

WHS: The University of Kentucky Web Homework System

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WHS is a web-based instructional support system operated in the public interest by the University of Kentucky Department of Mathematics and The University of Kentucky Information Systems. Its primary functions are the distribution of supplemental instructional materials such as web pages and streaming video, and the hosting of sets of homework assignments. It was developed and is employed solely to assist traditional classroom instruction by conserving teacher time through automation of routine tasks, and the facilitation of communication and collaboration.

There are three main categories of WHS users: students, teachers, and authors. Anyone can become a student simply by registering as a new user. Students participate in classes created and managed by teachers using materials created by authors. “Real” teachers at non-profit public and private institutions (all levels) can become teachers and authors on WHS. There are no charges for the accounts or for system usage for non-commercial educational or public service functions.

Note on Browsers: Some features of mathclass.com depend on modern browsers such as Netscape 6.0 or higher and Internet Explorer 5.1 or higher. Users of older browsers may find that some buttons do not work. For the most part these are shortcuts and the basic functionality will be available.

WHS Student Usage

Acquiring and Getting Started With Your WHS Student Account

Use of WHS requires an account. You may already have an account by virtue of your registration for certain classes or you may need to create your own account. In either case the first step is to select the “Web Homework” link on the mathclass.com main page. You will be presented with a login screen



Case 1. You don't have an account or are not sure whether you have an account.

In this case select “Register as a New User” and complete the form. If an account already exists which is identified either by your student number (social security number in most cases) or email address then the system will return a message to that effect. If you receive such a message go to Case 2, below.



There are a number of items which may need clarification.

You can actually use any school in the “Select Your School Menu”. Thus if your school isn't there or the name used isn't familiar simply select any school (e.g. University of Kentucky) to get started. This is something you can always change at any time.

The student number (social security number) must be 9-digit number which is not already in use as an identifier. Its sole use is as a unique account identifier within the system. It actually need not be the social security number and you can provide a random number which will work provided no other account is already identified with it.

The email address is very important. If you do not have one then you should get one (e.g. from hotmail.com) and use it. For immediate purpose of registration you can use a fake email address. For instance if Mary M. Mullins is a student at Ludwig Beethoven High School she might use Mary_M_Mullins@ludwig_beethoven.k12.ky.us which is highly unlikely to be in use by any other student with a WHS account. **DO NOT USE SOMEONE ELSE'S EMAIL ADDRESS** since (1) email sent to you by the system will be directed to that address and (2) your email address becomes

your login.

If there are no problems with your student number or email your account will be created immediately with your email address as login and your social security (or student) number as password.

If the system tells you that someone else already has an account with that email or student number then that person is almost certainly you. Most likely an account was created for you by virtue of your pre-registration in a class. Such accounts will have your student number as both the login and password. Go to case 2, below, and attempt to log in with your student number as both login id and password. If you are not able to log in this way then send a help message by pressing the “Help” button on the bar below the picture on the login screen. It may have happened that someone accidentally entered your social security number or email.

Assuming you have no problems you will receive the following screen which will, among other things, remind you that you will need to add at least one class in order to use your account and that you should change your password.



The “start” button at the bottom will take you to the main WHS screen..

Case 2. You already have an account (including when you have just been through case 1).

If your account already exists but you don’t know the login or password (e.g. if it was created because of your registration in a class) then your login and password will both be your student or social security number. In all other cases your initial login will be your email address and your password your student or social security number.

Select the “Web Homework” link on the mathclass.com main page and log in. This will take you to the WHS Main Page. There is a vertical row of eight links on the left of the page. Your student account will give you access to the resources addressed by the top six.

Lifetime of a Student Account

Unless there is an academic reason to do otherwise all student accounts (and all classes) are routinely deleted at the end of each term. This generally happens during Christmas break, in early June, and in mid-August.

To get Started

Select the “Assignments” link. If your account was created from registration information you should be able to select your class(es) in the “Select Class” menu. Otherwise (e.g. if you registered as a new user) you will see “No Classes” listed.



In order to participate in WHS as a student you must register for at least one class.

Adding and Dropping Classes

To add or drop a class select “Add/Drop Classes” at the WHS Main Page. The “Select Class” menu lists all classes available at your school. You can add any class “For Browsing” or “For Registration”.

If you add for browsing you will be able to submit any of the assignments for evaluation by the system but the results will not be sent to the teacher of the class, nor will any questions or comments you make be sent to the teacher. Your results will, however be retained by the system and you will be able to view them at any time.

If you request registration in a course then:

you automatically add it for browsing. However in addition a request is sent to the teacher for admission to the class.

If the teacher subsequently admits you then all of your results, including results on assignments done before the teacher admits you, will be presented to the teacher.



You should not casually request registration for a class since any teacher of a class for which a student is registered can change the password of that student. This feature of the system is there to guard against forgotten student passwords and to prevent students who are not serious from draining teacher time and system resources.

Registration in Class At Other Schools

You can register for any class listed at any school in the system. Select the bar at the bottom of the “Add/Drop” to get a screen at which you can select another school and be presented the available classes at that school. The choice of adding for browsing or registration is the same. The check box labeled “Include Course List Names” is a convenience for other teachers. If it is checked some extra information is appended to the name of the class which tells other instructors how to create their own versions of the class in question.

Registration in Multiple Classes

You can register in any number of classes at any number of schools for browsing or registration.

Dropping a Class

The “Drop Class” menu on the “Drop/Add” screen works exactly as one would expect. However you can only drop a class for which your status is “browsing”. If your registration for a class has been approved by the teacher then in order for you to drop the class the teacher must withdraw that approval and restore your status to “browsing”.

Class Announcements

At the announcements link at the top of the main screen the student can access three categories of information related to each class.

The class announcement window contains class routine information of the type a teacher might write on the blackboard to remind students of upcoming tests, daily assignments, changes in schedule, etc.



The class homepage is a link to a class page maintained by the teacher which typically contains structured class information such as the syllabus, additional links to resources, etc.

The course homepage contains general information important to all students in all classes or sections of the course. It contains material such as course objectives, uniform exam schedules, etc. which are not specific to any one class or section.

Assignments

Students participate in WHS classes by working on assignments and communicating with the teacher.

To work on the assignments for a class select “Assignments” at the WHS main screen then select the class and assignment. The “Display Assignment” bar will cause the assignment to be presented on the screen.

Assignments are typically in the form of a set of problems with which students can interact by providing responses in a variety of answer formats. Some aspects of the assignments are:

Version Numbers

There is a “Version Number” line immediately beneath the name of the assignment. This is used for assignments which do not have a unique form. For instance some courses employ assignments which are practice examination generators. Each time they are called they present a random sample of problems based on the material for an upcoming exam. Each random exam comes associated with a number called the version from which the system can re-construct that particular exam. This permits teachers to point groups of students to a single version for discussion, provides for individual homework assignments (or examinations) on the same material for each student, and supports web-based class-placement and large-scale diagnostic examinations such as the Kentucky Early Mathematics Testing Program (KEMTP). There is no harm in entering a version number for an assignment which has only one form.

Video and Html Links

Certain problems may contain embedded html links to hints or supplemental material. The most common use of this feature is brief streaming video links of a minute or two which contain a solution to the given problem or a similar one. The current video links in assignments require a data rate of at least 100k bps and will not work on convention 20k dialup connections.

Working an Assignment

Embedded links notwithstanding WHS assignments are generally intended to be printed out and worked in a conventional manner with answers checked when students connect back to the system and enter them at a later time. (In cases where there are multiple forms of the assignment the version number appears on the printout.) However the majority of the assignments are presented so that the system will immediately return the correct answer to a question upon checking the one submitted by the student. This is equivalent to permitting the student to “look at the answer in the back of the book” and it is not uncommon for students to extract the correct answers before attempting the problems.

When assignments are presented in this format it is in keeping with the use of the system as a “low stakes” activity (like conventional homework) with acceptance by the student of responsibility for interacting in a manner which best suits their learning style and needs.

When responses are entered to some or all of the questions in an assignment and the “Submit and Record Results” button at the bottom of the assignment is pressed the system (a) records all of the student responses, (b)immediately returns an evaluation page and, (c) sends the student and teacher an email with a synopsis of the results.

In the most common format the evaluation page contains:

1. the full statement of each problem for which a response was entered,

2. A statement as to whether the answer given is correct or incorrect. Note that for multi-part problems the answer to each component must be entered correctly for the system to consider the question to have been answered correctly),
3. the student's answer,
4. the correct answer (whether the correct answer is display depends on the author of the assignment),
5. a comments window in which the student can enter a question or comment which will be forwarded to the teacher.

A web page is set up for the teacher in which all of the comments are organized. Through it the instructor can respond to individual comments by email since the system knows the student's email address.

There is no limit to the number of times a student can submit solutions to a particular assignment. It is quite common for students who have previously submitted homework to re-work and re-submit solutions while reviewing for examinations.

Checking Homework Results

Students can review a synopsis of the assignment information recorded by the system at any time by clicking the "**Homework Scores**" bar on the main page. This will display the information for the currently selected course. Exactly the same information is available to the teacher of students registered for the course.

There are two types of information displayed:

1. A Homework Summary table in which the columns correspond to homework assignments and in which the rows indicate the number of the assignment, the number of problems attempted, the first date on which a problem in the assignment was attempted, and the last date on which a problem in the assignment was attempted.
2. A set of tables, one for each homework. In each table the columns correspond to the individual problems and there are two rows labeled "missed" and "right". The entries of the table are html links whose labels are dates in the form "month/day". **The dates are those of the first time an incorrect or correct answer was submitted to the problem.** Thus a link labeled "8/27" in the "Missed" row and "Q4" column of the table for problem set 10 means

that the first time that the student submitted an incorrect answer to that problem was on August 27. A link labeled “8/30” in the “Right” row of the same column means that the first submission of a correct answer to that problem by the student occurred on August 30.

