

Differential Calculus Content - FYMSiC Meet Up (Jan 31st, 2024)

1. Review?

- SFU: Diagnostic (in-person) test - precalculus concepts MC test - detailed email with a score to the student
- UBC Diagnostic test - filters students to take which course (someone said it is no longer in the chat)...correct, UBC still has a diagnostic test but it is no longer used to filter students. At UBC we condensed most of our calc courses into a single course so no need for filtering anymore....the diagnostic test is still administered (online for participation points) to give students feedback on their preparation. Students who struggle on the test are recommended to review high school materials and are pointed to online resources
- McMaster - no diagnostic, but we spend a few weeks to review functions
- UofManitoba: We have a diagnostic test (5%) set up in the beginning of the semester; (online) in theory students can take it twice, and we post a booklet written by D.W. Trim and T.G. Berry if students want to review for these pre-calculus topics.
- Cape Breton - We do have a diagnostic test, but you can avoid it if you have a high enough grade in your Grade 12 math course. If you don't pass the test you get moved into a 6-credit version of Calculus 1. We've moved to a weekly 3 hour lab, which has worked very well for us. It's really used as a problem session, and we tend to bake precalc review "just in time" when we introduce some problems
- Mount Allison: We have a Math Assessment Test, and if students don't pass it they have to enrol in pre-calc instead of Calc I. This year we significantly revised the test so it covered more of the material that we need.
- UTM: Depends on the level of course. We don't have any formalized precalc testing/assessment, but it's been discussed quite a lot.
 - In MAT137 (with proofs) we start with two weeks on logic (what it means to prove something, what quantifiers are, how to structure a proof based on the logical structure of the statement being proved) before jumping into [the epsilon-delta definition of] limits
 - In MAT135 and MAT132, lower-level courses, we start with 1.5–2 weeks of precalc review, mostly functions, graph transformations, log rules, etc.

2. Limits

- We spend too much time far too early. We only need one limit for derivatives and we forget what that limit is saying - Indy
 - Start with integration, then derivatives, and then limits :-O
 - What is missing: why would you care about a limit?
 - (Or anything else, really...indy)
- Contrast intuitive approach to limits vs theoretical (including "pathological cases")
- Use discrete examples (table of values of a function)

- Applied calculus - focus on applications - bigger focus on modelling at Mount Allison, might define limits hand wavy
 - Calculus 2, a slightly more rigorous conversation about limits - elimination of integration techniques and sequences/series
 - Only fact you care about limits you need for derivatives: If two functions agree everywhere except at one point, they have the same limit at that point
- Limits at infinity are a different concept, and done in a different lecture, though are still fairly intuitive: What happens when n gets really large?
- Simplify the algebra on assessments, give graphs - Lauren, THANK YOU :)

3. Continuity - IVT, MVT

- By finding c is not why we use IVT or such theorems - Indy
- Only to read and learn how to apply a mathematical theorem, plus develop their writing skills - Lauren
- MVT is one way to take information about the derivative to find out about the function (the derivative allows us to go the other way) - Randall

4. What is a derivative?

5. Derivative rules?

6. Related rates

7. Graphing

8. Optimization

9. Antiderivatives

- Most important is to figure out how it works
 - It is like a game to find the original function (calculus Jeopardy?)
- How to develop and explore new tools - integration tools - Ivan
 - Goal is not just to compute the antiderivative - answer is not important

When we say why learn math ...

- Always to see the world in a different way – Indy
- We train people how to solve problems. You'll learn the other stuff when you need it. - Tyler

We do not tell students WHY we do certain things. – Indy

- Communicate the reasons why we teach students to learn certain things.

What's wrong with getting students to work abstractly for the sake of learning how to do that? (re: trig substitution integration) – Randall Nothing at all –indy

How do we start the course?

How much freedom do we have in deciding about the course content? (engineering, certified programs)

Thinking of functions quantitatively

Some kind of intuitive/thinking approach

Good book with nice examples:

Differential Calculus

Problems and Solutions from Fundamentals to Nuances

<https://doi.org/10.1142/13324> | January 2024

Pages: 328

By (author):

Veselin Jungić (Simon Fraser University, Canada),

Petra Menz (Simon Fraser University, Canada), and

Randall Pyke (Simon Fraser University, Canada)

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