Implementing E-Learning in the Teaching of Calculus

Colloquium
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Introduction

- E-learning for Calculus I: a web-based platform for
  - self-paced student learning,
  - on-line assessment, and
  - immediate feedback.

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- A practicioner's view

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- Implementing assessment mechanisms in e-learning
  - summative assessment
  - formative assessment

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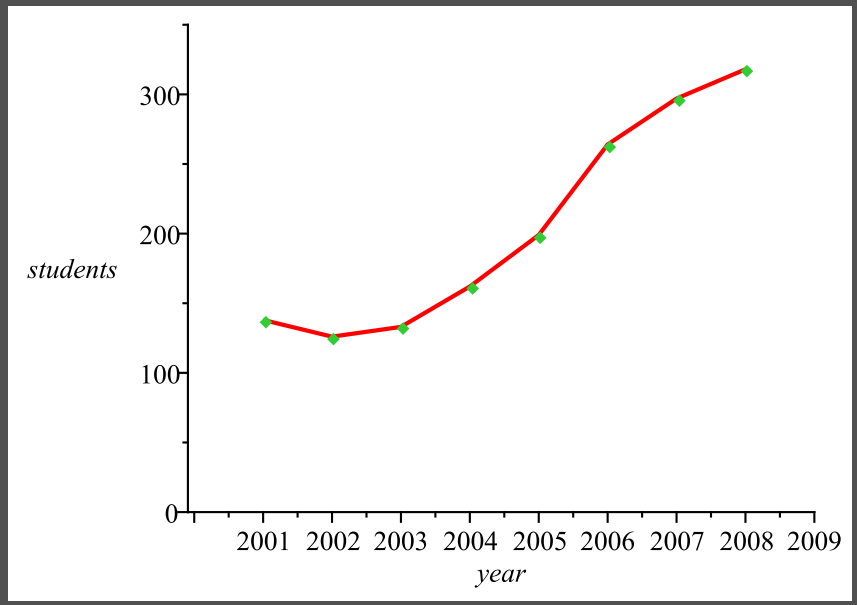

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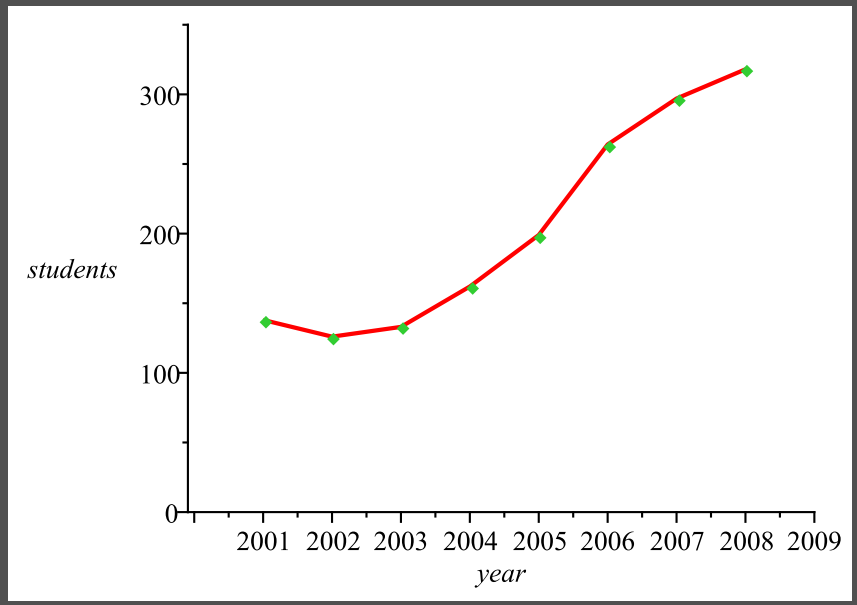

- stable graduate student numbers: stretching of resources

First-Year Mathematics

- First-Year Syllabus (of Three-Year BSc Study Programme)

Essential Mathematical Skills

Semester 1

- Calculus I
- Probability I
- Geometry I
- Mathematical Computing

Semester 2

- Calculus II
- Introduction to Statistics
- Differential Equations
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besides, Calculus had not been updated for some 20 years...