Selecting a link in one of these tables results in the problem to which it corresponds being displayed in a separate browser window.

Note: For assignments such as practice examinations in which there are many variants on an assignment the links do not correspond to the precise problem but rather to one near it according to the scheme by which the tests are generated from a pool of problems.

Changing Account Information

Changing Passwords: You can change your password at any time at the “Change Password” bar. You should quickly change your password from the initial one to something more secure. If you lose your password then any teacher in whose class you are registered can create a new password for you. The teacher (nor anyone else) can recover the exact password that was lost.

Changing Other Account Information: The “modify account” bar on the main screen can be used to re-access the original registration screen and to change any of the information (e.g. email, school, student number, etc.) used to create the user’s account. The email is the most frequently changed of these as many people change their email addresses. When you change your email your new email automatically becomes your new login.

WHS Teacher Usage

Teacher access and use of WHS is an extension of WHS student access and usage. See the Student Usage guide for general account creation and modification information.

All teacher accounts begin as student accounts. See the student guide for instructions on creating a student account. If your school is not listed on the system then you can begin by creating an account for yourself at another school (e.g. the University of Kentucky).

Teachers at non-profit or public schools (all levels, all subjects) can request that their WHS student account be “promoted” to a teacher account by logging in with the student account and using the WHS Help system to request the upgrade. The request should include the teacher’s name, email address, school, school address and school phone number. If the teacher’s school is not listed in the

“schools” menu on the WHS registration screen then the request should also ask that it be added. Such requests are usually honored promptly and the higher level of access becomes available within a few days.

Go to the **Teacher Resources** link and select the **Setup Classes** bar. If you have access to the Class Management page pictured below then your account has teacher-level access.



In WHS teachers create and manage classes. Classes are created in the Class Management page

Creating a Class Your WHS Teacher Account

A class has the following attributes:

1. The teacher who creates the class

This is the name of the teacher whose account is used to create the class. The system knows which account is being used so this information is already available and is not entered in the creation process

2. The **name** of the class

This is the name which is displayed on, for instance, the assignment screen when students go to the system to do their homework. It should be descriptive but not too long.

3. The **school** at which the class is listed or “taught”

This is selected at the menu in the “Create Class” area of the Class Management screen. Any teacher in the WHS system can create a class at any school in the system. This is primarily a mechanism to accommodate teachers who work at more than one school.

4. The (optional) **class homepage**

Many teachers already maintain web pages or want to refer students to other resources. This provides convenient mechanism to direct students to such resources.

NOTE: The Class Homepage listing must be the complete URL for the page including the “http://”

5. The **homework list**

The homework list references a collection of class materials (almost always a collection of individual homework assignments) which has been assembled by a **coordinator** from the individual resources or “homeworks” created for the system by **authors**. Since basic teacher accounts do not carry coordinator/author privileges holders of these accounts must select an extant list from those publicly available. These are listed in the “Homework List” menu in the Class Creation area. Unless the teacher knows precisely which homework list he/she wants, however, it is usually difficult to know what the items in the menu represent. However the most common interest is in a list that is already associated with a class that is on the system. There is a straightforward way to identify the list associated with any class at any school.

Identifying the Homework list Associated with a WHS Class.

Go to the Add/Drop Classes link at the main page and select **Other Schools**. Select the school at which the class is listed, check the “Include Course List Names” box, and press the Submit bar.



The **Select Class** menu contains all classes at the school with the homework list associated with the class contained in parentheses. Thus as indicated above “Ma109 Problems” is the homework list for the University of Kentucky “Ma109test” class which is taught by the teacher “Eberhart”

Browsing the Contents of Lists

Teachers can browse the contents of all lists whether or not they are assigned to classes (including private ones) by going to the **Teacher Resources** link on the main page and selecting **Authoring Tools**. Although most of the tools on this page require authoring privileges the **Homework Testing** area is open to teacher accounts. One simply selects a list in the list menu of the **Homework Testing** area and presses “**Set Menus**”. It is not necessary to select the author of the list. Then at the “From List” menu select a homework to be inspected and press the “**Preview Homework**” bar on the same line.



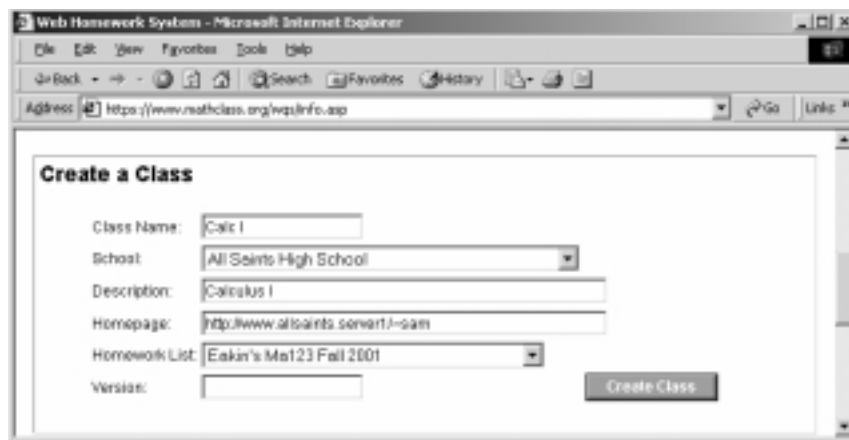
The ability of teachers to inspect and test the contents of lists provides a mechanism for one or more teachers to work with a coordinator in the development of a list. This is particularly useful for multi-section courses as it permits the coordinator to make changes in the course list available to the course teachers by first making the changes in private edition of the course list,.

The (optional) **version number of a list:**

The version number is a floating point of up to 9 digits which is between 0 and 1. The system will create a version of an assignment for each number specified. Conversely, if there is more than one version of an assignment possible the system will assign a version number to each variant.

If a version number is specified when creating a class then that version of each homework on the list will be presented to each student. If there is only one version then that one will be given regardless of whether a number is specified or not. This option is most commonly used for classes that are created with a list that contains a single diagnostic instrument, placement exam, survey, or such for which there are multiple possible forms but for which an individual teacher wants his/her students all to complete the same one.

The following submission would create a class called “Calc I” at All Saints High School, using Eakin’s Ma123 Fall 2001 homework list from the University of Kentucky with class homepage <http://www.allsaints.server1/~sam>. Note the full URL for the home page, including the “http//”.



Deleting Classes

In principle you can delete a class using the **Delete Class** area of the **Class Management** page. There is, however, one caveat: a class cannot be deleted if there is a single student enrolled. This includes browsers. Thus once a class is in use it is generally not feasible to remove it without the assistance of the WHS system administration.

Routine Deletion of Classes by the System

Unless the teacher makes a request to the contrary all classes are deleted at the close of every academic term. This typically happens during the Christmas break, some time in early June, and again in mid-August.

Adding Your Own Class

When you create a class it does not automatically appear in your **Assignment** and **Announcement** menus. In order to view the class as a student you must add the class at **Add/Drop Class** on the main page. In general it is a good idea to add the class for registration which automatically adds for browsing. As the teacher you have the option of admitting yourself for registration or removing your own registration at any time. See the following discussion of **Teacher Resources**

Modifying a Class

Classes are modified at the **“Choose a Class to Modify”** area of the **Class Management** page. Simply select the class, make the desired changes, and press **“Modify Class”**. Note that anything in the class description can be changed. In particular a class can be moved from one school to another.

Changing the Class Announcement

The most common class change is to edit the announcement. This can easily be done in a matter of seconds and it is not uncommon for an instructor to make several changes in a day.



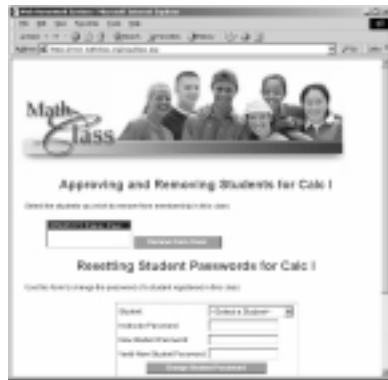
Managing Classes

The main class management screen for a particular class is accessed via the **Access Records** link at the Teacher Resources link off the main page.



Registration and Passwords

This is the page where the teacher grants and retracts student registration in the selected class. The names of students who have requested registration appear in a menu labeled **“Approve Registration”** and those registered in the class in a menu labeled **“Remove From Class”**. Approving and removing shift a name from one list to the other. A student’s name can disappear only if it is in the **“Approve Registration”** list and the student elects to drop the class at the Add/Drop Window. In particular the teacher must approve a student’s dropping a class by moving his/her name into the “Approve Registration” list.



Changing Student Passwords

The teacher can change the password of any student who is registered in one of his or classes. This acts in the student’s interest by providing a mechanism for recovering from lost passwords.

Teacher Passwords Cannot Be Changed by other Teachers.

Teachers cannot change the passwords on teacher accounts. This makes it possible for one teacher to register for another’s class without fear of losing control of his/her account. This also means that there is no simple recovery mechanism for teachers. Teacher accounts for which passwords are lost can be re-activated only by the system administration. The best protection against a lost password is to write the password down in a convenient place at home in such a manner that it is not identified as the password of an account. A document such as the notes page of a phone book (on which there are a number of other words, messages, notes, numbers. etc.) is a good choice.

If your teacher password is lost the simplest way to ask for help is to go to the mathclass.com page, select “login” or “Web Homework” and use the “Submit a Help Request” bar to ask the system administrator for assistance. In making such requests be sure to provide your correct email address and some means for the administrator to be convinced that you really are the owner of the account.

Student Records: A Primitive Grade Book

The **Update Class Grades** link on the Class Management page gives the teacher access to a primitive grade book which will record grades for three mid-term grades, a final exam, and a final grade. The grade book is provided primarily for teachers who give a common exam. It allows all teachers to enter the raw scores into the system for normalization (i.e. “curving”). The simple utility is not intended to serve as a substitute for a teacher’s grade book. When using it teachers should always print out and save hard copies.



