User Guide

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Contents

Preface

Audience

The information in this guide is intended for instructors using the Maple T.A. system for the first time.

Goals

This guide serves as an introduction to the Maple T.A. system and is grouped into three parts. Chapters One through Five provide information related to each component of the system. Chapters Six through Eight provide instruction on basic question creation using the Question Editor. Chapters Nine through Eleven provide instruction on advanced question creation, including the use of Flash movies and Applets, LaTeX, and Plain-text question creation.

Initially, the chapters should be read in sequence. This provides a linear introduction to the process of using the components in the Maple T.A. system. However, this guide can be used as a quick reference or as a launching point for the Help system.

1 Getting Started

1.1 System Overview

Maple T.A. uses questions found in the **Question Repository** as the basis for constructing **assignments**. The Question Repository is the location of all questions for class homework, test items, or other class problem material.

Four types of users interact with Maple T.A.:

- System administrators manage classes and users.
- Instructors create questions and assignments.
- Proctors validate student identity and grant assignment access.
- Students complete assignments created by instructors.

System administrators can create, modify, and delete classes. They can also create, modify, and delete users individually or by uploading a roster.

Instructors control the rules and policies for assignments, which can range from self-study and homework sessions to proctored exams. Once satisfied with the questions and rules in the assignment, it can be published for use by students. Instructors control availability and due dates, and set grading parameters. Grades are automatically recorded in the system **Gradebook** and, if necessary, these grades can be changed.

Proctors can log in to validate a student's identity prior to administering a proctored exam.

Students logged in to the system are allowed to register in your class, take assignments as you make them available, and review the results of assignments they have completed.

Once you log in to the Maple T.A. system, you can access your Maple T.A. class or classes. This is where all system interactions occur for instructors,

proctors, and students. A class contains questions, assignments, resource files, and the class gradebook.

Assignments

Maple T.A. has a variety of assignment types, including:

- Self-study practice
- Mastery
- Homework and quizzes
- Proctored exams requiring student validation

When an assignment is created, you specify the questions to be used, as well as assignment access and feedback parameters. After determining the content (questions), rules, and policies, you publish an assignment to the class web site for use by students. Students can review the results of any previously completed assignments.

Gradebook

After students complete an assignment, you can view the results in a **Gradebook** or create downloadable performance reports.

With Maple T.A., you can generate comprehensive performance reports for individual students and assignments, classes, or multiple assignments. You can also perform statistical item analysis of questions.

1.2 Logging On

Log in to the system using the username and password your system administrator has provided. The main system page is called the **System Homepage**. The **System Homepage** provides access to the classes you are teaching, and those in which you are a student or proctor.

If the system administrator has created a class for you, your class will be listed under the **Classes I Am Instructing** section on your system homepage. You can click on the class name to navigate to the **Class Homepage**.

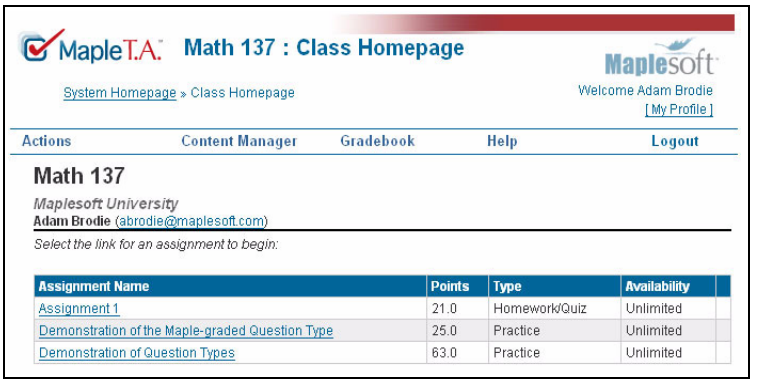
If your system administrator has not created a class for you, you can create a class.

1.3 The Class Homepage

Instructors access the **Class Homepage** to:

- Create and edit questions
- Create, publish, and manage assignments
- Access a gradebook that records student work and assignment results

Figure 1-A Class Homepage



From the **System Homepage**, click the link to your class to open the **Class Homepage**. The **Class Homepage** displays the class and instructor name, and the list of assignments, quizzes, and tests that you have posted.

The assignment list displays the name and type of assignment, associated points, availability (that is, scheduled dates and times), and specific policies in the assignment (for example, time limit). Click the listed assignment name to launch the assignment.

The following menu items are available from the **Class Homepage**.

- **Actions** -> Class Info, Add Child Class, User Manager, and Proctor Tools
- **Content Manager** -> Assignments, Question Repository, Course Modules, and Web Site Editor
- **Gradebook** -> Open, Add External Assign.
- **Help** -> Instructor, Other Help -> Proctor, Other Help -> Student, Getting Started, and About
- **Logout**

1.4 Creating a Class

Both instructors and administrators have sufficient privileges to create unique (new and empty) classes or ones based on shared material.

Creating a new class

1. Start at the **System Homepage**.
2. From the **Actions** menu, select **Administer Classes** (System Administrators only).
3. From the **Actions** menu, select **Add Class**.
4. Complete the class registration form. Detailed information on available fields is provided here:

   Course ID

   Select a unique string of letters and/or numbers as the Course ID.

   Class Name

   Select a unique name for your class. This name is displayed as the link to your Class Homepage. The class name should be between 5 and 50 characters long. It cannot contain the characters <, >, or &.

   Instructor

   Your name will be automatically entered in this field.

   School

   Enter the name of your school.

   Description URL

   Optional. If you have created a web page with additional information for your class, you can link to the page by providing the URL.

   Registration Locked

   Open registration allows students in the system to enroll themselves in your class. The default setting is locked, and students will not be able to enroll themselves into your class unless you unlock registration by clearing the check box.

   Featured Class

   Marking the class as a Featured Class allows the creation of child classes based on this class. This allows you to share assignments, quizzes, tests, and other resources. with other classes by adding an entry to the **Inherited Content From** drop down menu.

   Inherit Content From

   You can inherit content from a parent class. This gives you access to already created assignments, quizzes, tests, and other resources.

5. Click **Submit**. A summary of the class details is displayed.

Creating a copy of a class

1. From the Class Homepage of the class you want to share, select the **Actions** menu, and then select **Add Child Class**.
2. By default, you are listed as the instructor for the new class. Click the **Change Instructor** link to select a different instructor.
3. Enter details of the instructor you are searching for and click **Search**. Alternatively, you can search for the instructor in the list of registered users.
4. Select the instructor and click **Update**. The name of the instructor should be displayed.
5. Complete the Class Registration form and click **Submit**.

1.5 Adding Users to the System

System administrators and instructors that have create privileges can add users to the system. Users can be created from a roster (to add a large number of users at once) or individually. The system administrator can set up the system to allow students to create user accounts for themselves, but you have more control and the data will be more consistent if user accounts are created by a few chosen individuals.

User Rosters

User rosters are a convenient method to add a large number of users at once. Rosters are easily created and updated. Large numbers of users can also be removed using batch removal.

Creating a Roster

The user roster must be a comma-separated file (for example, ***.csv**) or tab-separated file (for example, ***.tsv**) that has one line for each user. The first line must be a header row that specifies the data contained in each column. The headers can be in any order, to make it easy to match your existing format.

The acceptable fields in the roster are as follows:

Login, First Name, Middle Initial, Last Name, Email Address, Student ID, Password, Role, Require User Validation

The corresponding header row values for these are as follows:

login, first, initial, last, email, student, password, role, validate

- The fields that are underlined are required.
- Login must be at least one alphanumeric character.
- First Name must be at least one alphabetical character.
- Middle Initial must be no more than one alphabetical character.
- Last Name must be at least one alphabetical character.
- Email addresses must be unique.
- Student IDs must be unique.
- Student ID must be at least five alphanumeric characters.
- Password must be at least five alphanumeric characters.
- If no password is provided, the system generates one which is displayed on the next page. You can print or save this page. If it is not printed or saved, the automatically generated login and passwords will be lost.
- Role can be Administrator, Instructor, Proctor, or Student. The role specified cannot exceed the level of the user who is creating the roster. The default is Student.
- Validate is a yes/no field and determines whether students have to review their data on first login and validate it. The default setting is 'yes'.
- If you have a null field (for example, a student did not provide a middle initial), use two consecutive delimiters.

  Note: If the header row includes Email and Student ID, you cannot have empty values for those fields in the rows of student data. If there are some students who do not have either an email or a student ID, you should use the value <Null>.

Uploading a Roster

You upload a user roster from the System Homepage. This will register users in the system.

1. From the **System Homepage**, click **Actions** and select **Administer Users**.
2. From the **Actions** menu, select **Roster**, and then **Import**.
3. To locate your class roster, click **Browse**. Navigate to the file and click **Open**.
4. From the drop-down menu, select the type of file being submitted as either Comma-separated or Tab-separated.
5. Click **Submit**. A table is displayed that includes all columns and information in the file.
6. Click **Enroll Roster**. A roster upload summary is displayed.

Updating a Roster

User rosters can be updated by importing rows with Login values that are already present in the Maple T.A. database. If an import row specifies a Login that already exists and an LDAP system is being used to maintain the database, then the user profile attributes are refreshed from the LDAP system. In this case, the only column required in the import row is the Login column. In other cases, the behavior is as follows:

- The imported attributes overwrite the corresponding attributes in the Maple T.A. database.
- Empty attributes are ignored and do not overwrite existing information. An attribute is empty if it is delimited by successive commas or tabs with no intervening character.
- An attribute may be overwritten to null by providing the special Maple T.A. string <Null> as its import value.
- An attribute that is specified as one or more spaces will be trimmed and will overwrite the database attribute with an empty string (different from a null value).
- Attribute values not included in the import (that is, with no column in the import) are not modified in the database.

Batch Removal

Large groups of students can be removed from the system at once using a special type of import. In this case, only the Login column of the import file is used or required.

1. From the **System Homepage**, click **Actions** and select **Administer Users**.
2. From the **Actions** menu, select **Roster**, and then **Delete**.
3. Select the radio button to determine if the users will be "permanently deleted (cannot be restored)", or "marked as deleted (can be restored)".
4. To locate the roster for batch removal, click **Browse**. Navigate to the file and click **Open**.
5. From the drop-down menu, select the type of file being submitted as either Comma-separated or Tab-separated.
6. Click **Submit**. A table is displayed that includes all information in the database for the users selected.
7. Click **Delete Roster**. A roster validation summary is displayed.

Users that are "permanently deleted" are removed from the entire system, along with any assignment answers or grades owned by those users. Users that are "marked as deleted" are moved to a separate database within the system and no longer have access to the system, but all of their information is

stored. They can be restored later by doing a search for deleted users in the Administer Users page, selecting the check boxes beside their names and clicking Restore. Permanently deleted users will not show up on a search for deleted users.

Adding Individual Users

You can also add users to the system individually. This is useful for adding a small number of users.

1. From the **System Homepage**, click **Actions** and select **Administer Users**.
2. From the **Actions** menu, select **Add User**.
3. Fill in the form.
4. Click **Submit**.

1.6 Registering Users in a Class

Before the **Gradebook** can begin tracking student performance, it must have students registered in the course. You can register students in a class by:

- Using the User Manager
- Allowing students to register themselves for your course
- Creating and uploading a class roster

To register students in your course, they must have an account in the system. Creating user accounts is usually done by the system administrator, although the administrator can give instructors the ability to create user accounts. In addition, the system administrator can set up the system to allow students to create their own user accounts.

The User Manager

You can select students to register in your class from a list of system users. All the students you want to register must already have an account in the system. You can search the list for a user that satisfies particular criteria.

1. From the **Class Homepage**, click **Actions** and select **User Manager**. From the **Actions** menu, select **Register Users**.
2. Enter search criteria to narrow the list of users down or to search for a particular student.
3. Select the checkbox beside the students you want to register in your class.
4. Click **Register**.

Student Self-Registration

Students can register for your class using the **Find classes open for registration** link on the **System Homepage**. The student selects the class he or she wants to enroll in, and clicks **Register**. The student then clicks **Confirm** and must complete the form on the **Student Registration** screen.

You can lock access to this form of registration from your class homepage. From the **Actions** menu, select **Class Info**, click **Edit**, and select the **Registration Locked** check box.

Class Rosters

Creating a Class Roster

A class roster has the same format as a user roster. See "User Rosters" on page 5.

Uploading a Class Roster

You can upload a class roster from your **Class Homepage**. This will register users in the system as students in your course. If you have create privileges and the user is not already in the system, a new account will be created.

1. From the **Class Homepage**, click **Actions** and select **User Manager**. From the **Actions** menu, select **Roster**, and then **Import**.
2. To locate your class roster, click **Browse**. Navigate to the file and click **Open**.
3. From the drop-down menu, select the type of file being submitted as either Comma-separated or Tab-separated.
4. Click **Submit**. A table is displayed that includes all columns and information in the file.
5. Click **Enroll Roster**. A roster upload summary is displayed.

As discussed in the User Rosters section, system administrators and instructors with create privileges can also import users from the **System Homepage**. This will add students into the Maple T.A. system, but you will still need to register the students into a course.

2 Sharing Content

Sharing content is an important part of using a system like Maple T.A. effectively. Sharing content makes a wider range of questions and assignments available to all users. You can share questions, assignments, and resources in a variety of ways, from choosing specific content to providing access to all the content in a class.

2.1 Sharing Questions

Questions are owned by a class. The creator of a question becomes the default owner of the question. Questions can only be modified by the owner.

Child classes automatically inherit questions from their ancestors.

Instructors can obtain question material for their groups in one of three ways:

1. **Create** a question. The instructor becomes the owner of this question.
2. **Inherit** a public question from an ancestor class. Instructors can use the question in their assignments, but cannot modify the question. Only the original owner (creator) of the question will be able to modify the question, and those changes will be automatically propagated to all subscribers' question groups. This is similar to the Question Bank inheritance rules in Maple T.A. 4.0.
3. **Shadow** a public question from another class. Instructors can use the question in their assignments, but cannot modify the question. Only the original owner (creator) of the question will be able to modify the question, and those changes will be automatically propagated to all subscribers' question groups.
4. **Clone** a public question from repository. This operation creates a local copy, or clone, of the public question and sets the owner to the instructor

who made the clone. Only this subsequent instructor will be able to modify the cloned question. All changes made to the original public question will *not* be visible in cloned questions.

The **Inherit**, **Shadow**, and **Clone** methods have disadvantages:

- When instructors **Inherit** or **Shadow** a public question, they should expect it to be modified by the question owner at any time without notice; however, the question most probably will be a valid question with all resources (images, etc.) in place.
- When instructors **Clone** a question, they can be sure that it will not be touched by anybody, but there is a danger of losing resources (images, etc.) because the cloning process does not copy the resources to the instructor's web space; therefore, they can be deleted any time by the original author of the question.

To create a question:

1. Click the **Question Repository** link from the menu bar.
2. Click **Questions**, then **New Question**.
3. Create the question and add it to one or more Groups.

To share a question:

1. Find the question that you wish to share.
2. Click the share button or click the checkbox beside the questions you wish to share and then click **Make Public**.

To shadow a question:

1. Click the **Public Questions** link.
2. Use the search methods available to find the public questions that you wish to use.
3. Add the question to one or more of your question groups by clicking the modify button or by clicking the checkbox beside the questions you wish to use and then clicking **Add To Groups**.

To clone a question:

1. Use the search methods to find the questions (Public or Private) that you wish to clone.
2. Click the clone button or click the checkbox beside the questions you wish to share and then click **Clone**.

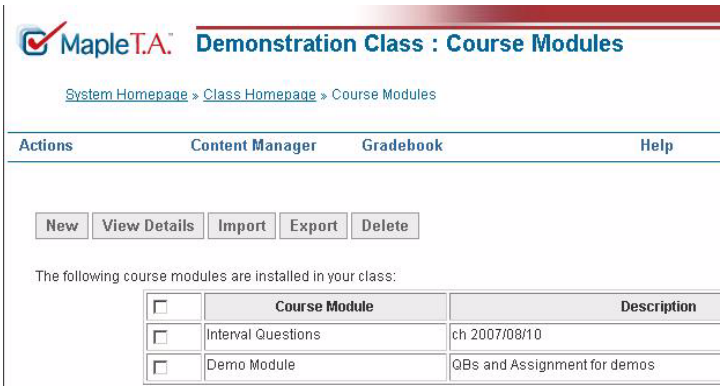
Inherited questions automatically appear in a class' repository as they are created.

2.2 Course Modules

If you want to share not just your questions, but also images and assignments that you have created based on those questions, you should use course modules. Once you create a course module, you can send it to other instructors who can upload it into their classes and use it as is or alter it to better suit their needs. Course modules can be uploaded to other installations of Maple T.A., not just the one at your institution.

> Note: Only local content can be included in a course module. If you are inheriting content from another class, you will not be shown the inherited content in the course module creation screen.

Figure 2-A The Course Module main menu screen enables you to create, import, export, or delete course modules and their contents.



To share content using course modules, first create a course module by choosing the items you want to include. Once you have created the course module, you can save the course module file (`.zip`) to your computer and then send that file to other instructors.

To create a course module:

1. Log in as an instructor and click on the class that contains the content you want to share.
2. Click **Content Manager**, then **Course Modules**.
3. Click **New**.
4. Select the question banks, assignments, and web folders that you want included in the course module. Click **OK**.
5. Enter a name for the module. Optionally, enter a description for any of the items you have included in the module. Click **OK**. The course module now appears in the list of course modules for your class.

To export a course module:

1. Log in as an instructor and click on the class name that has the course module you want to export.
2. Click **Content Manager**, then **Course Modules**.
3. Select the checkbox beside the course module you want to download and then click **Export**.
4. The following screen allows you to add URLs that you want changed. In most cases, the default URLs are the only ones that need to be updated. Click **OK**.
5. Once the course module is created and ready for download, you will see a link **click here to start the download**. Click that link to open the file download dialog.
6. Click **Save**, then browse to the location where you want to save the file. Enter a new file name or use the existing name of the course module and click **Save**.
7. Once the download is complete, click **Close**. You are returned to the download screen.
8. Click **Return** to go back to the **Course Modules** menu.

When you receive a course module, you need to import and install it or pieces of it to the desired class.

To import a course module:

1. Log in as an instructor and click on the class in which you want to import the content.
2. Click **Content Manager**, then **Course Modules**.
3. Click **Import**.
4. Click **Browse…** to locate the course module file (`.zip`) on your computer.
5. Click **Import**. The system will display the question banks, assignments, and web resources from the course module. If there are items that use the same name as those in your class, they will be highlighted in yellow on the upload screen.
6. Select the checkboxes beside the items you want to install and click **Install**. The selected items are installed in your class.

If you have uploaded a course module and decide that you no longer want to keep it, you can delete it. You can do one of two things: delete just the course module name from the list of course modules; or, delete the course module name from the list and all or part of its content from your class.

To delete a course module:

1. Log in as an instructor and click on the class name that has the course module.
2. Click **Content Manager**, then **Course Modules**.
3. Select the checkbox beside the course module you want to delete and then click **Delete**. This will remove the course module name from the list of course modules, but it will not delete the content of the course module from your class.
4. You will receive a warning. Click **OK** to delete the course module name from the list.

To delete course module content from a class:

1. Log in as an instructor and click on the class name that has the course module.
2. Click **Content Manager**, then **Course Modules**.
3. Select the checkbox beside the course module you want to delete and then click **View Details**.
4. Select the checkboxes beside the items that you want to remove from your class and click **Delete**.
5. You will receive a warning. Click **OK** to delete the course module name from the list and the selected content from your class.

2.3 Child Classes

If you have a class that contains content that you want to share with other instructors at your institution, you have the ability to share the entire class. The benefit of sharing the class rather than providing a course module is that there is a link between a parent class and any child class. Child classes will automatically get any changes that you make to the parent class content. With a course module, there is no link between your class content and the class in which the course module is uploaded.

Creating a child class can be done by an instructor or an administrator.

To create a Child Class:

1. Log in and click on the class you want to share.
2. Click **Actions**, and then **Add Child Class**.

3. Click **Change Instructor** and then browse the user list or use the search panel to find the user who will be the instructor for the child class. Select the radio button beside the user and click **Update** to change the instructor.
4. Enter the information in the registration form and click **Submit**. You will get a notice that the class was created.

2.4 Featured Classes

If you have a class that will be used by many instructors or from year to year, you may want to create a featured class. A featured class is similar to a shared class as described in the previous section. The main difference is that a featured class will appear in the drop-down list of classes from which you can inherit content when a new class is created.

To create a Featured Class:

1. Log in as a system administrator.
2. Click **Actions**, and then **Administer Classes**.
3. If the tree view is showing, click **Table View**.
4. Click the **Open** link for the class that you want to make a featured class.
5. Click **Edit**.
6. On the **Class Details** page, select the checkbox beside Featured Class. Click **Submit**.

Propagation of Material from Featured to Child Classes

The relationship between featured and child classes allows for quick and easy propagation of material, while still allowing certain features within the child classes to be customized. Details of this relationship are as follows:

- When an assignment is created in a featured class, all child classes will receive only a copy of all assignment attributes (names, policies, restrictions, etc.). The content of the assignment will not be copied to the child classes; instead, inherited assignments will point to one copy of the assignment content stored in the featured class.
- All changes made to the assignment content in the featured class will be immediately visible in all child classes.
- All changes made to the assignment attributes (names, policies, etc.) in the featured class will *not* be propagated to child classes, allowing them to have their own customized set of attributes.

- Instructors of child classes will be allowed to modify all attributes of the inherited assignments, but will not be able to modify assignment content.
- If instructors of child classes wish to customize the content of an inherited assignment, they will have to make their own copy of the assignment.

3 Question Repository

3.1 Overview

The Question Repository is used to create, organize, and search for questions. This replaces the use of Question Banks and Topics used in Maple T.A. prior to version 5.0.

There are three methods for authoring question banks in the system:

1. Question Editor
2. Maple T.A. `.qu` plain-text script files
3. LaTeX files that can produce math-intensive questions formatted to Maple T.A. specifications

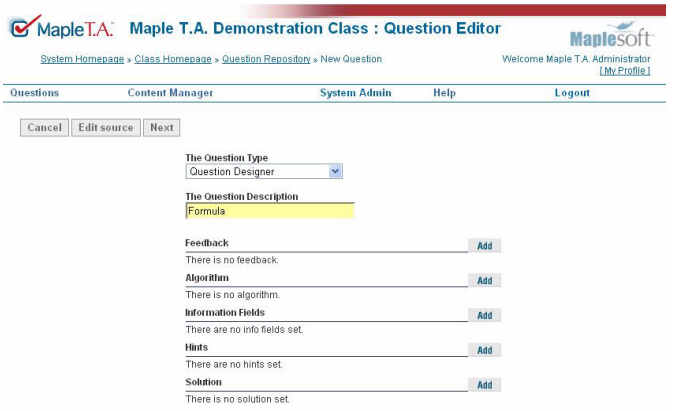
This document discusses using the Question Editor. For information on authoring questions banks using the other two methods, refer to the Maple T.A. help system.

3.2 Question Editor

To create a question using the Question Editor:

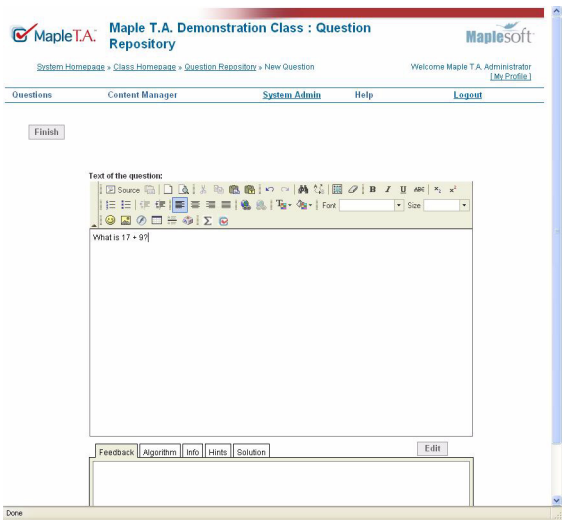
1. Click the **Question Repository** link from the menu bar.
2. Click **Questions**, then **New Question**.

Figure 3-A Question Editor - New Question



3. Enter the content of your question. Examples are provided in the *Example Questions* on page 21.

Figure 3-B Entering a Question



4. Once you have completed the question, click **Finish**.
5. Choose the groups (if any) that you wish the question to belong to and click **Submit**.

6. A preview of the question is displayed. Provide an answer and click **Grade** to see how the question is graded. Click **Edit** to continue refining the question as necessary.

