Latextools Manual

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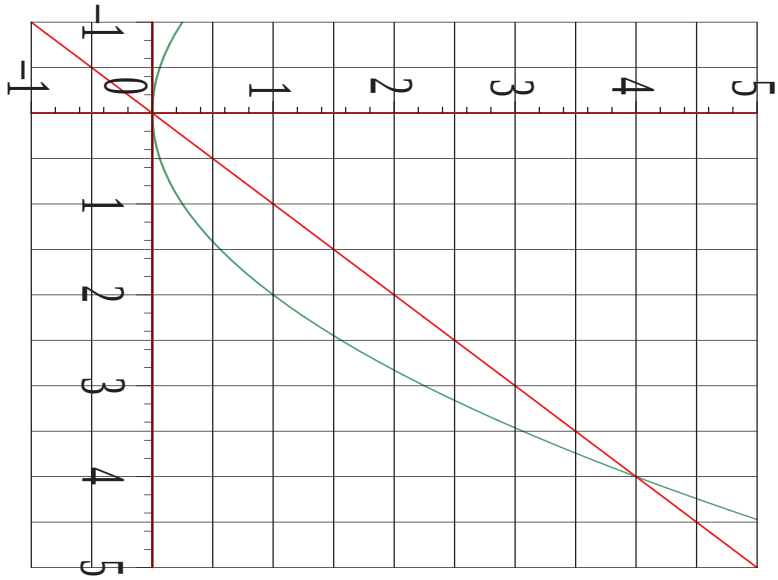


April 2, 2009

This manual shows how to make use of the facility Maple has to export worksheets to latex and html in creating papers, manuals, classnotes, etc.

1 Some history

Maple worksheets have been exportable to latex since there such things, and we, along with many other researchers have used Maple to produce eps diagrams and tex source files for papers. We have used Perl scripts to massage the tex output from Maple to produce classnotes, manuals, and textbooks. For example, the pdf and ps files in the following places were produced by this method.

http://www.ms.uky.edu/~carl/hand99/hand98.pdf Maple handbook for calculus students

http://www.ms.uky.edu/~carl/chisel/linprog/all/linprog.ps Ma 416 class notes

http://www.msc.uky.edu/carl/ma123/kob98/kob98tex/kob98.ps Calculus book by Koblitz

http://www.ms.uky.edu/~carl/chisel/vpsf97/all/book.ps Visual Problem Solving by Eakin and Eberhart

http://www.ms.uky.edu/~carl/ma341/lattice5.pdf A research paper in Topology

Recently, we have been more concerned with the export of Maple worksheets to html, because these can be used to prepare homeworks for Web Homework System (WHS), a Math Sciences service for teachers hosted on ***http://www.mathclass.org***

However, for various reasons, we have even more recently become interested in developing a method for massaging the latex export from Maple which does not rely on Perl scripts. The package **latextools** , whose current state is described here, implements the method. See the words **latexit** and **rootwork** described below; also see the words **htmlit** and **htmlrootwork** below for processing html export in a similar fashion. See also the words **mwsit** and **mwsrootwork** for processing the source worksheet in a similar fashion.

Latextools is still in development. Suggestions and comments should be sent to carl@ms.uky.edu

2 How to Latex the raw Latex export from Maple

2.1 What you need.

We assume you are working on a Windows XP machine which has access to Maple, MiKteX and Gsview4.5. Most of the Math Sciences machines at UK are in this category.

You can equip your home machine with these tools with a little effort.

The latest version of MiKteX is available free at ***http://www.miktex.org/***

and the latest Gsview4.5 is free at ***http://www.cs.wisc.edu/~ghost/***.

Gsview requires a Ghostscript.

You can use gs811 (also free) from ***http://www.cs.wisc.edu/~ghost/doc/AFPL/get811.htm***

You can install these on your computer by following the instructions supplied.

Maple is free to any employee of the University (Math Sciences has a site license). For others, the student version of Maple is around $120 and should work fine, although I haven't tested it.

Maple2e style files. You must have the latex style files that Maple uses. These can be found in the ETC directory in the Maple directory. There are 8 files in the directory. Select them and make a copy.

Now, create a directory that you will keep your Maple source worksheets and all the tex export from them. We will assume the directory is c://mystuff. **Paste the 8 style files into the directory**. If you have MikTex on your machine, you can put these files in the texmf folder and refresh the style files from the start button by selecting

MikTex->MikTex Options->General->Refresh Now

One other thing, very important. Use the **Classic Worksheet interface** in Maple. In Windows, you can change the Maple worksheet file association using the Worksheet File Association Selector application from the Tools folder of the Maple Start menu. The standard Worksheet interface is significantly different and will not work reliably.

You are ready to latex files with the latextools method. It would be nice to have a Latex 2e manual handy, if you want to put in much raw latex into the worksheet. I use a manual by Kopka and Baly [1] The MiKteX installation has good online help. Also there are plenty of other nice links. Here is one

http://it.metr.ou.edu/latex/latex2e.html

2.2 The procedure if you are doing it by hand

Using the **Classic Worksheet Interface**, open up a Maple worksheet and type in some stuff: text, input, and output.

Save the worksheet to the directory with the name, say sample. Save it as a classic (.mws) worksheet.

Export the worksheet to Latex. This is done from the file menu. Accept the file name suggested (sample.tex) and the suggested location (c://mystuff)

Open a cmd prompt. You can do this from the Start Button. Choose Run and type **cmd** in the input line and press enter.

In the window that opens up, you have to change directory. Type **c:** and press enter. Type **cd mystuff** and enter. The prompt line should read c:/mystuff

Now do a dir. That is, type **dir** and press enter. You will see a listing of the files in the directory. One of them will be sample.mws. That is the souce worksheet. Another will be sample.tex. That is the tex export from maple.

Now type **latex sample** and press enter. You will see some processing, ending with the message "Output written on sample.dvi".

Now type dvips sample and press enter. You will see some processing. At the end a postscript file sample.ps will have been created.

Now open up Gsview45 and look at the file. If you want to make changes, go back to the source worksheet, make the changes and resave and reexport. Then go to the command window and latex and dvips the file again. Look at the file again with Gsview. Repeat as necessary.

That's it.

2.3 Automating the procedure using latextools

The procedure outlined above has defects. Any changes in the documentstyle or preamble must be made by hand in the tex file that is exported from Maple. When you do this, the source document is not the Maple worksheet anymore, because if we reexport the worksheet to latex, the old tex file is written over, and any changes made by hand are lost. The package **latextools** is written to allow you to keep the worksheet as the source document.

3 How to use latextools

Latextools is a package of Maple words written to process Maple worksheets which have been exported to latex. You will need a worksheet which has the package in it. It will be in a section at the top of the worksheet. This will be your management worksheet, where you will keep the commands you are using to process your worksheets. Save the management worksheet in the work directory c://mystuff. We will assume you call it manage.mws. At the beginning of a Maple session where you plan to use latextools, open the **management worksheet** containing the package latextools. It will be in a section which you should open and execute, then close. Check to make sure that Maple is running in the **shared kernel mode** . Then the assignments you make in one worksheet are valid in any worksheet open in the same Maple session. So the words in latextools can be used with any worksheet in the session. Keep this worksheet open, because you will come back to it.

The package latextools contains a word **latextoolshelp()** which gives a brief help message

```
> latextoolshelp();
```

```
latextools version 2/5/2009: A package to process maple export to
latex.

  In all uses, you must export your worksheets to latex to get output.

  To prepare an exam, use makexam.  See makexam(Help=yes); for help.

    Note: There are examples posted at the MCtools Page
(msc.uky.edu/carl)

  To process a single worksheet, you can use latexit. See
latexit(Help=yes) for help.

  To combine several worksheets with a rootfile, use rootwork.  See
rootwork(Help=yes)   for help.

  To process a WHS homework prepared with MCtools[tagit] (Nov 10 2003
or later), regenerate the

  tagit homework with  LATEX˙:=yes, then export to latex, then process
it with latexit   using the

  option WHSprobs=yes.


 The package also contains words to process the html export from
Maple.

 Export to html, then use

 htmlit("worksheet","path") to process. See htmlit(Help=yes) for help.

 To create an html root, use

 htmlrootwork("rootname","path",Files=["file1","file2",...]); See
htmlrootwork(Help=yes) for help.


 The package also contains three words, mwsit, unmwsit and
mwsrootwork, which

 manage the bookmarks of a group of one or more worksheets.

 See mwsit(Help=yes) and mwsrootwork(Help=yes) for help.
```

The two main words in the package are **latexit** and **rootwork** .

3.1 Using latexit to process single worksheets.

If your worksheet does not have any raw latex in it, and consists only of Maple commands, output and text, you can simply export the worksheet to latex (say it is sample.tex in c:/tmp, then execute the command latexit("sample","c:/tmp"). A file samplewhs.ps will be generated in c:/tmp which you can view and print with ghostview. Otherwise, you can follow the procedure below.

3.1.1 The procedure

1. Prepare your document in a worksheet.

2. To omit a block of lines from the final document, put a *OMIT on the line above and a *TIMO on the line underneath (the * should be replaced by an underscore,). We call this a ***OMIT *TIMO block** . Thus, for example, you can put scratch work, notes, computations, etc that you needed to make your document between an OMIT and TIMO and exclude it from the tex file.