Student Comments

When students submit their answers to a problem set the system returns the full statement of the problem, the answer the student submitted, the correct answer (if specified by the answer format), and a dialogue box into which the student can enter comments or questions. In addition it sends an email to the instructor which gives the student’s name and question, the student’s answer, the homework assignment and problem number.



These comments are dynamically organized into a table which is accessible via the **Student Comments** bar on the **Class Management** page. Rows of the table contain the student’s name with an email link, a link to the question, the student’s answer, and the student’s comment. This makes it possible for the teacher to quickly email a response to the student



Accessing Student Homework Records

The simplest way to access the record of a particular student is through the table of registered students at the bottom of the records page. There is a link by each student's name which will display that student's individual homework record. This table also contains an email link to the student. This is useful when a teacher needs to encourage a student to pay more attention to the homework.

There are three bars on the records page which provide records of student homework.

- The **Homework Summaries** lists for each student in the class a summary of activity on the all class assignments to date. The student summary tabulates for each homework (1) the total number of problems attempted, (2) the date on which a problem in that homework was first attempted, and (3) the date on which a problem in that homework was last attempted.
- The **Assignment Summaries** provides a table which lists for the entire class each assignment all of the problems and the number of times it has been attempted it [**the number of students who have attempted it???**]. As with all summaries links are provided to the problem. This summary is useful in analyzing which problems students are finding the more difficult.
- The **Systemwide Summaries** provides the same information as the Assignment Summaries but for all classes which are using the same assignment in the current term. This gives the teacher some basis for comparison of a given class with others using the same homework.

WHS Author and Coordinator Usage

The basic teacher account does not include access to the WHS **Authoring Tools** page which is accessed from **Teacher Resources** at the main page. The page contains two areas, one for **Homework Installation** and the other for **List Management**.

Installing a Homework Set on WHS

Currently WHS “homeworks” are created by **Authors** using Maple or Microsoft Word. The Word “.doc” file or Maple “.mws” file is the homework **source document** . It contains the problem statements and diagrams together with formatting tags which carry the answer format, answers, and display information. For a given author a homework must have a unique name (e.g. “07_rates”) which is also the name of a directory or folder (the **source directory**) which contains only that homework. The homework is exported to html into its source directory with the same name. In the case of a Word document the compact html is used. Thus in the case of a homework named “07_rates” which is created in Maple the source directory is “07_rates” and it contains the source document “07_rates.mws” and the html version “07_rates.html”. The homework **zipfile** is a zip archive of the contents of the source directory which has the same name as the homework. This the zipfile for “07_rates” is “07_rates.zip”.

The details of the construction of a homework can be found in the draft text Communicating Mathematics . We assume here that an Author has created the homework “07_rates” which is to be the seventh assignment in a calculus class and wants to install it on the WHS server and has also created the zipfile “07_rates.zip”. At this point one uses the Homework Installation area of the **Authoring Tools** page.

The Author first creates the name space for the homework by entering the homework name in the **Create Homework** text cell and pressing the **Create Homework** bar .
THIS IS DONE ONLY ONCE UNLESS THE HOMEWORK IS SUBSEQUENTLY DELETED.



The author enters the path to the homework zipfile (or uses the browse key to load the path) into the “**Upload Zipfile**” text cell and presses the **Upload Zipfile** bar. This uploads the zipfile to the WHS server. The amount of time it takes depends on the speed of the server but typical times for a modest-sized file on a dialup line is one or two minutes.



The author selects the name of the homework in the **Install Homework** menu and presses the **Install Homework** bar.



Assuming there are no problems with the file the system will report that the homework has been successfully installed.

By selecting the homework in the **Show Homework** menu the author can view the displayed form and check the answers.

Some error checking is done in step 3 to make sure that questions are properly matched with answers. In most cases these will be reported and the resource installed so that it can be inspected.

Errors are corrected by editing the original source document, exporting it to html and making and installing a new zipfile by repeating steps 2-4. While this may sound like a lot of effort to correct a single typo the process is highly automated at this point and typically takes a minute or two. The advantages are that all of the information on the resource is contained in the source document which is highly portable and simple to maintain.

Homework List Management

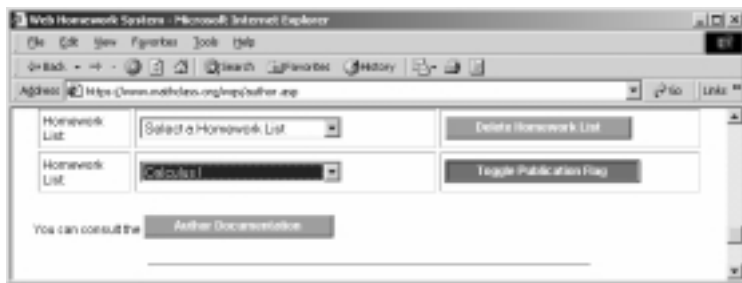
Homework Lists are created by **Coordinators**. While not necessarily the case **Authors** are usually **Coordinators** and visa versa. **Homework Lists** can (and frequently do) contain homeworks created by multiple authors. To be able to do this **Coordinators** are able to access and inspect the homeworks of all **Authors**.

Creating a List

The first step is to create the list name at “**Create Homework List**”



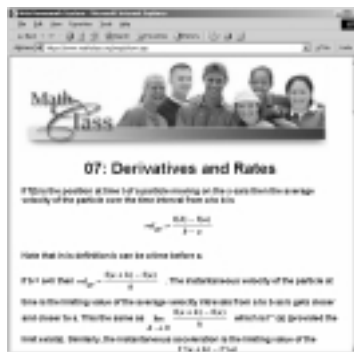
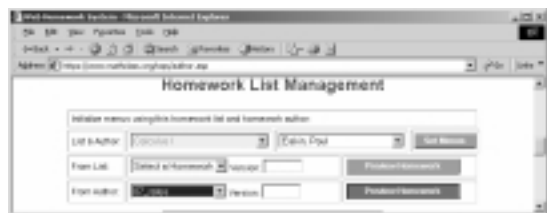
When first created lists are **private**. That is they cannot be used for classes. The coordinator can switch an a private list to **public** (or visa vera) with the **Toggle Publication Flag** bar. Once switched to public the list can be used for classes by all teachers.



Once it is created one adds or deletes homeworks from the list.

Suppose for instance we want to add the “07_rates” homework which was created by the **Author** Paul Eakin to the newly created Calculus I list.

At the top of the **List Management** area select the list one is working on and the author of interest and press the “**Set Menus**” bar. Now we can inspect the items in the list and the homeworks available from the author in the two inspecting menus. For instance selecting the “07_rates” in the “**From Author**” line and pressing “**Preview Homework**”



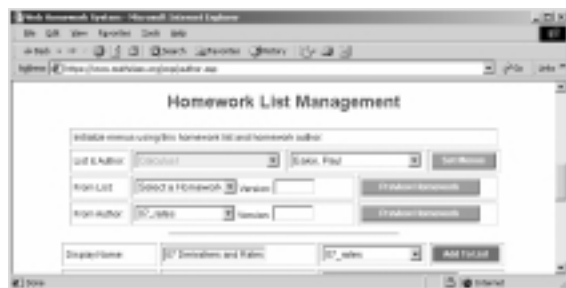
... allows us to be sure that this is actually the homework we want to add. Similarly, we can inspect the various items already in the list at the “**From List**” preview line.

Having decided that this is indeed the homework we want to add we add it to the list at the “**Add To List**” line by

Selecting the homework from the menu on the right

Entering the **display name** on the left.

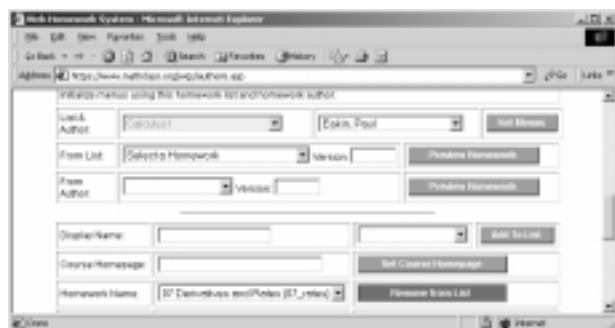
The display name is the name that will be included on the assignment list that is presented to students who are registered for classes using the list.



WHS organizes the display names in lexicographical order. Prefacing the display name with “01”, “02”, ... etc. is a simple way to force a given display order.

Removing a Homework from a List

Homeworks can be removed from the list at the “**List and Author**” line by selecting it in the “**Homework Name**” in the line with the “**Remove from List**” and then pressing the bar.



Removing A List

The owner of a Homework List can delete it by selecting it in the “**Delete Homework List**” line and pressing the “**Delete Homework List**” bar provided no class is using the list. In practice this makes it difficult to remove a list that is being actively used – except between terms which most classes from the previous term are deleted by the system.

A Tutorial Introduction to WHS Materials Authoring

WHS materials take the form of lists of problems or questions with interspersed text.

The process of “**posting**” resources to the WHS system is best viewed as consisting of a sequence of four distinct processes: design, formatting, posting, and revision.

Design is by far the most difficult as it contains most of the creative effort. In this component one creates the layout of the resource and creates a draft containing complete statements and solutions/answers to all of its problems and questions it. Emphasis in creating the draft is on the general layout of the document, the approximate wording of the problems and questions, and the carefully written out, mathematically rigorous solutions to all problems. In the latter careful attention should be paid to crafting the most general solution possible with approximations such as floating point results from calculators introduced as late as possible (if at all).

Although in practice much of the concept document is created at the keyboard it is best done with pencil and paper in a completely traditional form with as little reference to technology as possible.