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

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British terms and US equivalent

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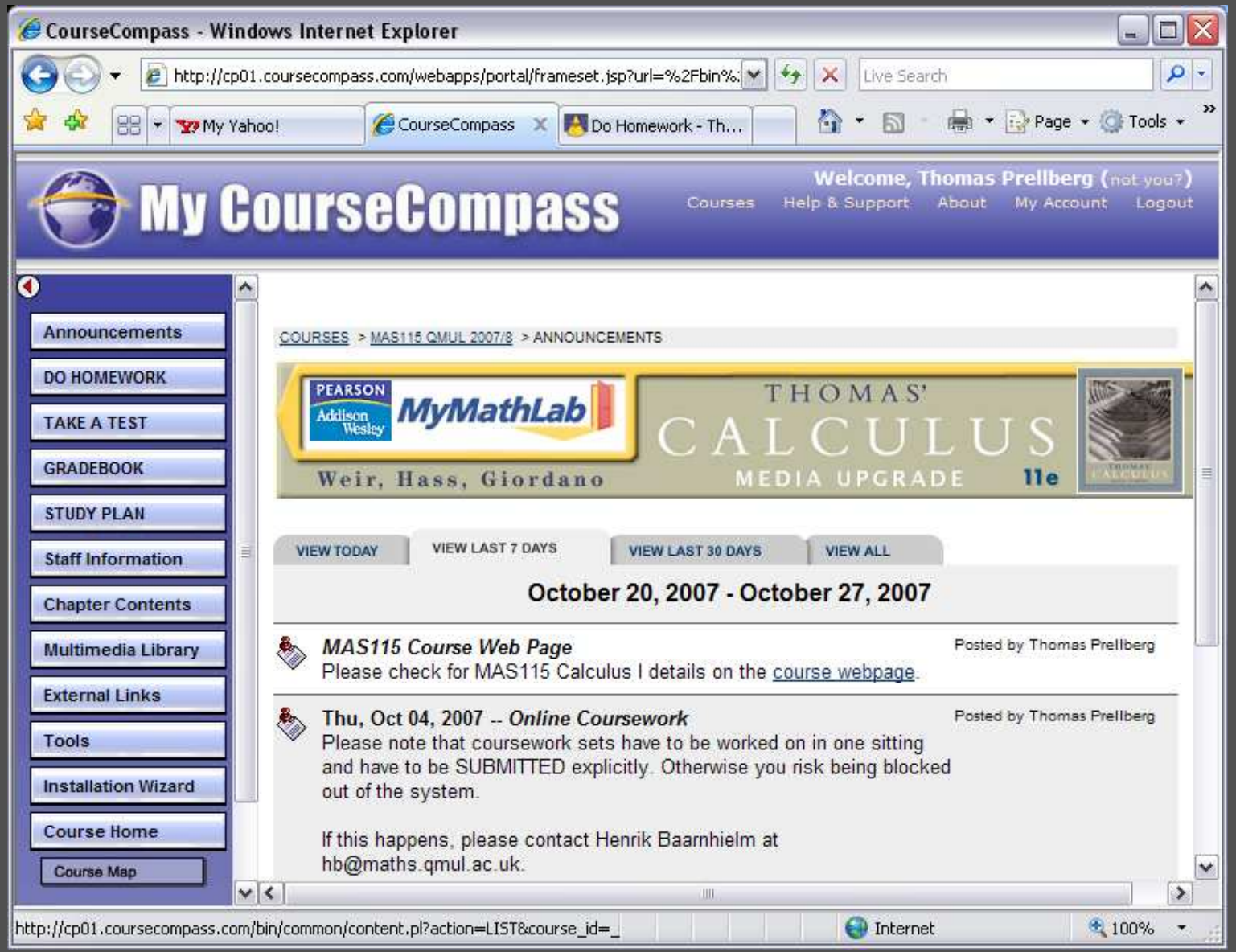
- Countless others such as Titbit: tidbit, etc.

