

Automatic Assessment and Feedback

Learning and Teaching Day Conference

Session on E-Learning

Thomas Prellberg

School of Mathematical Sciences, Queen Mary, University of London

November 7, 2007

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E-learning for Calculus I: a web-based platform for

- self-paced student learning,
- on-line assessment, and
- immediate feedback.

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For details of the general set-up: poster on

“Improving Student Performance ...”

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This talk will focus on the interplay of formative and summative assessment mechanisms

A New Approach to Calculus

General restructuring of first-year mathematics due to

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General restructuring of first-year mathematics due to

- dropping A-level standards

A New Approach to Calculus

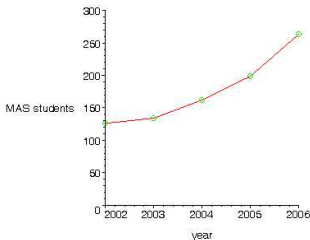
General restructuring of first-year mathematics due to

- dropping A-level standards
- poor retention of learning outcomes

A New Approach to Calculus

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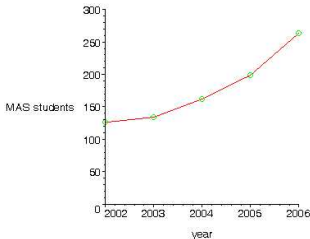
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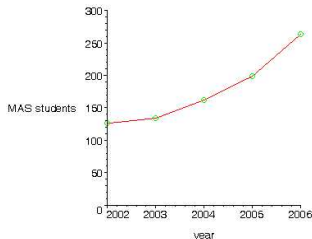


- stretching of resources

A New Approach to Calculus

General restructuring of first-year mathematics due to

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- stretching of resources

Suitable for e-learning: Calculus I and Calculus II

Selection of Thomas' Calculus together with CourseCompass /
MyMathLab (Pearson Education)

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- Established product (no pilot scheme)

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- Availability of more than 2000 exercises

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Similar products: Maple T.A., WileyPLUS with Webassign, ...

CourseCompass - Windows Internet Explorer

http://cp01.coursecompass.com/webapps/portal/frameset.jsp?url=%2Fbin%2F... Live Search

My CourseCompass

Welcome, Thomas Prellberg (not you?)
Courses Help & Support About My Account Logout

Announcements

DO HOMEWORK

TAKE A TEST

GRADEBOOK

STUDY PLAN

Staff Information

Chapter Contents

Multimedia Library

External Links

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Installation Wizard

Course Home

Course Map

COURSES > MAS115 QMUL 2007/8 > ANNOUNCEMENTS

PEARSON MyMathLab

THOMAS' CALCULUS MEDIA UPGRADE 11e

Weir, Hass, Giordano

VIEW TODAY VIEW LAST 7 DAYS VIEW LAST 30 DAYS VIEW ALL

October 20, 2007 - October 27, 2007

MAS115 Course Web Page Posted by Thomas Prellberg
Please check for MAS115 Calculus I details on the [course webpage](#).

Thu, Oct 04, 2007 -- Online Coursework Posted by Thomas Prellberg
Please note that coursework sets have to be worked on in one sitting and have to be SUBMITTED explicitly. Otherwise you risk being blocked out of the system.

If this happens, please contact Henrik Baamhielm at hb@maths.qmul.ac.uk.

http://cp01.coursecompass.com/bin/common/content.pl?action=LIST&course_id=... Internet 100%

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All the usual features (like in e.g. WebCT)

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- Video lectures
- Java-based animations
- Powerpoint slides
- Maple/Mathematica worksheets
- Revision help: flashcards/reviewcards
- ...

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But more importantly

- Exercises with integrated support/feedback

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But more importantly

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- Several environments: homework/quiz/test
- Personalised study plan

Features of Exercises

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- Intelligent, Mathematica-based engine:
more than multiple-choice questions!

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- Question pooling possible for more randomness

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- More than 2000 exercises available
- Fully integrated help available
- You can also design your own questions

Homework environment: sample problem

Do Homework - Thomas Prellberg - Windows Internet Explorer

http://www.mathxl.com/Student/PlayerHomework.aspx?centerwin=yes&home

CourseCompass Homework/Test M... Do Homework - ...

