BIRS

Working Groups Summary

- Calc for Engineering & Sciences.
  - Coordination of exams
    - Maybe one question different for instructors
  - Applications?
    - Should there be more
  - Guest speakers on applications.
  - Should we teach other things in first year?
    - Mathematical thinking
    - Shared course across Canada
    - Focus on a few main theorems & proofs.
    - Just-in-time teaching
      - Is this good?
      - Necessary for some disciplines.
    - Meetings with multiple instructors outside of class time to make connections across disciplines.
    - Would be a big loss if we lost some service courses if the home department decided to teach them instead.
    - Tutorials?
      - Present a poster (Calgary)

- Education Service Courses.
Education Service Courses

- Many problems here
- Focus on Elementary School Math Teaching
- What should the minimum standards be for elementary students? If any?
  - Yes, currently there is no fail system.
  - Match literacy goals?
- In Ontario, half of Grade 6 failed to meet minimum standards on annual math test in 2017.
- Lack of STEM aspirations can be linked to poor math confidence.
- Past 4 years, an Ontario teachers' college administered Grade 6-7 test to education students.
  - ⅓ scored below 70%
- Math instruction varies across Canada.
  - More than 100 hours of math instruction.
- Training more focuses on how to teach math instead of math itself.
- Course descriptions imply teachers are being taught geometry, probability, problem solving.
  - Geometry not really taught in grade school anymore.
- Arithmetic is a severe roadblock.
- Repository could help standardize the curriculum for teacher training.
- Math faculty & Education faculty
the curriculum is broken.

- Math Faculty & Education Faculty rarely happens.
  (if it happens, usually strong, but)
  often does not happen.
- Math Ed Students suffer math anxiety
- Little consensus in Math Ed Service Courses.

**Top issues:**
- Weak background
  - affects topics covered & breadth
- No prerequisites consensus.
- Lack of standardization
- Disconnect between Math & Education.
- Varying requirements for accreditation
- Uni instructors assigned to teach
  this are often sessionals
  - should be putting our best
  teachers there
- Varying provincial Math curriculum
guides.

**Business & Social Science**
- Some uni's have business & SS. in classes together
- Classes are essentially the same except
  examples are attempting to include applications.
- Make more authentic
- Sometimes topics are slightly different.

**Resources**
- Help centres
- TAs' are not always able to answer questions.
- Content can vary greatly.
- How do we build good resources to help struggling
  students?
  - hire undergrads who have taken
    the course?
- Instructor resources.
  - Maybe a repository could help.
- Which mathematics topics are Business
- Instructor resources.
  → maybe Repository could help.
- Which mathematical topics do Business students need?
  ● Short list
  ● Calculus = program screener

**Life Sciences**

- Range of courses varied
- Want courses to be authentic
- Change aim of courses.
  → remove some procedural components
  → add some more conceptual/applications
- Lose topics gain learning objectives.
- Deeper understanding of topics.
- Objections
  ● Equivalency requirement
  ● Student's language skills. (Higher demands)
  ● What about the math?!
  ● Instructor capabilities.
- Resources available
  → week-by-week outlines with objectives & worked examples.
- Want some examples that do not work to get students comfortable with the idea that things that seem obvious could be false.

Showcase

1. Andie

- Workshop
- Discussion with high school teachers, university instructors & students.
5. Michelle
   - elementary discrete math (proofs)
   - for math/stats students.
   - ~100 students per term
   - CompSci added it to their program
   - 1 section per term ⇒ 3 sections per term
   - same midterms/final exam
   - definitions were on all tests etc.
   - not all instructors using same definitions
   - had to pick & choose material from a large text
   - 50% dropped.
   - now have a list of definitions each week.
   - instructors meet once a week for at least an hour.

