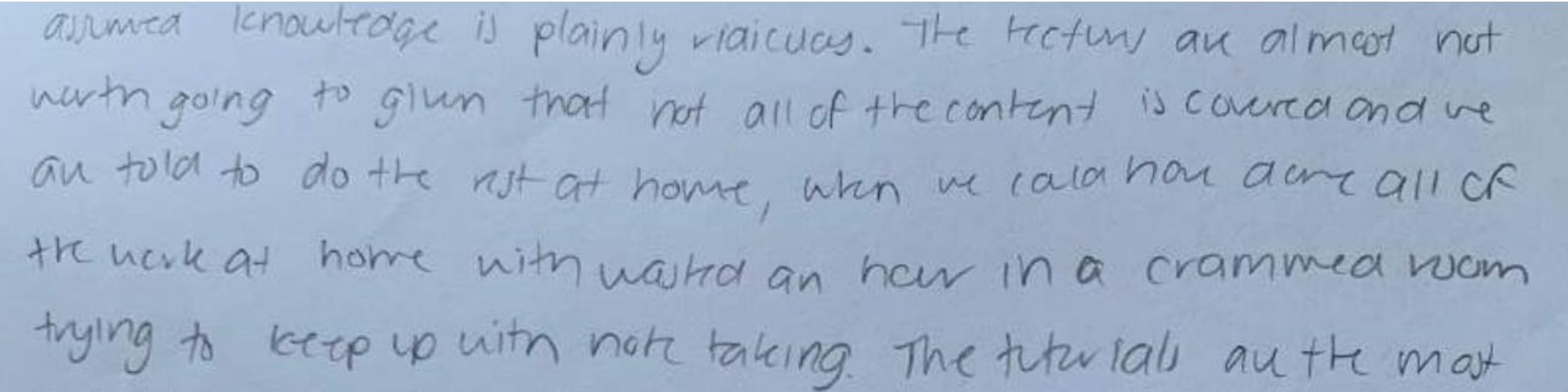
- (A)  $(2,1)$
- (B)  $(1,1)$
- (C)  $(2, \sqrt{2})$
- (D)  $(\frac{1}{2}, \frac{1}{\sqrt{2}})$
- (E) None of the above



# After explanation of MVT



# Managing expectations



assumed knowledge is plainly ridiculous. The lectures are almost not worth going to given that not all of the content is covered and we are told to do the rest at home, when we could have done all of the work at home with wasted an hour in a crammed room trying to keep up with note taking. The tutorials are the most

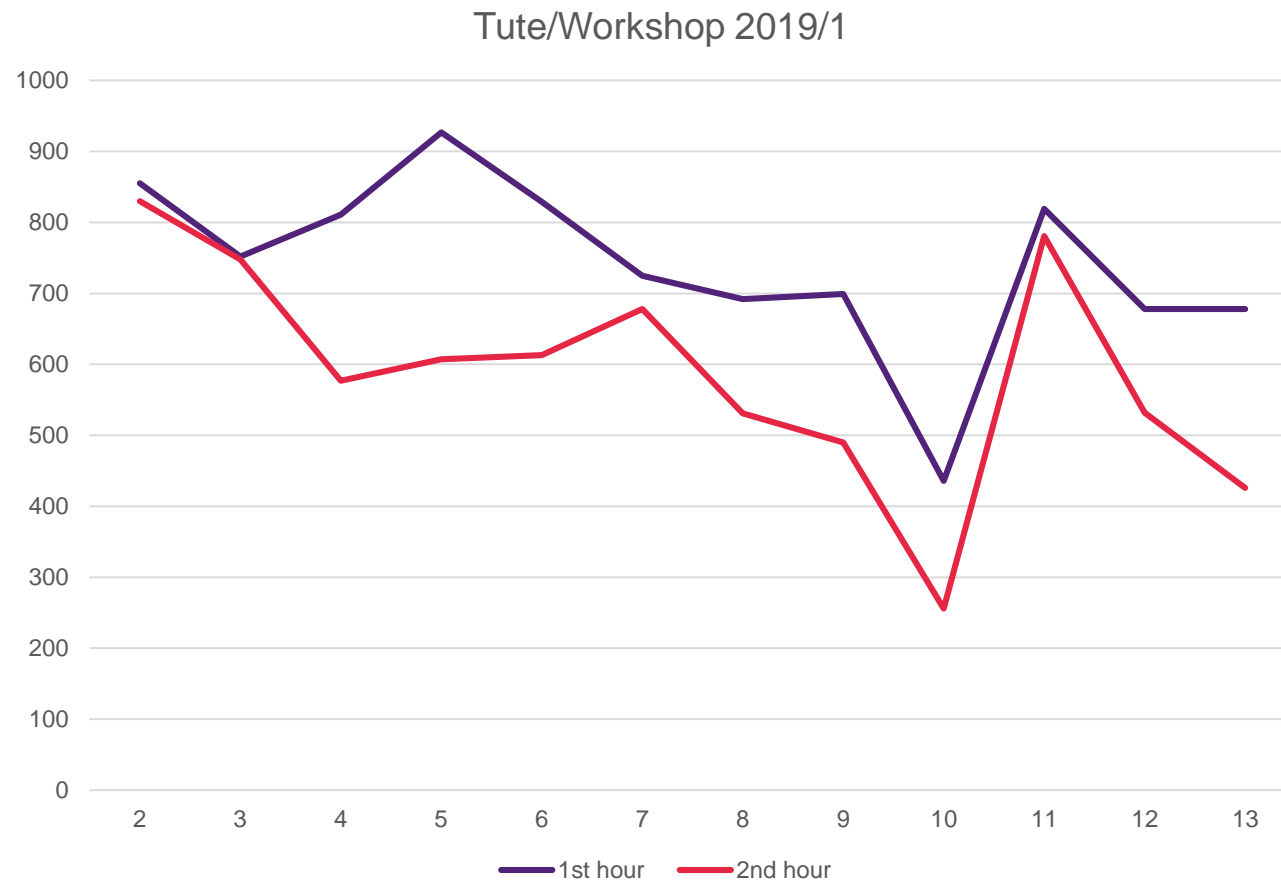
*I like the edge.edx format of teaching as this means I can do pre-study before each lecture. I feel like lectures are more wisely used when we get example and practice questions which may ultimately be similar to exam questions. Filling in the workbook during lectures (in my opinion) is not really an efficient way of using the time.*

