New Instructor Training

Jason Siefken
University of Toronto

U of T classes being 10 minutes past the hour; we will begin 10 minutes past.

*With materials from Professors Mayes-Tang and Gracia-saz

Warmup

Form groups of 4–5 with the restriction:

- No two group members are teaching the same F/Y course.

Learn about each of your group member:

- What do they research/study?
- What was a memorable experience they had as a TA?

The 5 Principles

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Principles

1. Give students time to struggle.
2. Say yes to your students' ideas.
3. Don't be the answer key.
4. Motivate with questions.
5. Play!

Questions?

- Think about the best instructor you ever had. Did any of the principles apply to them?
- Can these principles apply in a university setting?

Learning Objectives

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answer the questions...

- What do you want students to learn by the end of a lesson?
- What do you want students to be able to do by the end of a lesson?
- What do you want to stick with students at the end of a course? Several years after a course?

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Questions?

- Why would you — as an instructor — want to write learning objectives before planning a lesson?

Effective Learning Objectives

Good learning objectives

- Refer to specific skills/beliefs/attitudes you want students to have.
- Are measurable and provide the context in which they will be measured.
- Avoid vague phrases like “students will understand” and “students will see”.

Examples

By the end of the course,
students will be able to apply the comparison test to determine whether a series of the form $\sum 1/x^{\alpha}$ converges when $\alpha > 0$ is a fraction.

By the end of this lecture,
students will be able to explain how the “square root algorithm” relates to Newton’s method.

Example Learning Objectives

By Midterm 1, students will be able to

(MAT137)

apply the ε-δ definition of limit to prove whether a rational function has a horizontal asymptote.

(MAT136)

determine, using a slope field, whether a solution to an initial value problem has a horizontal asymptote.

(MAT133)

produce a real-word example of a function with a horizontal asymptote.

Questions?

- How would class be similar/different for each of the learning objectives?

Dee Fink's Framework

Situational Factors

1. Class Context: Number of students? Upper division/lower division? Hours of class per week? Tutorials?
2. External Context: Restrictions from the University? Department? Society?
3. Subject: Theoretical? Applied? Actively researched?
4. Learners: What are the goals of the learners? What is their life situation?
5. Teacher: What are your teaching strengths? Expertise?

Types of Goals

- Foundational: What information/ideas are important to **understand and remember**?
- Application: What thinking/skills should a student **acquire**?
- Integration: What ideas should students **connect** with their other courses/profession/life?
- Human: How should students **interact** with each other? Themselves? How should they **feel**?
- Meta: Learning how to learn.

Activity

Review your mini-lecture. What are its learning objectives?

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Mini-lectures

Lesson Planning

Lesson Planning—Objectives

By the end of today you will be able to

- write applicable learning goals for a lesson in your course;
- create a lesson plan based on your learning goals (“Backwards Design”);
- describe at least one activity that can tighten the “learning cycle”.

Lesson plans are documents that outline

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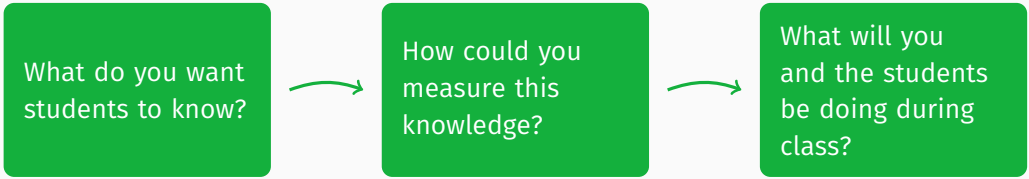
Backwards Design

Design happens in three stages by identifying



Lesson Planning

Which learning goal is best for a first-year calculus course for students majoring in biology?

By the end of the course, students should be able to...

(A) Explain why the graph of an antiderivative is the shape that it is.

(B) Graph antiderivatives.

(C) Given the graph of a function, sketch an antiderivative passing through a particular point.

(D) Understand antiderivatives and the FTC.

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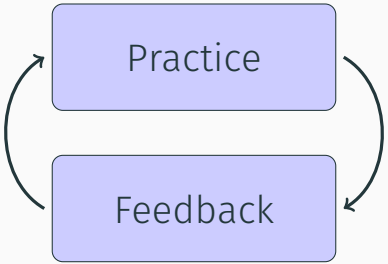
- How could you measure (C)?
- What could you do in class to achieve (C)?

