DRILL

Depository of Repetitive Internet-based probLems and Lessons

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http://www.trinity.edu/vadim/drill.pdf
http://www.trinity.edu/vadim/drill/ponomarenko.html

Introduction

About DRILL

DRILL is an online quiz-taking system. Questions are generated randomly and are graded instantly. Wrong answers may be rewarded with a help screen with a lesson on the topic of the error. The current version is specialized to test algebra skills needed for calculus, including many common student errors.

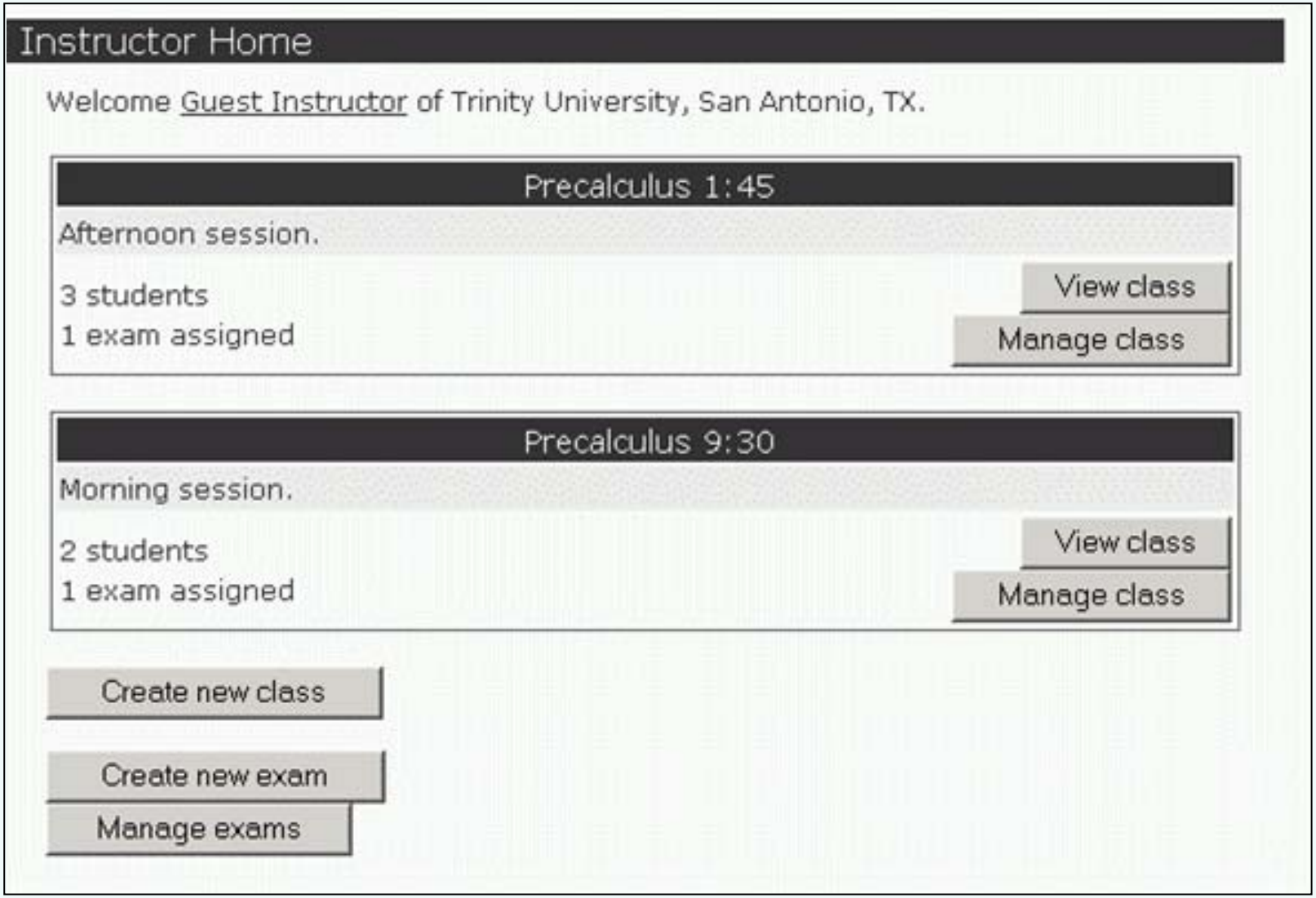
Instructors have the ability to manage multiple classes simultaneously. Exams may be created to be automatically assigned at later dates and due dates may be imposed. Every exam is different, so students may never memorize correct answers.

