

# Blending Team-based learning with Mastery grading

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**What problems do we want to address?**

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- Avoid lectures

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- Get students participating

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- Provide a supportive environment for asking questions

- Students earn grades, rather than feeling that it's at the whim of the professor

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- What is the advantage of coming to class?
- Productive failures!

## Preparation for subsequent courses

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- Does the grade really reflect mastery?
- Did the student get more out of the course than just the content?

# Team-based Learning

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- Students are required to prepare ahead of class, and are held accountable for doing so.
- All in-class work is in teams (not groups!), which do not change throughout the semester.
- Peer-evaluation ensures that student's grades are directly related to their level of group participation.

## Setting the Stage

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- Focus on the goals of a college education, and how the course structure supports those goals.
- Reference the need for personal accountability in earning the desired grade.
- Give students time with their teams.
- Provide plenty of detail, as the grading structure tends to be complicated.

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- An initial survey of students is helpful in creating teams.
- Spread out ability/confidence levels.
- Teams last for the entire semesters.
- Peer evaluations that affect final grades keep students accountable to their teams.

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- Accountability is pushed to the students, and checked via readiness assessments.
- Feedback should be immediate when a student arrives unprepared.

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- Scratch off sheets for the tRAT give immediate feedback.



Three of these might be descriptions of tangent lines. One is definitely not. Pick the one that can't be a tangent line.

1. A line touching a curve exactly once.
2. A line intersecting a curve twice.
3. A line intersecting a circle twice.
4. A horizontal line touching a circle.

Suppose  $\lim_{x \rightarrow a^+} f(x) = 1$  and  $\lim_{x \rightarrow a^-} f(x) = 2$ . Which of these is definitely true?

1. The function is continuous at  $x = a$ .
2. The limit  $\lim_{x \rightarrow a} f(x)$  does not exist.
3. The function stops existing at  $x = a$
4. Kevin Bacon

Why can't we use the Direct Substitution Property (just plugging in the value) in evaluating this limit?

$$\lim_{x \rightarrow 2} \frac{x^3 - 7x + 6}{x^2 - 4}$$

1. The denominator evaluates to 0.
2. The function is rational.
3. The numerator evaluates to 0.
4. The function is not a polynomial.

# Mastery Grading

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## Using Standards-Based Grading for Exams

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- Students have individual folders so they know what objectives still need to be met.
- Each assessment contains all previously tested objectives.
- The final exam includes all objectives, and gives students a chance to show any previous missed objectives have been mastered.

## Example Standards

- Show, via the definition, that a function is continuous at a point.
- Calculate an antiderivative of a polynomial function.
- Use the 1st derivative test to classify extrema of a function.
- Evaluate an indefinite integral using substitution.

A single problem might allow students to pass multiple standards.

1. A 1.5m tall woman is walking towards a 10m tall lightpost at 2 m/s. How fast is the length of her shadow changing when she is 10m away from the post?
  - Correctly set up a problem involving at least two related rates.
  - Solve a problem involving at least two related rates.
  - Correctly find the derivative of an implicit function.
  - Calculate the derivative of a polynomial function using the power rule.

## **Results and student feedback**

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## Benefits of the method

- Understanding the course content - most importantly, this can be done without lectures. Students are given the readings and the RATs assess student understanding (first, individually and then with their team).

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- The immediate feedback lets the instructor know what gaps exist in understanding after the readings.
- Team activities leave room for more complex applications, rather than just drilling skills.
- Developing the skills for working effectively on a team - crucial skills to prepare our students for careers after college.

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- Students report feeling accountable to their team-mates, which increase attendance and engagement.
- Students report feeling lower anxiety in the course, because their failures have the opportunity to be productive.