Maple T.A. provides the following question types:

- Mathematical & Scientific Free Response Question Types (14 varieties including formula, numeric, and questions that use the Maplesoft™ Maple™ mathematical software to grade and plot student responses)
- Multiple-choice (permuting and non-permuting)
- Multiple-selection (permuting and non-permuting)
- True-or-False
- Ungraded Essay
- Fill-in-the-blank including text region or drop down menu
- Question Designer
- Key Word or Phrase
- List
- Clickable Image
- Short Phrase
- Matching
- Multipart Questions (consisting of parts that are of any question type; can be nested)
- Palette Questions (using a programmable palette of symbols for the entry of student responses)
- Questions with applet interaction
- Questions using web references / objects (including plots)

3.3 Example Questions

This document discusses three question types: Question Designer, Maple-graded, and List. You are guided through the process of designing a simple multiple-choice question using the Question Designer, followed by editing the previous question to incorporate randomly determined parameters. You will also learn how to insert 2-D math into your question. Creating a Maple-graded question, inserting plots into the Maple-graded question, and a creating List question will also be discussed.

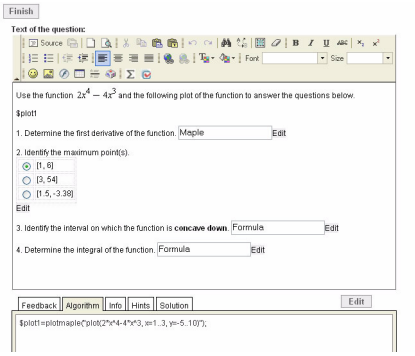
The Question Designer

The Question Designer provides a flexible format for creating free response questions that can include multiple response cells. These questions are similar to multipart questions in that they provide a shell structure in which to embed other questions.

The Question Designer is an authoring environment as familiar as your word processor. Using the Question Designer, you enter question text and the correct answers wherever they should appear. Many formatting options such as bold, italics, and fonts are available through the text editor icons. You can also insert images, tables, or links to other file resources.

When you are satisfied with the appearance of the question, you define answer regions, or **Response Areas**, and then apply grading and other behaviors. Like all questions in Maple T.A., you can insert algorithmic variables and inline math expressions as required.

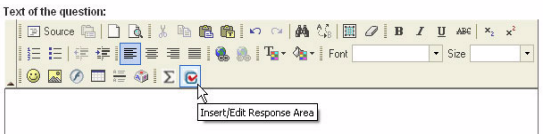
Figure 3-C Question Designer



From the Question Designer, you can launch the **Response Area** window, which allows you to define the question type, weighting, grading behaviors, display behaviors, and correct answers. You can define additional behaviors according to the individual question mode you select. Additionally, you can add feedback, algorithms, hints, and solutions.

At the top of the Question Designer is the toolbar which includes the unique **Insert/Edit Response Area** button that you use to activate the **Response Areas** defined in your question.

Figure 3-D Insert/Edit Response Area



The Question Designer supports the following question types:

- Formula Question Types: Formula, Formula Mod C, Restricted Formula, Equation, Vector of Formulas, and Chemical Equation
- Maple-graded Question Types: Formula and Maple Syntax
- Multiple-choice, Non-permuting Multiple-choice (displayed horizontally or vertically)
- Numeric Question Types: With and without required unit dimensions
- List Questions, including text or menu input styles, exact or relaxed graders, multiple correct or incorrect responses can be specified, partial credit can be defined for each response
- Essay Question

The following provides instruction for creating a simple multiple choice question using the Question Designer. In addition, navigating, previewing, and enhancing the appearance of a question are discussed.

Multiple-choice Question using the Question Designer

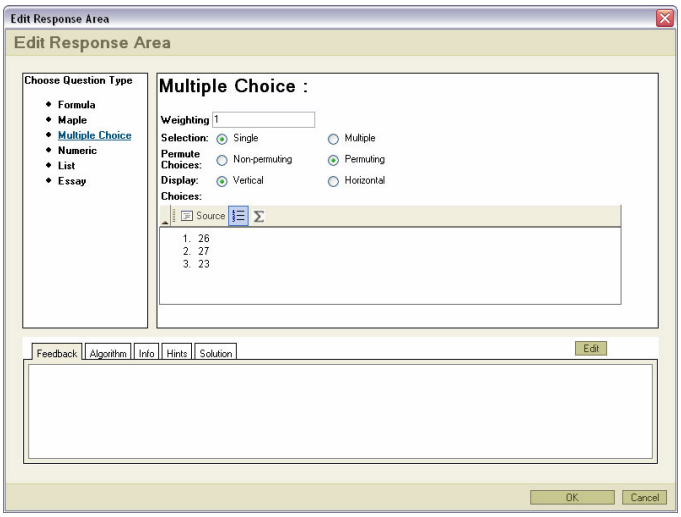
To use the Question Designer:

1. Select **Questions**, then **New Question**.
2. Select the **Question Designer** question type from the **Question Type** menu.
3. Enter "Multiple-choice" in the **Question Description** field.
4. Click **Next**. The **Question Editor** opens the **Question Designer**.
5. In the **Text of the question** field, enter the following:

   Question: What is 17 + 9?

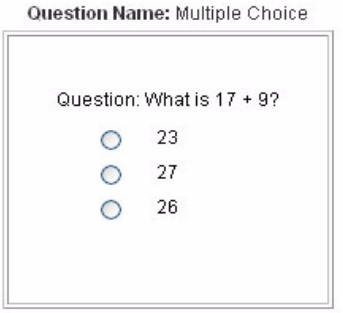
6. Click the **Insert/Edit Response Area** button to launch the **Edit Response Area** window.

Figure 3-E Edit Response Area



7. Select **Multiple-choice** in the left pane.
8. Select **Permuting** in the Permute Choices row.
9. Highlight and delete **choice 1** and enter 26.
10. Highlight and delete **choice 2** and enter 27.
11. Press **Enter** to display a third multiple choice option.
12. Enter 23. Now that you are finished entering choices, click **OK**.
13. Click the radio button beside the correct answer to mark this answer as correct and click **OK**.
14. Click **Finish**. The **Question Editor>Preview Question** window opens, displaying the question as it appears to the student.

Figure 3-F Multiple-choice Question Preview Window



To test and review your question:

1. In the **Question Editor>Preview Question** window, select the correct answer (26) and click **Grade**. The **Preview Grade** window opens. A **Correct** icon is displayed along with your answer matching the correct answer. Click **OK** to close this window and return to the **Preview Question** window.
2. Again in the **Preview Question** window, select an incorrect answer (23) and click **Grade**. The **Preview Grade** window opens. An **Incorrect** icon is displayed along with your answer and the correct answer. Click **OK** to close this window and return to the **Preview Question** window.

In the next example, the Multiple-choice question created in the previous example is extended by specifying algorithmic variables, hints, solutions, and feedback.

Multiple-choice Question with Randomly Determined Parameters

Specifying algorithmic variables allows you to generate a question that changes each time you view it. Because values in the question are randomly

determined for each instantiation, students answer variations of the same question.

Figure 3-G Question Editor with Algorithmic Example

To specify algorithmic variables:

1. In the **Preview Question** window, click **Edit**. The **New Question** window opens.

   Note: This procedure will overwrite the first question and not create a new one.

2. In the **Question Description** field, change the description to "Multiple-choice Enhanced".
3. Click **Next**. The Question Designer window displays.
4. Select the Algorithm tab and click **Edit**.
5. Enter the following code in the text box:

   $a=range(10);
   $b=range(10);
   condition:ne($a, $b);
   $sum = $a + $b;
   $product = $a*$b;

- The range(n) function generates a random integer in the range 1,..., n (inclusive). There are n numbers in that range. Hence, it is a selection of one number from a choice of n.
- The condition:ne function ensures the two variables are not equal.
- $ is required to indicate a variable.
- The question variables are set to $a and $b. These will range from 1 to 10. The answer is set to $sum, which is the integer value of $a+$b.
- As this question is multiple-choice, you must generate wrong answers to be displayed alongside the correct answer. For variation, the wrong answer variable $product is set to the randomly generated variable $a*$b.

- All lines end with a semicolon.

6. Click **Save**. The **Question Designer** window is displayed.
7. Select the Feedback tab and click **Edit**. The **Edit Feedback** window opens.
8. Enter the following text in the feedback text field:

   The sum of $a and $b is $sum.

   Note: As the instructor, you can choose to have this information shown to students when they view their graded assignments.

9. Click **Save**. The **Question Designer** window is displayed.
10. You must now edit the text of the question and the answer choices to use the variables. In the **Text of the question** field, replace:

    What is 17+9?

    with

    What is $a + $b?

11. Double-click **Edit** below the multiple choice options and replace the previous answers with the variables **$sum** and **$product**.
12. Delete the third option by clicking the **Back Space** key.
13. Click **OK**.
14. Ensure that the **$sum** variable is selected to be the correct answer.
15. Click **OK** to return to the **Question Designer** window.
16. Click **Finish**. The **Preview Question** window opens. Test the question by selecting an answer and clicking **Grade**.

    Note: Using the **Question Designer**, you can add feedback, algorithms, hints, solutions, and information fields in the same interface as the question text as illustrated in this example. You can also add these fields in the **New Question** screen by selecting **Edit** beside each field. For all other question types, the **New Question** window is the only place to add these fields.

The following example provides instruction for creating a multiple choice question using the question designer to determine a square root.

Multiple Choice Question Incorporating 2-D Math

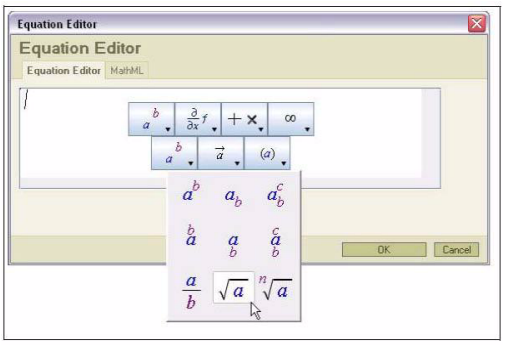
1. Select **Questions**, then **New Question**.
2. Select the **Question Designer** question type from the **Question Type** menu.
3. Enter "Multiple-choice with 2-D Math" as a description in the **Question Description** field.

4. Click **Next**. The **Question Designer** window displays.
5. In the **Text of the question** field, enter the following:

   What is

6. Click the **Sigma** Σ button to insert 2-D math. The **Equation Editor** opens.
7. Right-click in the **Equation Editor** field. From the displayed palettes, select a square root symbol. The symbol is displayed in the Equation Editor.

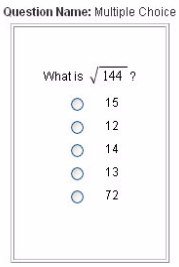
Figure 3-H Equation Editor



8. Replace the "a" in the square root with 144 and click **OK**. The square root of 144 is now displayed in the text region in the **Question Designer**.
9. After adding a question mark to complete the question, click the **Insert/Edit Response Area** icon.
10. Select **Multiple-choice** in the left pane.
11. Select **Permuting** in the Permute Choices row.
12. Enter 12, 14, 72, 13, and 15 as possible answers, one for each field.
13. Click **OK**.
14. Click the radio button beside the 12 to mark this as the correct answer and click **OK**.

15. Click **Finish**. The **Question Editor>Preview Question** window opens, displaying the question as it appears to the student.

Figure 3-I Multiple choice question incorporating 2-D math preview



Maple-Graded Question

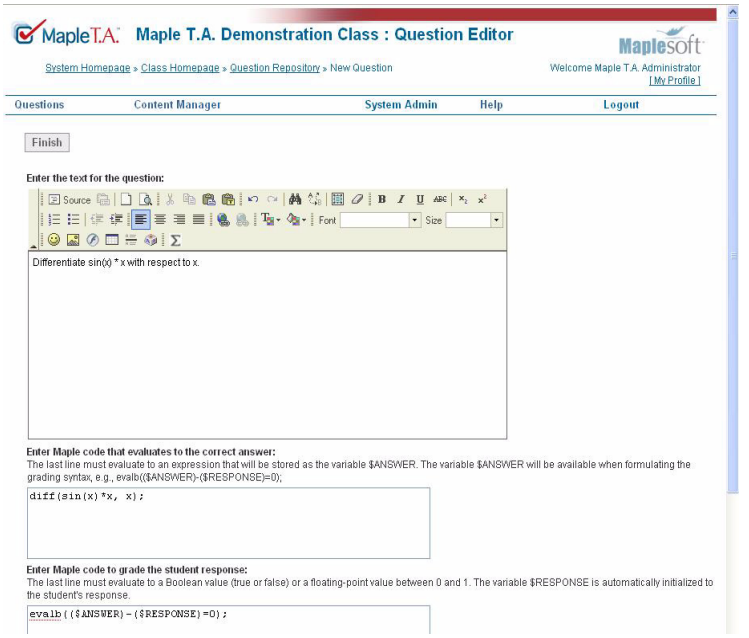
The Maple-graded question type uses Maple to evaluate a student response and to render a plot of the student's response. The Maple-graded question type gives you access to the computational power of Maple. It includes facilities for algebra, calculus, differential equations, discrete mathematics, graphics, numerical computation, and many other areas of mathematics. You can also use Maple to create questions whose responses require sets, differential equations, unevaluated integrals, and many other types of mathematical data. You can find common errors and reward partial marks.

With the Maple-graded question type, you also have access to the plotting capabilities of Maple. You can use Maple to plot a student response (or a function derived from a student response, such as the definite integral of the student response) for a Maple-graded question type. You can also use Maple to display a plot for any question type.

You must adhere to the following guidelines when using Maple code for Maple-graded questions:

- A Maple-graded question must use valid Maple code to evaluate the answer. Complete each line of code with a semicolon. For information on Maple code, refer to your Maple system documentation.
- The grading code must evaluate to a Boolean value or a floating-point number between **0** and **1**.
- Use the long form name for all package commands, for example, VectorCalculus[ArcLength].
- Maplet applications are not presently accessible in Maple T.A.

Figure 3-J Question Editor - Maple-Graded Question



To create a Maple-graded question:

1. Select **Questions**, then **New Question**.
2. From the **Question Type** menu, select **Maple-graded**.
3. In the **Question Description** field, enter "Differentiation".
4. Click **Next**.
5. Enter the text of the question field:

   Differentiate sin(x) * x with respect to x.

6. Enter **Maple code that evaluates to the correct answer**:

   diff(sin(x)*x, x);

7. The following **Maple code to grade the student response** is provided automatically:

   evalb(($RESPONSE)-($ANSWER)=0);

$RESPONSE is a system variable that corresponds to the response the student entered when completing the question and $ANSWER refers to the correct answer you entered in step 6.

8. By default, the Maple-graded question type accepts **Formula** expressions. In **Maple-graded Formula** question types, students can enter a math formula, that is, an expression constructed of numbers, variable names, and the standard arithmetic expressions and functions. The student must not use Maple commands in the response. The instructor must write code such that the student does not have to use a trailing semicolon in the response. For details, refer to the Maple T.A. Help system.
9. Scroll to the top of the page and click **Finish**.
10. Enter the correct answer, cos(x)*x+sin(x), and click **Grade**.

Plotting the Student's Response

Using the Maple-graded question type, you can generate a plot of the student's response. This allows students to visually check their response before proceeding.

To plot the student's response:

1. Click **Edit**, and then **Next**. The **Question Editor>Edit Question>Maple Graded** window opens.
2. Scroll to the bottom of the question. Using a standard plot command in Maple, enter the student's response as well as the derivative of the question. If the student is correct, the plot region will display a plot with a single curve. In the **Plotting** field, enter:

   ```
   plot([$RESPONSE, diff(sin(x)*x, x)], x=-10..10);
   ```

   $RESPONSE is a system variable that corresponds to the student's response.
3. Scroll to the top of the screen and click Finish.
4. Test the question by entering a response and selecting the **Plot** link. The plot is displayed in a separate window.

Inserting a Maple Plot in the Question Feedback

You can also insert a Maple generated plot in the question text, hints, or feedback of any type of question.

To insert a Maple plot as an algorithmic variable:

1. Click **Edit** to edit the current question.

2. Click the **Add** button in the **Algorithm** section.

3. Enter the following:

   $plot1=plotmaple("plot(sin(x)*x, x=-10..10)");

4. Click **Save**. You can use the algorithmic variable **$plot1** to display the Maple plot in all question types anywhere algorithmic variables can be used (that is, in the question text, hints, and feedback).
5. Click the **Add** button in the **Feedback** section.
6. Enter the following:

   A plot of the expression is $plot1.

7. Click **Save**.

Apply Partial Grading to Maple-graded Questions

You can modify Maple-graded questions to allow grading between 0.0 and 1.0 for part marks. The following is a simple application of partial marks. In solving $3x + 6 = 12$ for x, students may add 6 to 12 instead of subtracting it. If they made this error, but divided by 3 properly, they would get a result of 6. In this case, the instructor can give them half marks by using the grading code shown below:

Text for the question	Solve for x in the following equation: 3x+6=12
Maple code that evaluates to the correct answer	solve(3*x+6=12,x);
Maple code to grade the student response	if ($RESPONSE=6) then 0.5 else evalb($RESPONSE-($ANSWER)=0 end if;

See Chapter 8 for more in-depth coverage of the Maple-graded question type.

List Question using the Question Designer

To create a List question:

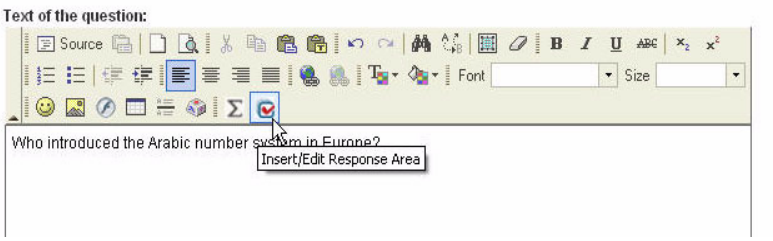
1. Select **Questions**, then **New Question**.

2. Select the **Question Designer** from the **Question Type** menu.
3. Enter "List" as a description in the **Question Description** field.
4. Click **Next**. The **Question Designer** window opens.
5. In the **Text in the question** field, enter the following question:

   Who introduced the Arabic number system to Europe?

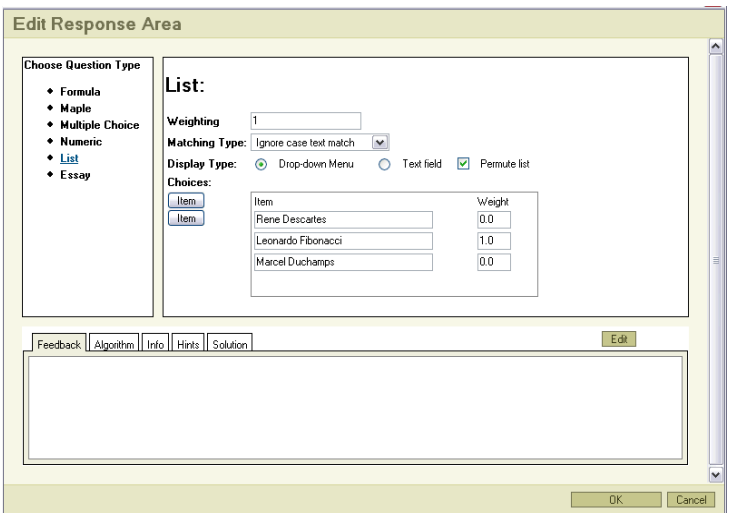
6. Click the **Insert/Edit Response Area** button to launch the **Edit Response Area**.

Figure 3-K Insert/Edit Response Area Button



7. In the Choose Question Type area, click **List**.

Figure 3-L List question type using the Question Designer



8. The default Matching Type is set to **Exact text match** which applies strict grading, case-sensitive, literal string-matching as your grading mode. To invoke a less stringent grader that ignores case sensitivity and

punctuation, select **Ignore case text match**. The List mode also provides a regular expression-matching grader, useful for customization of the grading routine. These fields are applicable when the Display mode is set to Text Field, which presents students with a blank response area. For this example, select **Drop-down Menu**. Ensure the Permute list check box is selected.

9. Enter answer choices in the **Item** fields. To add additional items, click the **Add Item** button.
10. As you add possible answers, the system assigns them a credit value of "0.0" in the right column. Additional answers are graded as fully correct ("1") or partially correct answers (with any value between 0 and 1 assigned). Edit the weight for Leonardo Fibonnaci and enter 1.0.
11. Click **OK** to exit the **Edit Response Area** window.
12. Click **Finish** to exit the **Edit Response Area** window.
13. Click the **Finish** button at the top of the **Question Designer**. The Question Bank Editor displays the question as it is viewed by students.

Numeric Question using the Question Designer

1. Select **Questions**, then **New Question**.
2. Select the **Question Designer** from the **Question Type** menu.
3. Enter "Question Designer Numeric" as a description in the **Question Description** field.
4. Click **Next**. The **Question Designer** opens.
5. In the blank text area, enter the following question:

   Round 2.76789 m to three significant digits.

6. Click the **Insert/Edit Response Area** button (check mark symbol) to launch the **Edit Response Area** window.
7. In the **Choose Question Type** area, select **Numeric**.
8. Enter the correct answer "2.77" in the **Numeric Part** field.
9. Click the blank field next to the **Units Part** field and enter a required unit dimension for the correct answer (in this case, **m** for meters.) If you do not enter a required unit dimension, the system displays only a single response cell that accepts only numbers for student answers. If you do enter a required unit dimension, students are presented with two cells: one for the number part and one for the unit dimension. The student must enter correct values in both cells to receive full marks for the question.
10. To set the margin of error, click the **Required with** menu, which is set to **Absolute Accuracy** by default. You can specify absolute precision (student

answers must match the defined answer exactly), or a significant figure precision for an exact answer match.

11. Modify the tolerance by choosing one or more of the numeric formatting options. The available options are:

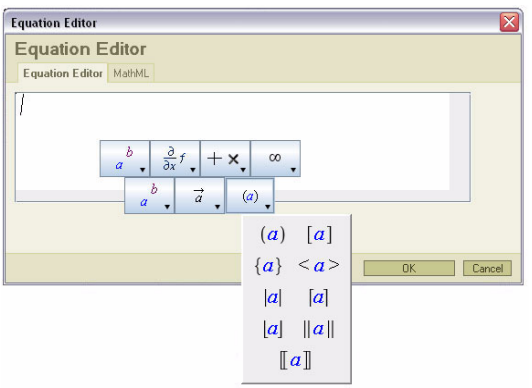
- Absolute Accuracy
- Set # figures
- Margin of error
- Margin in n'th digit
- Percentage margin.

12. Click **OK** and then **Finish** to save and preview the question.

Equation Editor

You can enter symbolic math in any question type. In the **Add Question Text** window, (this window usually displays after the **Question Editor>New Question** window for each question type), click the **Sigma** Σ button in the toolbar. The **Equation Editor** dialog opens. Right-click to access the palettes.

Figure 3-M Enter symbolic math



3.4 Downloading Questions

To back up questions by downloading to your hard drive:

1. From the **Question Repository**, find the questions you wish to save.
2. Select the checkboxes next to the questions.

3. Click **Export**. The files are saved as `testbank.qu`.
4. A message is displayed indicating the download is complete. Click **Close**.

You can import the saved question bank file (plain-text script file), and then continue editing or install it in your class.

To open a question bank file that was downloaded to your hard drive:

1. From the **Question Repository**, click **Questions**, then **Import Question Bank**
2. To locate your file, click **Browse**.
3. Navigate to the source file on your hard drive and click **Open**. The path and filename are displayed in the **Question Bank** field.
4. Select how the questions will be organized when importing.
5. Click **Import**. The topics are displayed in the left panel of the **Question Bank Editor**.
6. Save your imported question bank. From the **Actions** menu, select **Save Question Bank**.

When you upload a question bank file into the system, it performs a set of validation routines to ensure that the questions function. Occasionally, you may encounter an error with a variable name or definition upon uploading. The following is a summary of the system's analysis of variables upon initial loading of a question bank file.

- For variables displayed within HTML text, for example, in a question statement or feedback area, a problematic variable does not produce a data value generated from its definition. Instead its variable name is displayed, highlighted in red.
- For variables appearing in non-displayed field parameters, for example, the answer to a question, the variables $ANSWER and $RESPONSE default to 0. All others have the variable name passed.

4 Assignments

4.1 Overview

Assignments are created by selecting questions from the Question Repository. The assignments you create can be organized such that Maple T.A. reorders questions, generates questions, or displays a subset of questions. Each student viewing your assignment can potentially complete a unique set of questions.

The **Assignment Editor** allows you to create new assignments, edit the content, properties, and appearance of existing assignments, delete assignments, and change the order of existing assignments.

Assignment Editor Main Menu

From the **Class Homepage**, click **Content Manager** and select **Assignments**. From the **Assignment Editor** main window, you can:

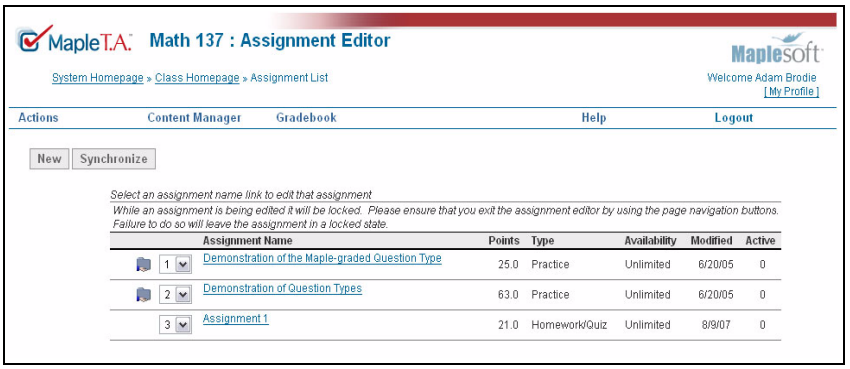
- Click **New** to create a new assignment.
- Reorganize the order of displayed assignments using the numbered list beside each assignment.
- Open assignments for editing by clicking the assignment name link.

