

New Instructor Training

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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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Learning objectives
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-world 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.

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

- **what** you will do in your class and
- **when** it will happen.

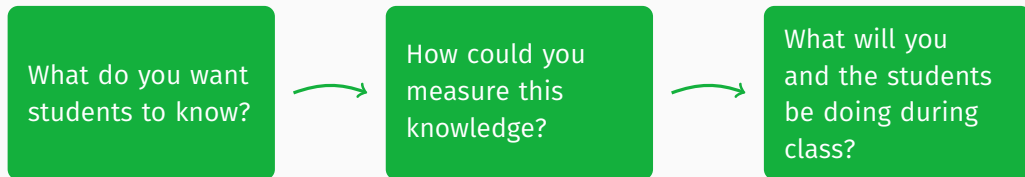
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Backwards Design

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.

Lesson Planning

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

- How could you **measure** (C)?

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Lesson Planning

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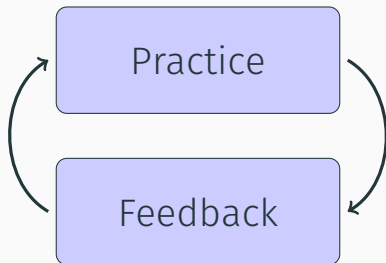
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- How could you **measure** (C)?
- What could you **do in class** to achieve (C)?

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
 - \vdots
- Homework

“Active” Calculus Class

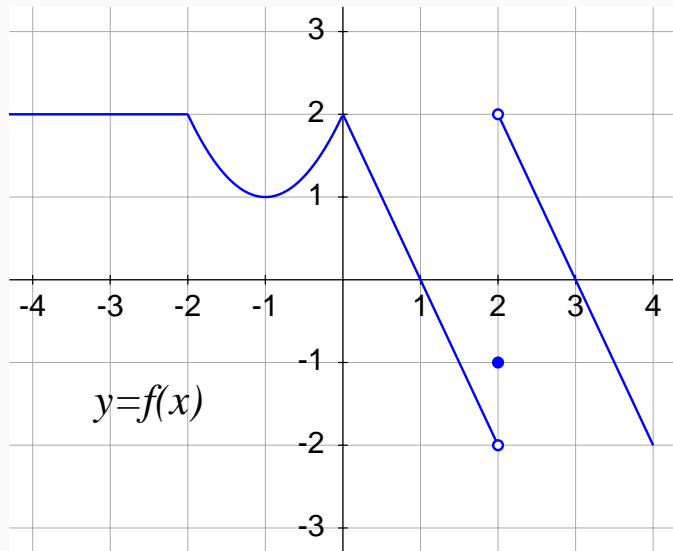
- Background
- Ask a “hard” question
- Definition
 - Have students generate examples
 - Discuss examples
- Re-ask similar question
 - Get student ideas
 - Explain relation to definition
 - \vdots
- Homework

Techniques to Tighten the Loop

Think, Pair-Share

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

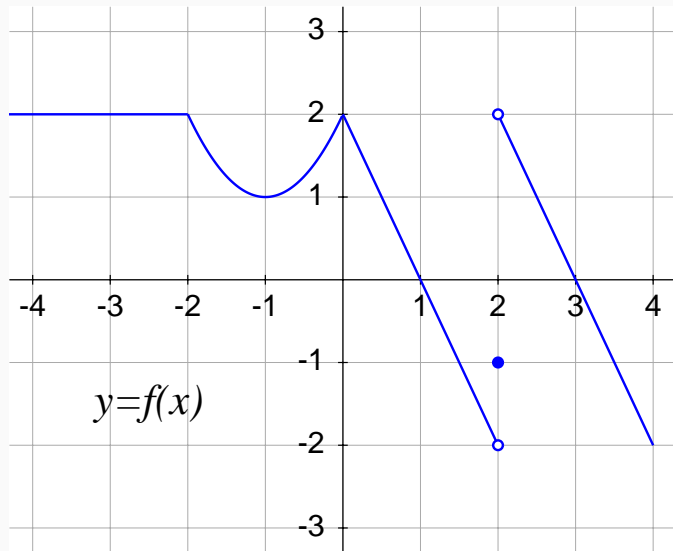
Think, Pair Share Example



Compute

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

Think, Pair Share Example



Compute

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

Choose from

-2

-1

2

DNE

other

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
