working group 1:

calculus is here to stay !!! (too bad :-P)

dream team:

_____ , steve, kerri, sean, edward, nicola, shambhavi, andie

birs ubco: august 2022

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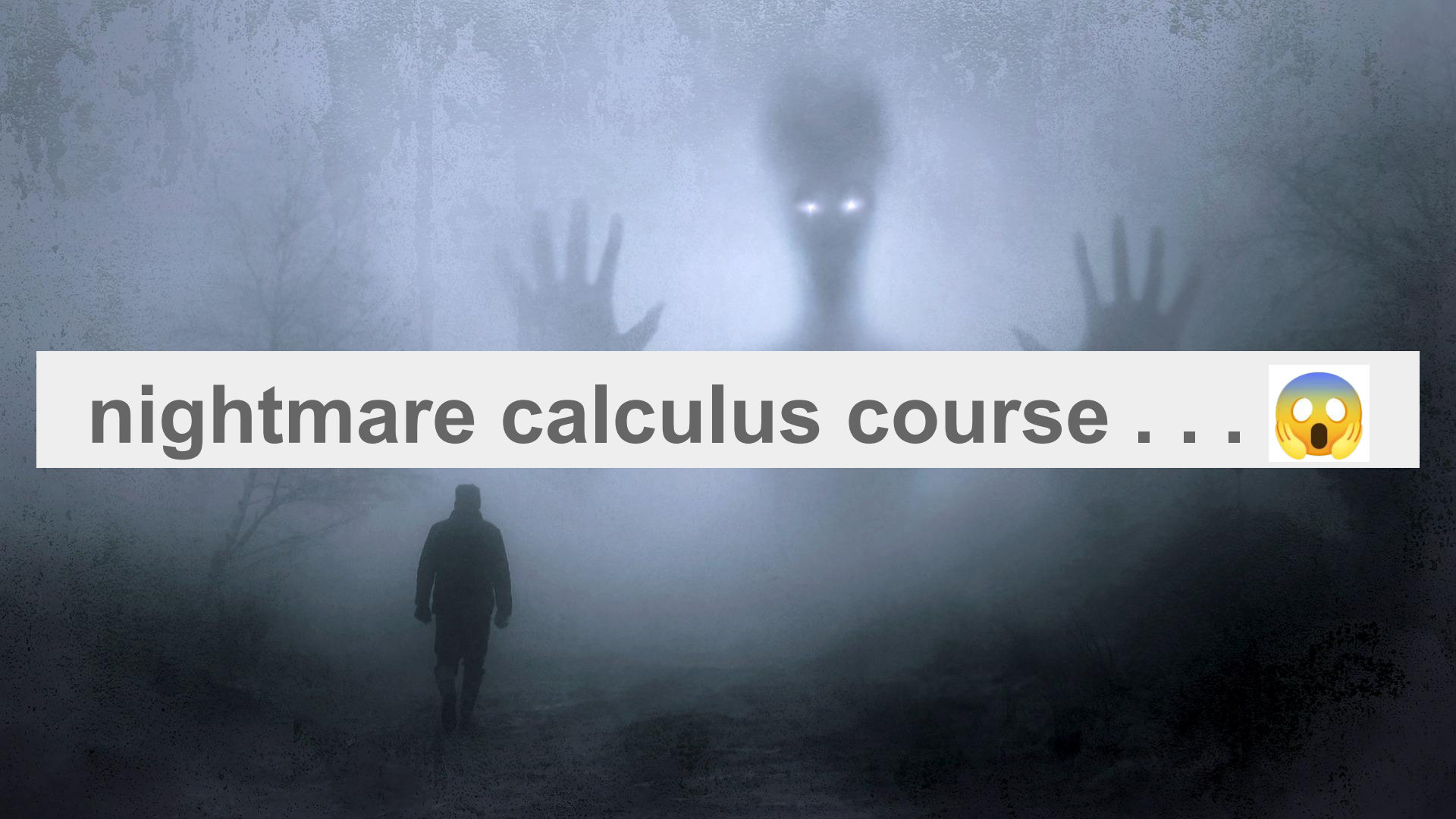
Nightmare
Course
Dream
Course
Hopeful
Realism


nightmare calculus course . . .