To activate other options, hover your mouse over the assignment name. Six option buttons are displayed.

- Edit assignments by clicking **edit**.
- Copy assignments by clicking **copy**.
- Delete assignments by clicking **delete**.
- Hide/show assignments from student view in the **Class Homepage** by clicking **hide/show**.

- Print assignments. Clicking the **print** link displays the print preview of the assignment. You then have the option to print the assignment or click **Back** to return to the **Assignment Editor**.
- View a summary of the assignment by clicking **summary**.

Figure 4-A Assignment Editor



The **Assignment Editor** main menu lists assignments created for your class. These assignments may be populated with a series of assignments based on testing materials or other shared questions. If not, you initially see a blank list here. For more information on shared classes, see Chapter 2.

Warnings and Locking Mechanism

When an assignment is opened for edit, the system checks and warns the instructor whether the assignment has associated student records in the Gradebook or is currently in use by a student.

> **Note:** The number of students currently using the assignment is displayed in the **Active** field of the **Assignment Editor** main menu.

- If the assignment is currently in use, the questions in the assignment are locked so that an instructor cannot edit them. You can edit some of the policies of the assignment like the time limit for example.
- If the assignment is not currently active, the assignment is *locked for editing* so that new active tests cannot be started during the editing process. Students who try to start the assignment while it is locked are notified with a warning message.

4.2 Creating Assignments

The **Assignment Editor** organizes assignment creation into a four step process.

1. Naming your assignment
2. Selecting questions
3. Establishing rules and policies
4. Reviewing, finishing, and publishing assignments to your class

To start a new assignment:

1. From the **Assignment Editor** screen, click **New** to begin a new assignment. The **Assignment Editor** displays four tabs: **Choose Name**, **Select Questions**, **Set Policies**, and **Review & Finish**.
2. Proceed to the instructions in *Naming Assignments*.

4.3 Naming Assignments

The assignment name is displayed to students on the **Class Homepage**.

To name your assignment:

1. In the **Choose Name** tab, enter a name for your assignment in the **Choose A Name For Your Assignment** field.
2. Optional. Click the **Advanced** button. Add assignment-level page headers and text for the results page in the appropriate fields.
3. Proceed to the instructions in *Selecting Questions*.

4.4 Selecting Questions

The **Select Questions** tab of the **Assignment Editor** allows you to select questions (individually or as a group) from the question repository, assign question weighting, scramble the sequence of delivery, and merge individual questions to form specific question groups.

To select questions from the repository:

1. In the **Assignment Editor**, click the **Select Questions** tab.

2. From the **Question Group** list, select a source question bank.
3. If required, expand the topic lists and select the questions you want from the list on the left using the check boxes. Click the **Add** button after selecting a question or complete the selection process and click the **Add As Items** button. In either case, individual questions are added to your assignment.
4. Optional. To add a selection of items as a group, select questions using the check boxes. Click **Add As Group** to include them as a pool of questions within your assignment.
5. Optional.

- Change the default question weighting (one point per question) to match your requirements.
- Select **Scramble questions** to randomly order the questions when assignments are created.
- Reorder questions within your assignment by using the drop-down lists.
- **Merge** individual selected questions to form new question groups in your assignment.

6. Proceed to the instructions in *Setting Policies*.

Individual Versus Grouped Questions

Individual Questions If you add selected questions to your assignment as individual questions, each one is included in every version of the assignment served to a student, and you control question weighting individually.

Question Groups Adding questions in question groups provides you with the added option of selecting a group of questions and having the system select from the questions at random, according to criteria you specify (for example, choosing three of seven questions from the group each time a new assignment is created for a student). You set a single point value that is applied to every question in the group.

4.5 Setting Policies

In the **Set Policies** tab of the **Assignment Editor** window, you can:

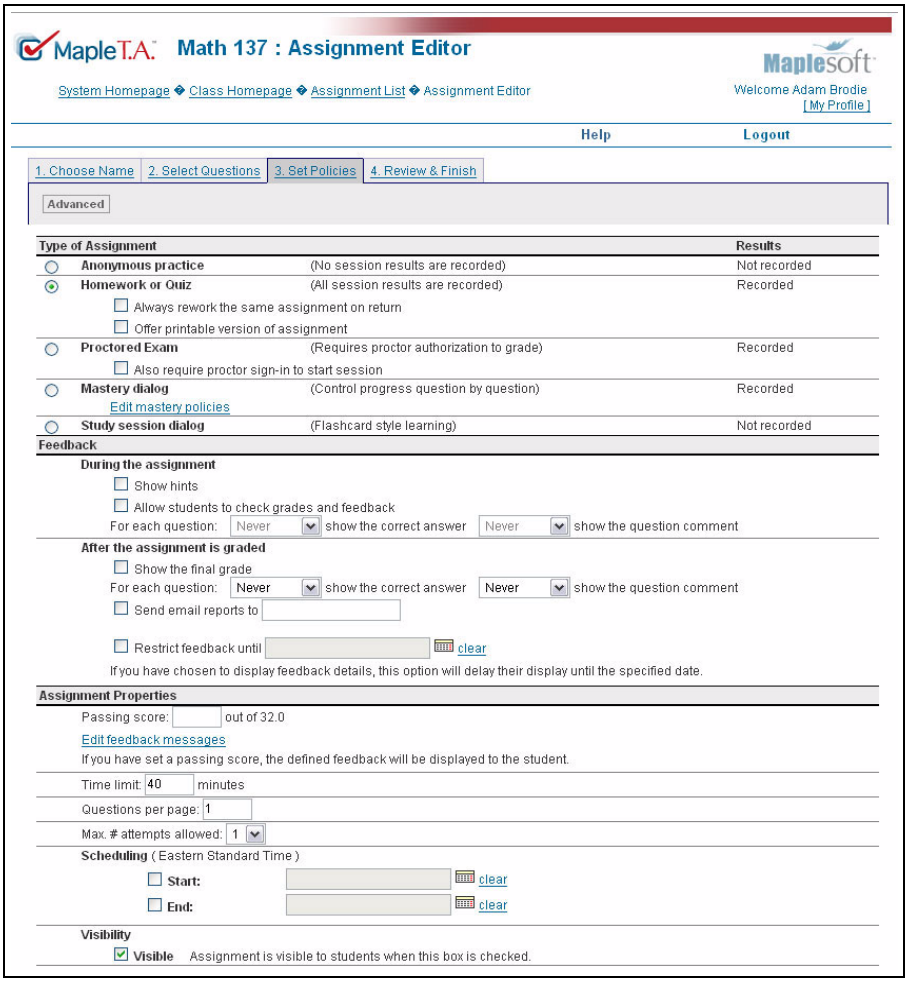
- Select the type of assignment
- Set feedback options for the assignment

- Decide when to make it available to your class
- Establish other grading policies

You can configure the number of questions on a page, create test instruction sheets and headers, and set policies for restricted access, repeated attempts, and other options.

Students answer questions one page at a time, and the system records their responses between pages. Jumping from question to question within an assignment is allowed until students complete all questions (or choose to ignore the warnings to do so) and submit their responses for automatic grading.

Figure 4-B Assignment Editor, Set Policies Tab



Assignment Types

You can create graded assessments (**Homework or Quiz** and **Proctored Exam**), ungraded practice tests (**Anonymous Practice**), or assignments with set criteria (**Mastery** and **Study Session**). To take any assignment, the student must be logged in and registered in the class.

To set the assignment type:

1. Select one of the options in the Type of Assignment group box in the Set Policies tab of the Assignment Editor. Homework or Quiz is the system default assignment type.
2. For any assignment type, you can click the Advanced button to set prerequisite conditions.

Homework or Quiz assignments have the following format.

- Students are presented with an assignment consisting of any number of instructor-selected questions.
- Questions are delivered either in an instructor-specified or random sequence.
- Student responses during sessions are recorded after every question, so assignment sessions can be interrupted and continued upon next login.
- By default, Homework or Quiz assignments can be attempted multiple times for credit. To limit the number of attempts a student can make on a particular assignment, use **Assignment Properties** of the **Set Policies** tab in the **Assignment Editor**.
- Results for every attempt at a Homework or Quiz assignment are recorded in the Gradebook for the class.

Proctored Exams are similar to Homework or Quiz assignments, but with an additional security measure to confirm the identity of the student taking the test. All Proctored Exams require a proctor to authorize students submitting their test for grading. You can require proctor authorization to validate student identity and grant assignment access at the start of a proctored exam. Students must be registered in your class. They are required to provide their student login and password to access assignments in addition to proctor authorization.

There are two types of proctors: **Global** and **Local**.

- Global proctors are defined by the System Administrator and can give authorization for any class.
- Local proctors are defined by the Instructor and can only give authorization for a particular class. To set up a local proctor, navigate to the **Class Homepage**. From the **Actions** menu, select **User Manager**. From **Actions** menu, select **Register Users**. In the User Role row, select the Proctor radio button. Select, or search for, a user from the list of registered users and click **Register**.

Proctors can give authorization directly, at the student's computer, or remotely through the **Proctor Tools** menu. In both cases, the proctor must sign in by giving a login name and password. To give authorization remotely,

the proctor must login, select the class and from the **Actions** menu, select **Proctor Tools**.

Anonymous Practice assignments are similar to Homework or Quiz assignments; however, the students results are not recorded. Any number of questions can be included, and the assignment is delivered in an instructor-specified sequence (or scrambled). Graded assignment reports are produced upon conclusion of the assignment, but results are not recorded in the Gradebook. Students can view their results at the end of the session; no permanent record is maintained. Results can be printed, but are only available for as long as a student displays them.

Study Session assignments usually draw from a large pool of assignment material (often algorithmically generated to produce limitless question permutations). The instructor chooses the questions to include, but these assignments are delivered one-question-at-a-time, and the student submits each question for grading individually and immediately, instead of having the entire test graded at the end.

For Study Sessions, students control the study process by practicing question after question. You can provide hints and full solutions for questions to students while they work. Results are displayed one question at a time and are not recorded in the Gradebook.

Mastery assignments are similar to study session assignments, except the results are recorded in the Gradebook. These assignments usually draw from a large pool of assignment material (often algorithmically generated to produce limitless question permutations). The instructor chooses the questions to include and sets criteria for mastery. These assignments are delivered one-question-at-a-time, and the student submits each question for grading individually and immediately, instead of having the entire test graded at the end.

For Mastery assignments, instructors create carefully structured collections of questions grouped by learning objectives. The default delivery is in sequential order. You can specify additional criteria for your assignment, by clicking the Edit mastery policies link.

For a summary of assignment attributes, see the following table.

Table 1: Assignment Attributes

Assignment Type	Graded	Recorded in Gradebook	Hints Available	Solutions Available
Anonymous Practice	yes	no	yes	no

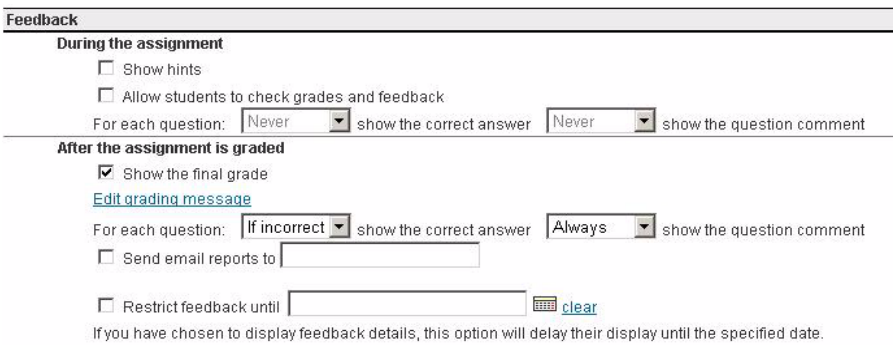
Table 1: Assignment Attributes

Assignment Type	Graded	Recorded in Gradebook	Hints Available	Solutions Available
Homework/ Quiz	yes	yes	yes	no
Mastery	yes	yes	yes	no
Proctored Exams	yes	yes	yes	no
Study Session	yes	no	yes	yes

Feedback

You can specify which feedback elements are displayed to students when they grade an assignment. The default system behavior is to show the final assignment grade as well as question feedback, but you can switch either of these elements on or off, control access to hints during assignment sessions (before grading), or allow students to check grades while taking an assignment.

Figure 4-C Feedback



Hints

You can allow access to question hints (if they exist) in any assignment type. Hints will appear as hyperlinks below the question answer region and the student can click on the link to display the hint, if they want.

- To display hints during an assignment, select the **Show hints** check box.

Feedback

You can show feedback during the assignment or after it is graded, for example, displaying the grade, correct answer, or comment for each question. In the drop-down lists of the **Feedback** group box, select from **Always**, **If correct**, **If incorrect**, or **Never** condition options for displaying the correct

answer and question comment. You can also restrict feedback until a certain date.

- To allow students to display a grade for each question while they are taking the assignment, select the **Allow students to check grades and feedback** check box.
- To display the final grade after the assignment is graded, select the **Show the final grade** check box. You can customize the message students receive by clicking the **Edit grading message** link and modifying the default messages.
- To restrict the feedback to a certain date, select the **Restrict feedback until** check box and enter in the date. This is very useful if you give students a certain amount of time to do a homework assignment and you don't want to the students who finish early from giving answers to other students.

Hints and **Question Feedback** (contained in the **Comment** field of a question) are not always present in the source question bank content. You can add hints or comments by using the **Question Editor** and editing these fields for individual questions. If you choose to display hints and comments and your source questions lack them, the system simply ignores the display settings.

Sending Email

Maple T.A. can send you an email whenever a student completes an assignment in **Homework** and **Proctored** mode. The email will contain the name of the class, assignment, student and their grade. To receive email notification, select the **Send email reports to** check box and enter your email address.

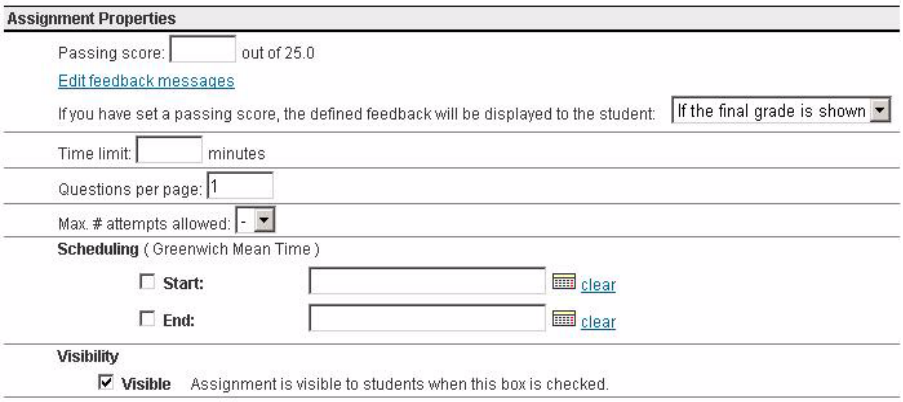
> Note: To use this feature, your system administrator must have an SMTP server configured.

Assignment Properties

In the **Assignment Properties** section, you can set the following information.

- Passing score
- Time limit
- Number of questions on a page
- Maximum number of times an assignment may be taken
- Scheduling
- Visibility

Figure 4-D Assignment Properties



Setting a Passing Score

You can set a passing score for the assignment. If you set a score, the system assesses each attempt as either Pass or Fail, and records this information in the **Gradebook** automatically. The field shows the total available score for the assignment (for example, out of 10), which varies according to the composition of your assignment.

You can customize the message students receive by clicking the **Edit feedback messages** link and modifying the default messages. You can use the drop-down menu to specify when to display the feedback: **Always**, **Never**, or **If the final grade is shown**.

Setting a Time Limit

You can set a time limit for Homework or Proctored assignment types. If you set a limit, the program shows the student the time remaining during the course of the test. If the time limit expires during the test, the system informs the student, and does not allow the student to enter responses to any more questions.

> Note: The timer does not stop until the student runs out of time or clicks **Grade**. The timer will continue to run even if the student clicks **Quit and Save**.

Setting the Number of Questions per Page

By default, the program displays one question per page when presenting an assignment to students. You can use this option to deliver more than one question per page. If you have used question annotations and set the annotations to display at the top or the bottom of the page in which the

question is loaded, your annotations appear as a page-level header or footer (rather than immediately before or after the question).

> Note: Mastery and Study Session assignments automatically serve one question at a time. This is part of their instructional design and this setting cannot be changed for these assignment types.
>
> Tip: If you are concerned about a student's ability to assess complicated questions over a slower online connection, it is recommended that you accept the default setting of one question per page. Loading one question at a time usually allows a student to move through the assignment effectively, but also saves each question response as it is completed.

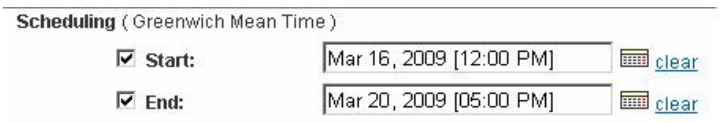
Setting the Maximum Number of Attempts

You can set the maximum number of times a student can take an assignment. If the student attempts more than the maximum amount, a message is displayed indicating the restriction. In this case, the student can click the **Exception** button displayed in the restriction message screen. A proctor or the instructor can then provide authorization.

Scheduling

Using the calendar function under **Scheduling**, you can set **Start** and **End** times for each assignment. These times govern the availability of the assignment to students in your class. Scheduled times refer to your server clock and system's time zone set by your system administrator.

Figure 4-E Scheduling



Before and after the indicated availability window, the assignment is still displayed in the list viewable by students on your Class Home Page, but it cannot be selected. Note that unavailable assignments will continue to be listed on the **Assignment Editor Main Menu** page. Additionally, unavailable assignments will appear in the student's past results page, if the student completed them.

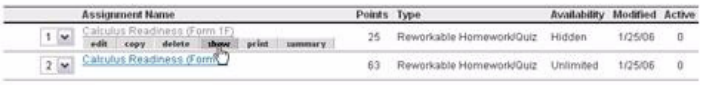
Visibility

Check the **Visible** check box to include the assignment in the list of assignments displayed to students on your Class Home Page.

Alternatively, you can select the assignments to display to students by doing the following.

In the **Assignment Editor** main menu, click the **show** option available on mouse rollover of the assignment name. Note that if the assignment is already visible for students, the rollover menu will include **hide** instead of **show**.

Figure 4-F Setting Visibility of Assignments



Advanced Policies

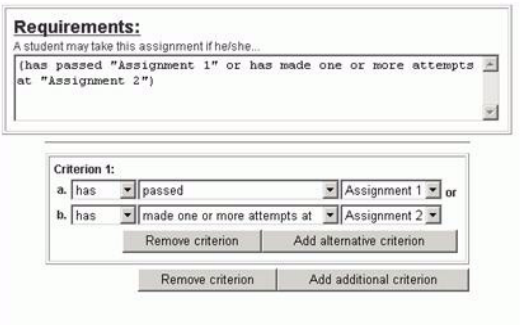
Setting Assignment Requirements: Limiting Student Access to Assignments

You can restrict access to an assignment so that only students meeting certain criteria can take the assignment. You can also create assignment requirements that refer to the current assignment, even if you are working with a new assignment that has not yet been saved. The assignment on which you are working is now listed along with all other available assignments in the Criterion specification box. This is useful when you want to ensure minimum competencies in prerequisite topics. For example, you can limit access to students who have already passed an earlier assignment.

To restrict assignment access:

1. From the **Assignment Editor** screen in the **Set Policies** tab, click **Advanced**. The **Set Policies - Advanced** screen with a **Requirements** field is displayed.
2. To set criteria, click **Design**. A **Criterion 1** rule based field opens. The program adds input fields for the first criterion, as shown:

Figure 4-G Restricting Student Access



The program automatically propagates the settings in the **Criterion** panel to the **Requirements** panel, and updates the criteria in this field as soon as you select a different option from the list. You do not need to take any action to add the criterion to the text area.

> Note: You can also enter the criterion directly in the **Requirements** field, but using the **Designer** is recommended.

Criterion Options

- The first drop-down list gives a choice between **has** and **has not**.
- The drop-down list in the middle lists a range of states and actions, as shown.
- The drop-down list on the right lists all of the assignments for the class, including the assignments whose restrictions you are defining.
- **Adding an OR Criterion**: Click the **Add alternative criterion** button immediately below the list of assignments. The program adds the list fields for another criterion.
- **Adding an AND Criterion**: Click the **Add additional criterion** button at the bottom right of the form, below the frame that encloses the criterion fields. The program adds another criterion group, in a separate frame.
- **Deleting a Criterion**: To delete an OR criterion, click the **Remove criterion** button inside the frame for that criterion group. The program deletes the last criterion from the group. You may have to change the settings for the remaining criteria in the group to set the requirements that you want. To delete an AND criterion group, click the **Remove criterion** button at the bottom of the form, below the last criterion group. The program deletes the last group. You may have to change the settings for the remaining groups to set the requirements that you want.
- **Save Changes to Criterion**: To close the **Set Polices - Advanced** page and save changes made to the criteria, click the **Set Policies** tab.

4.6 Reviewing and Saving Assignments

In the **Review & Finish** tab of the **Assignment Editor**, you can review assignment summary information, including:

- "Assignment Type
- "Questions Selected
- "Scheduled Availability
- "Rules and policies you established

To change settings in your assignment:

1. In the **Review & Finish** tab, click the highlighted link in the category to be changed.
2. A prompt appears asking whether to return to the tab where the option is set. Click **OK**. The appropriate **Assignment Editor** tab opens.
3. Make changes and return to the **Review & Finish** tab.

Finishing an Assignment

To accept and publish the assignment you have created or modified:

- Click **Finish** in the **Review & Finish** tab. You are returned to the **Assignment Editor** list of assignments for your class, where your new assignment is displayed in the list of all class assignments.

Assignment Status

Consider the following information regarding your assignment status.

- If you have scheduled the assignment for immediate availability, your new assignment is available for students in the **Class Homepage**.
- The system does not save partially completed assignments until you click **Finish** in the **Review & Finish** tab of the **Assignment Editor**. If you begin to create an assignment and then abandon it without clicking **Finish**, your additions and changes are lost. If you need to leave the Assignment Editor without finishing the assignment, it is recommended that you mark the assignment as hidden so that students cannot access it. Hide assignments from student view in the **Class Homepage** by hovering the mouse over the assignment name in the class assignment list, and then clicking **hide**.
- If the server shuts down before you click the **Finish** button, your editing changes will be lost. When the server restarts, it uses the last saved version of your assignment data. To reduce the risk of this during long assignment editing sessions, it is recommended that you periodically click the Finish button, then select your assignment from the main **Assignment Editor** list of assignments to start a new editing session.

4.7 Special Cases

Deleting Assignments

You can select and delete assignments in the main **Assignment Editor** window. If there are grades associated with an assignment, and you rename

or delete the assignment, a copy is made. Also, results continue to be available through individual student records.

Shared Assignments: Saving Your Changes

Inheritance has changed slightly so that now you only inherit the content (groupings of questions and their weightings). When you edit an inherited assignment, only the options in the policy tab can be changed. Assignments can still be copied to make a local assignment that can then be fully edited.

5 Gradebook

5.1 Overview

Maple T.A. automatically stores assignment session scores in the **Gradebook**. The Gradebook stores information for each student, such as the assignment start time, the time spent on the assignment, and the individual assignment question performance.

The Gradebook allows you to:

- View, analyze, and report scores and statistics for students, assignments, and question items
- Review and edit student results
- Create reports organized by student, assignment, or by question
- Export grades to comma-delimited, Microsoft® Excel, or XML files

To access the Gradebook:

- From the **Class Homepage**, click **Gradebook** and select **Open**.