Formatting is the process of deriving a WHS source document for the resource from the conceptual draft. Source documents are prepared using commercial word processors and computer algebra systems. For the most part formatting involves presenting the draft document in electronic form with the inclusion of formatting tags (control lines) which inform the WHS system of the beginnings of problems, specify answers and their format, indicate material to be ignored, etc. At this time documents on the system are prepared in Microsoft Word 2000 (with the Microsoft Office Html Filter 2.0 which is downloadable from Microsoft), Microsoft Word 2002 (which contains the filter), and Maple 6 and Maple 7.

It is important to remember that the objective of the formatting step is to create an initial source document which the WHS system can display. The first version of a resource is almost always preliminary with corrections, improvements in presentation, inclusion of diagrams, etc. done through several repetitions of the revision and posting steps which follow.

Posting to WHS is a purely formal process of communicating the source material and presentation instructions to the WHS server.

Revision is the iterative process of revising and re-posting the source document until we are satisfied that the resulting resource is completely free of errors and meets our instructional objectives. At one extreme revision can be a very quick and simple check that spelling, mathematics, and performance are acceptable while at the other it can include a substantial amount of enhancement such as adding functionality, including or upgrading diagrams, etc.

A Simple Problem Set on Solving Quadratic Equations

Suppose, as a concrete example, that we are teaching an elementary algebra course and want to develop and post on WHS a three-problem homework set on solving quadratic equations. The types of problems, their order, and their level of difficulty, and the notation will probably be suggested by the examples and problems in the course text or supplements. For instance from those sources we might decide that we want: (1) a problem on completing the square, (2) a problem on applying the quadratic formula, and (3) a simple application. One might even decide that he or she would like to have problems somewhat analogous to certain examples in the book. For instance perhaps the course text or another available book contains a problem asking for the points of intersection of a line and a circle or has a “story problem” which involves finding the points of intersection of two circles. It is quite appropriate to use such general characterizations of problems as points of departure for your own. At the other extreme it is, for a number of reasons, a very bad idea to simply copy problems from other sources.

Copying published material will almost certainly violate the publisher’s copyright. Materials posted on WHS are accessible to anyone over the internet and hence are not protected by the “fair use” provisions of copyright law

While commercial textbook publishers will often grant permission to use material derived from a text you have adopted this permission is typically withdrawn if the adoption is no longer in effect.

If this happens one can lose a very large investment in materials preparation.

Permission granted you to adapt copyrighted material would almost certainly not be transferable to others. This would almost certainly prevent your sharing your efforts with others and would hold any prospects for publishing your work hostage to the copyright holder even if the percentage of such material were miniscule.

It is important to realize that copyright protects the way the author has organized a collection of ideas regardless of the manner in which the work is presented. This protection extends to “derived works”. Thus converting printed material to web format is covered by copyright just as translating it into a foreign language is protected. Moreover the presentation of solutions to problems in a book is known to fall under the derived works provisions.

With these admonitions one must admit that the creation of a really new elementary mathematics is a very, very rare event. Virtually all problems in texts were derived from problems in previous texts which were themselves “borrowed” from earlier sources. Authors in general contribute the selection, organization, and notation. If a mathematics student or teachers sets about writing down a collection of problems related to a given topic (e.g. quadratic equations) it is highly likely that a close approximation to every one of them will exist in a number of texts. However it would be highly unlikely that the same order, wording, or mathematical notation would occur elsewhere. Thus as a matter of principle one can safely expect to avoid copyright conflicts if one uses other sources only for general inspiration and direction while carefully “making up” his or her own problems and expressing them in his or her own words.

Finally, we should not omit the sense of accomplishment involved in creating an original resource to support the teaching and understanding of a mathematical idea. At its highest level this is a very pure form of communication of one’s understanding and love of (or passion for) mathematics and desire to share it with others in the form of an experience. To the extent that the vision and words expression it are not our own that feeling of satisfaction is greatly diminished.

Design of the Draft Document

The following is a possible design draft of a simple exercise set on quadratic equations. Its objective is to establish the form of the document with complete (though perhaps rough) versions of the text and complete, correct solutions or answers to all problems and questions. Although the version below is formatted draft documents (or portions of them) may be typed with mathematics in calculator syntax or by hand. Writing the general document on a word processor (or Maple) using calculator syntax for mathematics and then filling in solutions and diagrams by hand is common and efficient.

Title: Solving Quadratics

Problem 1

If $3x^2 + 5x + 10$ is written in the form $a(x - b)^2 + c$ then

a = _____,

b = _____, and

c = _____.

Solution

$$3x^2 + 5x + 10 = 3x^2 + 5x + 10 = 3\left(x + \frac{5}{6}\right)^2 + \frac{95}{12}$$

a = 3

b = -5/6

c = 95/12

Problem 2

If x is a positive number such that $x^2 - 3x - 12 = 0$ then x = _____.

Solution:

$$x = \frac{-(-3) \pm \sqrt{-3^2 + 4 * 12}}{2}$$

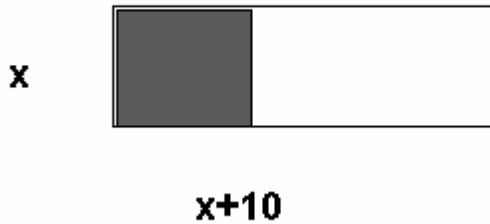
The positive choice is "+" so $x = \frac{3}{2} + \frac{1}{2}\sqrt{57}$

Problem 3.

A rectangle has an area of 24 square feet and its length is 10 feet greater than its width.
What are the dimensions of the rectangle?

Solution:

In the diagram x must be positive.



$$\begin{aligned}
 x(x+10) &= 24 \\
 x^2+10x-24 &= 0 \\
 (x-2)(x+12) &= 0 \\
 x = 2, x = -12
 \end{aligned}$$

As mentioned earlier the above would typically be sketched by hand. The important features are that we have identified the material to be presented, rendered it in draft form, and carefully solved the problem and written out the correct answer. In general we avoid using calculators even though we may ultimately allow students to present floating point answers In that case we will need to specify a level of accuracy which should be referred to the absolutely correct answer (if possible) rather than another approximation.

Form of the Draft Document

Formatting is the process of producing a WHS source from the original draft.

A WHS **source document** is a Word, Maple, or other conventional or mathematical text processing system file. In WHS all development, edits, changes, etc. are done in the source document and the entire WHS resource is generated (or re-generated) from that source. This greatly simplifies the maintenance and sharing of materials and makes it possible to maintain compatibility or as WHS changes.

Formatting Tags

The author of a WHS document describes both the content and the manner in which the WHS system will present it and handle reactions to it through a small number of **formatting tags**. These tags tell WHS how to derive the homework from the source

Formatting tags have the form “TEXT_” or “TEXT_[PARAMETER LIST].” Since these forms can occur in the body of documents there are several conventions governing their placement:

in order for a tag to be recognized as a formatting tag by the WHS system it must be the first expression on a line. A line containing a formatting tag is called a tag line or equivalently a control line. There are two general facts about tags that must be remembered lest one arrive at unexpected results.

- **Tags must begin the control line they define.**
- **all information following the tag on a tag line is ignored by the WHS system**
- **any two tag lines must always be separated by a non-tag line (which may be blank).**

Sections

The major components of a WHS document are called **sections**. Sections are blocks of the source document delimited by tag lines. A section is initiated by a control line and terminated by the next one in the document.

Sections may be text, problems, answers, or material such as descriptive comments which is to be ignored by the system. **Sections which are to be ignored are begun by the “SKIP_” tag.**

The Global Header Section

Every WHS document must contain a global header section which is delimited (in its simplest form) by an “H_” tag. All information before the global header tag is ignored. Global header sections are typically used for titles, instructions, introductions, etc.

The simplest of all WHS documents would be the following:

H_

SKIP_

This would display a single blank line. Technically, the “SKIP_” line could be omitted. However as a matter of practice it is always a good idea end text sections with a SKIP_ . This prevents extraneous document “scaffolding” and comments from being displayed and provides more control over the source document. For instance it is often convenient to add some white space between major sections of a document for readability. Without the terminating “SKIP_” such space would be incorporated into the displayed document.

Question Tags

Most questions in WHS are initiated by a “QM_[]” tag. The brackets in the tag accept a semicolon-delimited argument of which the first entry is the precision expected of all responses. The precision is followed by the correct answers which students will enter or select. For instance the control line “QM_[.01;sin(x);sqrt(2)]” instructs the system that a problem is to follow for which the response to the first component is “sin(x)” and that to the second is “sqrt(2)”. The precision, “.01” says that if the answer-type is of a form for which the student response is entered in calculator syntax then the entered expression must agree with the stated correct answer to within .01. In the case of the “sin(x)” response this says that for each x within a randomly selected range the value of sin(x) must differ in absolute value from the corresponding value of the answer expression to within .01. In the case of the sqrt(2) response it says that the absolute value of sqrt(2) minus the student response must be at most .01.

IMPORTANT: In the current WHS tags cannot contain any formatted material !

For instance, the tag “QM_[.01;sin(x);sqrt(2)]” given above cannot be presented to the WHS server as “QM_[.01;sin(x); $\sqrt{2}$]” . A source document containing this tag line would evoke a blank posting.

Answer Tags

The type of answer expected is governed by the choice of answer tag. There are a number of answer forms. The two simplest are the character answer, “AC_[]”, tag and the listbox “AS_[]” tag. The argument for the “AC_” tag is the width, in characters, of the answer box into which the student will enter his/her response. Thus “AC_[10]” creates a text box entry line 10 characters wide. The argument to the “AS_[]” tag is a semicolon-separated sequence of alternative choices. When the system encounters this tag it creates a listbox or “pull-down list” from which any of the choices in the argument may be selected.

With this brief introduction we can create a formatted document (created in Maple) based on our rough draft.

H_

Solving Quadratics

SKIP_

problem 1 (Note this line will not post. Problem numbers are added by the system – this “problem 1” label helps locate the source for problem 1 in the source document if it has to be edited).

QM_[0;3;-5/6;95/12]

If $3x^2 + 5x + 10$ is written in the form $a(x - b)^2 + c$ then

a =

AC_[5]

b =

AC_[5]

, and c =

AC_[10]

.