3. You can use Maple to generate diagrams and typeset mathematics for your document. These are handled automatically.

4. You can also use ordinary latex to typeset math that Maple cannot handle. There are two ways to do this.

i) If there is a block of lines of latex, put a *LATEX on the line above and a *XETAL on the line underneath (the * should be replaced by an underscore). We call this a ***LATEX *XETAL block** .

ii) Any latex which is outside a block of lines should be selected and converted to the **latex character style** , which should be modified as to be visible. For example the polynomial $y=u^2 - 5u + 2$, when converted to latex character style typesets to $y = u^2 - 5u + 2$.

5. Save the worksheet to your work directory c:/mystuff. We will assume the name you give it is mysheet.mws. Then export the worksheet to latex in this directory.

6. In the management worksheet, type the input below and press enter.

```
> latexit("mysheet","c://mystuff");
```

The first argument is the name of the worksheet you are processing. The second argument is the location of the tex file mysheet.tex

What happens is that the file mysheet.tex is opened and written to a new file mysheetwhs.tex (in c://mystuff) after some changes are made. Also any eps graphics files mysheet*.eps are recolorized and the default border is removed. Then the file mysheetwhs.tex is latexed to produce a dvi file mysheetwhs.dvi. Then the file mysheetwhs.dvi is dvips'ed to produce a file mysheet.ps

At that point you can open Gsview4.5 and view the postcript file mysheetwhs.ps. If it satisfactory, you can convert it to a pdf file using the convert menu in Gsview4.5. Otherwise, you can make needed changes to the source worksheet mysheet.mws and go through the process again until perfection is obtained.

That's it.

3.1.2 Example 1

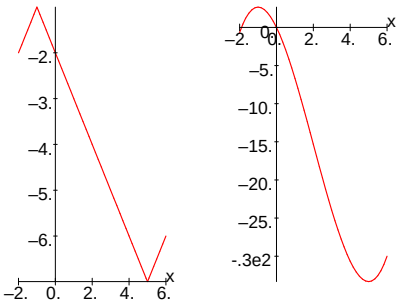
Here is a piece of a test from 1988 made up in latex. I have just pasted it into a textcell. There was a picture missing, so I generated the picture with Maple. I also added a problem which I created in place with Maple. The code has been blocked off with OMIT and TIMO. The test has been enclosed with the pair LATEX and XETAL. **Note.** In order that latexit work correctly, it helps to put the tags OMIT, TIMO, LATEX, and XETAL just after the beginning of a group range. These can be created in a text cell by putting the cursor where you want to break off a section and pressing the F3 key. Join groups with the F4 key. (See the Edit Menu).

First with *'s replacing the underscore's to disable the tags.
*OMIT

```
> f := unapply(piecewise( x¡-1,1,x¡5,-1,1 ),x);
```

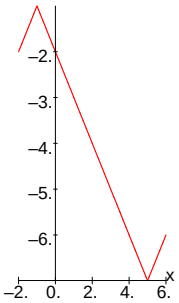
$$f := x \rightarrow \mathbf{piecewise}(x < -1,\ 1,\ x < 5,\ -1,\ 1)$$

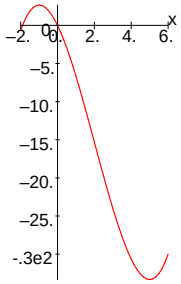
```
> pl1:=plot({int(f(x),x)},x=-2..6,discont=true,thickness=3):
> pl2:=plot(int((x+1)*(x-5),x),x=-2..6,thickness=3):
> plots[display](matrix([[pl1,pl2]]));
```



*TIMO

*LATEX
\begin{enumerate}
\item If $y=u^2 - 5u + 2$, and $u=8 + 1/x$, then the derivative $\Frac{dy}{dx}$ at $x=2$ is
\vspace{.5in}
\item If $f(x)=\sqrt{3x^4 - 11}$, then $f'(x)=$
\vspace{.5in} \item Suppose a function $y=f(x)$ has both of the following properties: (1) $f'(x) > 0$ when $x > 5$ and when $x < -1$, (2) $f'(x) < 0$ when $-1 < x < 5$. Which of the graphs could be the graph of the function?





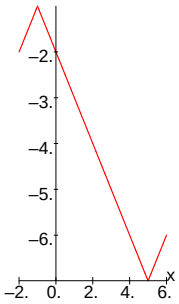
\end{enumerate} *XETAL

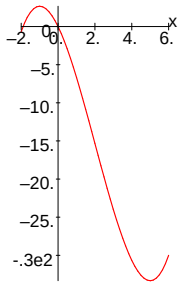
Next with the tags activated.

1. If $y = u^2 - 5u + 2$, and $u = 8 + 1/x$, then the derivative $\frac{dy}{dx}$ at $x = 2$ is

2. If $f(x) = \sqrt{3x^4 - 11}$, then $f'(x) =$

3. Suppose a function $y = f(x)$ has both of the following properties: (1) $f'(x) > 0$ when $x > 5$ and when $x < -1$, (2) $f'(x) < 0$ when $-1 < x < 5$. Which of the graphs could be the graph of the function?





3.1.3 Example 2

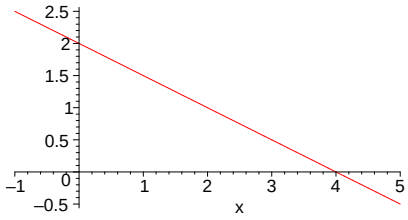
Here is an example of a problem formatted by hand, not in a LATEX XETAL block, but with the latex commands selected and converted to the **Latex Character Style** . In the source worksheet, I have made this character style magenta for easy identification.

1. Compute the following definite integrals:

   a) $\int_0^1 x^2\,dx =$ _____

   b) $\int_0^{\frac{\pi}{2}} \sin(\theta)\,d\theta =$ _____

2. What is the area in the first quadrant which lies under the linear function graphed below.



   Answer = _____

Here we have blocked off the code for the graph.

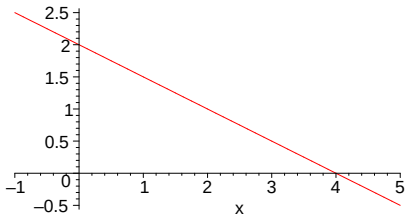
Now, Here is the same example, enclosed in a LATEX XETAL.

1. Compute the following definite integrals:

   a) $\int_0^1 x^2\,dx =$ _____

   b) $\int_0^{\frac{\pi}{2}} \sin(\theta)\,d\theta =$ _____

2. What is the area in the first quadrant which lies under the linear function graphed below.



Answer = _____

3.1.4 The Help=yes option of latexit

If you execute latexit with the option Help=yes set, you get this help message

```
> latexit(Help=yes);
```

2/5/2009

Export your worksheet to latex.

Then

latexit("worksheet","path") where

worksheet is the name of the worksheet (omit the .tex suffix)

path is the path to the directory with the exported tex files, eg, c://temp

Options:

New=yes set to no to latex again after hand changes.

NumPass=2 is the number of passes through latex

FixEps=yes: set to no to keep the pictures grayscale

Color: set to no to keep the fontcolor black

Docstyle=DOCSTYLE,

Pkgs=PKGS,ExtraPkgs="",

Preamble=PREAMBLE,ExtraPreamble="",

Abbrevs=ABBREVS,ExtraAbbrevs=[],

Styles=PSTYLE,ExtraStyles=""

Dvips=no: set to no if you want to generate postscript by hand

Help=no: set to yes to get this message

WHSprobs=no: set to yes if you want to process a WHS homework which has latex

```
  versions of

  the problems (use MCtools Nov 15 2003 or higher with LATEX˙ set to
yes or both before           you

  re-tagit and export to latex)

  Picwidth=2.5: set to larger or smaller width in inches to change the
default size of       diagram

  (Note: Import external eps, png, bmp, jpg files with

"includegraphics[bb=llx lly urx ury,height=yin,width=xin]–name.xxx"
style)

  Purpose="notes":  set to amspaper to use ams styles.

  Supress=""  set to mapleinput to remove the mapleinput before
latexing, or [mapleinput,maplettyout]

    to remove also the maplettyout.  Get other styles by inspecting
the latex source file.
```

As you can see, latexit has a lot of options, all with pre-assigned defaults. Initially, you would accept all the defaults, but you may want or need to change an option. Most of them are sufficiently explained in the help message.

There is a large group of options, starting with Docstyle and ending with ExtraStyles, that allow you to change the preamble of the latex export from Maple. For example, Docstyle is set to "[11pt]{article}". If you wanted 12pt, you could change that easily.

For wholesale changes in these options, you will want to examine what the current defaults are. I have put their definitions in the appendix, in the section on Default Styles. There is one wholesale change you can make: if you want to use the ams styles, change the **Purpose=** option to **amspaper** .

The WHSprobs= option is important if you plan to use latextools to extract latex versions of the WHS homework problems. It is covered in some detail later in this manual.

Latexit is still in a state of developement, so your suggestions are solicited.