CourseCompass



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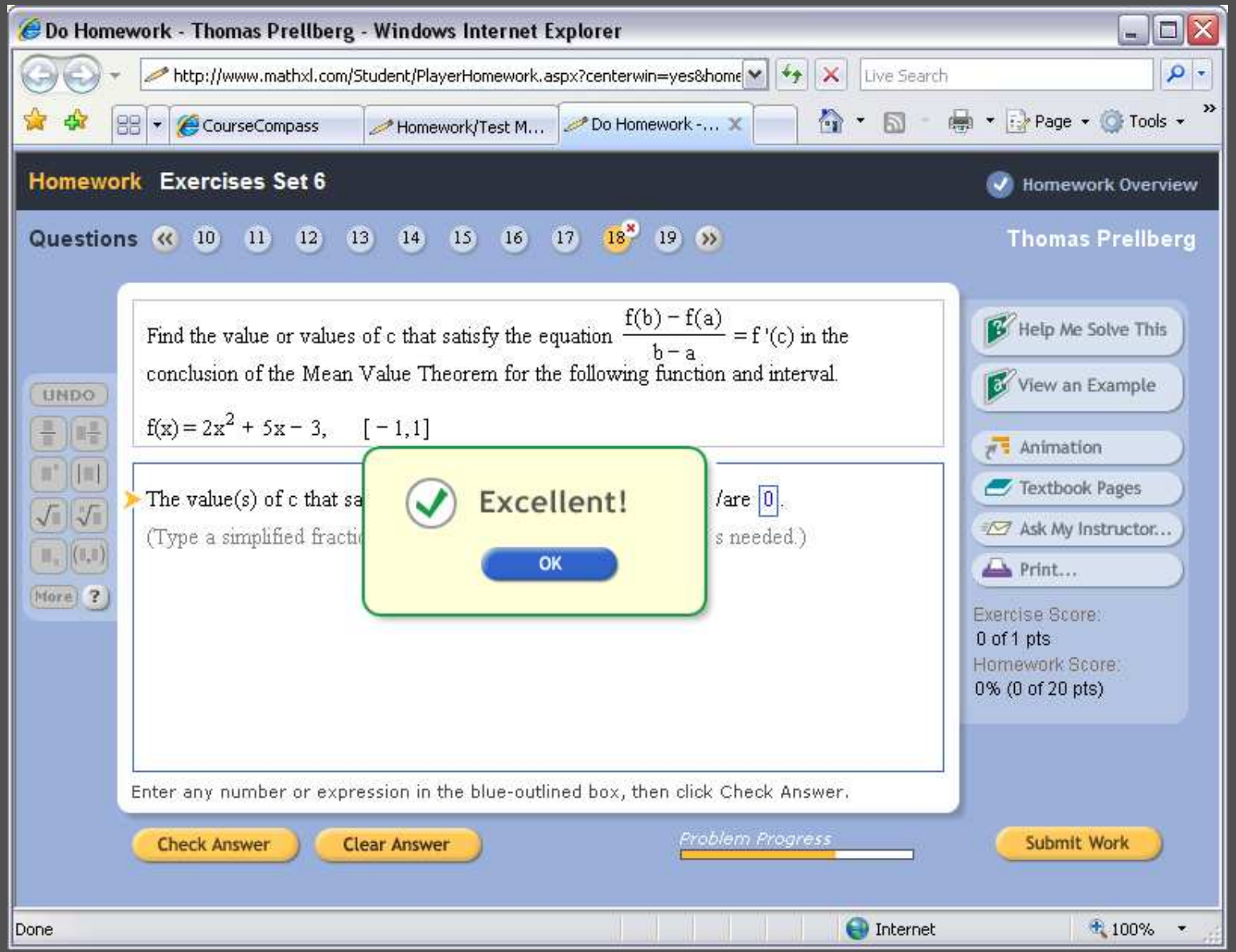
- You can also design your own questions