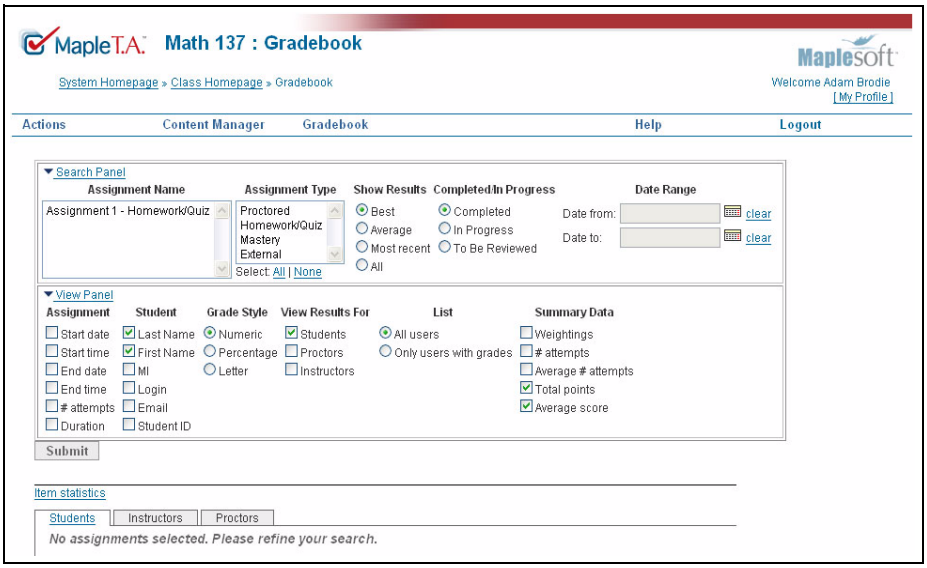
5.2 Gradebook Views

The Gradebook provides three views of assignment data: by student, by assignment, and by assignment item or question.

- To view the grades for an assignment, select an assignment in the search panel and select Submit. The results are displayed below the Search and View panels.

- To view summary statistics for each assignment, click the link to a particular assignment in the student results table. From this view, you can see summary statistics for each question on an assignment.

Figure 5-A Gradebook



Generating Reports

You can change assignment weighting, grades, or add comments from within a generated report of an assignment or test.

To generate a report in the Gradebook:

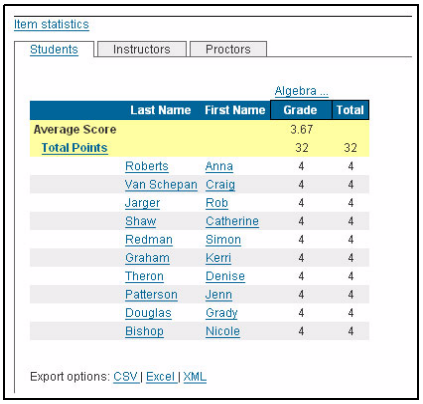
1. In the **Search Panel**, select the assignment(s) to include in the report.
   - To include more than one assignment, press the CTRL key and click the assignments.
   - To include all assignments, select **All**.
2. Specify the search criteria from the following options:
   - Assignment Type - To specify a single type of assignment from Proctored, Homework/Quiz, Mastery, and External.
   - Show Results - To display results, for example, best or most recent.
   - Completed/In Progress - To display only Completed, In Progress, or To Be Reviewed assignments.
   - Date Range - To specify date range. Assignments completed within that date range will be included in the report.
3. In the **View Panel**, select the data to include in the report from the following options:

- Assignment - To display the date and time the assignment was started and finished, the time required to complete, and the number of attempts.
- Student - To display student information, such as first and last name, middle initial, login and password, email address, and student ID.
- Grade Style - To indicate presentation style for the grade.
- View Results for - To display statistics for student, proctors, or instructors (multiple items can be selected simultaneously).
- List - To display all users, or only users with grades.
- Summary Data - To display the weightings information, number of attempts and average number of attempts, total number of points, and average score.

4. Click **Submit** to generate the report.

5.3 Student Statistics

Figure 5-B Student Statistics



From the generated report, you can view a student record report, change the weighting for assignments, and change grades.

To view a student record report, click on the first or last name of a student in your generated report. The student record report contains the following details about the student: login, email, student ID, number of completed assignments, and number of active assignments. The student's best and average scores are displayed for each assignment, as well as the number of attempts. The overall class best score, average score, and number of attempts

are displayed for comparison purposes, as well as the total points for the assignment.

Additional information about each assignment session is displayed: start and end time and date, and duration.

Assignment Weighting

To set weightings for each assignment, generate a report with the Weightings option selected, and then click the **Weighting** link in the report. You can set weighting for each assignment with respect to the cumulative grade for the class. Enter the weighting for each assignment, with the total for all assignments equal to 100%. You can Lock individual assignments to prevent their weighting from being adjusted.

Additionally, you can change the total points of the assignment. If, for example, one question was clearly too difficult in comparison to the rest of the assignment, you can override the total points, making the assignment out of 9 instead of 10 points.

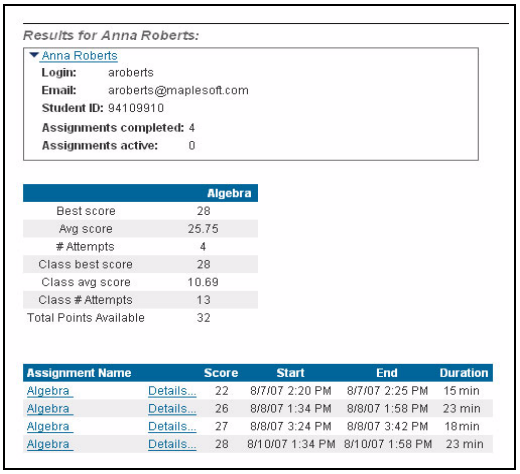
The **Zero** button sets all weightings to 0% and the **Reset** button resets the weightings to the original settings.

Changing Grades

From a generated report, you can change a student's grade. You may change a student's grade for several reasons:

- The system does not automatically grade essay questions, so you must enter a grade for any essay questions included in your assignment.
- You might choose to raise a student's grade based on effort, improvement, or other subjective measures.
- You might choose to apply a curve, based on the performance of the entire class.

Figure 5-C Student Record



To change a student grade:

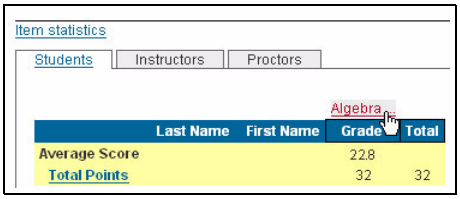
1. In the resulting report, click the student name. The student record opens as shown in Figure 5-C.
2. Beside each assignment is a link called **Details**. Click this link to display the assignment results.
3. Edit the grade in the **New Grade** field.
4. Optional. Add comments in the **Comment on Grade** box. These comments are strictly for your records; they are not visible to the student.
5. Optional. Add comments in the **Instructors Comment** box. Students see these comments when they review their performance on the test. You can add personalized comments to help individual students understand their scores and master the material.
6. Click **Update** at the top of the page.
7. Click **Submit** to regenerate the statistical information.

5.4 Assignment Statistics

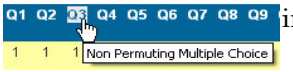
From the generated report, you can view details about the assignments.

To view assignment details, click on one of the assignment links at the top of the student report table.

Figure 5-D Assignment Link

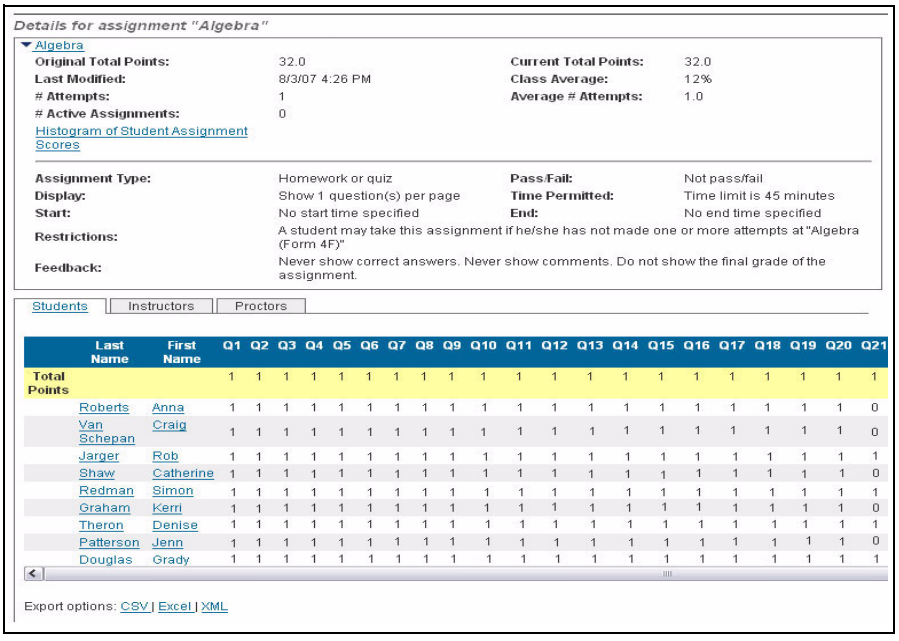


The following details are displayed: original and current total points, date last modified, class average, number of attempts, average number of attempts, and number of active assignments. Details about the assignment setup are displayed as well. A histogram of the assignment statistics is provided.

The student report table now displays the students' performance on each question in the assignment. Click on a question 

in the table to display the details of the question.

Figure 5-E Assignment Statistics



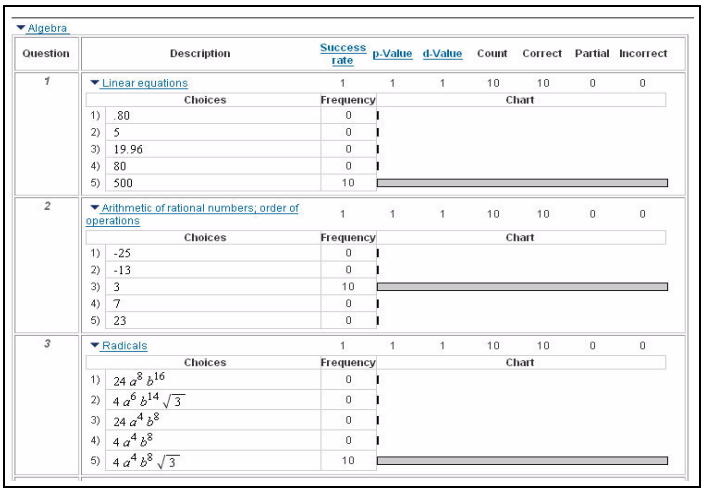
5.5 Item Statistics

The system collects statistical data on the questions used in your assignments. It can automatically produce various statistical analyses based on item usage and student performance.

View item statistics by clicking on the **Item Statistics** link below the View Panel. Statistical information for each question includes the success rate, p-Value, d-Value, number of times the question was answered, the number of times the question was answered correctly and incorrectly, and if any partial marks were given.

Additionally, for non-permuting, non-algorithmic multiple choice questions a chart is automatically displayed with the frequency each choice was selected.

Figure 5-F Item Statistics



5.6 Add External Assignment

The Gradebook gives you the ability to add the marks of an assignment that is not in the system. To add the marks of an external assignment:

- From the **Class Homepage**, click **Gradebook** and select **Add External Assign**.
- Enter the assignment name, total points, and a passing score in the appropriate fields.

- Enter a score for each student and, optionally, a comment.
- Click **Save** to finish, or **Save & Add Another**, to add another external assignment.

External assignments are displayed in the gradebook with other assignments.

6 Content Creation in the Question Editor

6.1 Question Types

There are many different question types that you can choose. The following table lists the most used question types and gives a brief description.

Blanks – Blank questions are a type of free-response question. They present the student with a question and response object in which to enter their response. The response object can either be a text region or a drop-down menu of choices. The blank question does not provide as many features as the list question.

Clickable imagemap - A clickable image question presents an image with a number of hot spots. Students are required to identify the correct image element by clicking the appropriate hot spot.

Essay – An essay question provides a text region for the student to enter their response. It is not automatically graded by the system. Student responses are sent to you, the instructor, who scores them traditionally, and assigns a grade in the system Gradebook. No answer or feedback is available to the student.

Formula – The formula question allows instructors to compare student results to a specified answer. It has several variants that can be accessed as a drop-down menu in the formula question creation screen.

Formula mod C – accept answers within an additive constant
Formula with physical units – requires units as well as a numeric value
List (ordered or unordered) – accept answers as lists of values
Restricted – the correct answer only uses basic operations
Equation – the correct answer contains an equal sign
Chemistry – the correct answer must match the given formula

Question Designer – The Question Designer is a powerful and flexible question container that can hold multiple response areas, i.e., answer regions supporting various question types including formula, Maple-graded, numeric, multiple-choice, multiple-selection, essay, and list types – all in a single question. Note: The Question Designer supersedes the Inline question type.

Key words – Key word or key phrase questions search the student's response for specified key words or phrases but ignore other text. This question type is not supported by the Question Editor.

List – List questions are a type of free-response question. They present the student with a question and response object in which to enter their response. The response object can either be a text region or a drop-down menu of choices. With list questions, you have the ability to give partial credit to certain answers.

Maple-graded – The Maple-graded question type uses the Maple™ computer algebra system to generate algorithmic variables in questions, generate plots, and evaluate student responses. The Maple-graded question type gives you access to the computational power of Maple. You have access to many different kinds of mathematical objects, not just simple expressions. The Maple-graded question type allows for questions with complicated answers, questions with different possible answers, and questions requiring a powerful answer-equivalence checker. You can even find common errors and assign partial grades.

Matching – Matching questions display two lists. A student must match each element of the first list with an element in the second list. Matching question types allow only 1 to 1 matches in the correct answer. Matches of 1 element to many are not available in the system.

Multipart – A multipart question can contain a variety of related question materials, data, even case scenarios for different types of assessment and learning. Although the multipart mode is a question type, its component question parts can be of any question type, including multipart. This allows nested multipart questions. You must create the question parts in a separate topic and then create the multipart question that combines all the parts.

Multiple-choice – Multiple-choice questions in the system can have any number of choices, but there is only one correct answer. You can add incorrect choices after questions are initially created. You can deliver the question with the choices permuting or remaining static.

Multiple-selection – Multiple-selection questions are similar to multiple-choice questions. The key difference is that they can contain more than one correct answer. You can deliver the question with the choices permuting or

remaining static. The grading for a multiple-selection question is as follows, with the exception that if the numerator is less than 0, it is set to 0.

$$\frac{\#\text{ selected correct answers} - \#\text{ selected incorrect answers}}{\text{Total \# of correct answers}}$$

Numeric – The numeric question type compares a student's response to a given number, with or without units. You have the ability to set a tolerance in the answer that you will accept, from a certain number of significant digits to a percentage.

Palette – Palette questions enable you to use an Equation Editor to create your own customized palette for student response entries.

True or false – True-or-false questions are treated as a class of multiple-choice question featuring only two choices.

In *Example Questions* on page 21 we explored the Question Designer as a container for authoring multiple-choice, Maple-graded, list, and numeric type questions. Examples of formula questions, essay questions, and other question types can be found in Maple T.A.'s built-in help system. In Chapter 8 we take a closer look at the Maple-graded question type.

6.2 Enhancing questions

You can enhance your questions by including feedback (or comments that a student will see when they finish their assignment), information fields, hints, and even a fully-worked solution.

Feedback

To return custom feedback when a student enters an incorrect response, each question type supports a feedback field. The comment in this field is displayed after grading. In the comment field, you can include additional explanations about solution method or final answer. When editing a question in the Question Editor, you can add or edit the comment.

To add or edit a comment:

1. On the **New Question** window, click the **Add** or **Edit** button in the **Feedback** area.
2. Enter or edit the comment in the text box. Comments can include HTML-formatted text, JavaScript™, and variables.

3. Click **OK**.
4. To add your changes to the cached question bank, proceed to the **Question Display** screen, and then click **Finish**.

Information Fields

The info field allows you to add information subfields to a question to indicate subtopic, learning objective, level of difficulty, authorship, ownership, or other information. The information fields are defined as name/value pairs and can be used for sorting and filtering during assignment creation. When editing a question in the **Question Editor**, you can add or edit information fields.

To add or edit information fields:

1. On the **New Question** window, click the **Add** or **Edit** button in the **Information Fields** area.
2. Enter or edit field names and corresponding values in the **Field** and **Value** text boxes.
3. Each question can contain any number of information fields. To add rows, click the **More** button.
4. Click **OK**.
5. To add your changes to the cached question bank, proceed to the **Question Display** screen, and then click **Finish**.

Hints

You can enter hints that can be displayed when taking an assignment. To use hints, you must enable them in the **Set Policies** tab of the **Assignment Editor**. When editing a question in the **Question Editor**, you can add or edit hints.

To add or edit a hint:

1. On the **New Question** window, click the **Add** or **Edit** button in the **Hints** area.
2. Enter or edit the hint in a text box. Hints can include text, HTML-formatted text, JavaScript™ code, and variables.
3. Each question can contain any number of hints. To add hint boxes, click the **More** button.
4. Click **OK**.
5. To add your changes to the cached question bank, proceed to the **Question Display** screen, and then click **Finish**.

Solution

In the solution field, you can enter a worked solution that is displayed in Study Session assignments. In these sessions, the student can view the solution before entering an answer or after submitting the question to be graded. When editing a question in the **Question Editor**, you can add or edit the solution.

To add or edit a solution:

1. On the **New Question** window, click the **Add** or **Edit** button in the **Solution** area.
2. Enter or edit the solution in the text box.
3. Click **OK**.
4. To add your changes to the cached question file, proceed to the **Question Display** screen, and then click **Finish**.

   Note: The solution field is only shown in study session assignments. To include a solution that can be used in other assignment types, you should use the feedback field.

6.3 Including Formatted Math Expressions in Questions

Maple T.A. renders the question text as HTML/MathML if the **Use HTML:** check box has been selected. This allows you to include formatted math expressions in questions.

There are three ways to create nicely formatted expressions in Maple T.A.:

1. The built-in mathml function
2. The built-in Equation Editor
3. Maple's MathML[ExportPresentation] function

Using the mathml Function

Maple T.A. contains a built-in mathml function. This is an algorithmic function that accepts a string and, treating it as calculator-style syntax, transforms it into MathML.

For example, suppose we define an algorithmic variable $y as follows:

$y = mathml(“x^n”)

Then $y will be rendered as x^n wherever it is referenced in the question statement, comment, and hints.

This function is designed for small expressions and is limited in scope. For full MathML functionality, it is recommended that you use either the Equation Editor or Maple's MathML[ExportPresentation] function.

Using the Math Editor

Maple T.A. provides a graphical equation editor for use with all question types except fill in the blank. This editor is the same editor that is included with Maple and is used to translate the graphical form of your expression to MathML code.

To use the equation editor:

1. Add a question.
2. Click **Next**.
3. Enter the text of your question. When you get to the place where you would like to add a formatted expression, click the **Sigma** Σ button. This brings you to the **Equation Editor** screen.

Figure 6-A The Equation Editor applet is used to create a nicely formatted expression.

4. Create your expression. Use keyboard shortcuts or right-click in the region to get a palette from which you can choose.
5. When you are finished creating your expression, click **OK**. The expression appears in the question text window.
6. Finish creating your question as you would normally.

Note: You can include algorithmic variables in your math expressions. If the variable name is alphabetic only, you can enter $var in the Math Editor and it will maintain the variable name as one unit. If the variable name is alphanumeric, you

will have to use an alphabetic name in the editor and then replace it with the correct variable name in the question text area.

Using Maple's MathML[ExportPresentation] Function

Maple's MathML[ExportPresentation] function can take any expression in Maple and convert it to presentation MathML for display purposes.

To use Maple's MathML[ExportPresentation] command:

1. Create an algorithmic variable for the expression that you want to use.
2. Create a second algorithmic variable for the MathML version of that expression using Maple's MathML[ExportPresentation]. This variable will be used for presentation purposes only.

For example, suppose we define an algorithmic variable $z as follows:

```
$z =  maple("MathML[ExportPresentation](x^2-3*x+2)")
```

Then $z will be rendered as $x^2 - 3x + 2$ wherever it is referenced in the question statement, comment, and hints.

6.4 Including Images in Questions

You can include a number of different types of images in your questions: static images, Maple plots or animations, and images with algorithmic variables overlaid.

Static Images

You can include static images in all question types. They can be included in the question text itself, the comments, the hints, or the solution.

To include a static image in a Maple T.A. question, there are two steps.

Step 1: Upload the image to the class web site.

1. Log in as an instructor and click on the class in which you want to use the image.
2. Click on **Content Manager**, then **Web Site Editor**.
3. Create a subfolder where you can place the image. It is possible to upload your image at this point, but for maintainability, it is recommended that you create a subfolder and place your images in it.

a) Click **"new subfolder …"**.

b) Enter a name for your subfolder in the text region and click **OK**. You are returned to the Web Site Editor page with your subfolder expanded.

4. Click **"upload file(s) to this point …"**.
5. Click **Browse…** to locate the file on your computer.
6. Select the radio button beside **Single File – Save As:** to use the same name that the image has on your computer or enter a name for the file in the text region. The name must be alphanumeric and can contain "_", "-", or a single period. It cannot start or end with a period and it cannot contain a space.
7. Click **OK**.

If you click on the image in the class Web Site Editor, you will be shown the URL for that image. You can click on that link to see the image.

Step 2: Include an html reference to the image in your question or solution.

1. Create or edit a question in the **Question Editor**.
2. In the field where you want to include the image (question text, feedback, hints, or solution), click the **Insert/Edit Image** button.
3. Under the **Image Info** tab, click **Browse Server** and select the image you uploaded in Step 1. You will be shown a preview of the image.
4. Click **OK** and the image will be added.

Note: The Browse Server screen (#3 above) also allows you to upload an image to the server, in case you had not previously uploaded the image through the Web Site Editor.

Maple Plots

There are two ways to include a Maple-generated plot in Maple T.A.: the drawMaplePlot script and the plotmaple command. The plotmaple command was added in Maple T.A. 2.5 and is now the recommended way to include Maple plots in questions. The drawMaplePlot script is still available, but does not provide the same functionality as the plotmaple command.

plotmaple command

The plotmaple command was introduced in Maple T.A. 2.5. With it, you create algorithmic variables that contain your plots. You can then reference these algorithmic variables in your questions, feedback, hints, or solutions.

Some of the benefits of using the plotmaple command are as follows:

1. You can specify in the command whether you want the image to be saved as a GIF or JPEG. This is important if you want to display most of your

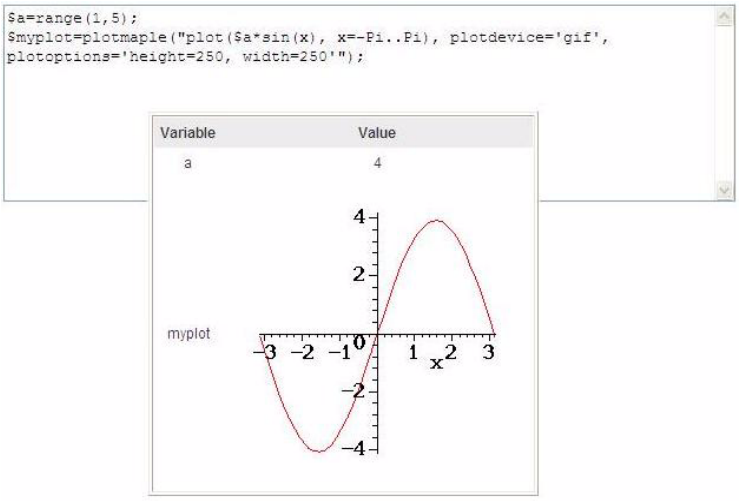
images as JPEGs, so you set the default image type to be JPEG, but occasionally want to add an animation to a question and, thus, require a GIF image for one question. Maple animations can only be displayed as animated GIFs.

2. You can define the height and width of the image without losing any quality in the image.
3. You can see the plot immediately in the algorithm editor. There is no need to finish the question before being able to tell if you used the correct plot command or if you need to change it slightly to improve the presentation.

The format of the plotmaple command in the algorithm editor is as follows:

```
$myplot=plotmaple("plot(sin(x), x=-Pi..Pi), plotdevice='gif',
plotoptions='height=250, width=250'");

$myanimation=plotmaple("plots[animate](sin(a*x),x=-Pi..Pi,a=1..4),
plotdevice='gif',plotoptions='height=200, width=200'");
```

Figure 6-B Using the plotmaple command, you can include algorithmic variables in your plot statement. You will see a preview of the image in the algorithm editor. Here, the algorithm editor text region and the corresponding image are shown.



7 Algorithmic Variables

You can use algorithmic variables to randomize your questions in Maple T.A. These algorithmic variables can use the built-in algorithmic generator or can use any of Maple's randomization routines.

7.1 Creating Algorithmic Variables in Maple T.A.

To create an algorithmic variable in Maple T.A., use the algorithm designer in the **Question Editor**. Algorithmic variables can be used in any question type and can be used in the question text, the answer region, as well as in the hints and feedback sections. Algorithmic variables are denoted by a dollar sign, for example, $var.