# Workshops

- 2-hr Collaborative workshops
- Structured:
  - ✓ 1st hour: Short tutor-led discussion of tute sheet, students discuss tute sheet; short quiz or a collaborative worksheet.
  - ✓ 2<sup>nd</sup> hour: Help with assessments e.g. assignment help, exam preparation.
- Students DO maths!!



# Workshop Attendance



1<sup>st</sup> Hour average = 80%  
 2<sup>nd</sup> hour average = 64%

Week 10: Labour Day Holiday  
 Week 5 and Week 11: Class Quiz

# Workshop Feedback

Relaxed atmosphere

Knowledgeable tutors

Different ways of explaining maths from different tutors

Liked the structure, formal first – giving an overview, summary, then individual group work.

Worksheets encouraged collaboration & discussion.

Opportunities to meet other students taking the same course.

Assignment help was very much appreciated.

Weekly quizzes provide motivation to stay on top of coursework

Well structured and planned

Lots of additional help with assignment

One-on-one help

More efficient than other courses

Learn the most from workshops, an advantage over lectures

Similar to school format; gentle adjustment to uni

Study time and space

Whiteboard work not great.

Noisy

Classes too large; need more tutors

Had to wait a long time to get help. Students suggested queueing system.

Not all tutors were on board: lack of rapport due to large class size, waste of resources, tutors not doing much when lead tutor was explaining; new tutors not given opportunity to practice teaching skills.

Collaborative space made it difficult to see when tutor is working on whiteboard.

More groupwork would be great.

# Student comments on 2-hour workshop

*I love the workshop format. I failed this class last semester so I can compare to what it was. The two hour tutorial is wonderful..*

*As a student who briefly took this course over summer and can compare the format directly to the more traditional tutorial format, I have found it to be more useful & engaging. Having multiple tutors available, being able to collaborate with other students, and having more time specifically for assessments all have greatly improved my engagement and overall experience with course content.*

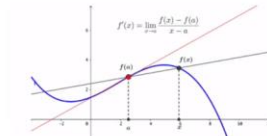
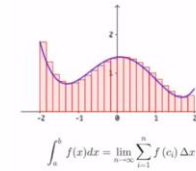
*Personally, I really enjoy the workshop format. I did a first year maths course at another uni, and comparing the workshop format to the standard tutorial, the difference is massive. I feel like I get the attention I need to succeed in the workshop format. I enjoy the sessions.*

*After already doing MATH1051 last semester, I can safely say that the tutorial/workshop format has greatly improved. I find my tutorial much more engaging and have more of an incentive to go with the weekly quizzes for bonus marks. I will definitely be continuing to attend them in the future.*