Homework environment: sample problem



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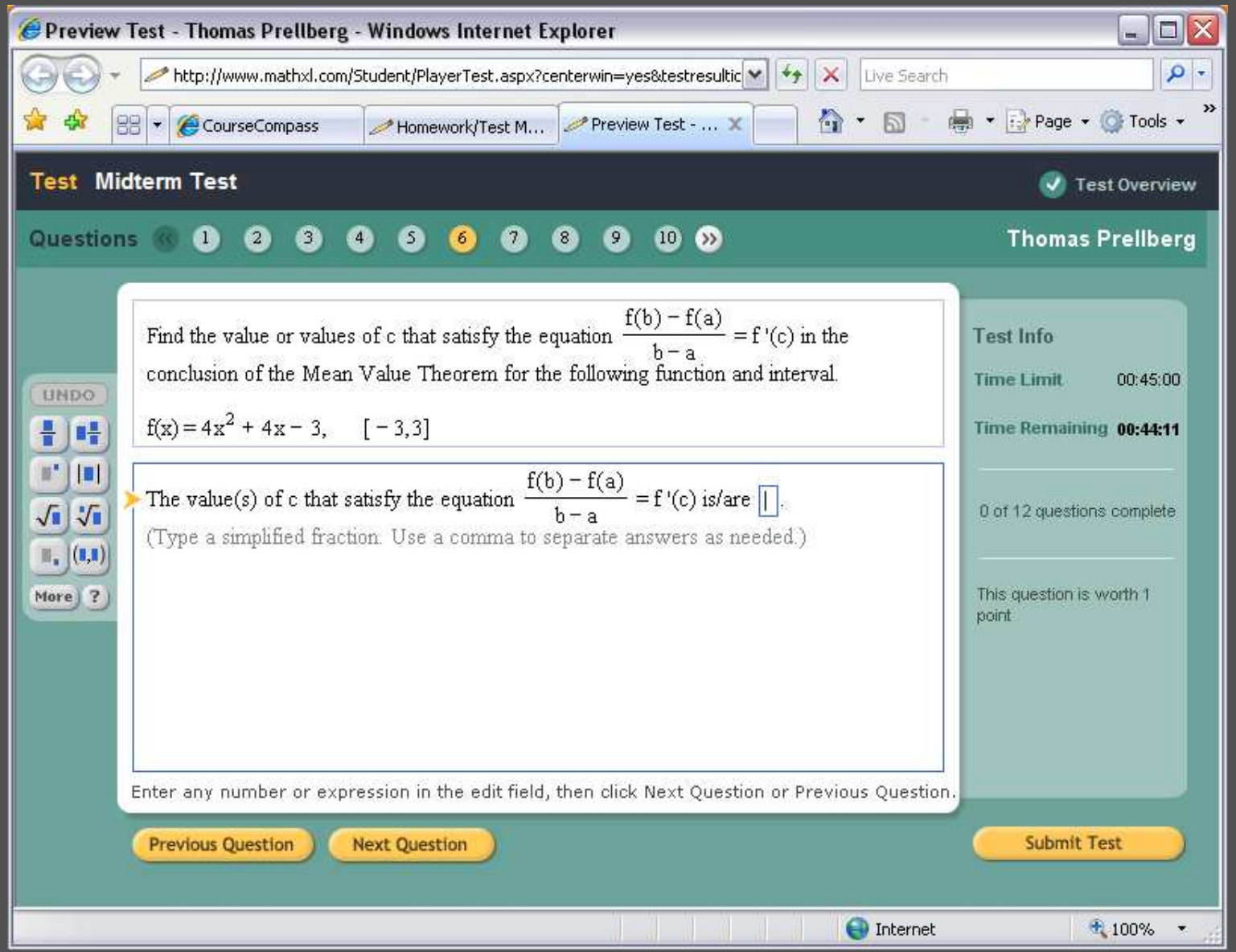
- "Ask my Instructor": enables the student to email the lecturer