To create an algorithmic variable:

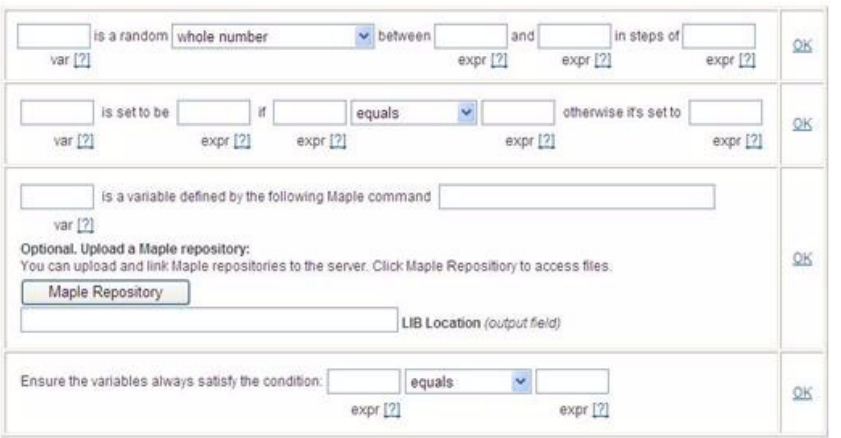
1. Upload an existing question or create a new one.
2. Click **Questions**, then **New Question**.
3. Choose the question type from the drop-down menu.
4. In the Algorithm field, click **Add**.
5. If you know the format of the command, you can type it in the text box and proceed to Step 7. Otherwise, click **Show Designer** to load the algorithm designer tool.
6. Type the required information in the algorithm designer template. Note that you do not need to use the $ to denote variables in the template. Click **OK** to add the command to the algorithm text box and display a possible value for the variable.

7. Click **Refresh** to have Maple T.A. generate another possible value for the variables.
8. Click **Save** to return to the main page for the question.

You can now continue creating your question and can use the variables that you created.

Algorithm Design Tool

Figure 7-A You can use the algorithm designer to create simple random integers, set conditions on the variables, or enter a Maple command that will generate a random object.



7.2 Maple T.A.'s Built-in Functions and Constants

Maple T.A. contains several functions for creating algorithmic variables. You can create random integers or real numbers, perform operations on lists of items, or set conditions on variables.

It is important to note that the algorithm generator in Maple T.A. works linearly. This means you must be careful to define variables before referencing them in other variable definitions.

Table 2: Numbers and Constants

e	2.71818...

Table 2: Numbers and Constants

pi (π)	3.14159...
2.9E8	Scientific Notation: 290,000,000

Table 3: Arithmetic Operators

Operation	Description
+	Addition
–	Subtraction
*	Multiplication
/	Division
^	Exponential

Table 4: Assorted Math Functions

Function	Return Value	Example	Output
abs(x)	Absolute value of **x**	abs (-2)	2
sqrt(x)	Square root of **x**	sqrt(9)	3
ln(x)	Natural (base e) logarithm of **x**	ln(1)	0
log(x)	Common (base 10) logarithm of **x**	log(10)	1
exp(x)	Base e exponential function of **x**	exp(1)	2.71818...
fact(n)	Factorial **n**	fact(4)	24
gcd(a, b)	Greatest common divisor of **a** and **b**	gcd(4, 6)	2
frac(a, b)	A string that expresses the fraction **a** / **b** in its lowest terms. This function can be combined with function **mathml** to produce nicely typeset fractions.	frac(4, 6)	"2/3"

Random numbers can be generated with the following functions:

Table 5: Random Number Generators

Command	Output	Example	Output
rint(n)	A random integer among **0**, **1**, ..., **n-1**	rint(3)	**0**, **1**, or **2**
rint (m, n)	A random integer among **m**, **m+1**, ..., **n-1**	rint(3, 6)	**3**, **4**, or **5**

Table 5: Random Number Generators

Command	Output	Example	Output
rint(m, n, k)	A random integer among **m**, **m+k**, ..., **m+q·k** where **q** is the largest integer such that **m+q·k** £ **n–k** Note that **rint(n) = rint(0,n)** **= rint(0,n,1)**	rint(3, 12, 3)	**3**, **6**, or **9**
range(n)	A random integer among **1**, **2**, ..., **n**	range(3)	**1**, **2**, or **3**
range(m, n)	A random integer among **m**, **m+1**, ..., **n**	range(3, 6)	**3**, **4**, **5**, or **6**
range(m, n, k)	A random integer among **m**, **m+k**, ..., **m+q·k** where **q** is the largest integer such that **m+q*k** £ **n** Note that **range(n) = range(1,n)** **= range(1,n,1)**	range(3, 12, 3)	**3**, **6**, **9**, or **12**
rand(m, n)	A random real number between **m** and **n** (inclusive)	rand(0.5, 9.5)	A real number between **0.5** and **9.5** (inclusive)
rand(m, n, k)	A random real number between **m** and **n** (inclusive), expressed to **k** significant digits. Note that in this definition, **k** represents the number of significant figures, not the step size (as it indicates in defining **range** and **rint**).	rand(0.5, 9.5, 3)	A real number between **0.5** and **9.5** (inclusive), expressed to **3** significant digits.

You can place conditions on your variables. For example, you can specify that two variables are not to be equal, or define a value for a specific variable based on the values of other variables.

Table 6: Conditions

Command	Effect
condition:x	Imposes the condition defined by statement **x**, which is typically constructed using one or more of the functions below.
if(a,b,c)	If statement **a** is nonzero, returns **b**. Otherwise, returns **c**. Typically, **a** is constructed using one or more of the functions below.
Function	**Return Value**
eq(a,b)	1.0 if **a** is equal to **b**; 0.0 otherwise
ne(a,b)	1.0 if **a** is not equal to **b**; 0.0 otherwise
gt(a,b)	1.0 if **a** is greater than **b**; 0.0 otherwise
lt(a,b)	1.0 if **a** is less than **b**; 0.0 otherwise
not(a)	1.0 if **a** is equal to 0.0; 0.0 otherwise

Example

The following code generates a non-zero integer variable $a between -10 and 10 (inclusive), and a string variable $b that reads either positive or negative, depending on the sign of $a.

$a = range(-10, 10);

condition: ne($a, 0);

$b = if(gt($a, 0), "positive", "negative");

Numbers can be manipulated and/or displayed in a specific format with the following functions.

Table 7: Number Formatting Functions

Function	Return Value	Example	Output
int(x)	The integer part of **x**	int(20.8571)	20
decimal(n, x)	**x** as a floating-point number, rounded to **n** decimal places. Trailing zeros are truncated and not displayed. However, see **numfmt** function below.	decimal(3, 20.8571)	20.857
sig(n, x)	**x** expressed as a floating-point number rounded to **n** significant digits. In cases of possible ambiguity, scientific notation is used to display the value.	sig(3, 20.8571)	20.9
lsu(n, x)	The unit in the **n**th significant place of **x** This operation is designed to be used when setting the tolerance for correct answers. For example, to accept an answer to within a tolerance of one unit in the third significant digit, use: $ans = <formula>; $tol = lsu(3, $ans); and set the answer field to: $ans ? $tol	lsu(3, 20.8571)	0.1
numfmt(fmt, x)	**x** formatted according to the template **fmt**	numfmt("#.00", 20.9)	20.90

There are several functions in Maple T.A. that operate on lists. These allow you to choose an item out of a list based on a property or a value. They are very useful if you want to create a question with the same stem or base information, but have answers with different properties.

Table 8: List Operations

Function	Return Value	Example	Output
min(a, b, c, d,…)	the smallest element from a list	min(2, -1, 3, 5, 4)	-1

Table 8: List Operations

Function	Return Value	Example	Output
max(a, b, c, d,…)	the largest element from a list	max(2, -1, 3, 5, 4)	5
switch(n, a, b, …)	the **n**th item from a list (where position numbering in the list starts at 0)	switch(1,"red","green","yellow")	green
switch(rint(n), a, b, …)	the **n**th item from a list (where **n** is a random integer from the given list)	switch(rint(5), 2, 3, 5, 7, 11)	either 2, 3, 5, 7, or 11
indexof(k, a, b, ..)	the index of item **k** within a list (where position numbering starts at 0) If **k** is not present in the list, the returned value is -1.	indexof(3, 2, 3, 5, 7, 11)	1
rank(n, a, b, c, …)	the **n**th smallest item from a list (where position numbering starts at 1)	rank(1, 9, 6, 11)	6

Table 9: Trigonometric and Hyperbolic Functions

sin(x), cos(x), tan(x), arcsin(x), arccos(x), arctan(x), sec(x), csc(x), cot(x)
sinh(x), cosh(x), tanh(x), sech(x), csch(x), coth(x), arcsinh(x), arccosh(x), arctanh(x),arcsech(x), arccsch(x), arccoth(x)

Table 10: Statistical Functions

Function	Return Value	Example	Output
binomial(n, r)	the rth binomial coefficient of degree n, that is, the number of ways of choosing r objects from a set of n, ignoring order	binomial(6, 2)	15
erf(z)	the cumulative probability for a standard normal distribution (that is, with mean 0 and variance 1)	erf(0)	0.5
inverf(p)	the inverse function of erf(z)	inverf(0.5)	0
studentst(k, x)	the cumulative probability distribution at x of the Students-t distribution with k degrees of freedom	studentst(2, 1.55)	0.869362
invstudentst(k, x)	the inverse function of invstudentst(k, x)	invstudentst(2, 1.55)	1.55

Table 11: More Functions

Function	Return Value
sum(var_name, start, stop, expr)	Sums the expression (**expr**) with respect to the dummy variable (**var_name**) between the values **start** and **stop**.

Table 11: More Functions

Function	Return Value
strcat(a, b, c, d, ...)	The concatenation of the strings in the list
mathml(f)	A string consisting of the formula f typeset in MathML Note: The system renders MathML; the MathML tags do not appear on the screen when the value of the string is displayed. See Section x.x[ca5] for more information on this function.
java(cn, a, b, c, d, ...)	The arguments **a**, **b**, **c**, **d**, … are passed to a custom Java evaluation engine that returns the result. The first argument (**cn**) must be a string giving the fully-qualified name of a Java class that implements the interface **gateway.question.random.AlgorithmicFunction.** This interface has a single public method. **public String eval(String[ ] args);** The arguments **a**, **b**, **c**, **d**,... are passed to **eval()** in a string array.
maple(text)	The text is passed to the Maple™ kernel, which returns the value of the last line processed. See sections 7.4 and 7.5.

Table 12: Examples

Command	Output
sum(i, 1, 20, i^2)	Evaluates **1^2 + 2^2 + 3^2 + ... + 20^2** and returns **2,870**
strcat("$a", " and ", "$b")	Returns “**cats and dogs**” when $a=”cats” and $b=”dogs”
mathml(“x^n”)	x^n
mathml(frac(4, 6))	$\frac{2}{3}$
java("com.mycompany.QuoteFunction", "SUNW")	A real-time quote for Sun Microsystems, Inc. stock (assuming that the class QuoteFunction had been suitably programmed)
maple(“diff(x^3,x)”);	3*x^2

7.3 Examples of Randomization Functions in Maple T.A.

The following examples demonstrate some of the randomization routines that are available in Maple T.A.

Basic Arithmetic

In this example we use a multiple choice question and ask the student to add two numbers. In the algorithm designer, we define two integer variables, $a and $b, and then define a third variable, $ans, which is the sum of $a and $b. In the choices to be displayed, we create an inline algorithmic variable that is the product of $a and $b by using the format ${expression}.

To create the question:

1. In the **New Question** window, select the **Multiple Choice** question type from the **Question Type** drop-down list.
2. Enter "Addition" as a description in the **Question Description** field.
3. In the **Algorithm** section, click **Add**. The **Edit Algorithm** window opens.
4. Enter the following code in the text box:

   $a=range(2,10);

   $b=range(3,15);

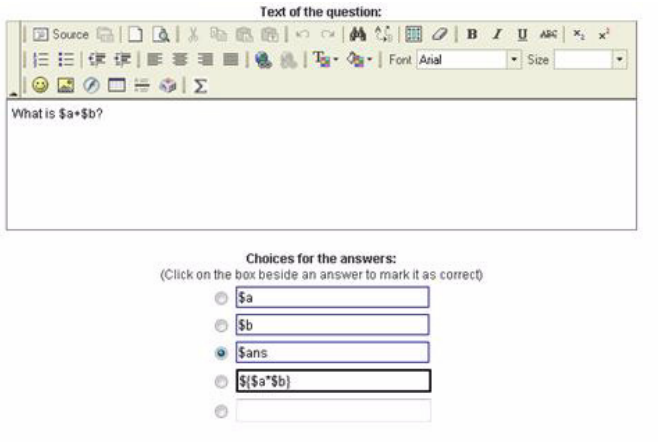
   condition:not(eq($a,$b));

   $ans=$a+$b;
5. Click **Save**. You return to the **New Question** window.
6. Click **Next**. The **Question Editor>Add Question** window opens.
7. In the **Text of the question** field, enter the following:

   What is $a + $b?
8. In the **Choices for the answers** section, enter $a, $b, $ans as possible answers, one for each field.
9. We can also define an algorithmic variable on the question screen. To do this, enter ${$a*$b} in the fourth choice box.
10. Select the radio button beside $ans to mark this as the correct answer.
11. Select *Yes* for **Change the order of answers**. Select *No* for **Allow more than one selection**.

12. Click **Finish**. The **Question Editor>Preview Question** window opens, displaying the question as it appears to the student.

Figure 7-B One of the features of Maple T.A. is the ability to define inline algorithmic expressions directly in questions by using the format ${expression}.



Calculating Area

In this example, we use a numeric question and ask the student to calculate the area of a rectangle given two algorithmically-generated values for the width and length. This example shows that you can combine commands, such as decimal(x,n) and rand(m,n). We've also added a condition on the variables $width and $length so that they will not be equal.

To create the question:

1. In the **New Question** window, select the **Numeric** question type from the **Question Type** drop-down list.
2. Enter "Area" as a description in the **Question Description** field.
3. In the **Algorithm** section, click **Add**. The **Edit Algorithm** window opens.
4. Enter the following code in the text box:

   ```
   $width=decimal(1,rand(2.5,6.5));
   $length=decimal(1,rand(4.5,10.0));
   condition:not(eq($width,$length));
   $area=$width*$length;
   ```

5. Click **Save**. You return to the **New Question** window.
6. Click **Next**. The **Question Editor>Add Question** window opens.
7. In the **Text of the question** field, enter the following:

Given a rectangle with width of $width meters and length of $length meters, calculate its area.

8. In the **Number** text box of **The correct answer:** area, enter $area.
9. In the **Units** text box of **The correct answer:** area, enter m^2.
10. In the **Specify precision** area, select the radio button beside **Require absolute accuracy**.
11. Click **Finish**. The **Question Editor>Preview Question** window opens, displaying the question as it appears to the student.

Color Combinations

This fill-in-the-blanks example illustrates the use of the switch command to customize the question. Given two lists of information, one of three pairs of colors and one of the colors when the pairs of colors are mixed, we can define a random index value and then base the question on one of these three pieces of matching information.

To create the question:

1. In the **New Question** window, select the **Question Designer** question type from the **Question Type** drop-down list.
2. Enter "Color" as a description in the **Question Description** field.
3. In the **Algorithm** section, click **Add**. The **Edit Algorithm** window opens.
4. Enter the following code in the text box:

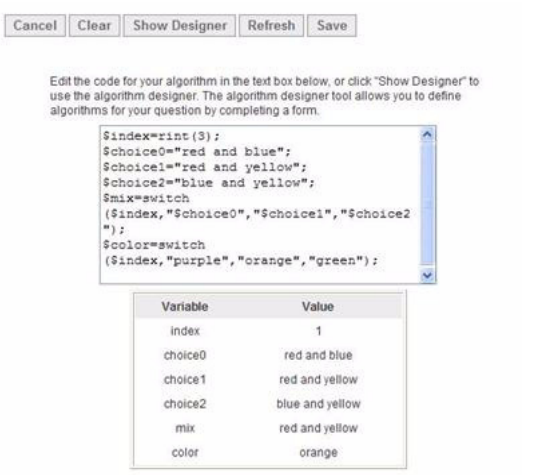
```
$index=rint(3);
$choice0="red and blue";
$choice1="red and yellow";
$choice2="blue and yellow";
$mix=switch($index,"$choice0","$choice1","$choice2");
$color=switch($index,"purple","orange","green");
```

5. Click **Save**. You return to the **New Question** window.
6. Click **Next**. The **Question Editor>Add Question** window opens.
7. In the **Text of the question** field, enter the following:

   When you mix $mix, you get $color?
8. Position the cursor after the word "get" but before the period and click the **Insert/Edit Response Area** button.
9. Choose **List** question for the question type.
10. Leave the radio button beside **Text** field selected. Add $color as the first item and set the Weight to 1.0.
11. Click **OK** to return to the **Question Editor>Add Question** window.

12. Click **Finish**. The **Question Editor>Preview Question** window opens, displaying the question as it appears to the student.

Figure 7-C The Algorithmic Editor shows both the algorithmic commands and a sample value for the variables.



7.4 Randomization Routines in Maple

In addition to Maple T.A.'s built-in functions, you can access Maple routines as well from within Maple T.A. In particular, Maple has many randomization routines that can be used in Maple T.A. This section discusses a subset of the available functions. The function rand will generate a random integer, while randpoly will generate a random polynomial with specific properties. The LinearAlgebra package contains the RandomMatrix and RandomVector functions. The RandomTools package contains a variety of functions for creating random Maple objects, from simple random integers or polynomials to lists of values that follow specific probability distributions. In addition, since Maple is a programming language, you could write your own customized program in Maple to generate any type of variable or object that you need.

All random number generators use the same underlying random number sequence, so when using Maple's randomization routines, you must include randomize( ): as the first part of the call. This uses a number based on the system clock as the initial state instead of the default seed that is used in Maple. If you don't include randomize( ), each call will return the same

sequence of values since each call to Maple from within Maple T.A. starts a new Maple kernel and that will reset the default randomization seed.

Notes:

When entering multiple commands, ensure that all (except the last) have a trailing colon. The last command should have a trailing semi-colon.

When referencing negative (or possibly negative) random variables in a maple variable definition, be sure to place the negative variable in parentheses, otherwise you may receive an error message.

Random Integers

The rand( ) function is a simple way to create random integers. You can also use the RandomTools[Generate] command as shown in the RandomTools section below.

Table 13: Random Integers

Function	Return Value
rand( )	Generates a 12-digit non-negative integer
rand(n)( )	Generates a random integer between **0** and **n-1** (inclusive)
rand(a..b)( )	Generates a random integer between **a** and **b** (inclusive)

Random Polynomials

The randpoly( ) function is the most straightforward way to create random polynomials. You can also use the RandomTools[Generate] command as shown in the RandomTools section below.

Table 14: Random Polynomials

Function	Return Value
randpoly(variables, options)	Generates a random polynomial in terms of variables using the options specified. The most common options are used to specify the type of coefficients and exponents, the degree of the polynomial, and the number of terms in the polynomial.

These options are specified as follows:

coeffs=rand(a..b) – the default is rand(-99..99)
degree=n – the default is 5
expons=n – the default is rand(6)
terms=m – the default is 6, but this value is overridden by the degree option if there is a conflict

LinearAlgebra Functions

The two most common random objects that can be created using the LinearAlgebra package are Matrices and Vectors. You can create both row and column vectors.

Table 15: LinearAlgebra Functions

Function	Return Value
LinearAlgebra[RandomMatrix] (m, n, density, generator)	Generates a random m x n matrix using the options specified.
LinearAlgebra[RandomVector][o] (dimension, density, generator)	Generates a random vector using the options specified. [o] can be used to specify a row vector instead of a column vector (which is the default).

Some examples:

$M=maple("randomize(): LinearAlgebra[RandomMatrix](3,3)"); returns a random 3x3 matrix

$V=maple("randomize(): LinearAlgebra[RandomVector][row](6, generator=rand(1..5)/10))"); returns a row vector of 6 elements whose entries are rational numbers with a denominator of 10 and a numerator between 1 and 5. The elements are returned in simplified form.

RandomTools Functions

There are many functions in the RandomTools package, including subpackages that implement different pseudo-random number generators. There are several RandomTools[Generate] functions that can be used to create random objects, a selection of which are included in the table below. Each of the functions in the table below should follow RandomTools[Generate], as in RandomTools[Generate](choose({a,b,c,d,e,f}));

Table 16: RandomTools Functions

Function	Return Value
choose(collection)	Select one of the entries in a non-empty collection with equal probability
complex(flav)	A random complex number with real and imaginary parts described by the given random flavor flav
exprseq(flav,n)	An expression sequence with n entries where each entry is described by the given random flavor flav
float(opts)	A random floating-point number in a particular range. The options can include a range (e.g., range=2.532..7.723) and the number of digits (e.g., digits=4).
identical(expr)	Describes the object expr itself

Table 16: RandomTools Functions

Function	Return Value
integer(opts) negint(opts) nonnegint(opts) nonposint(opts) nonzeroint(opts) posint(opts)	A random integer in a particular range. The options can include a range (e.g., range=0..10) and a statistical distribution from where the integer is chosen (e.g., distribution=poisson[5])
list(flav, n)	A list with n entries where each entry is described by the given random flavor flav
listlist(flav, m, n)	A list of m lists, each with n entries, where each entry is described by the given random flavor flav. In the case where only m is given, n is assumed equal to m.
rational(opts) negative(opts) nonnegative(opts) nonpositive(opts) nonzero(opts) positive(opts)	A random rational number in a particular range. The options can include a range, a statistical distribution from where the rational number is chosen, or a denominator.
polynom(coeffs, x, opts)	A random polynomial in a given number of variables x with coefficients coeffs of a given random flavor. The default degree of the polynomial is 5, but you can specify the degree of the polynomial by using the degree option (e.g., degree=3).
set(flav,n)	A set containing n entries where the entries of the set are described by the given random flavor flav. The final set can contain fewer than n entries if the same object is generated more than once.
truefalse(opt)	Describes the values true or false. By default, the values true and false will be chosen with equal probability, but you can modify this by using the probability option (e.g., probability=p, where p is a numeric value between 0 and 1 that specifies the probability that the object will be true).

Some examples:

$a=maple("randomize(): RandomTools[Generate](integer(range=2..9))"); returns a random integer between 2 and 9 (inclusive)

$b= maple("randomize():
RandomTools[Generate](list(rational(denominator=30), 10))"); returns a list of 10 rational numbers whose denominator is 30. They are returned in simplified form.

$c=maple("randomize():
RandomTools[Generate]([integer(range=3..10),rational(range=3..10, denominator=13)])"); returns a list of two elements where the first element is an integer in the range 3 to 10 and the second element is a rational number between 3 and 10 whose denominator is 13

You can also include other Maple commands in the algorithmic variable definition. $d=maple("randomize():
seq(RandomTools[Generate](integer(distribution=normald[3.5, 1.5])), i=1..10)"); creates a 10-item sequence of integers that follow a normal distribution.

7.5 Examples of Randomization Functions in Maple

The following examples include the Maple T.A. source code required to generate the question.

Degree of polynomial

This numeric question uses Maple to generate a random polynomial and Maple's MathML[ExportPresentation] function to generate a nicely formatted version of it. We then ask the student to determine the degree of the polynomial.

To create the question:

1. Click **Questions**, then **New Question** to create a new question. The **New Question** window opens.
2. From the **Question Type** drop-down menu, select **Numeric**.
3. In the **Question Description** field, enter "Degree of polynomial".
4. In the **Algorithm** section, click **Add**. The **Edit Algorithm** window opens.
5. Enter the following code in the text box:

   ```
   $a=range(0,2);
   $b=range(2,5);
   $poly=maple("randomize(): randpoly(x,degree=$b)");
   $displaypoly=maple("printf(MathML[ExportPresentation]($poly))");
   ```

6. Click **Save**.You return to the **New Question** window.
7. Click **Next**. The **Question Editor>Add Question** window opens.
8. In the **Text of the question** field, enter the following:

   What is the degree of $displaypoly?

9. In the **Number** text box of **The correct answer:** area, enter $b.
10. Leave the **Units** text box of **The correct answer:** area blank.
11. In the **Specify precision** area, select the radio button beside **Require absolute accuracy**.
12. Click **Finish**.

Intersection of Sets

Here we use the RandomTools[Generate](set) function, to generate two unique sets and ask the student to determine the intersection. This question is written as a Maple-graded question because we want the student to enter a set as the answer.

To create the question:

1. Click **Questions**, then **New Question** to create a new question. The **New Question** window opens.
2. From the **Question Type** drop-down menu, select **Maple-graded**.
3. In the **Question Description** field, enter "Intersection of sets".
4. In the **Algorithm** section, click **Add**. The **Edit Algorithm** window opens.
5. Enter the following code in the text box:

   ```
   $set1=maple("randomize():RandomTools[Generate](set(pos-
   int(range=8),5))");
   $set2=maple("randomize():RandomTools[Generate](set(pos-
   int(range=10),4))");
   ```
6. Click **Save**.You return to the **New Question** window.
7. Click **Next**. The **Question Editor>Add Question** window opens.
8. In the **Text of the question** field, enter the following:

   What is the intersection of $set1 and $set2?
   Enclose your answer in braces.
9. Enter **Maple code that evaluates to the correct answer:**

   $set1 intersect $set2
10. Change the **Maple code to grade the student response** to:

    is($RESPONSE=$ANSWER);
11. In the **Select the type of expression you want to accept:** drop-down list, choose Maple syntax – e.g., diff(2*f(x),x)
12. Click **Finish**.