3.1.5 exercise

Take the source worksheet for this manual, and save to your work directory c://mystuff as say latextools.mws. Then export it to latex and process it with latexit.

3.1.6 Importing Graphics.

When a pictured generated by a Maple command is exported to latex it is exported as a grayscale eps file, and the style files that come with Maple handle the inclusion of the picture into the tex file automatically. The option **Picwidth=** can be set to change the default size of the graphic. One of the functions of latexit is to restore the color in the eps file and remove the border around the picture. This works for all the standard colors, and if you really have a color you want duplicated, you can addit to the list of colors to be restored.

Occasionally, you may want to insert a graphic into the worksheet that was not generated with Maple. Say, for example, you have a **jpg** , bill.jpg, you want in your document. Put it in the export directory, and insert this line in your worksheet

(underscore)pic[bill.jpg;bb=0 0 640 480,width=640pt,height=480pt]

Now, when you export and latexit, the diagram will occur in the postscript output. You may have to experiment with the bb (**bounding box**) entry to get things to look right.

3.1.7 The Purpose=amspaper option

If your texmf installation includes amstex, you can write math papers using these styles. A sample can be found at ***http://www.msc.uky.edu/carl/communicating_math/Examples_page.htm***

We have added some abbreviations. For example for _df we substitute f^{\prime}. So, wherever a _df is found, it is replace with f^{\prime}.

We have also added some newcommands to the preamble.

You can see how these changes are fed into latexit.

Basic instructions for use.

1 Open the latextools section and execute it.

2. Execute these input cells below. They define the abbreviations and newcommands needed to process this particular set of notes.

```
> abrv:=[[”“˙df”,”f^{“‘prime}”],
  [”“˙Kn”,”$K˙{2}$”],
  [”“&”,”&”],[”“˙S2”,”$S˙{2}$”]]:
  preamb := ”“n“‘raggedright
  “‘newcommand{“‘shseq}[4]
  {“‘left(#1˙{#2}“‘right)˙{#3}^{#4}}
  “‘newcommand{“‘pt}[2]
  {“‘left(#1˙{i}“‘right)˙{#2}^{“‘infty}}
  “‘newcommand{“‘pttwo}[2]
  {“‘left(#1“‘right)˙{#2}^{“‘infty}}
  “‘newcommand{“‘map}[3]
  {#1˙{#2}:#3˙{#2+1} “‘to #3˙{#2}}
  “‘newcommand{“‘invlim}[2]
  {“‘varprojlim“‘left(#1˙{i},#2˙{i}“‘right)}
  “‘newcommand{“‘shinvlim}[2]
  {“‘varprojlim“‘left(#1,#2“‘right)}
  ”:
```

3. Save the worksheet in a directory and export it to latex in that directory.

4. Then execute the latexit command below, after modifying the first argument to the name of the worksheet as you saved it, and the second argument to the path to the directory containing the latex export.

```
> latexit("buckets04",
  # change buckets04 to whatever name you save the worksheet with
  "c:/carl/whit3",
  # change this to the folder where you exported to latex
  Purpose=amspaper,
  ExtraAbbrevs=abrv,ExtraPkgs={"amscd"},
  ExtraPreamble=preamb,FontSize="12pt");
```

```
index words duplicated

buckets04whs.tex created

buckets04whs.dvi created.

fixed eps files (removed their borders and recolored if Color=yes is
set)

buckets04whs.ps created sucessfully.

finished
```

5. If you are performing step 4 on a math sciences machine, everything should go fine. Then you can open the postscript file (it is named the same as your worksheet with 'whs' appended) with ghostview and view it. If it is what you want, save it to pdf file for dissemination.

3.2 Using rootwork to process a rootfile of worksheets

You may want to gather some of your worksheets into a set of class notes, or a manual, or a book.

You may want a table of contents, perhaps an index. You may want a titlepage. You can make a rootfile to handle this, using the word **rootwork** in latextools. Rootfiles in latex are a very convenient way of developing a set of classnotes, or homeworks, or writing a book from a lot of separate texfiles. A **latex rootfile** is a short file which only has a preamble and \begin and \end{document} lines. Between these are a bunch of \include{filename} statements, where filename is a latex file with no preamble, nor a begin and end document line. Then when you latex the rootfile it processes all of the included files. In this way you can 'grow' a book or set of class notes, complete with table of contents and an index if you want.

3.2.1 A suggested procedure

1. open your **management worksheet** and execute latextools

2. select the files that you have processed with latexit that you want to put in your rootfile. For example, say you want to make a manual out of your file mysheetwhs.tex that you created above.

3. type the following input line and execute.

```
> rootwork("myroot","c://mystuff",Files=["latextoolswhs"]);
```

What happens is that a short file myroot.tex is created which has a preamble, and an include for the file latextoolswhs. Then this file is latexed twice and then dvips'ed to create a file root.ps which has a table of contents and an index. You can examine the file root.ps with Gsview4.5. You can expect to want to make changes. This could be done by editing the root file directory, however we would like to do it by making changes in the management worksheet.

3.2.2 root

To change the table of contents. You do this in the source worksheets by changing the way the manual is sectioned. See the Insert Menu for creating and deleting sections and subsections. See the Edit Menu for splitting and joining sections. You can also copy closed sections and then paste them to other locations in the same or different worksheets. Then rexecute the rootwork command.

To add or delete words from the index. Add a word by selecting it with your cursor and changing the character style (upper left hand corner of worksheet) to index. In this worksheet, that color of the text changes to darkgreen to make the index words visible.

To add a title, use the Title= option.

```
> rootwork("myroot","c://mystuff",Files=["latextoolswhs"],Title="A
  manual for latextools");
```

The Help=yes option. Use this to print out a help message for rootwork

```
> rootwork(Help=yes);
```

```
2/5/2009 rootwork("rootname","path",Options)

    where rootname is the name you want for the rootfile

    and path is the path to the directory with the latex files.

    Brief instructions:

    Export your worksheets to latex and process them with latexit.

    Make a rootfile with rootwork, and add the files as includes to
make a

    large document.

  Options:

    Newroot=yes  set to no if you don't want to redo the rootfile.

    Files=[]  set to a nonempty list of files you want to include in
the rootfile.

    Numpass=2  set to the number of times to latex the root file.

    Titlepage=""  set to whatever you want just after begin–document"

    usually a title page, otherwise set the Title Author and
Frontpiece below

    if you want a generic titlepage

    Title=""  set to a non empty string if you want a title page.

     Author""  set to the name of the author for the title page.

    Frontpiece=""  set to the name of a graphic file (eps or jpg).

    Dvips =yes  gives a postscript file

    Fonts=regular  set to sansserif for MS sans serif

    Lengths="  set to pageheight, pagewidth, etc

    Amspaper=no set to yes if the documentstyle is amsart

    Mkindex=yes  creates an idx file of words in Files marked with
```

Character style index

Contents=yes gives a table of contents

Pagestyle=headings set to none if you don't want that.

As you can see, rootwork has as many options as latexit. The help message explains most of them sufficiently well.

The word rootwork is under developement, so your suggestions are solicited.

3.3 Processing WHS homework with latextools

MCtools is a Maple package which is used to produce homework sets that students can access from the WHS server at

http://www.mathclass.org

There are a large number of homework sets here, and we want to describe a way of converting these to a latex format.

In order to do this successfully, you will need to know a little about how to use the MCtools package. Read the Manual for WHS Authors, and the rest of this manual.

3.3.1 A procedure for generating both latex and html versions of a homework

WHS has a set of answer formats which cover a large portion of the types of answers you might expect of students in an automated grading system. We introduce here a set of answer fomats which can be used to produce mathclass homeworks and tests or to produce latex homeworks and tests. They fall into two groups: the multiple choice formats as_ , ar_, aq_, and arq_ and the answer box formats ac_, an_, af_, ai_, ae_, and acef_

3.3.2 multiple choice formats as_, arq_, ar_ and aq_

as_

as_ is the standard selection box in WHS unless LATEX_=yes. The latex version is shows all alternatives in a table. Don't get too fancy with this format because the WHS format is not fancy.

```
> ragit("All triangles are scalene.",as˙([True,False],Rightone=2));
```

```
QM˙[.05;False]
AH˙[0]
All triangles are scalene.
AS˙[True;False]
SKIP˙
```

```
> LATEX˙:=yes:
  ragit("All triangles are scalene.",as˙([True,False],Rightone=2));
  LATEX˙:=no:
```

All triangles are scalene.

☐ ***True*** ☐ ***False***

◇ **2**

Here is the help message from as_

```
> as˙(Help);
```

```
as˙(l)  returns a list from which to circle

 the correct answer (listed first or enclosed in square brackets)if
LATEX˙=yes, else it returns an AS format for tagit, taking the same
arguments (randomize and rightanswers)  the tagit format does.

Options:

Shuffle=no, or =yes or =[3,2,1] to reverse the order of 3 alternatives

Rightone=1  Change if the correct answer is not the first answer.
```

ar_, aq_, and arq_

arq_ provides an array of radio buttons or checkboxes (no mix)

ar_ and aq_ are the same, except ar_ is for radiobuttons and aq_ is for checkboxes.

