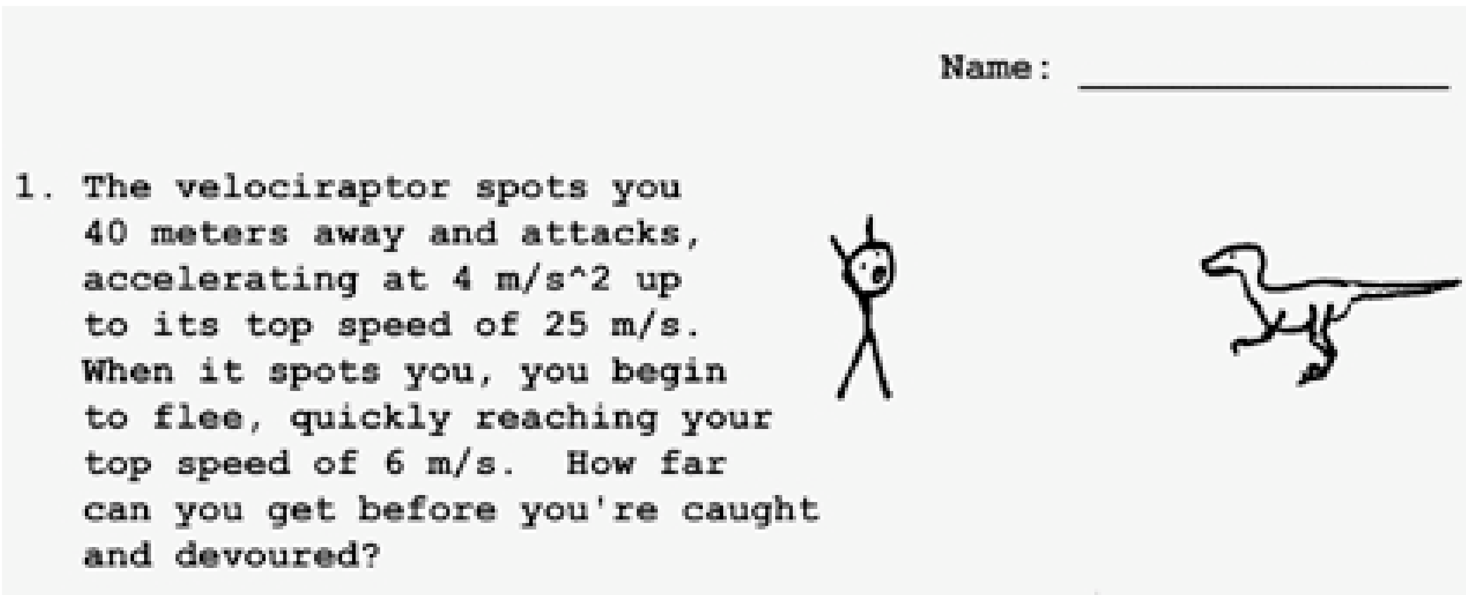
MATH 8001

March 9, 2012

Writing exams



Name: ________________

1. The velociraptor spots you 40 meters away and attacks, accelerating at 4 m/s^2 up to its top speed of 25 m/s. When it spots you, you begin to flee, quickly reaching your top speed of 6 m/s. How far can you get before you're caught and devoured?

Pick up lecture notes and submit group work exercises after class.

Assignment due Friday, March 23: Write a 50-minute mid-term exam covering current material from your current course, or (if you are not currently teaching) material of your choice.

Look for Jon's LaTeX template; indicate what sections/material the exam covers.

REPORT TO THE PRESIDENT

ENGAGE TO EXCEL: PRODUCING ONE MILLION ADDITIONAL COLLEGE GRADUATES WITH DEGREES IN SCIENCE, TECHNOLOGY, ENGINEERING, AND MATHEMATICS

Executive Office of the President

President's Council of Advisors on Science and Technology

FEBRUARY 2012

Recommendation 3.

Launch a national experiment in postsecondary mathematics education to address the mathematics-preparation gap.

College-level skills in mathematics and, increasingly, computation are a gateway to other STEM fields. Today many students entering college lack these skills and need to learn them if they are to pursue STEM majors. In addition, employers in the private sector, government, and military frequently cite that they cannot find enough employees with needed levels of mathematics skills. This lack of preparation imposes a large burden on higher education and employers. Higher education alone spends at least $2 billion per year on developmental education to compensate for deficiencies. Also, introductory mathematics courses often leave students with the impression that all STEM fields are dull and unimaginative, which has particularly harmful effects for students who later become K-12 teachers. Reducing or eliminating the mathematics-preparation gap is one of the most urgent challenges—and promising opportunities—in preparing the workforce of the 21st century.

This national experiment should fund a variety of approaches, including (1) summer and other bridge programs for high school students entering college; (2) remedial courses for students in college, including approaches that rely on computer technology; (3) college mathematics teaching and curricula developed and taught by faculty from mathematics-intensive disciplines other than mathematics, including physics, engineering, and computer science; and (4) a new pipeline for producing K-12 mathematics teachers from undergraduate and graduate programs in mathematics-intensive fields other than mathematics. Diverse institutions should be included in the experiment to assess the impact of the intervention on various types of students and schools. Outcome evaluations should be designed as a collective effort by the participating campuses and funding agencies.

Any issues arising in your current teaching?

Writing exams

Getting started: writing a test from scratch

1. Identify the central ideas and, then, the most important tasks.
2. Write/choose candidate problems.
3. Review materials and ask, what did I miss? Choose problems to reward full participation in the class.
4. Trim back, following fine-tuning tips on next page.

Fine-tuning tips

1. Work through the exam completely. Ask someone else to work through the exam. (What is the golden ratio?)
2. Don't be redundant or overly comprehensive.
3. Check that details do not distract from the concept you want to test.
4. Vary the level of problems.
5. Avoid problems that require tricks or clever observations.
6. Consider breaking long problems into steps.

(**Note**: This is a previous test question; it was a great problem, but a pain to grade, so we're putting it on the review this time.) Consider the curve parametrized by

$$\mathbf{x}(t) = \left(\frac{t^2}{2}, \frac{t^4}{\sqrt{8}}, \frac{t^6}{6}\right), \qquad -\infty < t < \infty$$

1. Briefly describe (in words) the behavior of the curve near $t = 0$.
2. Evaluate $\lim_{t\to 0} \mathbf{x}'(t)$ and $\lim_{t\to\infty} \mathbf{x}'(t)$. If either does not exist, explain why not.
3. Evaluate $\lim_{t\to 0} \mathbf{T}(t)$ and $\lim_{t\to\infty} \mathbf{T}(t)$. If either does not exist, explain why not.
4. Find $\mathbf{T}(1)$ and $\mathbf{N}(1)$. You do not have to find a general expression for $\mathbf{N}(t)$.
5. Parametrize the osculating plane of the curve at the point $\mathbf{x}(1)$.

McCallum's essay in Appendix

Exams reflect the values of the course and the instructor.

One of McCallum's values: Ask students to reason from graphical and numerical data.

(Pages with "Exam Problems not for Distribution" removed…)

Other philosophical issues

- multiple-choice questions?
- advance warning about format/content?
- high distribution or low distribution?
- calculator or no calculator?