Matrix Determinant

In this example, we use Maple's LinearAlgebra[RandomMatrix] function to create a square matrix with entries between -9 and 10. Again, we use MathML[ExportPresentation] to generate a nicely formatted version for display.

To create the question:

1. Click **Questions**, then **New Question** to create a new question. The **New Question** window opens.
2. From the **Question Type** drop-down menu, select **Maple-graded**.
3. In the **Question Description** field, enter "Determinant".
4. In the **Algorithm** section, click **Add**. The **Edit Algorithm** window opens.
5. Enter the following code in the text box:

   ```
   $n= int(rand(2,4));
   ```

$matrix=maple("randomize():LinearAlgebra[RandomMatrix]($n,$n,generator=rand(-9..10))");
$m=maple("printf(MathML:-ExportPresentation($matrix))");

6. Click **Save**. You return to the **New Question** window.
7. Click **Next**. The **Question Editor>Add Question** window opens.
8. In the **Text of the question field**, enter the following:

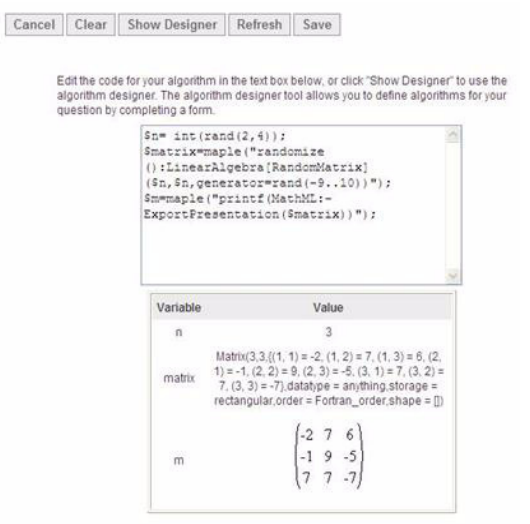
   Calculate the determinant of the following matrix.
   $m .
9. Enter **Maple code that evaluates to the correct answer:**

   LinearAlgebra[Determinant]($matrix);
10. The following **Maple code to grade the student response** is provided automatically:

    evalb($ANSWER-$RESPONSE=0);
11. In the **Select the type of expression you want to accept:** drop-down list, choose:

    Formula – e.g., x^2 sin(x^2)
12. Click **Finish**.

Figure 7-D Two Maple commands are being used; one to create the matrix construct, and one to generate a nicely formatted version for display.



8 Maple-graded Questions

Maple T.A. offers numerous question types to ensure you can present and properly grade your question. The Maple-graded question type connects to the Maple engine when grading students' responses. This will give credit for any response that is mathematically equivalent to the correct answer. For example, if your Maple-graded question is $\frac{d}{dx}\sec(x)$, the system would accept $\sec(x)\tan(x)$, $\frac{\tan(x)}{\cos(x)}$, $\frac{\sin(x)}{\cos 2(x)}$, or anything equivalent as correct. If your question asked for a set, the system would accept any response that contained the correct elements, regardless of the order in which the student gave them. You can write questions that ask for differential equations, unevaluated integrals, and so on. You can write questions that have more than one answer or infinitely many answers.

This document will guide you through the creation of some example Maple-graded questions. The examples reflect only a small sampling of the possibilities.

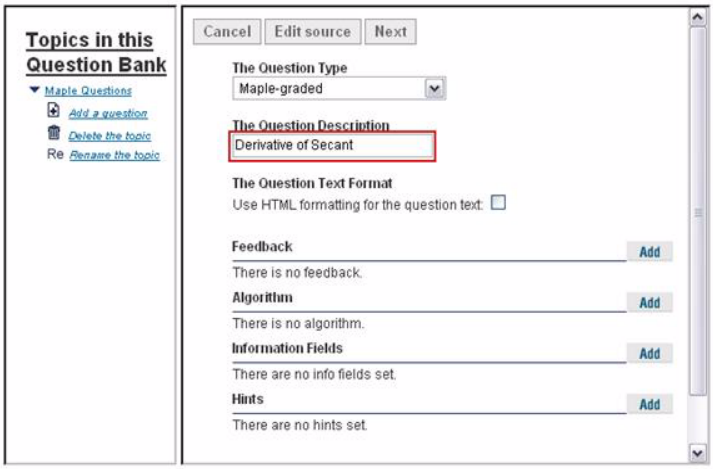
8.1 A Basic Maple-graded Question

In this first example, we build a question that asks for the derivative of $\sec(x)$ and uses Maple to grade the response.

1. Log in as an instructor and go to the **Question Editor**.
2. Click **Questions**, then **New Question** to start a new question.
3. From the **Question Type** menu, select **Maple-graded**.

4. In the **Question Description** text region, enter the description **Derivative of Secant** as shown in Figure 8-A.

Figure 8-A Creating a Maple-graded question



5. Click **Next** to proceed to the **Maple-graded Question and Answer** screen. This screen displays regions to enter the question text, the Maple code for calculating the correct answer, the Maple code for grading the student response, and more.
6. In the first text region, enter the question text as shown in Figure 8-B.

   Compute the derivative of $\sec(x)$.
7. In the second text region, enter the Maple code that will compute the correct answer. The system stores this result in the variable $ANSWER, which can then be used in the grading routine.

   $diff(\sec(x), x)$;
8. The third text area includes Maple code to grade the student response. The last line of your Maple code must evaluate to **true** for a correct response, **false** for an incorrect response, or a floating-point value between 0 and 1 for partial credit (available as of Maple T.A. 2.5). Maple's **evalb** command is frequently the best way to do this, but any Maple command that returns a boolean is allowed. This region already contains the code

   evalb(($ANSWER) – ($RESPONSE) = 0);

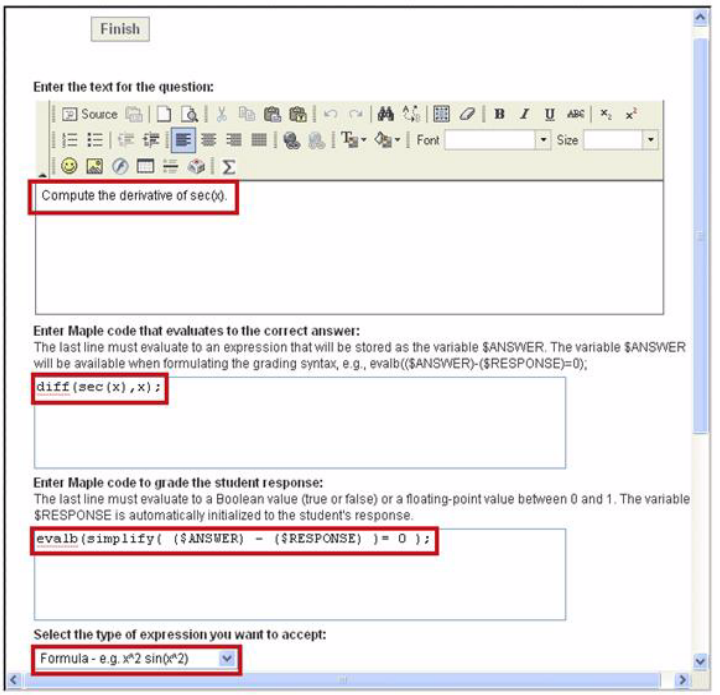
   For this example, alter the line of code to,

   evalb(simplify(($ANSWER) – ($RESPONSE))= 0);

   The system stores the student response in the variable $RESPONSE, which you can use as a Maple variable anywhere inside your Maple code.

Caution: We strongly recommend that you test your Maple code in a Maple worksheet. Frequently, you will find that your first version of Maple code is inadequate to give credit for all correct answers. In this example, if we had just used **evalb(($ANSWER) – ($RESPONSE) = 0)**, the system would only give credit for sec(x)tan(x) and reject all other responses, even if they are algebraically equivalent to sec(x)tan(x). The reason is that **evalb** does not perform any simplification.

Figure 8-B The Maple-grading Question and Answer screen



9. From the drop down menu titled **Select the type of expression you want to accept**, ensure **Formula - e.g. x^2 sin(x^2)** is selected.

   Note: The Formula option accepts basic algebraic expressions, either by entering them in standard calculator syntax, for example, (2x/y + sin(x y))(4x^2-1), or by using the symbol palette. When the student submits a response with this option selected, the system translates it into Maple syntax so that the Maple engine can apply your Maple code to it. If you want the student to enter equations, differential operators, integral signs, summations, vectors, matrices, DEs, or other advanced mathematical expressions, select the **Maple syntax – e.g. diff(2*f(x),x)** option. This option allows a much wider range of student response types. However, it requires the student to enter the response using proper Maple syntax because the system runs your Maple code directly on what the student types. Also, this option

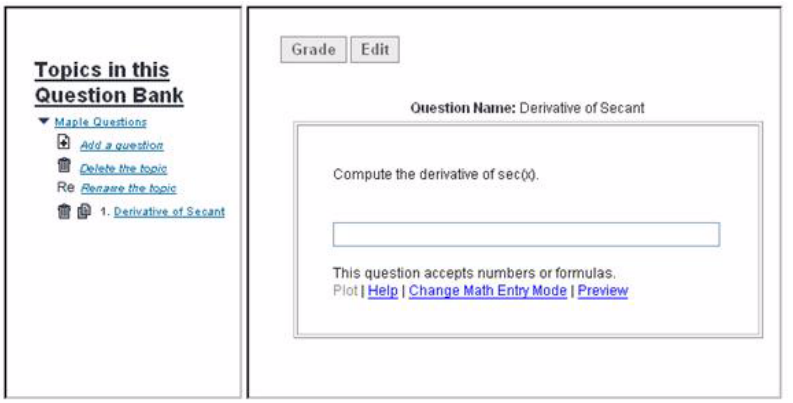
allows the student to enter Maple commands, for example, diff(sec(x),x);, so you need to be careful when you choose it.

10. Click **Finish**. This will take you to the **Preview** screen in which you can test your question or start a new one.

Testing Your Question

1. Now pretend you are a student doing the assignment and enter a typical response in the text area as shown in Figure 8-C.

Figure 8-C A preview and test of the question



2. Click **Grade** to check that Maple is correctly assessing the response.
3. Click **OK** and you will return to the **Preview** screen. Try a variety of student responses to convince yourself that the Maple code for grading the question is adequate.
4. If the question or the Maple code needs revision, click **Edit**.

8.2 A Randomized Question

To provide multiple problems of the same form or to hinder cheating during exams, you can include random parameters such as random problem data or coefficients into math questions.

In this example, we build a question that asks for the equation of a 3-D plane that passes through the points <1,0,0>, <0,1,0> and a third point picked at random. This example will also show how to use multiple lines of Maple code to grade a more complicated question.

1. Click **Questions** and then **New Question**. Select **Maple-graded** as the question type.
2. Enter the description **Equation of a plane**.
3. Click **Add** next to the **Algorithm** heading. This will take you to an **Algorithm** screen in which you define the random variables.
4. Click **Show Designer**. This will take you to a point-and-click interface for designing random variables.

   Note: Once you become familiar with Maple T.A.'s syntax for designing random variables, you can simply type the randomization code into the text region and skip the Show Designer step.

   a) Here we will define three random coordinates for the third point. In this example, we call the coordinates **a**, **b**, and **c**. Enter the name of the variable in the first text box, **a**.

   b) Select the data type from the adjacent menu, **whole number**.

   c) Enter the lower and upper bounds of the variable in the next two text boxes, **-2** and **5** respectively.

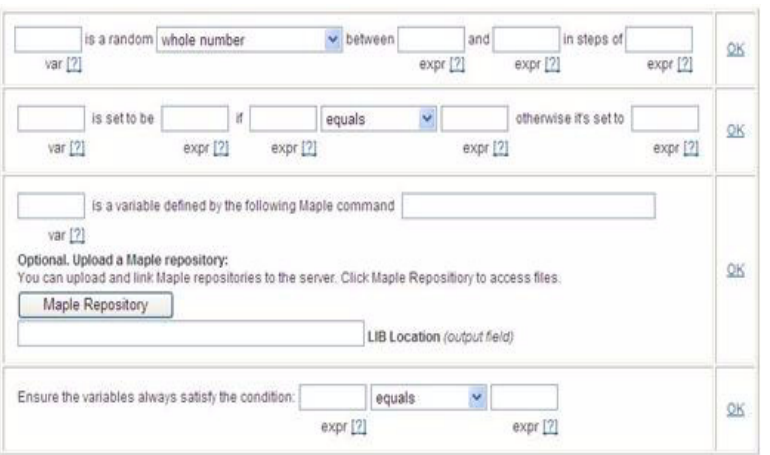
   d) Ignore the final text box since we want the increments of this variable to be in steps of one, the default.

   e) Click **OK** and the random variable is added to the text region below the variable regions as shown in Figure 8-D.

   f) Repeat these steps for **b** and **c**.

   When referring to the random variables, use the names **$a**, **$b**, and **$c**.

Figure 8-D Defining algorithmic variables using the algorithm designer



Notes:

- You can also create random Maple variables. Enter these variables in the third row of the Algorithm Designer or directly in the algorithm text region as $<var name> = maple("<maple command>");
- We recommend wrapping random variables inside parentheses when referring to them inside a Maple statement. Otherwise, if the random variable turns out to be negative, Maple will generate a syntax error and every response will be marked wrong. This is due to the fact that Maple is unable to parse statements like 5+–2.

5. When you are finished, click **Save** to return to the **New Question** window.
6. Click **Next** to go to the **Maple-graded Question and Answer** screen.
7. Enter the question text.

   Find the equation of the plane that passes through <1,0,0>, <0,1,0> and <$a,$b,$c>. Write your answer in the form Ax+By+Cz+D=0 (using lower case x, y and z).

8. Enter the Maple code for calculating the correct answer.

   n := LinearAlgebra:-CrossProduct(<$a,$b,$c>-<1,0,0>, <0,1,0>-<1,0,0>);
   n[1]*(x-1)+n[2]*y+n[3]*z=0;

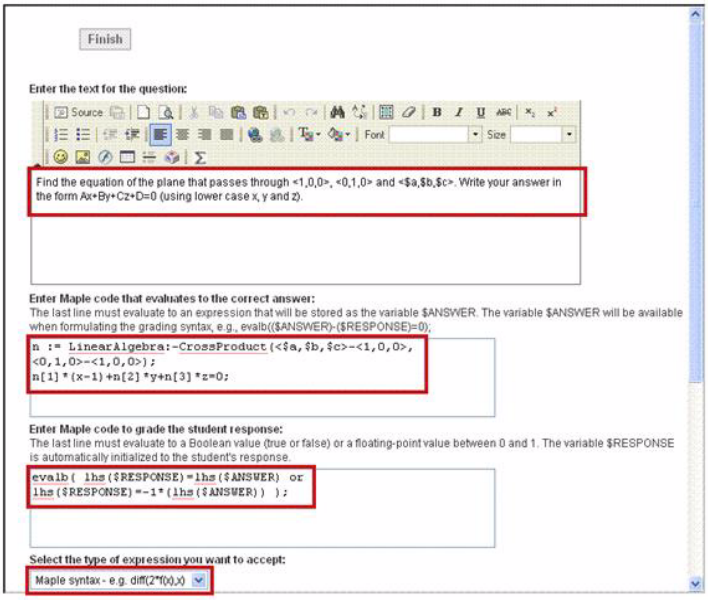
9. Enter the Maple code for grading the student response.

   evalb(lhs($RESPONSE)=lhs($ANSWER) or
   lhs($RESPONSE)=-1*(lhs($ANSWER)));

10. Set the expression type as **Maple syntax – e.g. diff(2*f(x),x)**, because students will be entering an equation.

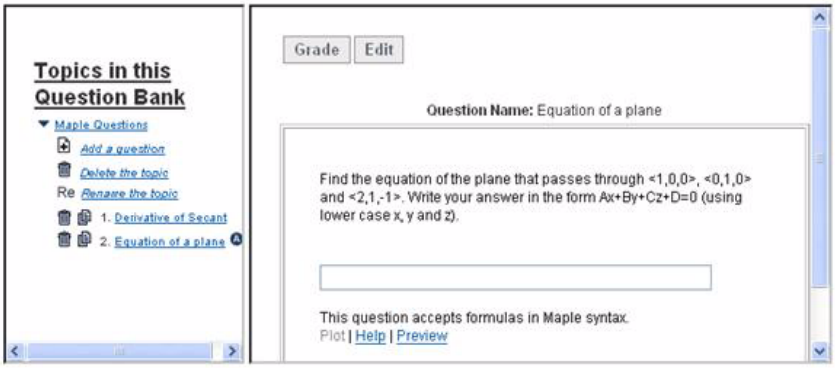
Caution: If this option is set to **Formula (e.g., x^2*sin(x))**, the system will not parse the equal sign in the equation the student enters and will grade the response as incorrect.

Figure 8-E The question definition and Maple syntax to grade the response



11. Click **Finish** to preview the question as shown in Figure 8-F.

Figure 8-F The question as it would appear to the student. Notice that the third point has been randomly generated by Maple T.A.



8.3 A Question with Infinitely Many Correct Answers

Part of the power of using Maple in Maple T.A. is that you can ask questions that have an infinite number of correct answers, and let Maple do the work of determining if the student's response is correct. You don't have to provide a long list of possible answers to your markers.

In this example, we build a question that asks for a function that is increasing on a given interval. We will use a different verification routine (verify), and we also show the ability to plot the student's response.

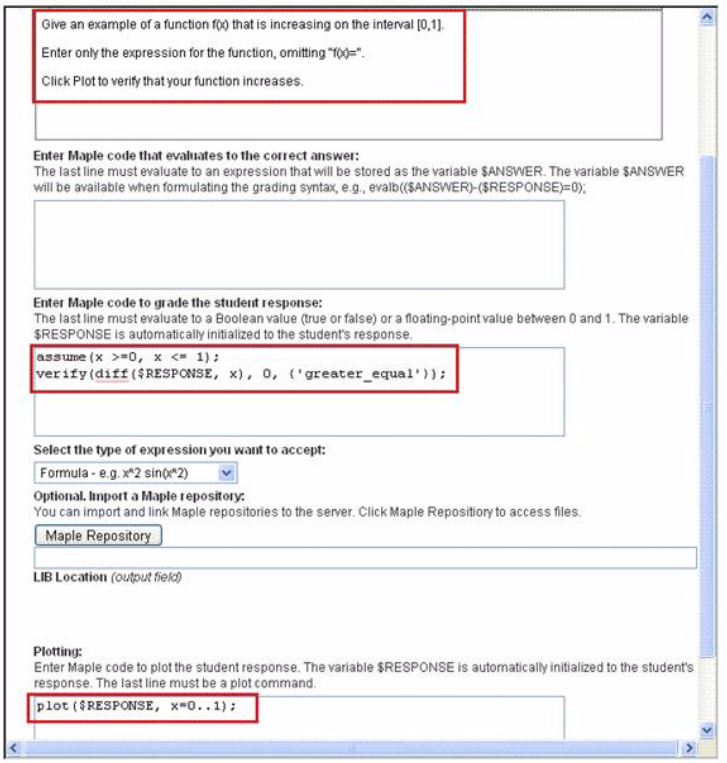
1. In the **New Question** window, add a Maple-graded question and enter the description, **Increasing function**.
2. Proceed to the **Maple-graded Question and Answer** screen.
3. Enter the question.

   Give an example of a function f(x) that is increasing on the interval [0,1].
   Enter only the expression for the function, omitting "f(x) =".
   Click Plot to verify that your function increases.

   In this question, simple HTML tags are used to format the question nicely.
4. Since this problem has infinitely many correct answers, we won't enter specific code in the Maple answer code text region.
5. Enter the Maple grading code.

   ```
   assume(x >=0, x <= 1);
   verify(diff($RESPONSE, x), 0, {'greater_equal'});
   ```
6. Ensure **Formula - e.g. x^2 sin(x^2)** is selected.

Figure 8-G Including plotting code in a Maple-graded question

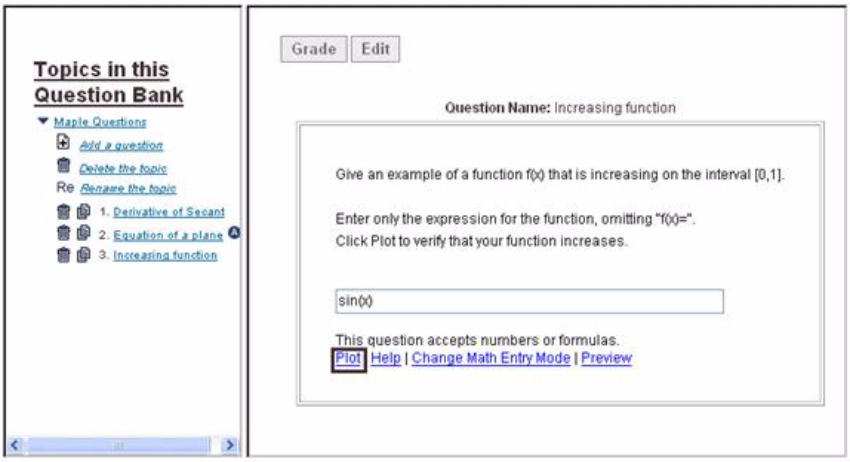


7. The **Plotting** text region allows you to plot a student's response by entering a Maple plot command and including $RESPONSE as the expression to plot. In the **Plotting** text region, enter

   plot($RESPONSE, x=0..1)

   When the student is answering the question, they can click the **Plot** link to see a plot of their response. For this example, if they understand the concept of an increasing function, seeing the plot allows them to verify that they have entered a correct function. This feature is only available using the Maple-graded question type.
8. Click Finish to see a preview of the question as shown in Figure 8-H.

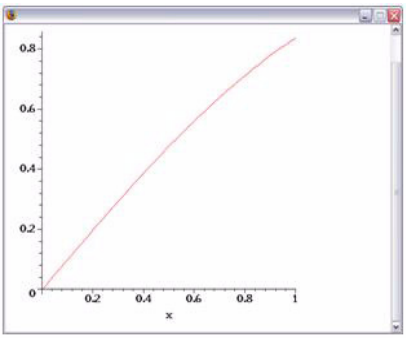
Figure 8-H The increasing function question preview



Testing your question

Now, enter a response, say sin(x), and click the **Plot** link as shown in Figure 8-H. Figure 8-I shows the result.

Figure 8-I A plot of the student's response



8.4 Another Question with Infinitely Many Correct Answers

This example asks for an antiderivative of the function f(x) = x sin(x).

1. In the **New Question** window, add a new question and proceed to the **Maple-graded Question and Answer** screen.
2. Enter the question:

   Use integration by parts to give an antiderivative of the function f(x) = x sin(x).

3. Since this problem has infinitely many correct answers, we won't enter specific code in the Maple answer code text region.

4. Enter the Maple grading code:

   is(diff($RESPONSE, x) =x*sin(x));

5. Ensure **Formula - e.g. x^2 sin(x^2)** is selected.

The system will mark correct any response of the form $\sin(x) - x\cos((x) + C)$, where C is a constant, because we are asking Maple to differentiate the response. (The code **evalb(simplify($RESPONSE – int(x*sin(x),x)) = 0)** is not appropriate here, as it would mark *incorrect* any response in which $C \neq 0$.)

We use **Formula** as the type of expression to accept in order to prevent Maple-savvy students from entering "int(x*sin(x), x)" as the response.

8.5 Accepting Approximations of Exact Symbolic Answers

This example asks to find the perimeter of a circle where the radius is selected at random. The student's response is graded correct if it is within 5% of the correct answer.

1. In the **New Question** window, add a new Maple-graded question.
2. Open the **Algorithm** screen and enter:

   $r=range(2, 5);

This function generates a random integer in the range 2 to 5 inclusively.

3. Proceed to the **Maple-graded Question and Answer** screen and enter the question:

   Find the perimeter of the circle with radius $r correct to four significant digits.

4. Enter the Maple answer code:

```
exact:= 2*Pi*($r):
evalf( exact, 4 );
```

5. Enter the Maple grading code:

```
evalb( abs( evalf( $RESPONSE - $ANSWER ) / $ANSWER ) < .05 );
```

6. Ensure **Formula - e.g. x^2 sin(x^2)** is selected.

This problem will mark correct either the exact symbolic expression $2\pi r$ or any numeric response that is within 5% of $2\pi r$ evaluated to four significant digits. Notice that the radius $r of the circle is randomly generated.

8.6 Questions with Vectors and Matrices

This example looks to determine the direction from a randomly generated point that the function x^2y^2 is increasing fastest. This question uses the VectorCalculus and LinearAlgebra packages to grade the response.

1. In the **New Question** window, add a new Maple-graded question.
2. Open the **Algorithm** screen and enter:

```
$p1=range(-3,3);
$p2=range(-4,4);
```

3. Proceed to the **Maple-graded Question and Answer** screen.
4. Enter the question:

   In what direction from the point <$p1, $p2> is the function $f(x,y) = x^2y^2$ increasing the fastest?
   Express your answer as a vector in the form < a, b >.

   Note: Be sure to include a space between '<' and 'a'. Otherwise, Maple T.A. treats this as the beginning of an HTML tag and this will not be displayed correctly.