SKIP_

prob 1 calculations (note that this will not appear in the posted homework since it is in a section initiated by a skip tag.

> 3*((x+5/6)^2) + 3*(10/3 - (5/6)^2);

$$3\left(x + \frac{5}{6}\right)^2 + \frac{95}{12}$$

>

Problem 2

QM_[.001;3/2+sqrt(57)/2]

If x is a positive number such that $x^2 - 3x - 12 = 0$ then x =

AC_[10]

SKIP

prob2 calculations

question asks for the positive root

> solve(x^2-3*x-12 =0, x);

$$\frac{3}{2} + \frac{1}{2}\sqrt{57}, \frac{3}{2} - \frac{1}{2}\sqrt{57}$$

>

>

Problem 3.

QM_[0;2;10]

A rectangle has an area of 24 square feet and its length is 10 feet greater than its width. What are the dimensions of the rectangle?

Width =

AS_[1;2;3;4;5;6;7;8;10;12;24]

Length =

AS_[1;2;3;4;5;6;7;8;10;12;24]

.
SKIP_

prob 3 – calculations

width is positive solution

```
> solve(x*(x+10)=24,x);
```

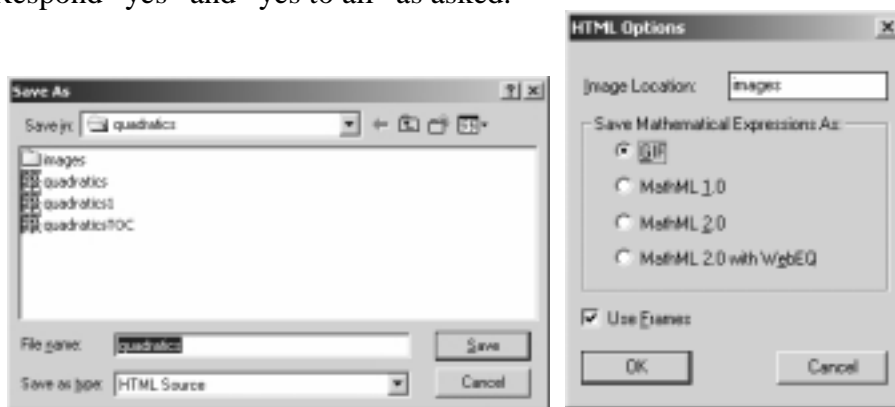
2, -12

height = 2+10 = 12

Posting the Formatted Document

Once we have properly formatted source document “posting” the resource to WHS is straightforward and mechanical. Here we demonstrate the process on the Maple worksheet developed in the previous section. The recommended steps in posting are as follows:

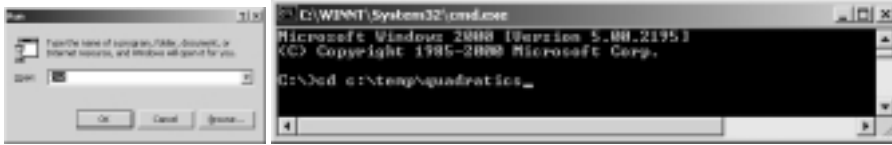
1. Decide on a name for the resource and save the source document under the chosen name in a directory (folder) with the chosen name. The directory will be called the **source directory**. In general it is good practice to use lower case letters for the name as WHS is case-insensitive to resource names. Since our resource involves quadratic equations we choose the name “quadratics” for the resource. We:
2. Create a directory called “quadratics”, and Save the worksheet as “quadratics” in the “quadratics” directory.
3. Export the worksheet in html format into the source directory using the same name, using frames, and selecting “gif” image format. The default choice of “images” for the location of the images is a good choice. If the document has previously been saved as html in this directory then the software will ask if one really intends to replace what is already there. Respond “yes” and “yes to all” as asked.



4. Create a zip archive of the contents of the source directory, giving the chosen resource name to the archive. There are numerous free, shareware, and commercial applications for

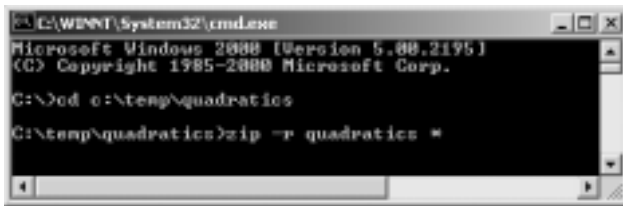
creating zip archives. The free “[zip.exe](#)” which can be found via a web search can be used in a command window in MS Windows as follows.

5. Open a command shell at “Run” on the “Start” menu and change to the source directory for the resource using the “cd” command

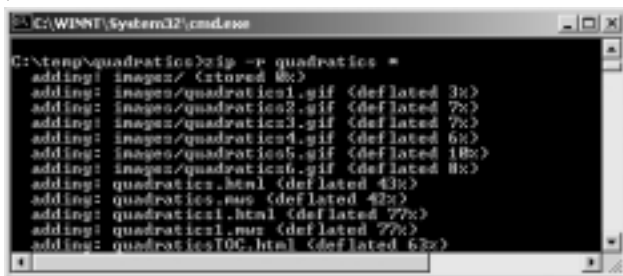


6. Check to see if zip is in the path by entering `zip -?` at the prompt. If it is not found add it to the path or simply copy `zip.exe` into the source directory using the windows explorer.
7. Execute the command : **zip -r quadratics ***

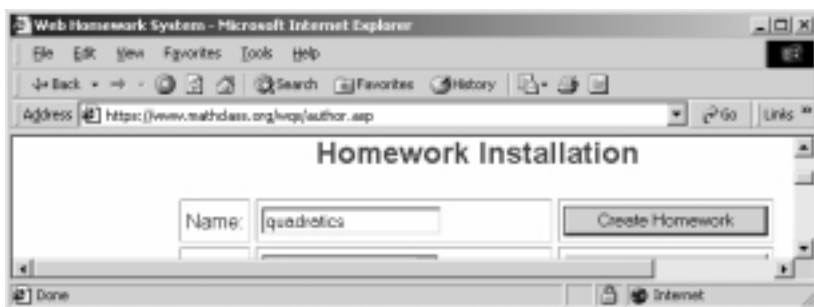
Note the “r” (recursive) is critical, as is the use of the precise resource name, as is the asterisk (*) which tells the application to include all of the files in the directory.



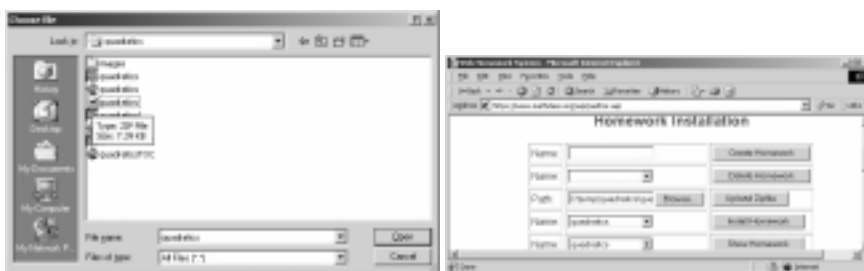
One should see files listed as they are added to the archive



8. Connect to www.mathclass.com and log in. At this point you must have an author account on the system. Select **Authoring Tools** at the **Teacher Resources** link on the main WHS page. In the **Homework Installation** area on the **Authoring Tools** screen enter the name of the resource on the “**Create Homework**” line and press the “**Create Homework**” bar.



9. Press the “**Browse**” button and select the zip file in the source directory.



10. Press “**Upload Zipfile**” and upon receiving notice that this has been done select the resource at the “**Install Homework**” line and press “**Install Homework**”. Upon receiving notice that the homework has been successfully installed, select the resource at the “**Show Homework**” line and press the “**Show Homework**” bar to view the results.

11. When processed and posted by WHS the above “quadratics” document produces the following display at the “**Show Homework**” bar.



While certainly not satisfactory this (or some equivalent) is the hoped-for outcome of the posting process: a source document from which we can successfully post on WHS a resource which can then be edited to an acceptable final form. The reader will note, for instance, that we have not included the diagram in the third problem. Indeed at this stage in the process we are content to have a posted document which we can inspect and improve one aspect at a time. This is the revision component.

Revising the Document: The Edit Cycle

Although it happens a resource that does not require revisions is a very rare item. Our example will be revised and expanded a number of times in subsequent sessions. The process, called the edit cycle amounts simply to making indicated changes to the source document and then repeating the posting operation. To someone who has posted but a few documents this might at first appear to be a large amount of work. However the limiting factor quickly becomes the speed of the author's internet connection. The "Posting" routine described above should seldom take more than a minute or two.

Initial Edits

If one has a fast connection a simple set of edits can be completed in less than a minute. For instance one obvious shortcoming of the current "quadratics" resource is the failure of the answer boxes to remain inline. The "broken line" appearance is result of the necessity of placing tags on separate lines and the fact that WHS ignores everything on a tag line (other than the tag itself). In order to place the first answer control line in question 1 we placed a <return> immediately after the "a =", which the system duly printed. The reason that breaks don't occur before "b =" and "c =" is that the <return>'s on the tag lines that preceded them were ignored. We need a means to tell WHS to ignore certain <return>'s terminating lines which precede control lines. This is the function of the "AH_" tag. When encountered this tag instructs WHS to ignore the <return> immediately before the next control line. Thus if we modify problem 1 above to change from:

problem 1

QM_[0;3;-5/6;95/12]

If $3x^2 + 5x + 10$ is written in the form $a(x - b)^2 + c$ then

a =

AC_[5]

b =

AC_[5]

, and c =

AC_[10]

.

SKIP_

To

problem 1

QM_[0;3;-5/6;95/12]

AH_

If $3x^2 + 5x + 10$ is written in the form $a(x - b)^2 + c$ then

a =

AC_[5]

b =

AC_[5]

, and c =

AC_[10]

.