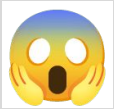
nightmare calculus course . . . 😱

- only privileged students have access to calculus

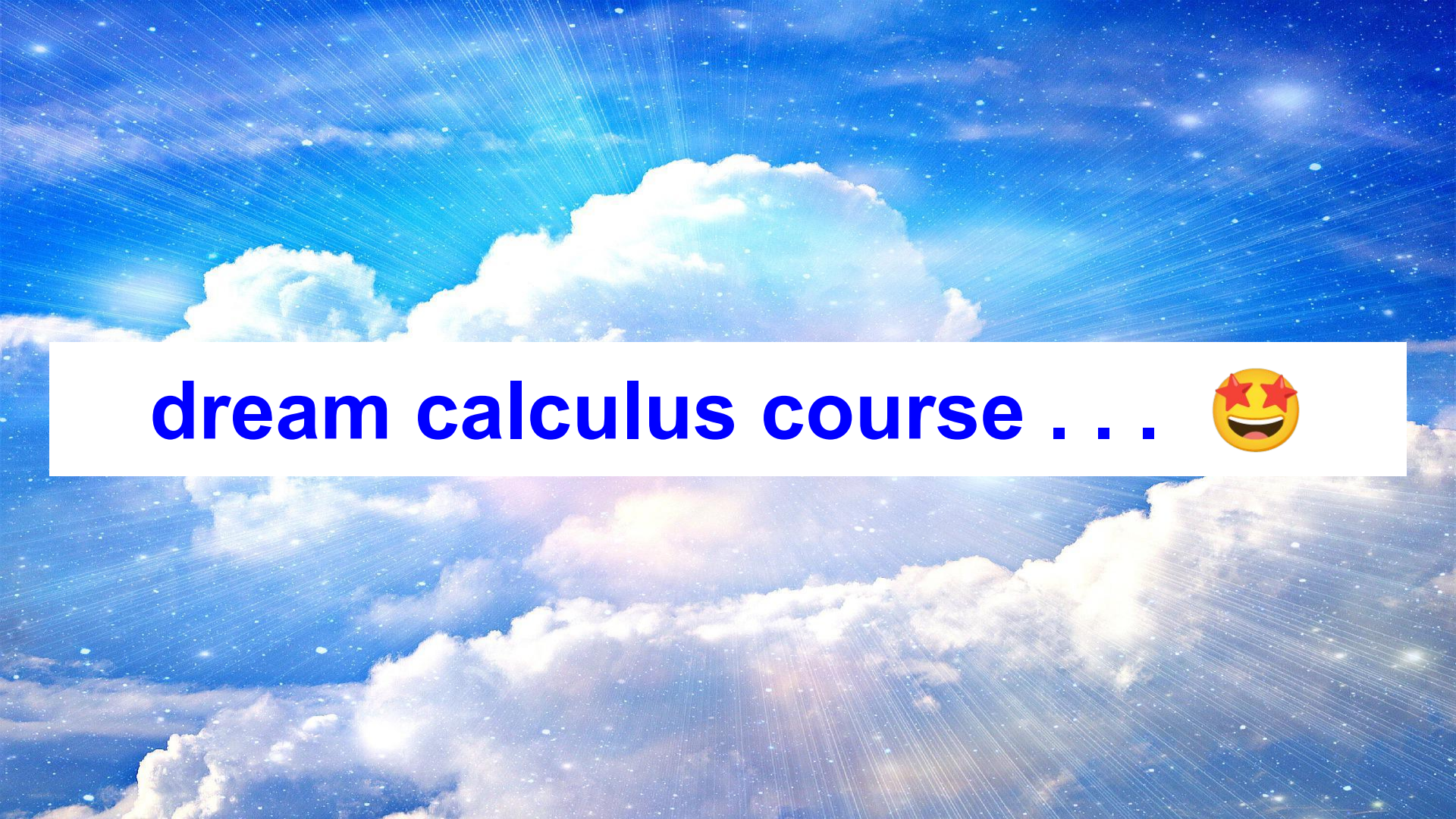
- 500+ students in the lecture and no tutorial/lab sections
- classrooms with limited technology, no TAs, multiple-choice exams

- course coordinator is a “*Dear Leader*”
- uncooperative & unprofessional colleagues

- the *status quo* remains

nightmare calculus course . . . 