DRILL was developed at Trinity University by the DRILL Project Team.

Cookies must be enabled to use DRILL.

Preview DRILL before applying for an account here.

Instructor Main Screen



Two-Dimensional Exam Creation

- [x] Skill exam
- [ ] Common algebra errors
- [ ] Field axioms
- [ ] Factoring
- [ ] Finding domains
- [ ] Long division/asymptotes
- [ ] Solving 1-variable equations
- [ ] Solving >1-variable equations
- [ ] Solving 1-variable inequalities
- [ ] Solving systems of inequalities
- [ ] Translation/reflection/stretching of graphs
- [ ] Combining functions
- [ ] Solving triangles
- [ ] Trigonometric identities
- [ ] Partial fractions
- [ ] Growth/decay/compound interest
- [ ] Polar representation of vectors/DeMoivre's theorem
- [ ] Solving nonlinear 1-variable equations
- [ ] Solving polynomial 1-variable equations

- [ ] Object exam
- [ ] Logs/exponents
- [ ] Powers/roots
- [x] Rational functions
- [ ] Trigonometric functions
- [ ] Absolute value
- [ ] Cartesian plane
- [ ] Polynomials
- [x] Piecewise-defined functions
- [ ] Complex numbers
- [ ] Reals
- [x] Vectors
- [ ] Matrices/determinants
- [x] Sequences/series
- [ ] Conic sections
- [ ] Parametric curves
- [ ] Polar coordinates
- [ ] Inverse trigonometric functions

Sample Question

Finding the standard form of a fraction with a complex number in the denominator.

Which of the following is equal to the complex number

$$\frac{-5}{9 + 9i}$$

written in standard form?

Your response was: $\frac{-5}{9} - \frac{5}{9}j$

The correct answer is: $\frac{-5}{18} + \frac{5}{18}j$

Help for this question:
To find the standard form of a fraction with a complex number, $A + Bi$, in the denominator, multiply by the fraction with the complex conjugate, $A - Bi$, in the numerator and denominator. Since a number over itself is 1, multiplying by this fraction does not change the value of the original number. Multiplying a number by its complex conjugate always results in a real number, so the new denominator will be a real number. In this case, the multiplication looks like this:

$$\frac{-5}{9 + 9i}\frac{9 - 9i}{9 - 9i}.$$

Carrying out the multiplication results in:

$$\frac{-45 + 45i}{162}.$$

Finally, separate the real and complex components to get the standard form:

$$\frac{-5}{18} + \frac{5}{18}j.$$

Results

	Of students that scored 100% on maximum quiz	Of students that did not
Earned B or better in Calc 1	57%	32%
Earned C or better in Calc 1	81%	56%

p-value < 0.01 145 students participated over several semesters 1998-2003

Part II:

Some thoughts on the state of Electronic Homework Systems from the perspective of a developer and user

Minor Challenges

Student interface (what kind of answers, how to enter)

Instructor interface (statistics, course management)

Security (dynamic question generation, access control)

Major Challenges

Enough Good Questions

Widespread Adoption

Writing Questions is VERY Hard

- To generate dynamically, need variables
- Must be sure that all combinations of variables make sense Ax(BxC)=(AxB)x(AxC)
- Should be sure that desired topic cannot be avoided (students can't trivialize questions)
- Should be sure that undesired topics are not tested (no trick questions)
- Should reflect theories of learning and cognition, and educational standards

Recipe for Widespread Adoption

- Most important: easy assignment creation
    1. Tied to sections of a specific book
       (RISK: too close a tie will cause duplication of effort)
    2. List of samples, such as in a book
       (NOT a list of links, to be clicked on one at a time)
    3. Other methods (such as in DRILL)
- Right number of questions to choose from
- NO programming or question design
- Validation by some authority