And here is the message from arq_.

```
> arq˙(Help);
```

```
arq˙(lst::listlist) constructs an array of radio buttons (default) or
checkboxes

 alternatives with the same identifier (Id below).

 The first alternative is assumed the correct one, unless modified
appropriately

 with the Rightone= option.

 Options:

 Help=no

 Button="radio"  change to Button="checkbox" for an array of checkbox
alternatives

 Rightone=1  For Button="radio" change to the correct alternative as
needed.

             For Button="checkbox" change to a list of correct
alternatives

 Numcols=1  Change to the number of columns you want.

 Shuffle=no  Insert a permutation of the number of alternatives (eg,
Shuffle=[3,1,2]) to shuffle the positions

             For problem maintainance purposes, in a problem
generator, if is recommended that you

             generate the permutation of the alternatives using
getparams

             or change no to yes to get a random permutation.
```

Id = -rand(1..10000)() If you want a particular identifier, use a positive

integer if you want WHS to shuffle it, otherwise use a negative integer

Labels="" Replace by Labels=1 to get ["A) ","B) ", etc] or Labels=2 to get red letter labels in html.

or Labels=[any list of strings]

Tableopts="" replace with

an appropriate format string

Cellopts="" replace with a format string for all cells or a list of

pairs [n,string], where n is the cell number to be formatted with string.

abc_ This combines the WHS answer formats AR_, AL_, and AB_

Here is a sample problem using the radio button. We have shuffled the answers (the default is not to do that) and made a row of checkboxes (the default is to make a column of checkboxes).

```
> ragit("Check the number which is a multiple of three.",brak(),
  ar'([2,5,7,9],Shuffle=[3,2,4,1],Rightone=4,Numcols=4));
```

```
QM'[.05;3]

AH'[0]

Check the number which is a multiple of three.

'brk'

lt'table gt'

lt'tr gt'

lt'td gt'

AR'[-1789;1]

'7'

lt'/td gt'

lt'td gt'

AR'[-1789;1]

'5'

lt'/td gt'

lt'td gt'

AR'[-1789;1]

'9'

lt'/td gt'

lt'td gt'

AR'[-1789;1]

'2'

lt'/td gt'
```

lt'/tr gt'

lt'/table gt'

SKIP'

To get the latex version, just make a new copy and add the latex=yes/no commands

```
> LATEX':=yes:
  ragit("Check the number which is a multiple of three.",brak(),
  aq'([2,5,7,9],Rightone=4,Numcols=4));
  LATEX':=no:
```

Check the number which is a multiple of three.

☐ **2** ☐ **5** ☐ **7** ☐ **9**

◇ ;;;;4

Here is an example of a use of aq_ to make a checkbox question. First we prepare a matrix by enclosing each negative in square brackets. Those will be the ones whose checkboxes should be checked. We are generating the html and latex versions in the same input cell.

```
> mat:=LinearAlgebra[RandomMatrix](3,4);
```

$$mat := \begin{bmatrix} -88 & 10 & -3 & 9 \\ 99 & -44 & -62 & 88 \\ -59 & 26 & -83 & 95 \end{bmatrix}$$

```
> for i from 1 to 3 do for j from 1 to 4 do
  if mat[i,j]¡0 then mat[i,j]:=[mat[i,j]] else mat[i,j]:=mat[i,j] fi
  od od:
```

```
> ragit("Check each number which is negative.",brak(),
  aq'(mat));
  LATEX':=yes:
  ragit("Check each number which is negative.",brak(),
  aq'(mat));LATEX':=no:
```

QM'[.05;1;;3;;;6;7;;9;;11;]

AH'[0]

Check each number which is negative.

'brk'

lt'table gt'

lt'tr gt'

lt'td gt'

AQ'[-5125;1]

‘-88‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘10‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘-3‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘9‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘99‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘-44‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘-62‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘88‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘-59‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘26‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘-83‘

lt˙/td gt˙

lt˙td gt˙

AQ˙[-5125;1]

‘95‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙/table gt˙

SKIP˙

Check each number which is negative.

☐ -88	☐ 10	☐ -3	☐ 9
☐ 99	☐ -44	☐ -62	☐ 88
☐ -59	☐ 26	☐ -83	☐ 95

◇ ;1;;3;;;6;7;;9;;11;

3.3.3 answer box formats

The number of answer box formats is larger than the number of multiple choice formats.

The ac_ format works like _AC in tagit for html and as expected in latex

```
> i:='i':ragit("Compute: ",Sum(i,i=1..25),".
  Answer:",ac˙(sum(i,i=1..25)));
```

QM˙[.05;325]

AH˙[0]

Compute: ‘ sum˙(i = 1)ˆ(25)i‘. Answer:

AC˙[15]

SKIP˙

```
> LATEX˙:=yes:
  ragit(”Compute: ”,(Sum(i,i=1..25)),”. Answer:”,ac˙(sum(i,i=1..25)));
  LATEX˙:=no:
```

Compute: $\sum_{i=1}^{25} i$. Answer:

◇ **325**

```
> ac˙(Help);
```

ac˙(a) returns answer box if LATEX˙=yes else it returns an ac format
for tagit, taking the same arguments that the tagit format.

Options: ansbox=[Height=.4,Width=1,Fill=””,Placement=”c”] change to a
list of arguments to ansbox (see ansbox(Help=yes) for options)

```
> ragit(ac˙(”1,0#1”));
```

QM˙[.05;1,0#1]

AH˙[0]

AC˙[15]

SKIP˙

```
> tagit(˙AC());
```

QM˙[.05;3]

AH˙[0]

AC˙[15]

SKIP˙

aw_ works like AW_

```
> ragit(” “”A three sided figure.“” defines what geometrical term?
  Answer: ”,aw˙(”triangle#Triangle”));
> LATEX˙:=yes:
  ragit(” “”A three sided figure.“” defines what geometrical term?
  Answer: ”,aw˙(”triangle#Triangle”));
  LATEX˙:=no:
```

```
> aw˙(Help);
```

af_ works like AF_ in html and as expected in latex

```
> ragit("Compute the derivative of ",f(x)=x^3+4*x-2,".
  Answer:",af˙(diff(x^3+4*x-2,x)));
> LATEX˙:=yes:
  ragit("Compute the derivative of ",f(x)=x^3+4*x-2,".
  Answer:",af˙(diff(x^3+4*x-2,x)));
  LATEX˙:=no:

> ragit("Compute the partial derivative of ",Pdiff(f(x,y),y)," if ",
  f(x,y)=x^3+4*x-2*sin(y*x),".
  Answer:",af˙(diff(x^3+4*x-2*sin(y*x),y)));
> LATEX˙:=yes:
  ragit("Compute the partial derivative of ",Pdiff(f(x,y),y)," if ",
  f(x,y)=x^3+4*x-2*sin(y*x),".
  Answer:",af˙(diff(x^3+4*x-2*sin(y*x),y)));
  LATEX˙:=no:

> ragit("Compute the definite integral: ",Int(f(x),x=1..3)," if
  ",f(x)=x^3+4*x-2,".  Answer:",af˙(int(x^3+4*x-2,x=1..3)));
  LATEX˙:=yes:
  ragit("Compute the definite integral: ",Int(f(x),x=1..3)," if
  ",f(x)=x^3+4*x-2,".  Answer:",af˙(int(x^3+4*x-2,x=1..3)));
  LATEX˙:=no:
```

acew_ is an array of ac_, ae_, af_, aw_, ai_ formats similar to ATcross in html, but it has a latex mirror also (unlike ATcross)

```
> g:= F-¿[F,ac˙(subs(x=2,F)),ac˙(int(F,x=0..1)),af˙(diff(F,x))];
> g(sin(x));
> acew˙(Help);
> ragit("Complete the
  table:",acew˙([[f(x),f(2),Int(f(x),x=0..1),Diff(f(x),x)],g(sin(x)),g(x
  ^2+3),g(exp(x))]));
> LATEX˙:=yes:
  ragit("Complete the
  table:",acew˙([[f(x),f(2),Int(f(x),x=0..1),Diff(f(x),x)],
  g(sin(x)),g(x^2+3),g(exp(x))],Numcols=4));
  LATEX˙:=no:
```

3.3.4 The procedure for adding latex to a WHS homework

First, you must open the source worksheet that was used to create the WHS homework.

Load the most recent MCtools and latextools you have (at least 3/20/09 as of this writing). If you have it at the top of the worksheet, execute it, and enclose the top of the worksheet in an ***OMIT *TIMO block** Also, in the top of the worksheet, place an input cell with the assignment LATEX_ := yes. Execute this.

Then you must convert each tagit line in the worksheet to the **'freeform' style** and rexecute. With LATEX_ set to yes, you will only get latex output. With LATEX_ set to both, you get latex and WHS versions of the problem.

Periodically, export your worksheet to latex and execute latexit(worksheet,path,WHSprobs=only). This will produce a file worksheet_lawhs.ps which you can inspect with GSview4.5. A couple of examples are shown in the next section.