- more content, less time
- assessment values *calculating* more than *understanding concepts*
- level of prior knowledge required for student success is disconnected from reality - with no opportunity to learn missing skills
- ***textbooks:***
  - $500 NFT textbook with $50+ weekly access fee for questions/answers
  - publishers get a cut whenever a student resells their used book
- majority of course focuses on different integration techniques
  (all of which *can* be done by technology but none of which *are* done by technology)
- ridiculously long algorithmic and computational problems done with no technology
  (looking at you, partial fraction decomposition)
- all problems done entirely by technology


dream calculus course . . .

dream calculus course . . .  *what?*

- ***students investigate and practice***
  - authentic applications
  - problem-solving and mathematical thinking
  - computational thinking with technology (e.g., Python for Newton's and Euler's method)
  - (mathematical) written and oral communication - and ethical thinking
- ***instructors***
  - interpret students ideas and perspectives
  - attend to issues of equity and inclusion in their teaching practice

- teaching happens at the speed of learning
- course coordination focuses on developing a *community of practice* (over curriculum and managing the teaching team/students/course dissemination)
- **not a gatekeeping course** – scaffolding and support for all students to succeed i.e., more supplemental instruction, co-course (same content, more time)

dream calculus course . . .  *who?*

- ***faculty:***
  - want and are excited to teach ***CALCULUS*** (especially BIRS participants here 😉)
  - pedagogical autonomy
- ***students:***
  - engaged, motivated, feel comfortable and welcome to participate
  - diverse backgrounds and diverse goals
  - help change/shape the course
- ***administrators:***
  - support innovation and seek faculty advice/opinions
- ***mutual trust:***
  - between instructors
  - between students
  - between instructors and students and administrators
- robust professional development for instructors and TAs

dream calculus course . . .  *how?*

- open source, free, well-written textbooks (i.e., Apex, Active Calculus)
- resources to implement practices supported by (accessible) education research
- recognize and appreciate the existence of technology (use it but not blindly!!!)
- small class sizes
- inclusive learning spaces that support student participation (where the technology actually works 😛)
- technology to create online/virtual experiences as good as in-person
- HAVE ACTUAL GOVERNMENT FUNDS FOR STEM EDUCATION
- reliable data to assess teaching and learning innovations

worst nightmare . . .

*No math course required for students in the **S** and **T** of STEM.*

- OR -

Each non-math discipline teaches their own version of a math course.

Mathematicians lose the privilege of teaching non-mathematicians.


changes we can make by 2030 . . . 😌

changes we can make by 2030 . . . 

- shift from *publisher textbooks* to *open & free textbooks* (e.g., Apex, Active Calculus)
- improve use of technology both when teaching and when learning

- include more active learning, authentic applications, problem solving
- streamline content (cannot reach *lean & lively* without removing something)

- employ principled negotiation in discussions with administrators

changes we can make by 2030 . . . 😌

- follow UBC's model:
  - large lecture systems (taught by rock stars)
  - small tutorials, split by discipline, focus on authentic problems
  - this model may appeal to administrators ()
- facilitate *communities of practice*
  - spread the word to the teaching team (instructors and TAs) to participate in ***FYMSiC*** (hello! 🙂), CMS, CMESG, professional development conferences/workshops
  - create local teaching and learning workshops
  - connect with high school teachers and faculty in other disciplines
  - connect with your Teaching and Learning centre

let’s keep the conversation flowing . . .