5. Enter the Maple grading code:

   ```
   gradientField := VectorCalculus:-VectorField(<2*x*y^2, 2*y*x^2>,
   cartesian[x,y]):
     gradientValue:=VectorCalculus:-evalVF( gradientField, <$p1, $p2>):
     LinearAlgebra:-Equal( $RESPONSE);
   ```

6. Ensure **Maple syntax – e.g. diff(2*f(x),x)** is selected.

Notice that the last line of Maple code uses the **LinearAlgebra:-Equal** command, which takes two vectors or matrices and returns **true** if and only if they have the same entries. The command **evalb($RESPONSE = gradValue)** would not work in this example because the "=" sign in Maple cannot be applied to Matrices or Vectors.

We set the type of expression to accept expressions as **Maple syntax** instead of **Formulas** because the **Formulas** option does not parse vector brackets < >.

8.7 Allowing for Partial Grading

This example asks for the zeros of an equation. Denoting by R the set of values submitted by a student and S the actual solution set, we will have Maple compute the grade as follows:

$$Grade = \frac{max(|S \cap R| - |S \backslash R|, 0)}{|R|}$$

This will produce a number between 0 and 1.

1. In the **New Question** window, add a new Maple-graded question.
2. Open the **Algorithm** screen and enter:

   ```
   $plot=plotmaple("plot(x^3-x, x=-2..2, y=-2..2), plotoptions='width=200,
   height=200' ");
   ```

3. Proceed to the **Maple-graded Question and Answer** screen.
4. Enter the question:

   Solve the equation , omitting "x = " from your answer.

   $plot

If there are multiple solutions, enter each separated by commas, e.g., 3,-2.

5. Enter the Maple answer code:

   solve(x^3-x,x);

6. Enter the Maple grading code:

   good := nops({$RESPONSE} intersect {$ANSWER});
   bad := nops({$RESPONSE} minus {$ANSWER});
   evalf(max(good-bad,0)/nops({$ANSWER}));

7. Ensure **Maple syntax – e.g. diff(2*f(x),x)** is selected.

Recall that in general the Maple grading code must always evaluate to either a boolean (true or false) or a decimal number between 0 and 1.

We set the type of expression to accept expressions as **Maple syntax** instead of **Formulas** because the **Formulas** option will not parse a sequence of values.

8.8 Performing a String Match

This example looks to find the set-theoretic difference between two sets. We will need to set the type of expressions to accept as Maple syntax instead of formulas because the Formulas option does not parse set notation { }. However, we need to be careful not to accept a response that calls Maple's **minus** operator for sets. That we can achieve by searching the response string for the word "minus".

1. In the **New Question** window, add a new Maple-graded question.
2. Open the **Algorithm** screen and enter,

   $plot=plotmaple("plot(x^3-x, x=-2..2, y=-2..2), plotoptions='width=200, height=200' ");

3. Proceed to the **Maple-graded Question and Answer** screen.
4. Enter the question:

   Find the set-theoretic difference {a,b,c,d,e} minus {c,a}.

   Enclose your response in braces.

5. Enter the Maple answer code:

{a,b,c,d,e} minus {c,a};

6. Enter the Maple grading code:
   evalb($RESPONSE=$ANSWER) and
   evalb(StringTools[Search]("minus","$RESPONSE")=0);

7. Ensure **Maple syntax – e.g. diff(2*f(x),x)** is selected.

8.9 Performing a Pattern Match

This example tests students' knowledge of the sum-product identities in trigonometry. We want to check that a response is not only mathematically equivalent to the correct answer, but also has the right form, and for that we will use Maple's **patmatch** function.

1. In the **New Question** window, add a new Maple-graded question.
2. Proceed to the **Maple-graded Question and Answer** screen and enter the question:

   Express $\sin(x) - \sin(y)$ as a product of the form
   $c \cdot \sin(f) \cdot \cos(g)$
   where f and g are expressions in x and y, and c is a constant.

3. Enter the Maple answer code:

   2*sin((x-y)/2)*cos((x+y)/2);

4. Enter the Maple grading code:

   ```
   if (is($RESPONSE=$ANSWER)) then
       patmatch($RESPONSE,
   a::realcons*sin('f'::anything)*cos('g'::anything));
   else false; end if;
   ```

5. Ensure **Formula - e.g. x^2 sin(x^2)** is selected.

This problem will mark the expression 2*sin((x-y)/2)*cos((x+y)/2) correct and the expression sin(x)-sin(y) incorrect.

8.10 Troubleshooting Maple-graded questions

Table 17: Troubleshooting

Problem	Solution

Maple T.A. keeps grading correct responses as incorrect.	• Test your Maple code in a Maple worksheet on several forms of the correct response.
	• If you used commands from a Maple package, make sure you included the package name with the commands. For example, instead of
	evalb(Norm(<$a,$b>, 2) = 1);
	you should use
	evalb(LinearAlgebra:-Norm(<$a,$b>, 2) = 1);
	• Check that all random variables in the Maple code have a $ in front of them.
	• Check that all random variables in the Maple code have parentheses around them. For example, instead of
	p := factor(x+2*$b);
	you should use
	p := factor(x+2*($b));
	• Check the type of expression to accept. If the correct answer is (or contains) an equation, vector, matrix, unevaluated derivative or integral, or a Maple command, the type of expression must be set to **Maple syntax**, not **Formula**.
	• Check that all instances of $RESPONSE and $ANSWER are in upper-case letters.

I'm seeing variable names instead of instantiated variable values in the question.	• Make sure that all references to random variables have a $ character in front of them.
My random Maple variables have the same values at each question instance.	• Make sure the Maple command that generates the random object has the prefix randomize(): The syntax is $<var name> = maple("randomize(): <maple command>");

9 Flash and Applet Questions

Maple T.A. supports Flash movies and Java applets. In fact, you can include a Flash movie or Java applet in any question type, as described in sections 9.1 and 9.2. In addition, you have the ability to create a question where students are graded directly on their interaction with the Flash movie or Java applet. This more advanced functionality is described in sections 9.3 and 9.4.

9.1 Flash Movies in Maple T.A. Questions

You can include Flash movies in your Maple T.A. questions, similar to the way you would add an image to the question. First, you would upload the Flash movie to a folder on your class web site; see *Including Images in Questions* in section 6.4 for details.

Next, you would include a reference to the Flash movie in your question as follows:

1. Create or edit a question in the **Question Editor**.
2. In the field where you want to include the image (question text, feedback, hints, or solution), click the **Insert/Edit Flash** button.
3. Under the Flash Info tab, click **Browse Server** and select the movie you had uploaded. You will be shown a preview of the movie.
4. Click **OK** and the movie will be added.

   Note: The **Browse Server** screen also allows you to upload a Flash movie to the server, in case you had not previously uploaded the movie using the Web Site Editor.

9.2 Java Applets in Maple T.A. Questions

Maple T.A. has a couple of built-in applets that you can use to dynamically label a static image or create a graph of a specific function.

Dynamic Labels on an Image

Maple T.A. includes a labeling applet that allows you to include an image and then place labels on it. This provides the ability to use the same underlying image for your questions, but position algorithmic variables on the image to generate variations.

To dynamically label an image:

1. Upload an image to a folder on your class web site and take note of its exact location; see section 6.4 for details.
2. Create or edit a question in the **Question Editor**.
3. In the field where you want to include the image (question text, feedback, or solution), click the **Source** button to view the html source.
4. Paste the following applet code into the source html where you want the labeled image to appear:

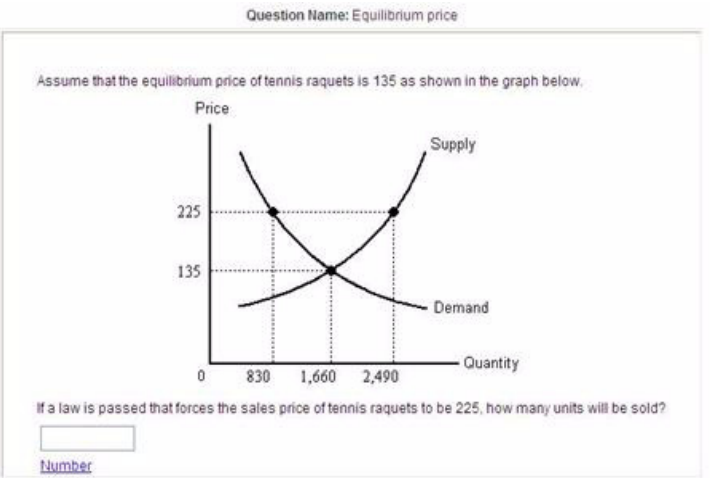
```
<div align=center>
   <applet code="applets.labelImage.LabelImage" width="316" height="258">
          <param name="image" value="../classes/classname/imagename">
          <param name="size" value="numberoflabels">
          <param name="label.1.x" value="x-position of first label">
          <param name="label.1.y" value="y-position of first label">
          <param name="label.1.text" value="text for first label">
          <param name="label.2.x" value="x-position of second label">
          <param name="label.2.y" value="y-position of second label">
          <param name="label.2.text" value="text for second label">
   </applet>
</div>
```

5. Modify the applet code to reflect the actual image and values you want to include. In particular:

- The value of "image" parameter should be set to the path to the image you uploaded in step 1.
- The value of "size" parameter is the number of labels to be added to the image.
- For each label, specify the x- and y-pixel coordinates as well as the text that should appear. Note that the text can be a variable from your question's algorithm, thereby creating a dynamic label.

Example: Consider the following question which uses the label image applet to add dynamic labels to points along the axes of a graph.

Figure 9-A The following image uses the labeling applet to incorporate algorithmically generated values for the axis labels.



Here is the applet code:

```
<div align=center>
  <applet code="applets.labelImage.LabelImage" width="316" height="258"
codebase="http://localhost:8080/mapleta/modules">
    <param name="image" value="web/mapledemo/Public_Html/sup_dem_graph.gif">
    <param name="size" value="5">
    <param name="label.1.x" value="15">
    <param name="label.1.y" value="107">
    <param name="label.1.text" value="$B">

    <param name="label.2.x" value="15">
    <param name="label.2.y" value="159">
    <param name="label.2.text" value="$A">

    <param name="label.3.x" value="76">
    <param name="label.3.y" value="250">
    <param name="label.3.text" value="$a">

    <param name="label.4.x" value="129">
    <param name="label.4.y" value="250">
    <param name="label.4.text" value="$b">

    <param name="label.5.x" value="184">
    <param name="label.5.y" value="250">
```

```
    <param name="label.5.text" value="$c">
  </applet>
</div>
```

In this example, an image file `sup_dem_graph.gif` from the class web site is added to the question and dynamically labeled with values $a, $b, and $c along the horizontal axis, and $A and $B along the vertical axis.

The variables themselves are defined in the question's algorithm:

```
$x=rand(100, 900, 2);
$y=sig(2, 5*(rint(19)+1));

$a=int($x);
$b=int(2*$x);
$c=int(3*$x);

$A=int(3*$y);
$B=int(5*$y);
```

Interactive Plots

The graph plotting applet is an interactive plot that is added to a question type for dynamic plotting. The applet displays axes for the graph even when the axes lie outside of the viewable area. You can shift-click and drag the graph area to shift the viewable area or you can ctrl-click and drag to rescale the image.

To add a graphing applet to your question:

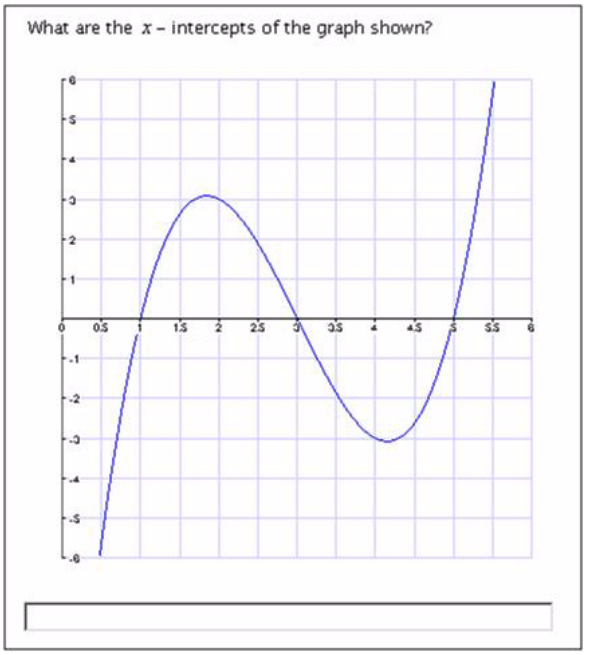
1. Create or edit a question in the **Question Editor**.
2. In the field where you want to include the image (question text, feedback, or solution), click the **Source** button to view the html source.
3. Paste the following applet code into the source html where you want the graph to appear:

```
<div align=center>
      <applet code="applets.grapher.Graph" archive="graphing.jar" width="250"
height="250">
            <param name="y1" value="an expression in x">
            <param name="xMin" value="position of smallest x-coordinate">
            <param name="xMax" value="position of largest x-coordiante">
            <param name="yMin" value="position of smallest y-coordinate">
            <param name="yMax" value="position of largest y-coordinate">
            <param name="gridLines" value="number of gridlines">
      </applet>
</div>
```

4. Modify the applet code to reflect the actual function, plot window, and number of gridlines.

Example: Consider the following question which uses the graphing applet to display a plot of the function y = (x-1)(x-3)(x-5).

Figure 9-B The graph of y = (x-1)(x-3)(x-5) generated with the graphing applet



Here is the applet code for this example:

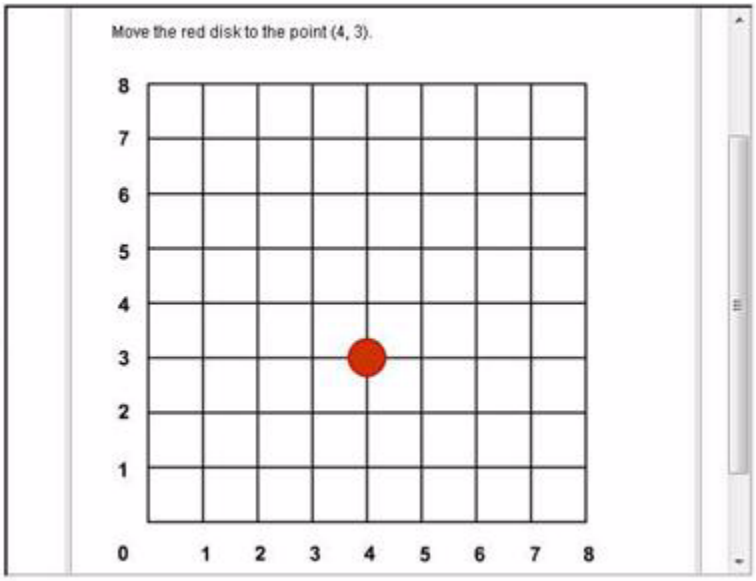
```
    <div align=center>
        <applet height="400" archive="graphing.jar" width="400"
code="applets.grapher.Graph">
            <param name="y1" value="(x-1)(x-3)(x-5)" />
            <param name="xMin" value="0" />
            <param name="xMax" value="6" />
            <param name="yMin" value="-6" />
            <param name="yMax" value="6" />
            <param name="gridLines" value="12" />
        </applet>
    </div>
```

9.3 Flash Question Type

With Maple T.A.'s Flash question type, you can create a Flash movie and integrate it into a Maple T.A. question which grades students directly on their interaction with the movie. Students use the mouse and/or keyboard to alter the movie or identify hot

spots in the movie in order to produce the correct answer. For example, the question in Figure 9-C asks students to move the disk to a specific point in the Cartesian plane.

Figure 9-C A Flash question in Maple T.A.



To create the Flash movie, you will need Flash development software (for example, Adobe® Flash® CS3) and some familiarity with Flash programming. Your Flash movie must implement the following features:

- A pair of variables called **response** and **locked** should be declared.
- Whenever a student interacts with the movie and brings it to a new state, that state should be translated into a text string and assigned to the variable **response**. You are free to decide for yourself how this translation is done.
- When the Flash movie starts up, it reads the variable response and finds a string that was returned by a previous call to GetVariable("response").

You must program the movie to initialize its appearance to the state consistent with that response.

- The Flash movie also reads the variable **locked**. This variable determines when a student is allowed to modify his/her response. When the value of **locked** is equal to *true*, this signals to the Flash movie that the question is in 'feedback' mode; in this case the movie should present in a form suitable for feedback

After creating the Flash movie you would upload it to a folder on your class web site as described in section 6.4. Finally, you need to host the Flash movie in a Maple T.A question, using our Flash question type. To do this, you need to create a source question bank file. Note that Flash questions must be authored outside of the question editor. Here is what the question source for Cartesian coordinates question looks like. Note that the value of the "movie" field should be set to the actual path to the Flash movie you would have uploaded to your class web site:

```
question=Move the red disk to the point ($x, $y).@
answer=$x,$y@
movie=<path to your .swf file> @
width=400@
height=400@
bgcolor=#FFFFFF@
mode=Flash@
name=Graph Coordinates@
editing=useHTML@
algorithm=$x=range(1,8);
  $y=range(1,8);@
```

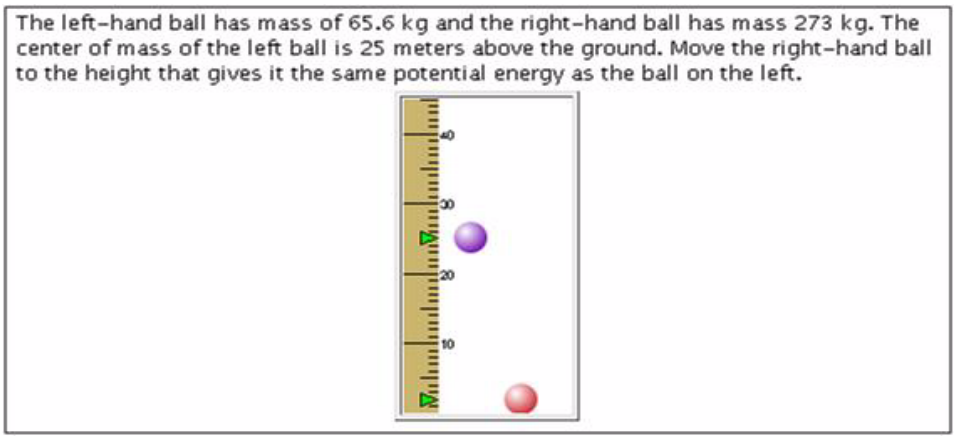
For full details and to see the Flash source code for the Cartesian coordinates example, please download the "Creating Flash Questions for Maple T.A." zip file from the Maple T.A. Content Center on our web site.

9.4 Applet Question Type

With Maple T.A.'s Applet question type, you can create a Java applet and integrate it into a Maple T.A. question which grades students directly on their interaction with the applet. Students use the mouse and/or keyboard to alter the applet or identify hot spots in the applet in order to produce the correct

answer. For example, the question in Figure 9-D asks students to move the red ball to a height that gives the desired potential energy.

Figure 9-D An Applet question in Maple T.A.



Initially the red ball is at the bottom. When the student moves the red ball to just the right height, the student's response is graded as correct.

There are three steps involved in creating an Applet question. Steps 1 and 2 require some familiarity with Java programming.

1. Create and deploy the Java applet.
2. Create and deploy a Java class grading.
3. Author the question.

Step 1: Create and Deploy a Java Applet

For this step, you will need some familiarity with Java programming. The applet is required to do three things:

1. Provide a **getResponse()** method which can be queried to find the current student response.
2. Call method **getParameter("response")** to read the **response** parameter for a string containing any previous attempt at a response to this question, and initialize the applet to display that state.
3. Call method **getParameter("locked")** to read the **locked** parameter, and disable user modifications if the flag is set.

You may also make additional **getParameter**(paramName) values to read any additional parameters for initialization. These are passed from the param fields in the question (see Step 3).

After creating the applet, place it in the "applets" folder (or an appropriate subfolder if packages are used) on the Maple T.A. server.

Step 2: Create and Deploy a Java Class for Grading

This is a server-side grader module that accepts the student response as prepared by the applet and compares it against the correct answer that you will set in Step 3.

Your grader class should implement three methods:

1. An **init(String** paramName, **String** paramValue**)** method with void return type. This method receives a set of name/value pairs which it can use for initialization. These are passed from the grader.param fields in the question (see Step 3).
2. A **grade(String** correctAnswerText, **String** studentResponseText**)** method with a double return type value between 0.0 and 1.0, where 1.0 is full credit. The method should compare the text of the student response with text representing the correct answer.

   Note: The student response text is delivered from the applet's getResponse() method. In many cases, grading will be performed by judging whether the response is "the same" as the correct answer text. However in some cases the correct answer text may only provide general guidelines for grading. For example, the correct answer might be "up and to the left" and the student response might be a point "(76,145)" that the student clicked on.

3. A **generateResponseMatchingAnswer(String** correctAnswerText**)** method with String return type. This method is called to get a sample correct answer to display as student feedback. The method must use the answer text provided to generate a string which the applet will display as the correct answer when passed the string as a response parameter.

   Note: In many cases, it will be enough to simply return the answer text in unmodified form. However when the answer text only provides qualitative grading criteria ("up and to the left") it's more difficult to generate a sample response. In that case it may be a good strategy to provide an "example" answer as a grader parameter in the testbank. E.g. set the answer text to be "up and to the left" and set grader.param.example=(140,27).

After your grader class is created, create a JAR file and place it in the /WEB-INF/lib folder so that it is accessible to the class loader. Then restart the Maple T.A. server.

Step 3: Author the Maple T.A Question

The last step is to host your Java applet in a Maple T.A question, using our Applet question type.

To do this, you need to create a source question file. Note that Applet questions must be authored outside of the Question Editor. Open a text editor, enter and fill in the following lines, and save the file with the name `filename.qu`, where filename is the name you choose to assign to the source question file.

```
qu.1.1.question=__@
qu.1.1.answer=__@
qu.1.1.applet=__@
qu.1.1.width=__@
qu.1.1.height=__@
qu.1.1.param.__=__@
qu.1.1.grader.class=__@
qu.1.1.grader.param.__=__@
qu.1.1.mode=Applet@
qu.1.1.name=__@
qu.1.1.editing=useHTML@
qu.1.1.algorithm=__@
```

For the example of the slider balls, a detailed explanation of these lines of code is given below.

```
qu.1.1.question=The left-hand ball has mass of $m1 kg and the right-hand
ball has mass $m2 kg. The center of mass of the left ball is $h1 meters above
the ground. Move the right-hand ball to the height that gives it the same
potential energy as the ball on the left.@
qu.1.1.answer=$h2@
qu.1.1.applet=applets.sliderBall.SliderBall@
qu.1.1.width=100@
qu.1.1.height=200@
qu.1.1.param.right=2@
qu.1.1.param.left=$h1@
qu.1.1.grader.class=gateway.question.grader.StringMatch@
qu.1.1.grader.param.ignoreCase=true@
qu.1.1.mode=Applet@
qu.1.1.name=Physics Applet Question@
qu.1.1.editing=useHTML@
qu.1.1.algorithm=$h1=int(rint(35)+5);
  $h2=int(rint(35)+5);
  $m1=rand(10,70,3);
  $m2=sig(3, $m1*$h1/$h2);@
```

10 Question Authoring in LaTeX

There are some question types (for example, graph sketching questions and matrix questions) which cannot currently be created within Maple T.A.'s question editor. These questions would have to be authored either in LaTeX or in plain-text script files. In fact, you can author and edit all question types using LaTeX to generate plain-text script files that can be imported into Maple T.A. Of course, it is recommended that you write and edit question banks using LaTeX only if you are an experienced LaTeX user.

10.1 Writing Questions in LaTeX

Requirements

To use LaTeX to author Maple T.A. questions, you need:

- `ed.sty`—the LaTeX style file for Maple T.A. question authoring. Download this file from *http://www.maplesoft.com/products/mapleta/latex2ta/index.aspx* and place it in the same location as your other LaTeX style files.
- A text editor
- LaTeX installed on your system
- Internet access

Authoring Process

To author in LaTeX:

1. Write your question in LaTeX using a text editor.
2. Run LaTeX on your question file and preview the output to ensure it is correct. You may perform multiple iterations of steps 1 and 2.
3. Use the web-based conversion service at *http://latex2ta.mapleserver.com/* to convert your LaTeX-format question file to Maple T.A. `.qu` format.
4. Save the `.qu` file when the conversion is complete.
5. Import and save the question file in your Maple T.A. class.

LaTeX Document Structure

The structure of the LaTeX file must be as follows. Mandatory items are bolded.

Table 18: LaTeX Document Structure

Code	Description
`\documentclass[12pt]{article}`	Beginning of document
`\usepackage{ed}`	The ed package is required
`\setImageBase{ }`	Location of the folder in Maple T.A. where your graphics will reside
`\begin{document}`	Beginning of document
`\begin{topic}{topic name}`	Beginning of topic
`\begin{question}{question type}`	Beginning of first question
`...`	
`\end{question}`	End of first question

`\begin{question}{question type}`
`...`
`\end{question}`
`\begin{question}{question type}`
`...`
`\end{question}`
	Your document may contain as many questions as you like.