SKIP_

and make corresponding changes in the other problems then the breaks will disappear. Note carefully in the above that we have left a blank line between the “QM_” and “AH_” tags since tags must not occur on consecutive lines. If we didn’t want to include that blank line then we could do the following.

problem 1

QM_[0;3;-5/6;95/12]

If $3x^2 + 5x + 10$ is written in the form $a(x - b)^2 + c$ then

AH_

a =

AC_[5]

b =

AC_[5]

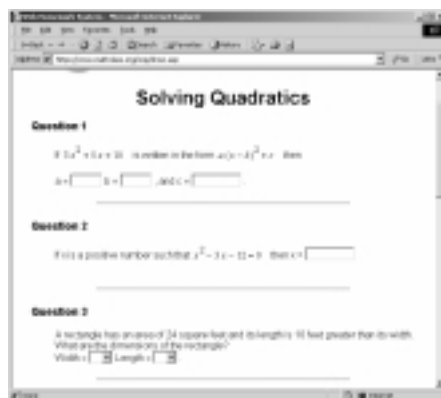
, and c =

AC_[10]

.

SKIP_

With these edits the worksheet is saved and all of the “Posting” steps are repeated (in about a minute) to produce the following:



This is better but the document is in need of additional enhancements (e.g. a diagram in problem 3) which will be added as we proceed through subsequent trips through the edit cycle.

Since the editing process is both creative and problem-solving there are few general rules to follow, save these:

Make one change at a time. If you make a single change to a “working” resource and “something breaks” then you know where to look for the problem.

Except for text edits take the time to document changes through comments as to what has been done to the worksheet

With this simple example we have been through the major steps in creating and posting a WHS resource.

More Details on WHS Formatting

The previous introductory tutorial demonstrated only a two of the WHS answer formats and control mechanisms. In what follows we describe the WHS authoring tools in more detail.

The initial and global header sections (H_)

In a WHS document the information in the input file (source document) which occurs before the first occurrence of a line beginning with "H_" is called the **initial section**.

The initial section provides space for comments on the document contents, macros, scratch calculations, etc. The initial section of the input file is ignored by the WHS system.

The "H_" symbol marks the beginning of the part of the document containing material which will

be displayed. It is called the **global header**. It may take the extended form "H_[m]" or "H_[m;s]" where arguments "m" and "s" are non-negative integers.

"H_" is equivalent to "H_[1]"

"H_[m]" is equivalent to "H_[m;1]".

The global header "H_[m;s]" on a problem set with s +mk problems instructs the system causes the system to display the first s problems in the set in order and then to present in random order a random selection of k additional problems, one from each group of m problems after the first s. If m > 1 this results in a different set of problems being presented each time the assignment is displayed.

A typical global header section might be as follows. (The "SKIP_" is explained in the next section).

H_

Chapter 2: The Riemann Integral

SKIP_



Sections in General

Except for the initial one a section of a document consists of a control line together with the text lines preceding the following control line. Two properties of sections are important in understanding certain requirements on the form of an input file:

- All information on a control line which follows the tag is ignored by the WHS system.
- Empty sections are not permitted. (equivalently, one cannot have two consecutive control lines)

Text Sections (T_)

A text section is one beginning with a control line whose tag is "T_" . The contents of a text section may include graphics will be displayed as it appears in the input file in the same relative position. Text sections can provide space for introductory material for problems at one extreme and space for entire text chapters at another. A typical text section might be:

T_

In the next three problems assume that you are on the moon. You may need to look up the appropriate acceleration due to gravity at that location.

SKIP_

This would format as:



Skip Sections (SKIP_)

A section beginning with a control line whose tag is "SKIP_" will be ignored by the WHS system. They provide space for comments and notes, calculations, etc. which make the source document portable and possible to maintain.

SKIP_ sections are important delimiters in WHS documents.

The global header section, each text section, and each problem must be followed by skip sections. (This is why we included the "SKIP_" lines in the examples of global header and text sections, above).

Answer Header Sections (AH_ or AH_[n])

The AH_ tag preceding an answer header section instructs WHS to ignore or add html line breaks before and after the text in the section. A single parameter with value 0, 1, 2, or 3

can be specified by adding [x] after the AH_. The normal text lines are output and, if the parameter is specified and has value 1 or 3, then it is followed by a line break, i.e.
. If the value is 2 or 3, then it is preceded by a line break. AH_[0] which is equivalent to AH_ instructs the system to ignore the line break terminating the final line of the section. This makes it possible to have answer boxes “inline”. Otherwise a <return> terminating the line just before an answer tag would force the answer box or menu it creates to always begin a line. The arguments 1,2, and 3 permit one to add spacing in order to set text off or display answer boxes or menus. The most common use is to force inline answers as in the example for Constant Answers, below. Note also the use of AH_[3] in the example illustrating the use of a textbox for Essay Responses, below.

WHS Problem Formats

Problems Requiring Answers: (QM_)

Sections beginning with a control line containing a tag of the form QM_[a;b;c; ... ;z] are ones for which answers are expected. The "M" stands for "multiple" and indicates that a single problem can have multiple answers in multiple formats. The first argument, "a" is the accuracy to which a submitted numerical answer must approximate the correct answer. Typical values are .001, .0001, and 0. The remaining arguments are, in order, the correct responses (perhaps to within "a") to each of the questions posed in the problem. There are five principal answer formats, each corresponding to a particular tag.

a. Constant Answers

Constant Answers are numbers or character strings. The numbers can take the form of any algebraic expression one might enter into a scientific calculator using "calculator syntax" (i.e. asterisks "*" are required to indicate multiplication and parenthesis required to indicate functional values (e.g. $\ln(6)$ rather than $\ln 6$). "pi" and "e" can be used for 3.14159... and 2.718..., respectively.

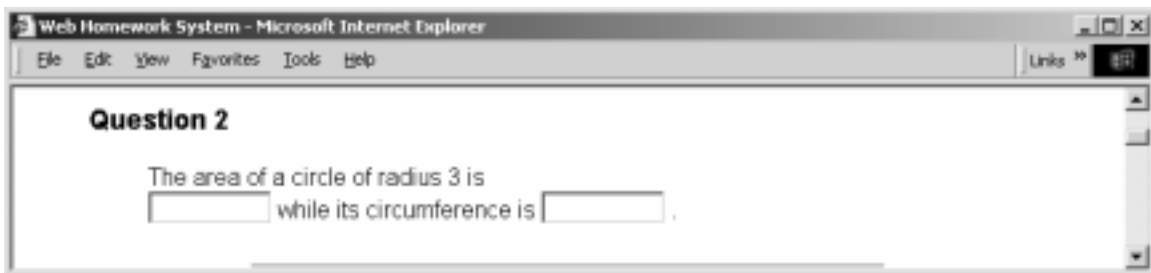
The argument "x" indicates the width (in characters) of the text box provided for the student answer.

An answer is deemed correct if it is within the error bound "a" of the correct answer. If the correct answer is a character string this requires that the submitted answer perfectly match

the given correct one (including spaces).

Here is a sample problem with two character answers:

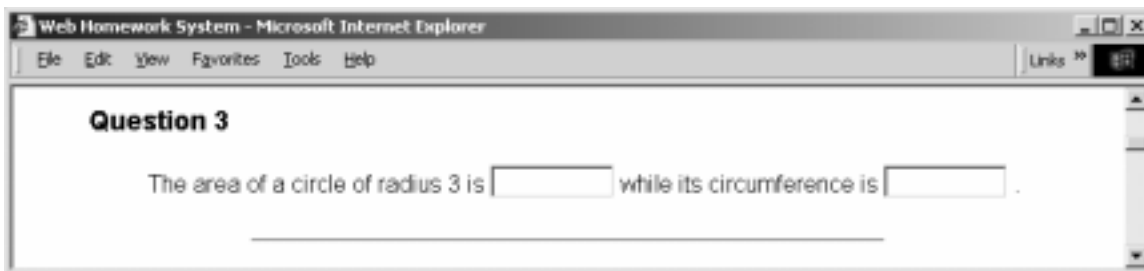
```
QM_[.001;pi*3^2;2*pi*3]
The area of a circle of radius 3 is
AC_[10]
while its circumference is
AC_[10]
.
SKIP_
```



This will create two text boxes into which the student may enter his/her answers. As noted in the previous tutorial the problem will not be in the form most would expect as it would, in each case, place the text box on the next line. In order to force the system to place the answer boxes inline one adds an Answer Header Tag, AH_ as indicated in the following. The tag instructs the WHS system to ignore the <return> on the line immediately preceding the next control line.

```
QM_[.001;pi*3^2;2*pi*3]

AH_
The area of a circle of radius 3 is
AC_[10]
while its circumference is
AC_[10]
.
SKIP_
```



The blank line between the "QM_" and "AH_" tags above is forced by the requirement that no section be empty.

b. Function and Integral Answers: AF__[size;var;numpts;lorange,hirange]

Function answers are algebraic expressions in calculator syntax. The answer provided in the argument line of the QM_ tag and the student answer are both expected to be in calculator syntax and expressed in terms of the single variable "var". The "size" argument declares the length (in characters) of the text box for the answer. The system evaluates the difference between the submitted and correct answer at "numpts" randomly selected points in the interval (lorange,hirange) and declares the answer correct if the absolute value of the difference is at most the tolerance, "a", declared as the first argument of the QM_ tag. The following is an example:

QM__[.001;cos(x);-sin(x)]

AH_

If $f(x) = \sin(x)$ then the derivative $f'(x) =$

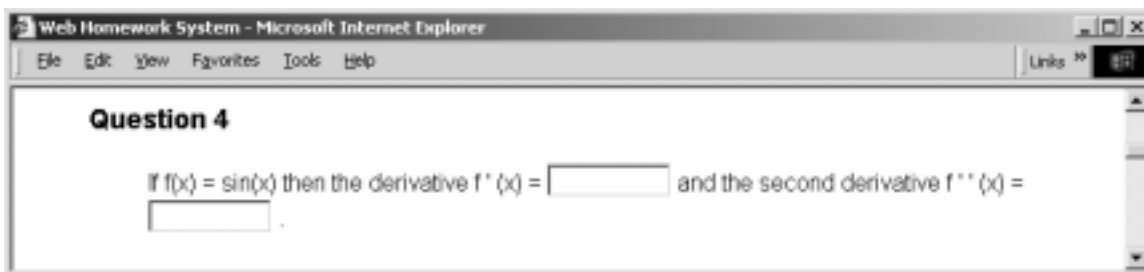
AF__[10;x;10;0;3]

and the second derivative $f''(x) =$

AF__[10;x;10;0;3]

.