6. Randall
   - New Arts program.
   - wanted a math component
   - math for computer graphics.
   - low prereqs.
   - math adverse students
   - sophisticated topics
   - difficult to find a textbook.
   - making lecture notes.
   - faculty lost track of why they needed it
   - engaging with faculty.
   - tie into future courses in their program
   - 2-stage testing
7. Laura
- Basket weaving
- Interactive application to create basket patterns
- Jupyter notebooks
- Create 3D basket model

8. Patrick
- Number visualization
  (a) Exponential function paper folding
  * Shows difference between $2^x$ and $x^2$
  (b) Factorials
  * 20 people line up for a picture
  * $20!$ seconds = 70,000,000,000 years.
  (c) Small numbers.
  * Row of quarters Vancouver to Toronto
  * Only one flipped tails rest heads.
  * $Pr$(skydive & land on the tail) = $Pr$(win lottery)

9. Gerta
- Calc for life sciences (Blended Course)
- Curve sketching
- Song for curve sketching, to help them remember.

10. Kseniya
- 72 students, 2 terms, same students.
- One problem continues through the term.
- Re-introduce wolves to maintain elk population.
- Week 1 & 2
  * Questions to ask
  * Assumptions
  * Qualitative sketches
(10) Kseniya
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- one problem continues through the term.
- re-introduce wolves to maintain elk population
- Week 1 & 2
  - questions to ask
  - assumptions
  - qualitative sketches
  - 3 types of predator functional responses
- Week 3
  - Asymptotic behaviour
- Week 4 & 5
  - changes in predation rate with respect to elk density
  - Chain rule / Deriv. Rules.
- Week 6
  - numerical methods of linear approx.
- Week 7-9
  - local/global min/max
  - inflection points
  - graphing.
  - Interpret.

(11) Indy
- normally think of topics then look for a book
- instead find a book to get topics.
- Puzzling Adventures of Doctor Ecco.
  - motivate math through puzzles.
- 6 assignments all typed.
- Alicia Burdess (problems page)

(12) Tyler
12. Tyler
   - tykenha.com/dump_polls
     - class response system.

13. Shawn
   - Inspiration
     1. Departments.
     2. Students
     3. Colleagues.
     4. Ourselves/each other

14. Darja
   - The Calculus Challenge
   - Uof M = Accessible University
     1. Low admittance.
   - PreCalc grades are not indicative
   - GPA trend dropping
   - incoming PreCalc grades improving
   - more people entering with A/A+
   - effect of grade in relation
   - In 2015, students coming in with A/A+
     were more likely to Fail Calc1
     than getting an A/A+.
   - Placement exams?
     1. Recommend - Recommend
     2. Require - Recommend
     3. Require - Restrict

Test Actions after.

15. Miroslav
   - very large class of Math or Life Science
   - enhance modelling component
Miroslav
- very large class of Math for Life Science
- enhance modelling component
- In Class
  - sell idea & motivate
  - demonstrations in class
- Students work on labs outside of class.
- TAs.
- Python
- Coding hard at first, but gets easier.

Peter Taylor - Integrity

- Art as Experience (Dewey, 1934)
  - treat students as if they are an artist to be.
- give students an experience each lecture
- "Works of Art" model
  - feel like I'm holding a work of art when I walk into class.
- Choice of Problems
  - work only problems that interest ME (a mathematician)
  - might not cover everything
  - Mathematics = (abstract) study of structure.
  - interested in understanding & working with complex systems.
  - this is what students will need to be able to do.
- New Curriculum Structure
  - non linear
  - investigative
  - huge change

Pedagogical Challenge
  - huge
complex systems.
> this is what students will need to be able to do.

- New Curriculum Structure
  - non linear
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- Pedagogical Challenge
  - Huge

- The Parent Game.

Next Conference:
May 3-5 at University of Alberta.
Starts Friday at 4:30. → Keynote: Keith Merrens.
- Saturday: What should we teach?
  → Keynote: Scott Rodney
- Sunday: Active Learning
- Perhaps working group on Assessment.