3.3.5 inserting graphics into a problem

A diagram, drawing or picture is sometimes needed to help explain a concept or motivate a problem, and the MCtools and latextools package has words to make this relatively easy to do. You can use **addpic** from the MCtools package to add your drawings to documents. Maple has two packages of drawing words you can use: **plots** and **plottools** . The Visual Problem Solving Handbook has lots of sample work to show how to draw diagrams. We will concentrate here on giving examples of homework problems which have problems. First, we will load the four packages we may need words from.

```
> with(MCtools);with(latextools):
> with(plots):with(plottools):
```

Addpic is the principal word for inserting a diagram into a document. Here is the help for it.

```
> addpic(Help);
```

To show how addpic works in mathclass homework, make a header for a sample homework, so we can post it later.

```
> currentdir("c:/carl/latextools");
```

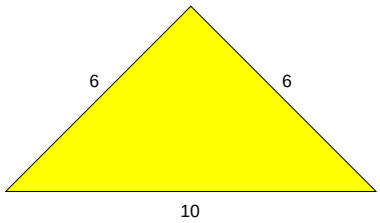
"c:\carl\latextools"

```
> currentdir();
```

"c:\carl\latextools"

So let us make a diagram of a triangle using textplot from plots and polygon from plottools.

```
> pic:=display(textplot([0,-.5,10]),textplot([-2.6,3,6]),
  textplot([2.6,3,6]),polygon([[-5,0],[5,0],[0,5]],color=yellow),
  axes=none,scaling=constrained):pic;
```



When we export this worksheet to html, the above image is saved to a numbered gif file. The simplest way to insert a diagram into a homework problem is to just include the name of the structure (in this case 'pic') in the tagit line. We can refer to this as the **visual method** . For example,

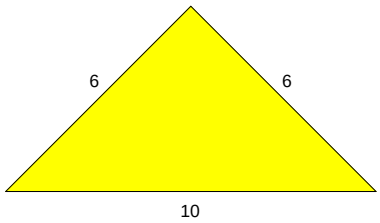
```
> ragit("Classify the triangle shown
  below.",brak(),pic,as`(["isosceles","right","equiangular"]));
```

QM`[.05;isosceles]

AH`[0]

Classify the triangle shown below.

`brk`



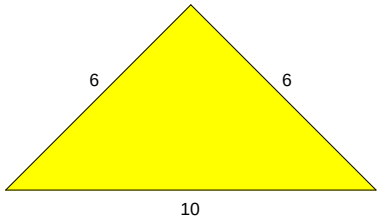
AS`[isosceles;right;equiangular]

SKIP

The latex version of this would look like this:

```
> LATEX:=yes:
  ragit("Classify the triangle shown
  below.",brak(),pic,as=["isosceles","right","equiangular"]));
  LATEX:=no:
```

Classify the triangle shown below.



☐ isosceles ☐ right ☐ equiangular

◇ 1

Pros and cons of the visual method.

One disadvantage of the visual method of inserting diagrams into problems is that you have to resize (usually shrink) the graphic after it is generated in the problem the first time. If you re-execute the tagit line, the worksheet remembers the dimensions you set. Resizing by hand involves grabbing a corner of the graphic with your cursor and then pushing in to make the dimensions smaller. With practice, this works very well generally.

A big advantage of the method is that it is easier to keep track of the graphic. Another advantage is that each time you export the worksheet to html or latex the grahic is exported also.

Using addpic.

The procedure addpic will save your graphic to the worksheet directory and put an html or latex instruction into the worksheet for including the graphic either in a mathclass homework or a latex homework. It is a little harder to keep track of the graphic if you use the addpic method rather than the visual method. First, you have to make sure you are in the homework directory before you execute the tagit line. addpic will warn you if the target directory is the default Maple directory, but otherwise you are on your own to monitor this.

```
> #currentdir("c:/tmp/addpicandragit");
```

```
> ragit("Classify the triangle shown
  below.",as˙(["isosceles","right","equiangular"],randomize=yes),addpic(
  pic,"isosceles"));
```

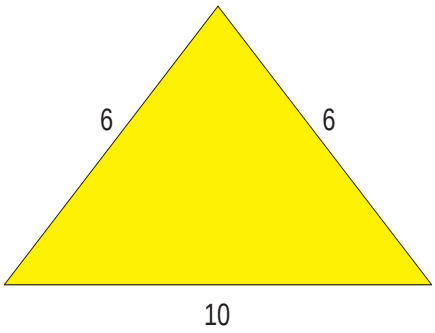
```
QM˙[.05;isosceles]

AH˙[0]

Classify the triangle shown below.

AS˙[right;equiangular;isosceles]

lt˙img src="isosceles.gif" alt="MaplePlot" /gt˙

SKIP˙
```

Here is the same problem in latex.

```
> LATEX˙:=yes:
  ragit("Classify the triangle shown below.",brak(),
  as˙(["isosceles","right","equiangular"],randomize=yes),addpic(pic,"iso
  sceles"));
  LATEX˙:=no:
```

Classify the triangle shown below.

☐ isosceles ☐ right ☐ equiangular



◇ **1**

Here is an example of a problem which has an external jpg you want to add to a problem. In order for this to work right you must have the jpg in
the current directory.

```
> ragit("Estimate the age of the person in the picture
  below.",as˙(["40-49","50-59",["60-69"],"70-79","80-89","90-99"]),
  brak(),addpic("lilshake",Format=jpg,Width=220,Height=313));
```

```
QM˙[.05;60-69]

AH˙[0]
```

Estimate the age of the person in the picture below.

AS˙[40-49;50-59;60-69;70-79;80-89;90-99]

˙brk˙

lt˙img src=”lilshake.jpg” alt=”MaplePlot” /gt˙

SKIP˙

To use the jpg

```
> LATEX˙:=yes:
  ragit(”Estimate the age of the person in the picture
  below.”,brak(),as˙([”40-49”,”50-59”,[”60-69”],”70-79”,”80-89”,”90-99”]
  ),brak(),
  addpic(”lilshake”,Format=jpg,Height=120,Width=125));
  LATEX˙:=no:
```

Estimate the age of the person in the picture below.

☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70-79 ☐ 80-89 ☐ 90-99

◇ **3**

```
> ragit(”Find the area of the isosceles triangle shown below. Answer:”,
  ac˙(evalf(5*sqrt(11),5)),addpic(pic,”atriangle”));
```

QM˙[.05;16.583]

AH˙[0]

Find the area of the isosceles triangle shown below. Answer:

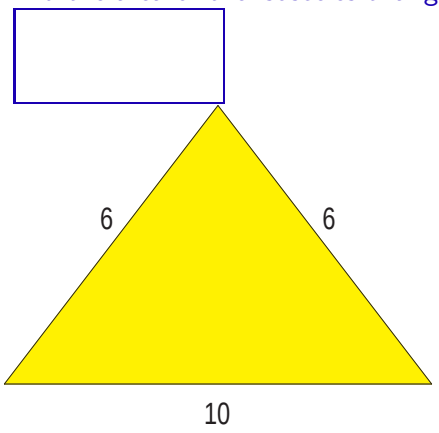
AC˙[15]

lt˙img src=”atriangle.gif” alt=”MaplePlot” /gt˙

SKIP˙

```
> LATEX˙:=yes:
  ragit(”Find the area of the isosceles triangle shown below. Answer:”,
  ac˙(evalf(5*sqrt(11),5)),brak(),addpic(pic,”atriangle”));
  LATEX˙:=no:
```

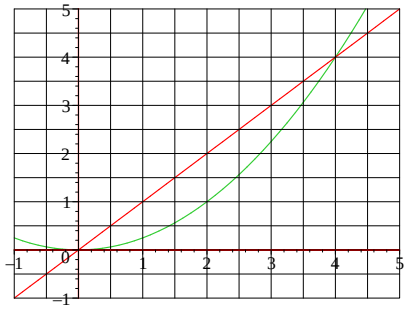
Find the area of the isosceles triangle shown below. Answer:



◇ **16.583**

Let's make up a calculus problem. Find the area between the curves $y = \frac{x^2}{4}$ and $y = x$. Let's draw a picture for the problem.

```
> pic2:=display(GP(llcorner=[-1,-1],wide=6,height=6,font=[TIMES,ROMAN,4
  ]),plot({1/4*x^2,x
  },x=-1..5,thickness=3),view=[-1..5,-1..5],axesfont=[TIMES,ROMAN,10]):
  pic2;
```




```
> ragit(precision='.01',"Find the area between the graphs of
  ",y=1/4*x^2," and ",y=x,", for ",ltlt(0,leq,x,leq,4),
  " shown below.",brak()," Answer:",ac`(int(x-1/4*x^2,x=0..4)),
  addpic(pic2,"twofuns"));
```

QM˙[.01;8/3]

AH˙[0]

Find the area between the graphs of ‘y = (1)/(4)“ x^(2)‘ and ‘y = x‘,
for ‘0 ¡= x ¡= 4‘ shown below.