SKIP_



c. Integral Answers: `AI_[size;var;numpts;lorange;hirange]`

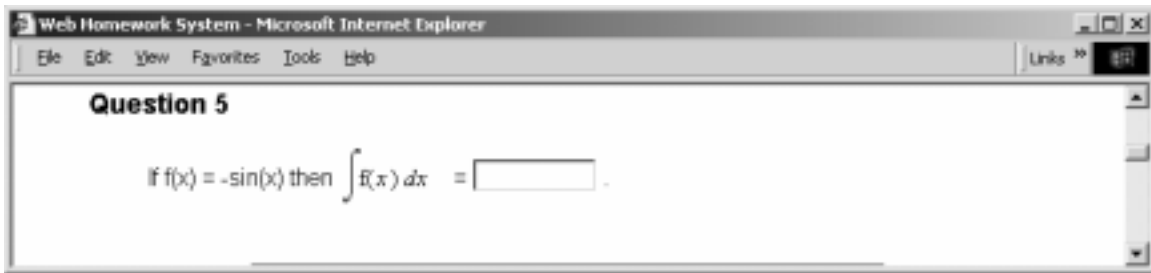
Integral answers are algebraic expressions in calculator syntax. The form is identical to the function answer format (`AF_`) with the only difference being the interpretation by the system. In this case the system checks that the values of the submitted expression and those of the correct answer agree to within the stated precision up to an additive constant.

`QM_[.001; cos(x)]`

`AH_`

If $f(x) = -\sin(x)$ then $\int f(x) dx =$
`AI_[10;x;10;0;3]`

`SKIP_`



d. Selection Answers: `AS_[choice_1;choice_2;...;choice_n]`

Selection Answers are lists of alternatives provided by a listbox. The system compares the string chosen from the list with the answer given in the argument to the `QM_` tag. The answer is correct if the strings are identical. This is case sensitive and includes spaces, punctuation. An example is:

`QM_[0;12;7]`

`AH_`

There are

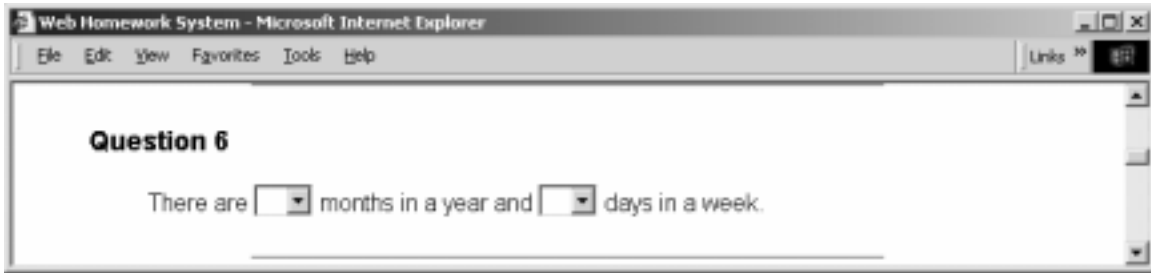
`AS_[2;7;30;12;14;10]`

months in a year and

`AS_[2;7;30;12;14;10]`

days in a week.

`SKIP_`



e. Multiple Choice Answers: AL_[label_1;label_2;...;label_n] and AR_[index]

The AL_ tag directs the placement of a line of “radio buttons” labeled “label_1” through “label_n”. The most common labels are the letters A through E. The labels typically reference choices for the answer to a question posed in the section preceding the control line containing the AL_ tag. An example is:

QM_[0;A;E]

AH_

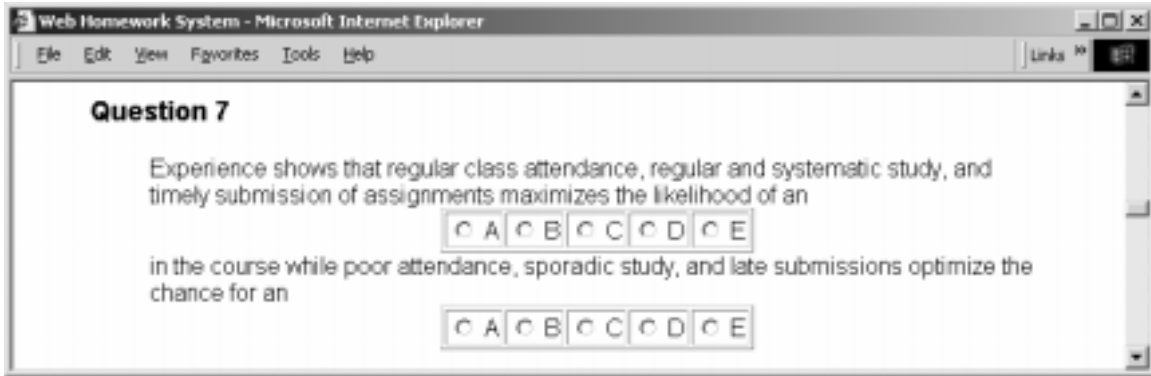
Experience shows that regular class attendance, regular and systematic study, and timely submission of assignments maximizes the likelihood of an

AL_[A;B;C;D;E]

in the course while poor attendance, sporadic study, and late submissions optimize the chance for an

AL_[A;B;C;D;E]

.
SKIP_



f. Row Answers: AR_[index]

Row answers are a multiple choice format which is typically employed when the choices are large and/or complex. In this format the answers are presented to the right of a vertical row of radio buttons with the answer indicated by selection of the button to the left of the correct choice. The correct answer is given on the QM_ line as the number (starting with 1) of the correct answer.

The same problem can have several AR_ answer sets. The first group of answers occurs with the AR_[1] tag, the second with AR_[2], etc. All tags of a smaller index must occur before any tags of a larger one.

QM_[0;1;2]

Systematic study correlates very well with academic success

AR_[1]

True

AR_[1]

False

The volume of a cube of edge 3 is

AR_[2]

9

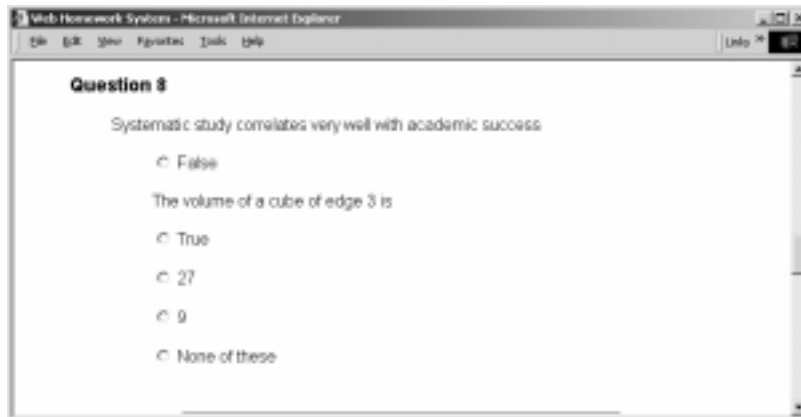
AR_[2]

27

AR_[2]

None of these

SKIP_



g. Checkbox Answers: AB_[label_1;label_2;...;label_n;None of These]

An AB_ tag directs the placement of a line of checkboxes labeled by the arguments to the tag. The labels reference choices from among alternatives to answer a question posed in the preceding section. Unlike the radio button choices for the AL tag the correct answer is expected to be the subset of the boxes selected. This is why the choice “None of these” or its equivalent must be included in order to provided for the empty set as an answer. The correct answer is indicated in the answer arguments to the QM_ tag by placing the argument line sequence to the AB_ tag in the answer line of the QM_ tag and deleting the choices which are not to be selected. An example is:

QM_[0;;1;;;4;;;1;2;;4;5;]

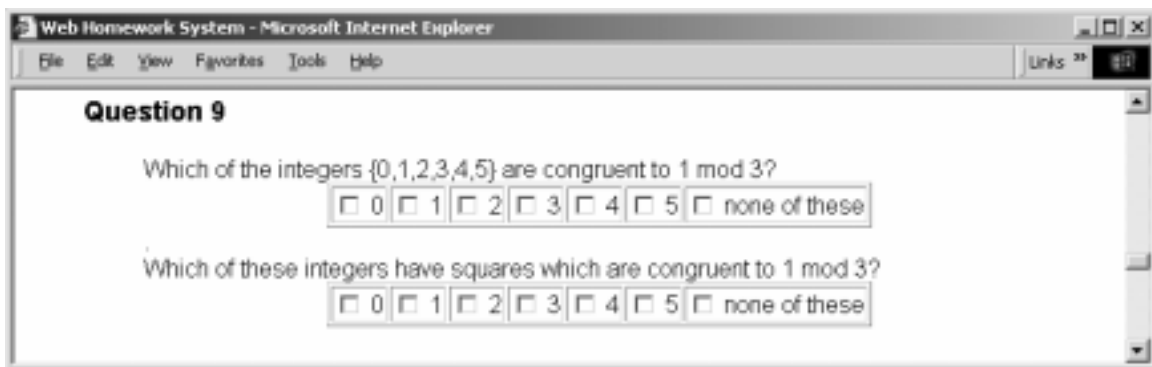
Which of the integers {0,1,2,3,4,5} are congruent to 1 mod 3?