`\end{topic}`	End of topic
`\end{document}`	End of document

The region between the **`\begin{question}`** and **`\end{question}`** macros is where you include the question details.

Question Structure

Each question in a topic has the following basic structure. Mandatory items are bolded.

Table 19: Questions Structure

Code	Description
\begin{question}{question type}	Beginning of question
\name{question name}	A name given to the question in the Maple T.A. question bank
\property{name1}{value1} \property{name2}{value2} ...	Information fields, useful when sorting questions in the assignment editor
\hint{first hint} \hint{second hint} ...	Hints available to students when taking an assignment
\comment{feedback text}	Feedback to students on the question
\qutext{question text}	Text of the question body
[additional, question-type-specific macros]	Each question type has its own required macros
\end{question}	End of question

In addition to what is listed in the table, each question type has its own set of LaTeX macros. For example, many math question types have a required \answer{ } macro for specifying the correct answer.

Sample Question File

You can copy the text of the sample question file below and save it into a LaTeX file on your local computer. Then go to the Maplesoft web site, run the file through the LaTeX conversion feature, and import the resulting question file into Maple T.A. (See below for detailed instructions.)

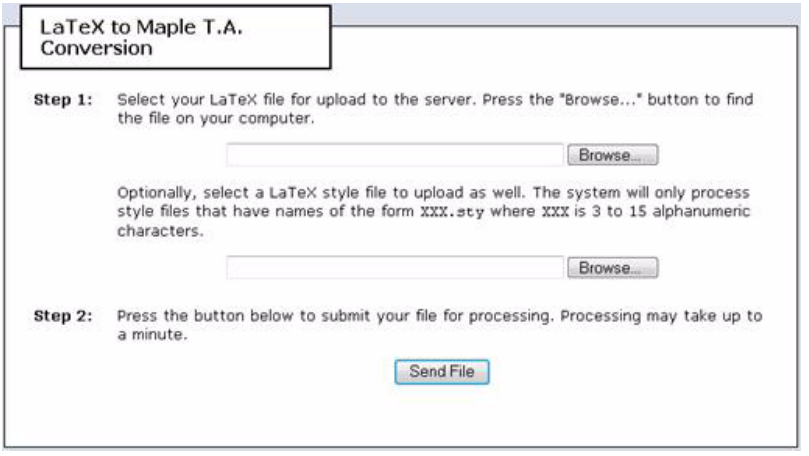
```
\documentclass[12pt]{article}

\usepackage{ed}

\setImageBase{web/myfolder/Public_Html/Images}

\begin{document}

\begin{topic}{Arithmetic}

%% Question 1

\begin{question}{Numeric}
\name{Addition}
```

```
\code{$a = range(1,10);
      $b = range(1,10);}
\qutext{What is $\var{a}+\var{b}$?}
\answer{\var{\var{a}+\var{b}}}
\end{question}

%% Question 2

\begin{question}{Formula}
\name{Multiplication}
\code{$a = range(1,10);
      $b = range(1,10);}
\qutext{What is $\var{a}\times\var{b}$?}
\answer{\var{\var{a}*\var{b}}}
\end{question}

\end{topic}

\end{document}
```

Converting into a Maple T.A. Script

Once you have written your question file, you can process it with LaTeX to preview your questions. Once you are satisfied with the content, use the LaTeX-to-Maple T.A. conversion service to convert your LaTeX file into a Maple T.A. `.qu` question file. The converter is located at *http://latex2ta.mapleserver.com/*.

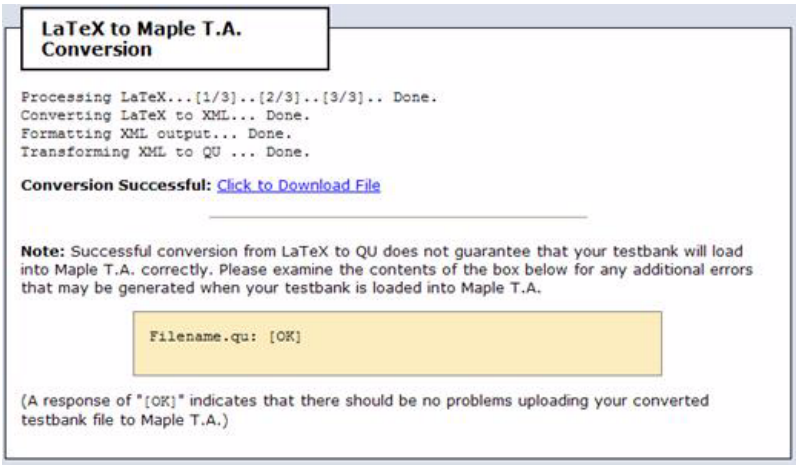
Figure 10-A LaTeX Conversion



In the first entry cell, you may either enter the absolute path to your LaTeX file, or click the first "Browse" button to choose the file by browsing your computer. If you have a separate style file that you have used in your question file, enter its path in the second entry cell or use the second "Browse" button. You do not need to upload `ed.sty`. The converter always has the current release of the `ed.sty` macros.

Click "Send File" to upload your files for processing. A successful conversion will result in a screen similar to the following:

Figure 10-B Completed LaTeX Conversion



Click the "Click to Download File" link to download the Maple T.A. `.qu` file to your computer. Then, from Maple T.A., you can import the question bank to your class site.

If there is an error during conversion, you will be shown the conversion log to help you identify the problem.

Sample .qu File

The file created by the conversion process is a Maple T.A. `.qu` question file. The text of the `.qu` file created from the sample LaTeX file above is shown here. Some authors prefer to create or edit `.qu` files directly using a text editor. We will explore the structure of `.qu` files in the next chapter.

```
qu.1.topic=Arithmetic@

qu.1.1.mode=Numeric@
qu.1.1.name=Addition@
qu.1.1.algorithm=$a = range(1,10);
```

```
$b = range(1,10);@
qu.1.1.question=
<p class="noindent">What is <math
xmlns="http://www.w3.org/1998/Math/MathML" display="inline">
  <mn>${a}</mn> <mo>+</mo> <mn>${b}</mn>
 </math>?</p>@
qu.1.1.answer.num=${$a+$b}@
qu.1.1.answer.units=@
qu.1.1.showUnits=false@
qu.1.1.info=@
qu.1.1.grading=exact_value@

qu.1.2.mode=Formula@
qu.1.2.name=Multiplication@
qu.1.2.algorithm=$a = range(1,10);
$b = range(1,10);
@
qu.1.2.question=
<p class="noindent">What is <math
xmlns="http://www.w3.org/1998/Math/MathML" display="inline">
  <mn>${a}</mn> <mo>&times;</mo>
  <mn>${b}</mn>
 </math>?</p>@
qu.1.2.answer=${$a*$b}@
qu.1.2.info=@
```

10.2 Working with Algorithmic Variables

One of Maple T.A.'s key features is its support for algorithmic question generation. Authors can write questions that use randomly-generated values in different assignment attempts.

Refer to the Maple T.A. Help System for detailed information about Maple T.A.'s algorithmic capabilities. Below we describe the LaTeX macros for algorithmic questions.

Defining the Algorithm

Use the **\code{}** macro to define the algorithmic variables used in the question. Separate each variable with a semi-colon, exactly as if you were defining the variables in the Question Editor.

Referencing Algorithmic Variables

To include a defined variable in the question text, hint, or answer region, use the **\var{}** macro.

\var{} can also be used to create an inline variable expression: a computed expression within a variable reference, constructed from nested **\var{}** macros. Use inline variable expressions when one variable is derived from another, for example a and 2a, or a, b and a2+b2. In this case, there is no need to make a separate variable definition for each algorithmically-generated quantity. Inline variable expressions allow for a minimum of variables. Not only does this benefit the author, but it reduces the load on the servers when students are taking assignments.

Table 20: Example of Question in LaTeX

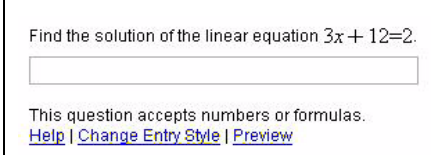
Sample algorithmic question in LaTeX

```
\begin{question}{Formula}
\qutext{Find the solution of the linear equation
$\var{a}x+\var{b}=\var{c}$.}
\answer{(\var{c}-\var{b})/\var{a}}
\code{
$a=rint(12)+2;
$b=rint(12)+1;
$c=rint(12)+1;}
\end{question}
```

Additional notes

```
\code{variable1=code1; variable2=code2; ...}
\var{variable name}
```

Question displayed in Maple T.A.



10.3 Placing Images in Questions

Setting the Image Base

To include graphics in your questions, begin by specifying a location in Maple T.A. where your images reside.

1. Select a location in your Maple T.A. web site for graphics files. Upload the graphics to this folder. Now click on the icon to the left of any of these graphics files to see its full path, which will have the form

   http://.../web/Public_Html/<folder>/...

   where <folder> is the folder that contains the images.
2. Insert the **\setImageBase** directive near the top of the LaTeX file to specify the path you determined in step 1. For example, if the folder that contains your graphics is "Images", use the directive:

   \setImageBase{web/Public_Html/Images}

   Note: \setImageBase has a global effect on your document, and grouping \setImageBase within braces will not localize its effect. The image base defined within the group will apply to the remainder of your document.

You may temporarily override the image base with **\ignoreImageBase**. This macro takes no arguments. Its effect is local, so upon leaving the current group or environment, the image base will revert to its previous value. For further details, see the Maple T.A. Help System.

Inserting an Image

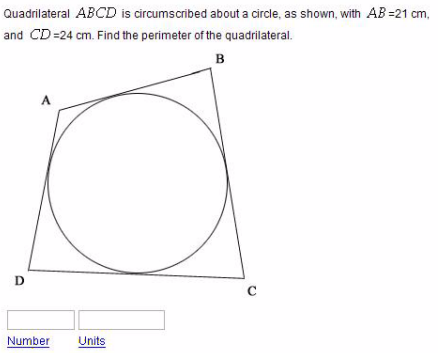
To include graphics in a question, use the **\image{}** macro. The format for the **\image** macro is **\image[extension]{filename}**. The extension argument is optional. It specifies the extension to be appended to the filename when the question bank is converted to Maple T.A. format. The default value is jpg.

Table 21: Example of Question with Image

Sample question with image in LaTeX

```
\begin{question}{Numeric}
\qutext{Quadrilateral $ABCD$ is circumscribed about a circle, as shown, with
$AB$=\var{a} cm, and $CD$=\var{b} cm. Find the perimeter of the quadrilateral.

\image{InsertImage.gif}}

\code{$a=range(5,25);
$b=range($a+1,$a+5);
$ans=2*(($a)+($b));}
\answer{$ans}[cm]
\end{question}
```

Table 21: Example of Question with Image

Additional notes
`\image[extension]{filename}`
Question displayed in Maple T.A.


You can also use the LaTeX macros for dynamically labeled images and graph plotting applets, rather than working with the applet code that we used in section 9.2. For complete details on images and plots in LaTeX questions, please consult the "Creating Maple T.A. Questions Using LaTeX" article which can be downloaded from the Maple T.A. Content Center.

10.4 Graph Sketching Questions

Overview

The Sketch question type displays introductory text accompanied by a set of axes. The student draws a graph on the axes by clicking points to be used as interpolation nodes.

Use the **sketch** environment to configure the applet, and to declare the ranges of the axes, a sample correct response, and a list of criteria that the student answer must meet. The **`\begin{sketch}`** macro takes one option and four required arguments, in the following format.

```
\begin{sketch}[gridlines]{xMin}{xMax}{yMin}{yMax}
  \example{point-list}
  \check{criterion}
```

```
  \check{criterion}
   ...
  \check{criterion}
\end{sketch}
```

Table 22: Sketch Values

gridlines	Number of horizontal and vertical gridlines in addition to the axes (default is 10)
xMin	Minimum x-value displayed on the x-axis
xMax	Maximum x-value displayed on the x-axis
yMin	Minimum y-value displayed on the y-axis
yMax	Maximum y-value displayed on the y-axis

The **\example{<point-list>}** macro describes a sample correct answer that is displayed if the student gives an incorrect response. The sketch is given as <point-list>, a space-delimited set of coordinates of the form x, y. The resulting sketch is a single curve interpolated from these points.

The **\check{criterion}** macro sets a criterion that the student's sketch must satisfy. Available criteria include:

Table 23: Sketch Criteria

goes_through(xcoord, ycoord)	Sketched function must pass through the point (xcoord, ycoord)
increasing	Sketched function must be increasing
decreasing	Sketched function must be decreasing
concave_up	Sketched function must be concave up
concave_down	Sketched function must be concave down
linear	Sketched function must be linear

In addition, you can perform many other checks (for example, evaluating the slope of the student's response at a given x-value). For a complete list along with detailed examples, visit the "Graph Sketching Question in LaTeX" page in the Maple T.A. Help System.

Table 24: Example of Sketching Question in LaTeX

Sample graph sketching question in LaTeX

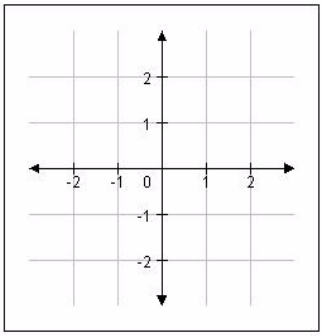
```
\begin{question}{sketch}
\qutext{Sketch the graph of the function $y=x+1$.}
\begin{sketch}[4]{-2}{2}{-2}{2}
  \example{-2,-1  1,2}
  \check{linear}
  \check{goes_through(0,1)}
\end{sketch}
\end{question}
```

Additional notes

```
\begin{sketch}[gridlines]{xMin}{xMax}{yMin}{yMax}
  \example{point-list}
  \check{criterion}
  \check{criterion}
    ...
  \check{criterion}
\end{sketch}
```

Question displayed in Maple T.A.

Sketch the graph of the function $y=x+1$.



Delete Selected | Clear

This section described how to author a graph sketching question in LaTeX. To see examples of other question types, please consult the "Creating Maple T.A. Questions Using LaTeX" article which can be downloaded from the Maple T.A. Content Center.

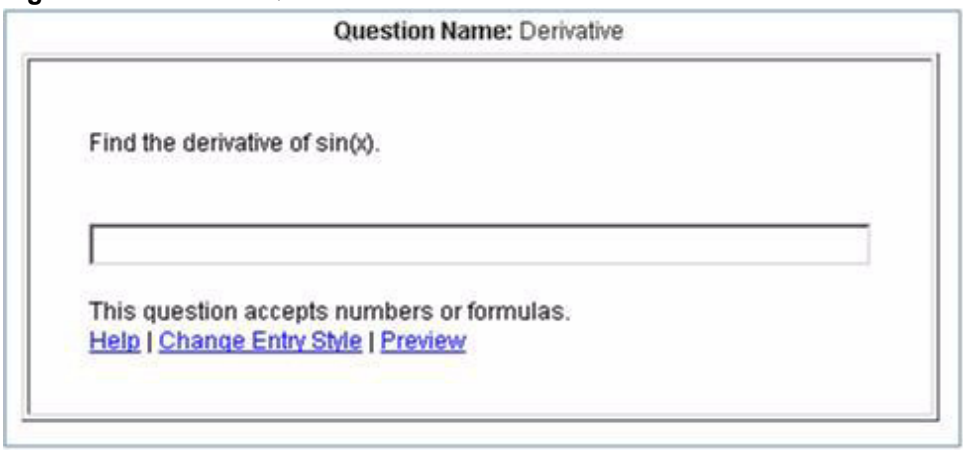
11 Plain-text Question Files

There are several ways to create questions for use in Maple T.A:

1. Use the Question Editor, as shown in the previous sections.
2. Create a plain-text file and upload it into the Question Repository.
3. Create a LaTeX file, convert it, and then upload it into the Question Repository.

We explore the second option in this chapter. Consider, for example, the following Formula type question in Maple T.A.:

Figure 11-A Formula Question



Here is what the underlying plain-text source for this question looks like:

```
mode=Formula@
name=Derivative@
comment=<p>The derivative of sin(x) is cos(x).</p>@
question=<p>Find the derivative of sin(x).</p>@
answer=cos(x)@
```

11.1 Question Tags

The following tables show the various tags that are used to create questions in the different formats. The question elements in the first table are common across all question types.

Table 25: Common Question Elements

Question Editor	Plain Text (.qu file)*	LaTeX
Question Type	mode	\begin{question}{**type**}
Question Description	name	\name{}
Feedback	comment	\comment{}
Algorithm	algorithm	\code{}
$a	$a	\var{}
Information Fields	info	\property{**name**}{**value**}
Hints	hint.i	\hint
Solution	solution	\solution
Use HTML	editing	

* All lines in the `.qu` file must be prefaced by qu.x.y. where x is the topic number and y is the question number.

The question elements in the following tables are specific to certain question types.

Table 26: Specific Elements to Multiple-choice/Multiple-selection Questions

Question Editor	Plain Text (.qu file)	LaTeX
Answer	answer	\choice*
Choices	choice.x	\choice

Table 27: Specific Elements to Formula Questions

Question Editor	Plain Text (.qu file)	LaTeX
Answer	answer	\answer

Table 28: Specific Elements to Maple-graded Questions

Question Editor	Plain Text (.qu file)	LaTeX
Question Sub-type	type	\type
Answer Code	maple_answer	Not available
Grading Code	maple	\maple
Repository	libname	Not available in question, but 'lib' can be used as an argument to an algorithmic variable
Plot Code	plot	\plot

11.2 Question Type Modes

Every question has a mode element which identifies the question type. Following are the values of the mode element for the various question types in Maple T.A.

Table 29: Values of Mode Elements

Question Type	qu.x.y.mode=<question_type>@
Blanks [text] [menu] [formula] options	qu.x.y.mode=Blanks@
Clickable imagemap	qu.x.y.mode=Clickable Image@
Constant of integration/Formula mod C	qu.x.y.mode=Formula Mod C@
Customized symbolic palette	qu.x.y.mode=palette@
Equation	qu.x.y.mode=Equation@
Essay	qu.x.y.mode=Essay@
Formula	qu.x.y.mode=Formula@
Formula with physical units	qu.x.y.mode=Dimensioned formula@
Inline	qu.x.y.mode=Inline@
Key words	qu.x.y.mode=Key Words@
List	qu.x.y.mode=List@
Maple-graded	qu.x.y.mode=Maple@
Matching	qu.x.y.mode=Matching@
Matrices with numeric/formula entries	qu.x.y.mode=Matrix@
Multipart	qu.x.y.mode=Multipart@
Multipart formula	qu.x.y.mode=Multipart Formula@

Table 29: Values of Mode Elements

Question Type	qu.x.y.mode=<question_type>@
Multiple choice	qu.x.y.mode=Multiple Choice@
Multiple selection	qu.x.y.mode=Multiple selection@
Non-permuting multiple choice	qu.x.y.mode=Non Permuting Multiple Choice@
Non-permuting multiple selection	qu.x.y.mode=Non Permuting Multiple Selection@
Numeric (with or without units)	qu.x.y.mode=Numeric@
Ordered list of formulas	qu.x.y.mode=Formula List@
Restricted formula	qu.x.y.mode=Restricted Formula@
Short phrase	qu.x.y.mode=Short phrase@
True-or-false	qu.x.y.mode=True False@
Unordered list of formulas	qu.x.y.mode=Multi Formula@
Vector	qu.x.y.mode=Ntuple@

11.3 Question Fields

Following are descriptions Maple T.A. question fields.

Table 30: Maple T.A. Question Fields

qu.x.y. <field name>	Required or optional	Can include HTML or MathML?	Field Type	Description/ Function
mode	Required	No	Internal directive	System command that identifies the question type
type	Required (in Maple-graded questions)	No	Internal directive	Specifies subtype of Maple question. For Maple Syntax questions, it is maple. For Maple Formula questions, it is formula.
name	Optional	Yes	Display - no variables	Displays text that identifies individual question.
editing	Optional	No	Internal directive	Indicates use of HTML editing in the question. Set directly or automatically by Question Bank Editor.
question	Required	Yes	Display - can contain variables	The question statement. Can contain any combination of text, MathML, HTML, tables, or references to images or objects.
algorithm	Optional	No	Internal directive	Contains variable definitions for use in the question. Must conform to the system formula and variable syntax.

Table 30: Maple T.A. Question Fields

qu.x.y. <field name>	Required or optional	Can include HTML or MathML?	Field Type	Description/ Function
answer	Required (except in essay, matching, and Maple-graded questions)	No	Internal directive	Defines correct answer for use in grading. If mathematical question, must conform to the system math/formula syntax.
answer.number or answer.unit	Optional	No	Internal directive	Defines correct number and units of answers in numeric questions. Required in numeric questions.
maple	Required (in Maple-graded questions)	No	Internal directive	Maple code to grade student responses and prevent cheating.
plot	Optional	No	Internal directive	Maple plot command that plots a student response or related function. Available in all Maple-graded questions.
grading	Optional	No	Internal directive	Defines grading mode in numeric questions. Required in numeric questions.
units	Optional	No	Internal directive	Reference to a customized table of units.
digit	Optional	No	Internal directive	Number of significant digits. Required for exact_sigd and toler_sigd grading modes in numeric questions.
perc	Optional	No	Internal directive	Percentage error (or tolerance). Required for toler_perc grading mode in numeric questions.
err	Optional	No	Internal directive	Absolute error (or tolerance). Required for toler_sigd and toler_abs grading modes in numeric questions.
tolerance	Optional	No	Internal directive	Absolute tolerance for formula questions (including subtypes).
choice.i	Optional	Yes	Display - can contain variables	Contains the ith choice in a multiple choice or multiple selection question. The values of i in a question must start at 1 and be consecutive.
comment or comment.i	Optional	Yes	Display - can contain variables	Contains feedback provided to students upon grading. The comment.i field provides response-specific in multiple choice questions. The values of i in a question must start at 1 and be consecutive.
hint.i	Optional	Yes	Display - can contain variables	Contains a hint. The values of i in a question must start at 1 and be consecutive.
solution	Optional	Yes	Display - can contain variables	Contains worked solution. Shown only in Study Session assignments.
info	Optional - user specified	No	Internal directive	Contains descriptive information about the question. Multiple user specified fields and corresponding values can be contained in this statement.

Notes:

1. **Internal Directive** fields are commands that are evaluated and performed by the system. They cannot contain HTML or MathML tags and must conform to the system syntax for algorithms, formulas, math expressions, or command switches.
2. **Display** fields hold question information that is used in displaying the question or related feedback, hints, or solutions. The `topic` and `name` fields cannot contain variable values because algorithmic variables are set at the level of the question.

11.4 Plain-text File Question Enhancements

There are some question types in Maple T.A. that can be enhanced by editing the `.qu` file. There are also some question types that can only be created or edited by using plain-text files or LaTeX files.

Response-specific Feedback

You can add response-specific feedback to multiple-choice and list questions by editing the `.qu` file.

> Note: If you create your multiple choice questions in the Question Designer, then you can add response-specific feedback without having to edit the .qu file. This feature was added in Maple T.A. 3.0.

Multiple-choice Question The following example shows three possible answers, each of which returns a different comment to the student if they choose it.

Example Question Script

```
mode=Multiple Choice@
name=MC1@
editing=useHTML@
algorithm=$f=mathml("2*x^2+10*x+12=0");
$g=maple("printf(MathML[ExportPresentation](2*x^2+10*x+12=0))");@
question=What is a solution to $f in simplified form?@
answer=1@
choice.1=x=2@
choice.2=x=4/2@
choice.3=2(x+3)(x+2)@
comment.1= Well done@
comment.2= Your answer should be in simplified form@
```

comment.3= Set one of the factors equal to 0 and solve for x@

List Question A basic List question can be created in the inline editor of the Question Editor. You can add response-specific feedback by editing the `.qu` file and uploading the altered question file. The following example shows four answers that each have feedback geared toward that question.

Example Question Script

```
question=Who first developed the General Theory of Relativity?@
grader=relaxed@
display=text@
answer.1=Einstein@
credit.1=1.0@
comment.1=Yes, but you should use his full name@
answer.2=Albert Einstein@
credit.2=1.0@
comment.2=Completely correct@
answer.3=Stephen Hawking@
credit.3=0.25@
comment.3=Partially correct. Stephen Hawking helped extend Einstein's
Theory of Relativity@
answer.4=Hawking@
credit.4=0.25@
comment.4= Partially correct. Stephen Hawking helped extend Einstein's
Theory of Relativity, but you should use his full name.@
mode=List@
name=partial credit@
editing=useHTML@
```

Key Word Questions

A key word question looks in the student response for the specific words that you have listed. If they appear anywhere in the response, the student will receive credit. This question type can only be created in plain-text or LaTeX files.

```
mode=key words@
question=<p class="noindent">Which two scientists independently discovered
inductance?</p>@
answer=Michael (Faraday) and Joseph (Henry)@
```

M

N

P

Q

S

T