Homework Exercises Set 6 Homework Overview

Questions << 10 11 12 13 14 15 16 17 18 19 >> Thomas Prellberg

Find the value or values of c that satisfy the equation $\frac{f(b) - f(a)}{b - a} = f'(c)$ in the conclusion of the Mean Value Theorem for the following function and interval.

$f(x) = 2x^2 + 5x - 3, \quad [-1, 1]$

UNDO

✓ Excellent!

OK

The value(s) of c that satisfy the equation are 0.
(Type a simplified fraction.)

Enter any number or expression in the blue-outlined box, then click Check Answer.

Check Answer Clear Answer Problem Progress Submit Work

Exercise Score: 0 of 1 pts
Homework Score: 0% (0 of 20 pts)

Help Me Solve This
View an Example
Animation
Textbook Pages
Ask My Instructor...
Print...

Done Internet 100%

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Exercise-specific support and help

- “Help Me solve This”: a step-by-step guide through the solution requiring the student to provide the result of intermediate calculations

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- “View an Example”: shows the full solution of a sample problem
- “Animation”: leads to a java-based applet for hands-on experimentation
- “Video”: shows a video of a lecture on the required topic
- “Textbook Pages”: leads to the relevant section in the textbook

Homework environment

Exercise-specific support and help

- “Help Me solve This”: a step-by-step guide through the solution requiring the student to provide the result of intermediate calculations
- “View an Example”: shows the full solution of a sample problem
- “Animation”: leads to a java-based applet for hands-on experimentation
- “Video”: shows a video of a lecture on the required topic
- “Textbook Pages”: leads to the relevant section in the textbook
- “Ask my Instructor”: enables the student to email the lecturer

Demonstration

Quiz/test environment: sample problem

Preview Test - Thomas Prellberg - Windows Internet Explorer

http://www.mathxl.com/Student/PlayerTest.aspx?centerwin=yes&testresultic Live Search

CourseCompass Homework/Test M... Preview Test - ...

Test Midterm Test Test Overview

Questions 1 2 3 4 5 6 7 8 9 10 >> **Thomas Prellberg**

Find the value or values of c that satisfy the equation $\frac{f(b) - f(a)}{b - a} = f'(c)$ in the conclusion of the Mean Value Theorem for the following function and interval.

$f(x) = 4x^2 + 4x - 3, \quad [-3, 3]$

UNDO

The value(s) of c that satisfy the equation $\frac{f(b) - f(a)}{b - a} = f'(c)$ is/are .

(Type a simplified fraction. Use a comma to separate answers as needed.)

Enter any number or expression in the edit field, then click Next Question or Previous Question.

Previous Question Next Question Submit Test

Test Info

Time Limit 00:45:00

Time Remaining 00:44:11

0 of 12 questions complete

This question is worth 1 point

Internet 100%

Quiz/test environment

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Help switched off, several options

- limit total time allowed

Help switched off, several options

- limit total time allowed
- limit number of attempts

Help switched off, several options

- limit total time allowed
- limit number of attempts
- block other features

Help switched off, several options

- limit total time allowed
- limit number of attempts
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Help switched off, several options

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- allow/disallow review
- password protection (proctor mode)

Help switched off, several options

- limit total time allowed
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- block other features
- allow/disallow review
- password protection (proctor mode)
- scramble question order

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Students get their personal study plan generated:

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Students get their personal study plan generated:

- Start by taking a sample test or assigned test

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Students get their personal study plan generated:

- Start by taking a sample test or assigned test
- Now the study plan indicates areas that need more practice...

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Students get their personal study plan generated:

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Students get their personal study plan generated:

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Students can monitor their own progress

Students get their personal study plan generated:

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- Now the study plan indicates areas that need more practice...
- ... and offers specific practice questions
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Students can monitor their own progress (and so can the lecturer)

Study Plan - Thomas Prellberg - Windows Internet Explorer

http://www.mathxl.com/Student/StudyPlan.aspx?userId=308



MyMathLab

Thomas Prellberg 11/7/07 1:12am



MAS115 QMUL 2007/8 [325] > [Back to Gradebook](#)


[Previous Student](#) [Course Calendar](#) [Next Student](#)










Study Plan

[Legend](#)  

Click a chapter below to start practicing, or follow these steps to create a personalized study plan.