AB_[0;1;2;3;4;5;none of these]

Which of these integers have squares which are congruent to 1 mod 3?

AB_[0;1;2;3;4;5;none of these]

SKIP_



The simplest way to produce the QM-line argument for a checkbox answer is to first complete the AB- control line (e.g. “AB_[0;1;2;3;4;5;none of these]” as above). Then duplicate the argument for that line in the QM-tag in the corresponding position (e.g. “QM_[0;] -> QM_[0; 0;1;2;3;4;5;none of these]). Then delete the incorrect answers while retaining the semicolon to the right of each (e.g QM_[0; 0;1;2;3;4;5;none of these]-> QM_[0; ;1;;;4;;]).).

h. Word Answers: AW_[size]

Word answers provide for situations when the correct answer is a character string but for which there is more than one correct choice. A common example is when there is more than one acceptable spelling. The argument for the AW_ tag itself is the size (in characters) of the answer box to be provided. When the tag is used one places in the answer position in the QM_ line a pound-sign (#)-separated sequence of acceptable answers.

QM_[0;center#CENTER#Center#Centre#CENTRE]

AH_

The point of intersection of any pair of different diameters of a circle is the

AW_[8]

of the circle.

SKIP_



It is important to note that the student answer must match one of the choices in a word answer exactly. This includes spaces and punctuation. Thus unless this is understood from general instructions (e.g. in the header section) questions in this format should remind the student of this requirement.

i. Tabular answers: AT_[ansbxsize;m;n;t11;t12;.....;tmn]

The tabular answer tag above creates a table of with m rows and n columns with t11 in the row1-column1 position, t12 in the row1-column1 position, ..., tmn in the rowm-columnn position with the understanding that if tij (but not the semicolon preceding it) is omitted

then an answer box of size “ansbxsize” is placed in that position. The expected answers corresponding to these boxes appear in the QM-line in the order in which the entries occur on the AT-line. For example :

QM_[.01;1;2;3]

AH_

The inverse of the matrix A =

AT_[2;3;3;3;5;0;1;2;0;0;0;]

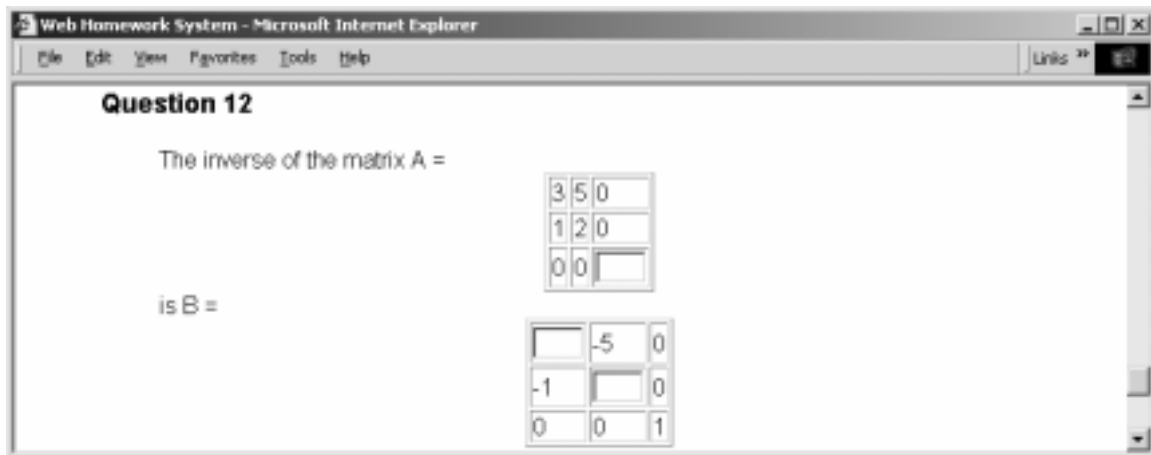
AH_

is B =

AT_[2;3;3;;-5;0;-1;;0;0;0;1]

.

SKIP_



Multiple Answer Formats in the Same Problem

The “M” in “QM_” indicates multiple answer formats are possible in the same problem. Just as each of the above examples contains more than one example of the particular answer tag, the same problem can call for any number of answers of any type. For example

QM_[.001; sin(x);0;1]

AH_

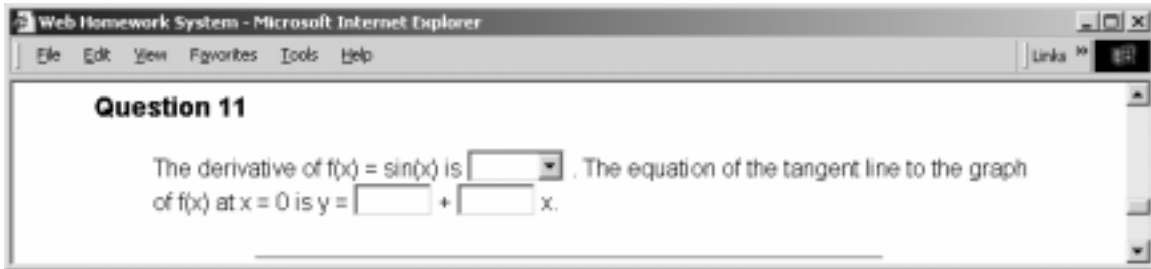
The derivative of $f(x) = \sin(x)$ is

AS_[sin(x);-sin(x);cos(x);-cos(x);tan(x);sec(x)]

. The equation of the tangent line to the graph of $f(x)$ at $x = 0$ is $y =$

AC_[5]

+
AC_[5]
x.
SKIP_

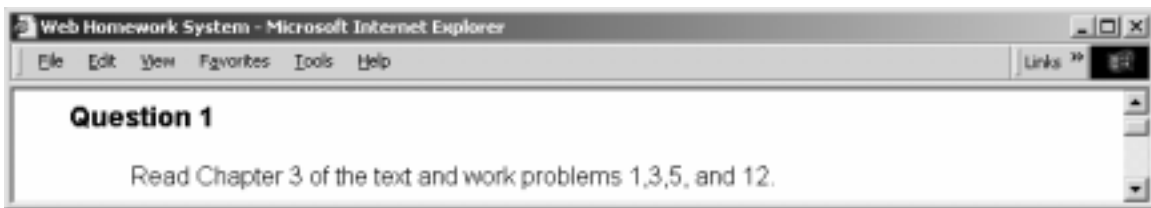


Problems Not Evaluated by WHS

Problems Not Requiring Answers: (QN_)

A section with the tag "QN_" on its control line is a problem with no provision for the submission of an answer to the machine. For instance:

QN_
Read Chapter 3 of the text and work problems 1,3,5, and 12.
SKIP_



Here we have appended a minimal SKIP section to satisfy the requirement that problems be followed by a SKIP section.

Problems For Which There is No Single Answer (QN_[])

Examples of this type could be surveys or “essay” answers. In this case one simply wants to record the student responses and make them available to the teacher for subsequent analysis. To have the system simply record the student responses but otherwise do no processing one simply uses “QN” where one previously used “QM”. One otherwise uses exactly the same form as the “QM” format and must provide accuracies and “correct” answers even though they are not to be used. The “correct” answers need not make any sense. They must be there for the system consistency-checking to work.

Example:

QN_[0;xxx]

Question 1: How many semesters of college mathematics had you taken prior to this course?

AS_[0;1;2;3;4;5;6;7;8;9;10; more than 10]

SKIP_

Question 1

Question 1: How many semesters of college mathematics had you taken prior to this course?

Note that simply by changing the “M” on a “QM” question to an “N” one can convert a system-evaluated problem to one for which the responses are not evaluated but are retained.

Essay Responses

There is a special answer form, used only with the QN_[] question format which opens a text cell into which students can enter or paste text responses.

Multi-line text answers: AX_[n]

The AX_[n] answer tag opens a text box of n rows by 40 columns in which the student

can enter or paste a text answer. This form is used only with questions of QN_ type.

Example

QN_[0;xyz]

Write a brief paragraph on how you spent your spring break last year.

AH_[3]

AX_[5]

SKIP_

Question 1

Write a brief paragraph on how you spent your spring break last year.

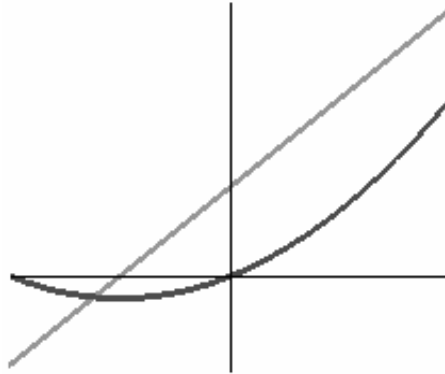
Suppression of Correct Answer Return: QM_N[]

The default behavior in WHS is to return the correct answer whenever a student submits a response to a question. This will be partially suppressed if the character immediately following the underscore is an upper case N. In this case the correct answer is displayed only displayed when a correct answer is submitted.

Inclusion of Graphics

WHS source documents are typically developed in word processing or problem solving environments which can be exported to html. If graphics are included in problems in WHS source documents they will be included in the html. For instance the following from a Maple source document produces the problem which follows.

QN_[0;xyz]



The green graph of the function $h(x)$ is a straight line. The red graph of the function $p(x)$ is not a straight line. One of p and h is the derivative of the other. In the space below explain which is the derivative of the other.

AH_[3]

AX_[5]

SKIP_

Question 1



The green graph of the function $h(x)$ is a straight line. The red graph of the function $p(x)$ is not a straight line. One of p and h is the derivative of the other. In the space below explain which is the derivative of the other.

Other Formats

Since WHS is continuously under development new tags appear and old ones are extended on a regular basis. For instance there is an answer format (the QA_ form) through which

authors can create specialized answer formats. The most recent author documentation can be found at the [Author Documentation](#) link