˙brk˙

Answer:

AC˙[15]

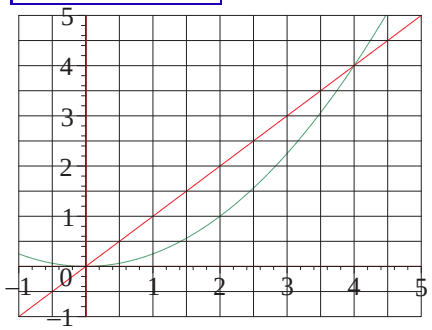
lt˙img src=”twofuns.gif” alt=”MaplePlot” /gt˙

SKIP˙

Here is the problem in latex

```
> LATEX˙:=yes:
  ragit(”Find the area between the graphs of ”,y=1/4*x^2,” and ”,y=x,”,
  for ”,ltlt(0,leq,x,leq,4),
  ” shown below.”,brak(),” Answer:”,ac˙(int(x-1/4*x^2,x=0..4)),
  addpic(pic2,”twofuns”));
  LATEX˙:=no:
```

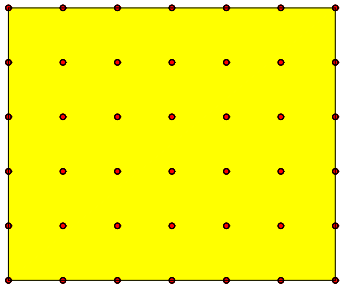
Find the area between the graphs of $y = \frac{1}{4}x^2$ and $y = x$, for
$0 \leq x \leq 4$ shown below.
Answer:



◇ $\frac{8}{3}$

3.3.6 more use of addpic

```
> geo := proc(m,n,r,clrs)
  local bord,nails;
  bord:=plottools[polygon]([[0,0],[n,0],[n,m],[0,m]],color=clrs[1]):
  nails := plots[display](
  seq(seq(plottools[disk]([i,j],r,color=clrs[2]),i=0..n),j=0..m)):
  plots[display](nails,bord,scaling=constrained,axes=none);
  end:

> geo(5,6,.05,[yellow,red]);
```



```
> band := proc(lst,clr)
  plot(lst,color=clr) end:

> pic:=(n,m)-¿plots[display](geo(n,m,.05,[turquoise,red])):

> #pic(2,4);

> acew˙(Help);
```

acew˙(lst::listlist) constructs an array of strings, expressions, and answer formats ac˙,an˙,af˙,ae˙,ai˙,aw˙

Options:

Help=no acew˙(Help) will retrieve this help

Numcols=1 increase as needed

Tableopts="" replace with an appropriate format string

Cellopts="" replace with a format such as "color=“"yellow“"" for all cells or a list of

```
> ragit("For each rectangle below, count the number B of boundary
  nails, the number I of interior nails, and also compute the area of
  the rectangle, assuming that adjacent horizontal or vertical pairs of
  nails are 1 unit apart.",brak(),
  acew˙([["‘B= ‘",ac˙(12),"‘I= ‘",ac˙(3),"‘Area =
  ‘",ac˙(8),(addpic(pic(2,4),"pic1"))],
  ["‘B= ‘",ac˙(14),"‘I= ‘",ac˙(6),"‘Area =
  ‘",ac˙(12),(addpic(pic(3,4),"pic2"))],
  ["‘B= ‘",ac˙(18),"‘I= ‘",ac˙(10),"‘Area =
  ‘",ac˙(18),(addpic(pic(3,6),"pic3"))]]),brak());
  LATEX˙:=yes:
  ab:=op([ansbox=[Height=.2,Width=.3,Fill="",Placement="c"]]):
```

```
> ragit("For each rectangle below, count the number B of boundary
  nails, the number I of interior nails, and also compute the area of
  the rectangle, assuming that adjacent horizontal or vertical pairs of
  nails are 1 unit apart.",brak(),
  acew˙([["$B=
  $",ac˙(12,ansbox=[Height=.2,Width=.3,Fill="",Placement="c"]),"$I=
  $",ac˙(3,ab),"$Area =
  $",ac˙(8,ab),(addpic(pic(2,4),"pic1",Height=30,Width=40))],
  ["$B= $",ac˙(14,ab),"$I= $",ac˙(6,ab),"$Area =
  $",ac˙(12,ab),(addpic(pic(3,4),"pic2",Height=30,Width=40))],
  ["$B= $",ac˙(18,ab),"$I= $",ac˙(10,ab),"$Area =
  $",ac˙(18,ab),(addpic(pic(3,6),"pic3",Height=30,Width=40))]],Numcols=7
  ));
  LATEX˙:=no:
```

QM˙[.05;12;3;8;14;6;12;18;10;18]

AH˙[0]

For each rectangle below, count the number B of boundary nails, the number I of interior nails, and also compute the area of the rectangle, assuming that adjacent horizontal or vertical pairs of nails are 1 unit apart.

˙brk˙

lt˙table gt˙

lt˙tr gt˙

lt˙td gt˙

‘B= ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

‘I= ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

‘Area = ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

lt˙img src=”pic1.gif” alt=”MaplePlot” /gt˙

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

‘B= ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

‘I= ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

‘Area = ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

lt˙img src=”pic2.gif” alt=”MaplePlot” /gt˙

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

‘B= ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

‘I= ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

AH˙[0]

lt˙/td gt˙

lt˙td gt˙

‘Area = ‘

lt˙/td gt˙

lt˙td gt˙

AC˙[15]

lt˙/td gt˙

lt˙td gt˙

lt˙img src=”pic3.gif” alt=”MaplePlot” /gt˙

lt˙/td gt˙

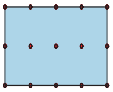
lt˙/tr gt˙

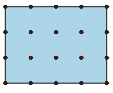
lt˙/table gt˙

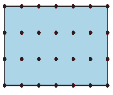
˙brk˙

SKIP˙

For each rectangle below, count the number B of boundary nails, the number I of interior nails, and also compute the area of the rectangle, assuming that adjacent horizontal or vertical pairs of nails are 1 unit apart.

$B =$ $I =$ $Area =$ 

$B =$ $I =$ $Area =$ 

$B =$ $I =$ $Area =$ 

◇ **12**
◇ **3**
◇ **8**
◇ **14**
◇ **6**
◇ **12**
◇ **18**
◇ **10**
◇ **18**

3.3.7 problem generators

One of the main advantages of using Maple to format problems is that it gives you the ability to create problem generators, that is, procedures which when executed will return problems which are essentially the same, except some numbers in the problem are different.

In order to create such a problem generator, you can start with any problem and parameterize it: Choose one or more things (usually numbers, but not always) in the problem which you want to allow to be different. For example, take a problem using the ac_ format:

```
> i:='i':ragit("Compute: ",Sum(i,i=1..25),".
  Answer:",ac˙(sum(i,i=1..25)));
```

One parameter in this problem is the number of terms, say n, that are being summed: So a simple parameterization of this problem would be

```
> prob:=proc(n)
  global LATEX˙; # This is needed if you want the latex version of
  the problem.
  local i;
  ragit("Compute: ",Sum(i,i=1..n),".   Answer:",ac˙(sum(i,i=1..n)));
  LATEX˙:=yes: # ragit returns latex version when LATEX˙ = yes
  ragit("Compute: ",Sum(i,i=1..n),".   Answer:",ac˙(sum(i,i=1..n)));
  LATEX˙:=no: # ragit returns html version when LATEX˙ ¡¿ yes
  NULL:
  end:
```

Note we are making this generator spit out both an html and a latex version. If you want a latex version version of your problem available, you always need to include the 3 lines which have LATEX_ in them. If you only want an html version, omit those lines and make only one call to ragit in the generator.

```
> prob(50);
```

"The allowable absolute error , .05, for the answer 1275 is 0.00% of the answer.\
Do you want to modify the precision? Make it negative to switch to relativ\
e error."

QM:=[.05;1275]

AH:=[0]

Compute: ‘ sum:=(i = 1)^(50)i‘. Answer:

AC:=[15]

SKIP:=

Compute: $\sum_{i=1}^{50} i$. Answer:

◇ **1275**

We can now create as many versions of this problem as we want, simply by executing the line prob(n); for as many values of n that we need.

We can put another parameter in this problem, namely the summand f(i) (currently f(i)=i). So, copy down the problem generator to a new input line and modify it. For example, we could have f(i)=a*i+b, for various values of a and b.

```
> prob:=proc(n,a,b)
  global LATEX:=;
  local i;
  ragit("Compute: ",Sum(a*i+b,i=1..n),".
  Answer:",ac:=(sum(a*i+b,i=1..n)));
  LATEX:=:=yes:
  ragit("Compute: ",Sum(a*i+b,i=1..n),".
  Answer:",ac:=(sum(a*i+b,i=1..n)));
  LATEX:=:=no:
  NULL:
  end:
```

```
> prob(25,3,2);
```

"The allowable absolute error , .05, for the answer 1025 is 0.00% of the answer.\
Do you want to modify the precision? Make it negative to switch to relativ\
e error."