- Take a [sample test](#) or an [assigned test or quiz](#). Then return to this page.
- Practice the topics you need to study ().
- To prove mastery(), take another [sample test](#) or an [assigned test or quiz](#). [Learn more](#)

[Show All](#)  [Show What I Need to Study](#) [Jump to where I worked last](#)

Book Contents for All Topics	Correct	Worked	Available Exercises	Time Spent
Ch 1: Preliminaries 	31	31	79	4h 16m 27s
Ch 2: Limits and Continuity 	29	30	116	2h 15m 37s
2.1 Rates of Change and Limits 	4	4	12	10m 20s
2.2 Calculating Limits Using the Limit Laws 	16	16	18	48m 19s
2.3 The Precise Definition of a Limit 	7	8	13	56m 31s
2.4 One-Sided Limits and Limits at Infinity 			25	
2.5 Infinite Limits and Vertical Asymptotes 	2	2	18	20m 27s
2.6 Continuity 			16	
2.7 Tangents and Derivatives 			14	

Central question:

“How do we get students to embrace this new technology to maximise their learning?”

Implementation

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- Work on these exercise problems is a prerequisite for access to coursework.

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- Assessed coursework consists of problems in quiz mode.

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- To encourage practice, multiple coursework submissions are allowed.
- Only the final submission counts.

- Mid-term and End-of-term tests are also done online as proctored time-limited tests

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- Mid-term and End-of-term tests are also done online as proctored time-limited tests
- The final exam paper is a conventional paper exam.

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 - 50% of the questions involve material not suitable for online assessment: definitions, theorems, simple proofs, etc.



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- The final exam paper is a conventional paper exam.
 - 50% of the questions are similar to online exercises.
 - 50% of the questions involve material not suitable for online assessment: definitions, theorems, simple proofs, etc.
- Conventional exercise classes are used to prepare for these.

Data on Student Performance

Item Analysis - Thomas Prellberg - Windows Internet Explorer

http://www.mathxl.com/Instructor/ItemAnalysisPopup.aspx

CourseCompass Gradebook - Thom... Item Analysis - ...

Item Analysis [Legend](#)  

Name Midterm Test **# of students submitted** 288
Date Due 11/09/06 5:10pm **total # of attempts** 288

Results View All Scores [Export class summary](#)

Results submitted by an instructor are not included in this data.

#	Question ID	Objective	Correct	Partial Credit	Incorrect	Incomplete	Avg Time Spent
1	2.2.31	Find the limit.	234	0	45	9	3m 14s
2	2.3.11	Find delta.	242	0	36	10	1m 55s
3	2.4.29	Find the limit involving $(\sin x)/x$.	249	0	24	15	2m 7s
4	2.4.61	Find the limit with noninteger or negative powers.	215	0	62	11	2m 30s
5	2.5.33	Find the equations of the asymptotes. Then graph the rational function.	185	92	5	6	4m 3s
6	2.6.21	Determine where a function is continuous.	215	0	61	12	1m 46s
7	3.1.33	Solve applications.	243	0	44	1	1m 11s
8	3.2.29	Find the derivative of all orders of the function.	227	59	1	1	3m 45s
9	3.6.13	Find the derivatives of rational powers.	178	0	105	5	5m 29s
10	3.6.45	Find the slope, the tangent line, or the normal line at the given point.	230	0	45	13	3m 51s
11	4.2.1	Find the values of c that satisfy the conclusion of the Mean Value Theorem.	188	0	88	12	4m 50s
12	4.2.33	Find the function from a given derivative whose graph passes through a given point.	241	0	41	6	2m 32s

Done Internet 100%

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Two types of data available:

- Statistical data on performance, broken down by individual problems
 - very useful to monitor student learning in a timely way
 - ability to identify and respond to specific difficulties

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- Statistical data on performance, broken down by individual problems
 - very useful to monitor student learning in a timely way
 - ability to identify and respond to specific difficulties
- Individual data on performance for each student
 - ability to see precisely when and for how long a student has been online: “Big brother is watching”

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The use of MyMathLab for Calculus has been a success.

- Usefulness of MyMathLab for other mathematics modules?
- Similar environments, e.g. MyStatLab for statistics modules?

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All this is relatively new, even in the US. About one month ago the American Mathematical Society solicited comments about online grading:

<http://firstyearmathematics.blogspot.com>