The Learning Cycle

Simplified model of learning



The Learning Cycle

Students need to

- know *what* to practice
- be motivated
- be able to judge improvements/regressions
- be comfortable making mistakes

⋮

Identify where *Practice* and *Feedback* occur

"Lecture-based" Analysis Class

- Background
- Definition
  - Easy example
  - Hard example
- Theorem
- Proof
  - Outline
  - Details
  - Re-emphasis of important/hard idea

    ⋮
- Homework

"Active" Calculus Class

- Background
- Ask a "hard" question
- Definition
  - Have students generate examples
  - Discuss examples
- Re-ask similar question
  - Get student ideas
  - Explain relation to definition

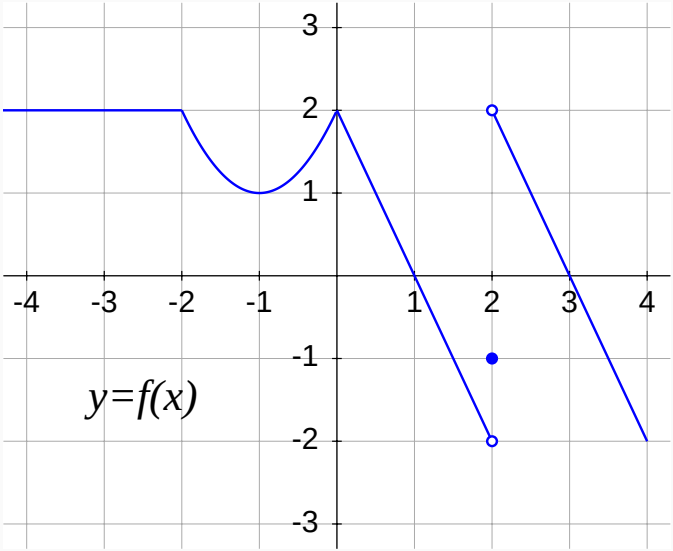
    ⋮
- Homework

Techniques to Tighten the Loop

Think, Pair-Share

- Ask question
- Individual thinking (& voting)
- Pair discussion (& voting)
- Class discussion

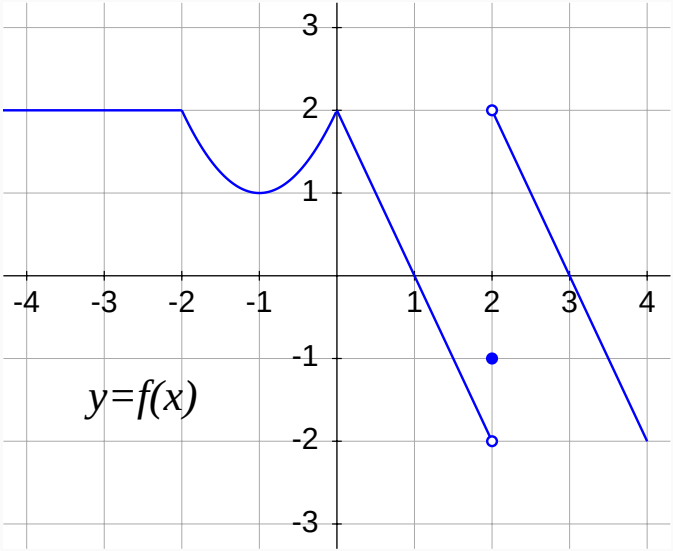
Think, Pair Share Example



Compute

1. $\lim_{x \to 0} f(f(x))$

Think, Pair Share Example



Compute

1. $\lim_{x \to 0} f(f(x))$

Choose from

-2

-1

2

DNE

other

Think, Pair Share Example

Which of these is a correct description of the set E of even integers?

1. $E = \{n \in \mathbb{Z} : \forall\, a \in \mathbb{Z},\ n = 2a\}$
2. $E = \{n \in \mathbb{Z} : \exists\, a \in \mathbb{Z} \text{ s.t. } n = 2a\}$

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For $n = 4$, which of the following statements is true?

3. $\forall\, a \in \mathbb{Z},\ n = 2a$
4. $\exists\, a \in \mathbb{Z} \text{ s.t. } n = 2a$

The function coth, defined by

$$\coth x = \frac{e^{2x}+1}{e^{2x}-1},$$

is called the “hyperbolic cotangent”.

1. Find its domain.
2. Find its three asymptotes.
3. To save you time, I have computed that $\coth'$ is always negative (on its domain). With this information, sketch the graph of coth.

Making Good Questions

Making Good Questions

A good questions ties to your learning goals and

- re-enforces, generates the need for, or explores a concept
- informs the instructor (answers will indicate whether to move on)
- is scaffolded (chunked)
- can be reasonably solved (in 1–4 minutes)
- generates controversy (depending on your goals)

Lesson Planning Pitfalls

How do I cover it all?

How do I cover it all?

- Prioritize learning goals
  - Is surface-level understand of many things important? (i.e., coverage)
  - Is deep understanding of *some* thing important?
  - What will help the students as future learners?
  - Which goals will have a lasting impact? (e.g., past the midterm)
- You don't need to "say it in class" for students to learn it
  - What goals are best addressed in homework? Through readings?
  - What goals are easiest for the students to achieve themselves? (i.e., without a subject-matter expert present)
- Discuss with other instructors

Make a Lesson Plan

Make a Lesson Plan

Resources available at
`https://github.com/siefkenj/teaching-resources`

Instructor Panel