Demonstration

Quiz/test environment: sample problem



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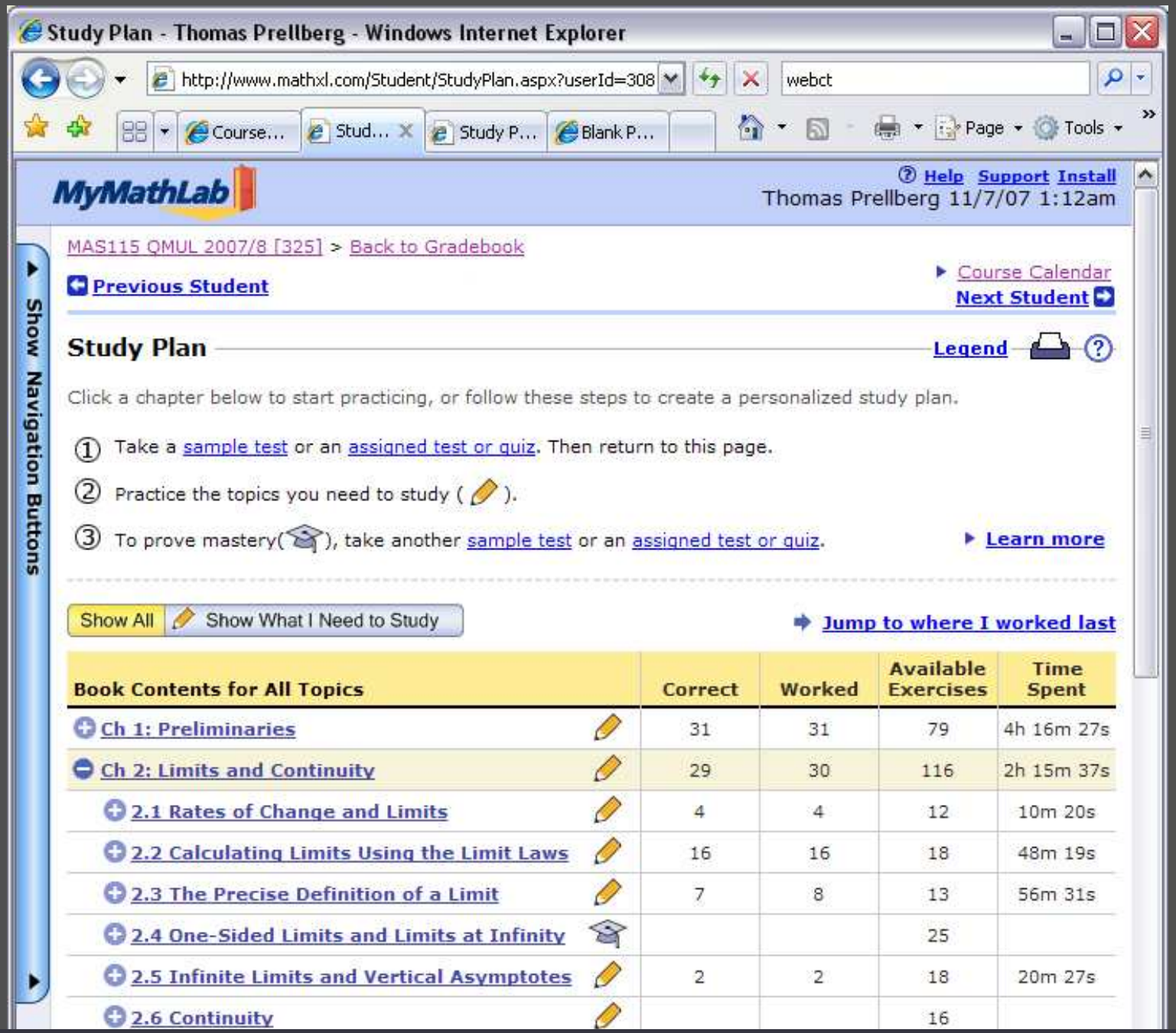
Study Plan - Thomas Prellberg - Windows Internet Explorer
http://www.mathxl.com/Student/StudyPlan.aspx?userId=308
webct
Course...
Stud...
Study P...
Blank P...
Page
Tools
MyMathLab
Help Support Install
Thomas Prellberg 11/7/07 1:12am
MAS115 QMUL 2007/8 [325] > Back to Gradebook
Previous Student
Course Calendar
Next Student
Show Navigation Buttons
Study Plan
Legend
Click a chapter below to start practicing, or follow these steps to create a personalized study plan.
① Take a sample test or an assigned test or quiz. Then return to this page.
② Practice the topics you need to study ( ).
③ 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

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Central question:

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- Only the final submission counts.