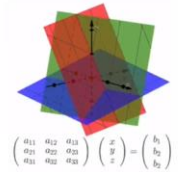




UQx: MATH1051  
Calculus & Linear Algebra I



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MATH1051  
Calculus & Linear Algebra I



Blackboard Survey (27/5/19, 146 responses)

1. I attend face-to-face lectures	3.41
2. I use the MATH1051 Edge.edX resources.	3.95
3. The MATH1051 edge.edx videos helped my learning.	4.43
4. The MATH1051 edge.edx quizzes and interactive animations helped my learning.	3.99
5. The MATH1051 edge.edx videos are easy to navigate.	4.42
6. What aspects of MATH1051 edge.edx helped your learning?	
7. MATH1051 edge.edx can be improved by .....	

## Q6: What aspects of MATH1051 edge.edx helped your learning?

*Much easier to navigate than lecture recordings; Can read ahead so students are not lost during the lectures; More precise explanation given in videos compared with lectures; Great for revision purposes; Consolidating f2f lectures; Visual; much better than reading a textbook; Learning twice (f2f & edge.edx); Practice questions after videos; It's accessibility is the best feature; Its a source of help and understanding without having to go to uni or email someone; Clarification if they missed something in lectures; A way of handling the large amount of content; Self paced learning; Manageable sized videos; More active than listening during lectures; More in depth than lectures; Catching up when there is a clash in class; Easier to keep up than in lectures; Catching up for late enrolments; Great for external students (ESP); I can get ahead; Balancing work & uni; Accessibility. Being able to choose when I want to learn has helped a lot. Adjust speed of videos!*

*... I'm a big fan of the online modules (edge.edx). I will never be able to learn from a lecture format with someone talking at me for an hour. This semester is so much better.*

## Q7: MATH1051 edge.edx can be improved by .....

*Want more challenging questions; Some issues with quizzes (blank questions & incorrect answers); More questions following videos; Written version of the video; Easier navigation of the platform. It would be nice to have a way to go to a specific video or quiz without having to go to the main page or skip through the sections. Maybe a menu on the side with all the chapters and quizzes? Exam style questions; Worked solutions; Better graphics; Better feedback instead of simply a cross or tick; Shorter videos; Whole section practice exam? A bit slow. Poh should speed up; Higher definition videos; Easier navigation for mobile phones*

# Online Discussion Forum

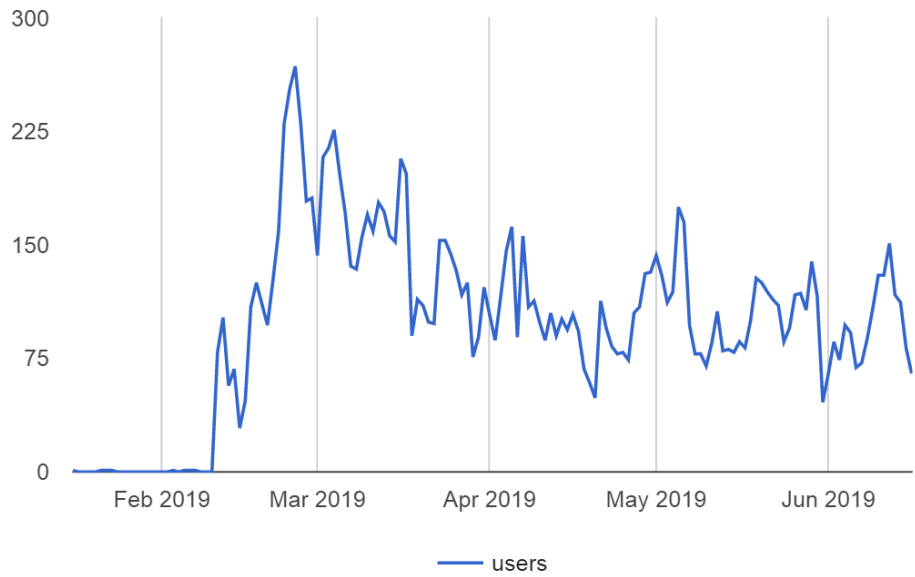


→ Delete

<input type="checkbox"/> Forum	Description	Total Posts	Unread Posts	Replies To Me	Total Participants
<input checked="" type="checkbox"/> <b>Main</b> ▾	General discussion for this course	24	24	0	12

→ Delete

Displaying 1 to 1 of 1 items | [Show All](#) [Edit Paging...](#)



## Class At A Glance

- 650** total posts \*
- 2293** total contributions \*\*
- 709** instructors' responses
- 313** students' responses
- 6 min** avg. response time



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# Thank you

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