QM:=[.05;1025]

AH:=[0]

Compute: ‘ sum:=(i = 1)^(25)3“ i + 2‘. Answer:

AC:=[15]

SKIP˙

Compute: $\sum_{i=1}^{25} 3\,i + 2$. Answer:

◇ **1025**

Of course, the problems above can be solved by brute force. We could modify this problem to test the students knowledge of summing arithmetic sequences in general, simply by changing the answer format from ac_ to ae_. Then they will need to type in an expression, using Maple syntax. This is close to calculator syntax and you should make a description of it available to your students.

```
> prob:=proc(n,a,b)
  global LATEX˙;
  local i;
  ragit("Compute: ",Sum(a*i+b,i=1..n),".
  Answer:",ae˙(sum(a*i+b,i=1..n)));
  LATEX˙:=yes:
  ragit("Compute: ",Sum(a*i+b,i=1..n),".
  Answer:",ae˙(sum(a*i+b,i=1..n)));
  LATEX˙:=no:
  NULL:
  end:

> prob(25,r,s);
```

QM˙[.05;325*r+25*s]

AH˙[0]

Compute: ‘ sum˙(i = 1)ˆ(25)r“ i + s‘. Answer:

AE˙[15;2;r;s;25;.1;1;.1;1]

SKIP˙

Compute: $\sum_{i=1}^{25} r\,i + s$. Answer:

◇ $325\,r + 25\,s$

As it turns out, it is convenient to have a procedure that we can use in ragit to generate a set of values for our parameters in a problem. This makes it easier to generate problems. What you do is restrict each parameter to a small set of values and have the procedure then randomly select values from those ranges. The procedure is called paramvals. Here is it's help page.

```
> paramvals(Help);
```

paramvals([args],ls1) where args is the sequence of arguments to the problem generator,

and ls1 is a list of lists of parameter names

and range specifications suitable for assignvals (See assignvals(Help=yes) below).

Note: this was written to be used in a problem generator.

Usually, you will call something like
paramvals([args],[[a,–2,3,1″],...])

Then when the generator is called with just a version number, the list which is printed

can be pasted back into the call to get the same inputs in case maintainance is needed.

Help for assignvals

assignvals(exprseq) takes a exprseq of ['X',range] or ['X',d,m..n] or ['X',perm,list]

or ['X',mat,list] or ['X',struct,command],and assigns X a random value chosen thusly:

1. for ['X',range] X is assigned a value in range, where range can be an integer range m..n,

or a set or list of values

2. for ['X',d,m..n] d is a positive integer, m..n is an integer range and X is assigned a random floating point with d significant digits between m/10^d and n/10^d.

3. for ['X',perm,list] X is assigned a random permuation of the elements in the list.

4. for ['X',list,listofvalues] X is assigned the listofvalues

5. for ['X',mat,list] X is assigned a random list of lists using list as the argument to LinearAlgebra[RandomMatrix].

Example: ['c',mat,[2,3,generator=rand(1..4),density=.8] assigns c a

2 by 3 list of lists of 20% zeros, 80% random numbers between 1 and 4.

6. for ['X',struct,command] X is assigned the output of the maple command.

Example: ['b',struct,plot(x^2,x=0..4)] assigns b the plot structure for the graph of x^2.

Note: no variable can depend on a variable assigned in that call to assignvals.

Example:

```
illegal  assignvals(['A',2..5],['B',–"t",b,c,1"],['C',[A,A,A,B]]);

legal    assignvals(['A',2..5],['B',–"t",b,c,1"]):
assignvals(['C',[A,A,A,B]]);


Options:

Help=no  change to yes to get this message.
```

To illustrate, if we want to employ this method to generate numerical values for n, a, and b in example above, we would take the parameters out of the line proc(n,a,b) and make them local. Then, we can invoke getparams to assign values to n, a and b. Note that we have restricted the range considerably in the problem. This tends to make the problems comparable in difficulty. As it stands, there will be 3^3 = 27 different possible versions of this problem. It is customary to have only 5 actual versions of a problem, one for the common version and 4 to choose from in the personal versions. Generally speaking when generating problems in this 'random' manner it is a good idea to look at the problems as you generate them to see if they are suitable. If they are, you can go ahead and past the current inputs into the problem line to fix the problem. This is useful for homework maintenance. Sometimes you need to make a change in a problem after you have posted the homework. If this occurs you would like to be able to repost the problem with the same inputs.

```
> prob:=proc()
  global LATEX˙;
  local i,n,a,b; #all parameter names should go in this line.
  paramvals([args],[[n,[25,30,35]],[a,[2,3,4]],[b,[10,15,20]]]);
  ragit("Compute: ",Sum(a*i+b,i=1..n),".
  Answer:",ac˙(sum(a*i+b,i=1..n)));
  LATEX˙:=yes:
  ragit("Compute: ",Sum(a*i+b,i=1..n),".
  Answer:",ac˙(sum(a*i+b,i=1..n)));
  LATEX˙:=no:
  NULL:
  end:

> prob(1,[30,2,20]);

current inputs are  (1,[30,2,20])

      "The allowable absolute error , .05, for the answer 1530  is 0.00% of the answer.\
       Do you want to modify the precision? Make it negative to switch  to relativ\
      e error."

QM˙[.05;1530]

AH˙[0]

Compute: ‘ sum˙(i = 1)^(30)2“ i + 20‘.  Answer:

AC˙[15]

SKIP˙
```

Compute: $\sum_{i=1}^{30} 2\,i + 20$. Answer:

◇ **1530**

Now often you might have two parameters you want to come from the same range but you want them to have different values. Use the perm assignment. To illustrate, suppose we wanted to choose which of two numbers is larger.

```
> prob:=proc()
  global LATEX˙;
  local i,p; #p is to be a permutation of the numbers in.
  paramvals([args],[[p,perm,[293828,2281883,3030392,2292929,2200229]]]);
  ragit("Which of the numbers ",p[1]," and ",p[2]," is larger?
  Answer:",ac˙(max(p[1],p[2])));
  LATEX˙:=yes:
  ragit("Which of the numbers ",p[1]," and ",p[2]," is larger?
  Answer:",ac˙(max(p[1],p[2])));
  LATEX˙:=no:
  NULL:
  end:
```

```
> prob (1,[[2281883, 2200229, 3030392, 293828, 2292929]]);
```

current inputs are (1,[[2281883, 2200229, 3030392, 293828, 2292929]])

"The allowable absolute error , .05, for the answer 2281883 is 0.00% of the answe\
r.\
Do you want to modify the precision? Make it negative to switch to relativ\
e error."

QM˙[.05;2281883]

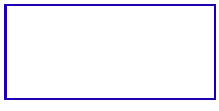
AH˙[0]

Which of the numbers '2281883' and '2200229' is larger? Answer:

AC˙[15]

SKIP˙

Which of the numbers **2281883** and **2200229** is larger? Answer:



◇ **2281883**

3.3.8 Problem generators using paramvals

Here is an example of a problem generator which

```
> prob1 := proc()
  global LATEX˙:
  local a,b;
  paramvals([args],[[a,perm,[1,2,3,4,5]],[b,struct,LinearAlgebra[RandomM
  atrix](5,5)]]);
  ragit("What is the value of the cell in row ",a[1]," and
  column,",a[2]," of ",Mat(b),"? ",ac˙(b[a[1],a[2]])):
  LATEX˙:=yes:
  ragit("What is the value of the cell in row ",a[1]," and
  column,",a[2]," of ",Mat(b),"? ",ac˙(b[a[1],a[2]])):
  LATEX˙:=no: end:
> prob1 (1,[[1, 3, 5, 2, 4],Matrix(5, 5,
  [[78,-2,33,-58,98],[-8,-69,-17,75,5],[-90,17,58,-31,-23],[-81,-87,-21,
  -30,19],[-43,37,15,-50,-93]])]);
```

current inputs are (1,[[1, 3, 5, 2, 4],Matrix(5, 5,
[[78,-2,33,-58,98],[-8,-69,-17,75,5],[-90,17,58,-31,-23],[-81,-87,-21,
-30,19],[-43,37,15,-50,-93]])])

QM˙[.05;33]

AH˙[0]

What is the value of the cell in row ‘1‘ and column,‘3‘ of ‘((78 , -2
, 33 , -58 , 98),(-8 , -69 , -17 , 75 , 5),(-90 , 17 , 58 , -31 ,
-23),(-81 , -87 , -21 , -30 , 19),(-43 , 37 , 15 , -50 , -93))‘?

AC˙[15]

SKIP˙

What is the value of the cell in row **1** and column,**3** of $\begin{pmatrix} \mathbf{78} & \mathbf{-2} & \mathbf{33} & \mathbf{-58} & \mathbf{98} \\ \mathbf{-8} & \mathbf{-69} & \mathbf{-17} & \mathbf{75} & \mathbf{5} \\ \mathbf{-90} & \mathbf{17} & \mathbf{58} & \mathbf{-31} & \mathbf{-23} \\ \mathbf{-81} & \mathbf{-87} & \mathbf{-21} & \mathbf{-30} & \mathbf{19} \\ \mathbf{-43} & \mathbf{37} & \mathbf{15} & \mathbf{-50} & \mathbf{-93} \end{pmatrix}$?