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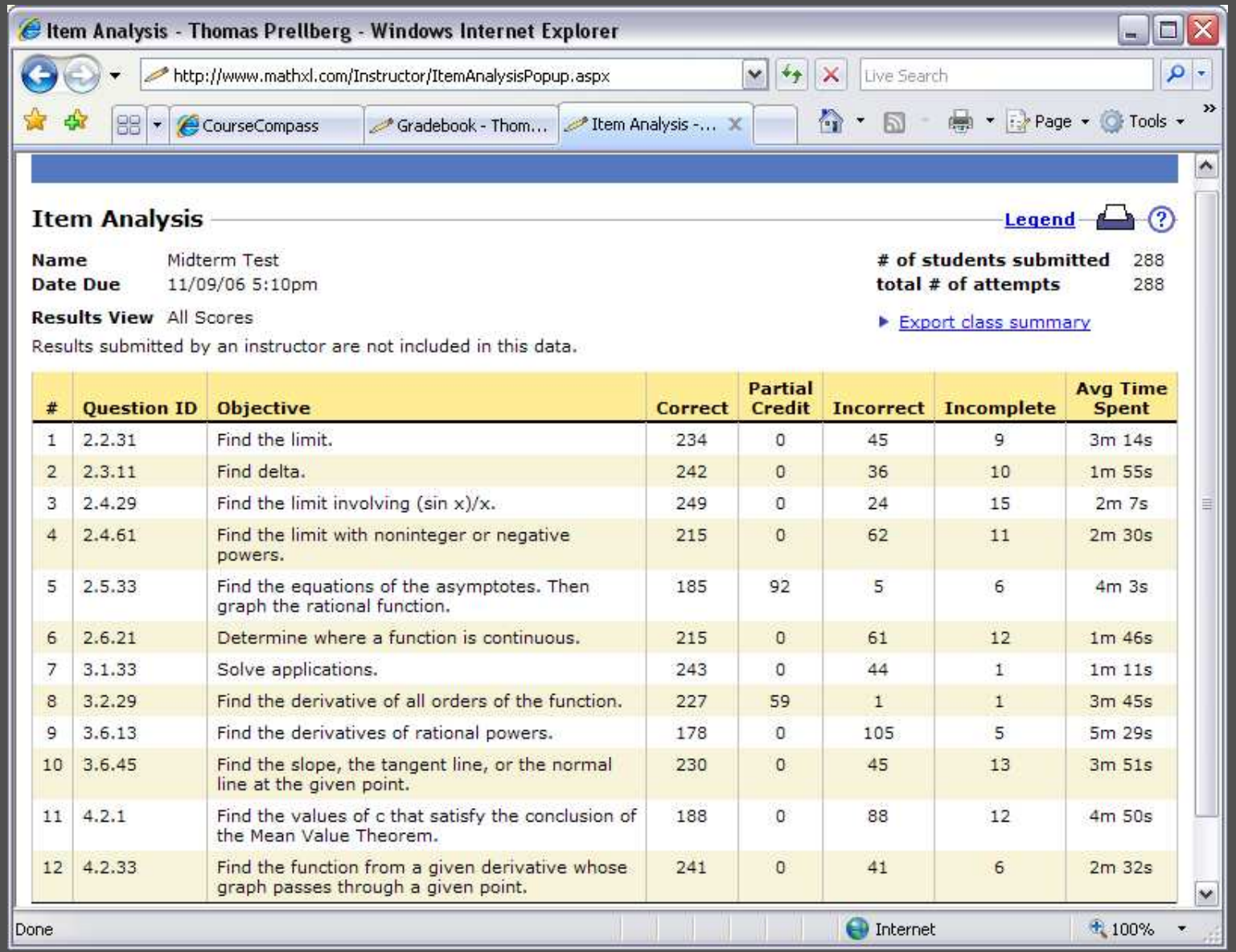
- Assessment
  - 10% ten courseworks
  - 10% two in-term tests
  - 80% final exam

Data on Student Performance



Item Analysis

Legend

Name Midterm Test
Date Due 11/09/06 5:10pm

# of students submitted 288
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

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  - 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"

Demonstration

Looking Back

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- Calculus I exam results correlated well with other exams
- Improvement across module boundaries:

EM test	1	2	3	**4**	5	6	**7**
2004/5	8.5	34.1	57.9	**77.3**	90.7	91.4	**95.7**
2005/6	14.1	25.6	53.8	**84.4**	89.4	95.0	**95.5**
2006/7	13.3	32.2	73.1	**88.6**	97.0	97.7	**98.1**

Cumulative pass rate in Essential Mathematics

"Essential Mathematics" achieved record pass-rates!

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Ongoing development with little established consensus. One year ago, the American Mathematical Society started to solicit comments about online grading:

`http://firstyearmathematics.blogspot.com`