◇ **33**

no

3.3.9 evaluate and make judgement

Here is another problem generator made using ragit and paramvals.

```
> prob := proc()
  global LATEX˙:
  local a,b,c,d,e,i,f,funcs1,dom1;
  paramvals([args],[[a,[seq(i,i=1..6)]],[b,[seq(i,i=1..6)]],[c,[seq(i,i=
  2..8)]],[d,[1,2,3]],[e,[1,2,3]]]);
  funcs1:=[f(x,y)=sqrt(a*x+b*exp(y)+c),f(x,y)=b*ln(x^2+c*y^2+c),f(x,y)=a
  /(b*x^2+exp(c*y))];
  dom1:=["increasing","neither","decreasing"];
  ragit("Evaluate the function ",funcs1[d]," at ",Pnt([x,y]) =
  Pnt(1,1/2),ac˙(subs({x=1,y=1/2},rhs(funcs1[d]))),brak(),
  "Consider the function ",f(1,y)," of ",y,": Decide if it is
  increasing, decreasing or neither over its natural
  domain.",as˙(dom1,Rightone=d) );
  LATEX˙:=yes:
  ragit("Evaluate the function ",funcs1[d]," at ",Pnt([x,y]) =
  Pnt(1,1/2),ac˙(subs({x=1,y=1/2},rhs(funcs1[d]))),brak(),
  "Consider the function ",f(1,y)," of ",y,": Decide if it is
  increasing, decreasing or neither over its natural
  domain.",as˙(dom1,Rightone=d) );
  LATEX˙:=no: NULL: end:

> prob(1,1,3,8,2,1);
```

current inputs are (1,[1,3,8,2,1])

QM˙[.05;3*ln(11);neither]

AH˙[0]

Evaluate the function ‘f(x,y) = 3“ text(ln)(x^(2) + 8“ y^(2) + 8)‘ at ‘(x,y) = (1,(1)/(2))‘

AC˙[15]

AH˙[0]

˙brk˙

Consider the function ‘f(1,y)‘ of ‘y‘: Decide if it is increasing, decreasing or neither over its natural domain.

AS˙[increasing;neither;decreasing]

SKIP˙

Evaluate the function $f\,(x,y) = 3\,\ln(x^2 + 8\,y^2 + 8)$ at $(x,y) = (1,\frac{1}{2})$

Consider the function $f\,(1,y)$ of y: Decide if it is increasing, decreasing or neither over its natural domain.

☐ increasing ☐ neither ☐ decreasing

◇ **3 ln(11)**
◇ **2**

```
> as˙(Help);
```

```
> prob(2);
> prob(3);
> prob(4);
> prob(5);
```

3.3.10 prob12

Here is a trig problem generator using arq_. (the old tbuttons) It always generates the same problem, only the order of the answers changes. We widened the table in html to 40% for readability.

```
> prob := proc()
  global LATEX˙:
  local ans;
  ans:=[3/2*pi,0,pi/3,pi/2,pi,5/4*pi,"All reals","No solution"];
  ragit("Solve for ",theta,", ",theta," in  [0,",2*pi,"):  ",
  2*sin(theta)^2 - sin(theta) = 3,
  arq˙(ans,Numcols=4,Tableopts="width=""40""%""""));
  LATEX˙:=yes:
  ragit("Solve for ",theta,", ",theta," in  [0,",(2*pi),"):  ",
  2*sin(theta)^2 - sin(theta) = 3,
  arq˙(ans,Numcols=4));
  LATEX˙:=no:
  NULL: end:
```

```
> prob();
```

```
QM˙[.05;1]

AH˙[0]

Solve for ‘“theta‘, ‘“theta‘ in  [0,‘2“ “pi‘):  ‘2“
(text(sin)(“theta))^(2) - text(sin)(“theta) = 3‘

lt˙table width="40%" gt˙

lt˙tr gt˙
```

lt˙td gt˙

AR˙[-771;1]

‘(3)/(2)“ “pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-771;1]

‘0‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-771;1]

‘(1)/(3)“ “pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-771;1]

‘(1)/(2)“ “pi‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-771;1]

‘“pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-771;1]

‘(5)/(4)“ “pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-771;1]

All reals

lt˙/td gt˙

lt˙td gt˙

AR˙[-771;1]

No solution

lt˙/td gt˙

lt˙/tr gt˙

lt˙/table gt˙

SKIP˙

Solve for θ, θ in [0,$2\,\pi$): $2\sin(\theta)^2 - \sin(\theta) = 3$

☐ $\frac{3}{2}\,\pi$ ☐ 0 ☐ $\frac{1}{3}\,\pi$ ☐ $\frac{1}{2}\,\pi$

☐ π ☐ $\frac{5}{4}\,\pi$ ☐ All reals ☐ No solution

◇ **1**

Here is the same problem, only with labels stuck in and a permutation of the alternatives so that we can recover a particular permutation for problem maintenance. Also, when using arq_ or acew_ in a homework which requires maintenance, you should make the identifier a parameter so you can use it again on re-execution.

```
> prob12 := proc()
  global LATEX˙:
  local ans,labels,p,i,id;
  ans:=[[3/2*pi],[0],[pi/3],[pi/2],[pi],[5/4*pi],["All reals"],["No
  solution"]];
  paramvals([args],[[p,perm,[seq(i,i=1..nops(ans))]],[id,[seq(rand(1000
  1..19999)(),i=1..1)]]]);
  ragit("Solve for ",theta,", ",theta," in  [0,",2*pi,"):  ",
  2*sin(theta)^2 - sin(theta) = 3,
  arq˙(ans,Numcols=4,Labels=2,Shuffle=p,Tableopts="width=""50"% ",Id=-id));
  LATEX˙:=yes:
  ragit("Solve for ",theta,", ",theta," in  [0,",2*pi," ):  ",
  2*sin(theta)^2 - sin(theta) = 3,
  arq˙(ans,Numcols=4,Labels="",Shuffle=p,Tableopts="width=""50"% "));
  LATEX˙:=no:
  end:

> prob12 (1,[[4, 8, 6, 5, 3, 1, 2, 7],15124]);

current inputs are  (1,[[4, 8, 6, 5, 3, 1, 2, 7],15124])

QM˙[.05;6]

AH˙[0]

Solve for ‘"theta‘, ‘"theta‘ in  [0,‘2" "pi‘):  ‘2"
(text(sin)("theta))^(2) - text(sin)("theta) = 3‘

lt˙table width="50%" gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color="red" gt˙lt˙b gt˙A) lt˙/b gt˙ lt˙/font gt˙

‘(1)/(2)" "pi‘
```

lt˙/td gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙B) lt˙/b gt˙ lt˙/font gt˙

No solution

lt˙/td gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙C) lt˙/b gt˙ lt˙/font gt˙

‘(5)/(4)“ “pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙D) lt˙/b gt˙ lt˙/font gt˙

‘“pi‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙E) lt˙/b gt˙ lt˙/font gt˙

‘(1)/(3)“ “pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙F) lt˙/b gt˙ lt˙/font gt˙

‘(3)/(2)“ “pi‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙G) lt˙/b gt˙ lt˙/font gt˙

‘0‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-15124;1]

lt˙font color=”red” gt˙lt˙b gt˙H) lt˙/b gt˙ lt˙/font gt˙

All reals

lt˙/td gt˙

lt˙/tr gt˙

lt˙/table gt˙

SKIP˙

Solve for θ, θ in [0,$2\,\pi$): $2\sin(\theta)^2 - \sin(\theta) = 3$

☐ $\frac{1}{2}\,\pi$ ☐ No solution ☐ $\frac{5}{4}\,\pi$ ☐ π

☐ $\frac{1}{3}\,\pi$ ☐ $\frac{3}{2}\,\pi$ ☐ 0 ☐ All reals

◇ **6**

no

3.3.11 The multiple choice format as_ : selection box answers

This is a selection box multiple choice answer format, for simple unformatted choices. The format is as_(answers) where answers is a list of alternative answers with the correct answer first. If the first alternative is not correct, put brackets around the correct one.

```
> ragit("Bill can mow a yard in 3 hours. Jim can mow the same yard in 5
  hours.  How many hours does it take Bill and Jim to mow the yard
  together, assuming they do not interfere with each other? Select the
  most nearly correct answer.",as˙([1.875,2.125,4,"None of the
  others"]));
  LATEX˙:=yes:
  ragit("Bill can mow a yard in 3 hours. Jim can mow the same yard in 5
  hours.  How many hours does it take Bill and Jim to mow the yard
  together, assuming they do not interfere with each other? Select the
  most nearly correct answer.", as˙([1.875,2.125,4,"None of the
  others"]));
  LATEX˙:=no:
```

QM˙[.05;1.875]

AH˙[0]

Bill can mow a yard in 3 hours. Jim can mow the same yard in 5 hours. How many hours does it take Bill and Jim to mow the yard together, assuming they do not interfere with each other? Select the most nearly correct answer.

AS˙[1.875;2.125;4;None of the others]

SKIP˙

Bill can mow a yard in 3 hours. Jim can mow the same yard in 5 hours. How many hours does it take Bill and Jim to mow the yard together, assuming they do not interfere with each other? Select the most nearly correct answer.

☐ **1.875** ☐ **2.125** ☐ **4** ☐ None of the others

◇ **1**

By default the first alternative in the list of alternatives is assumed the right answer. You can change this by setting the rightanswers option to the correct answer, or by enclosing the right answer in square brackets. You can also fix the order of the alternatives in the list to be the one given by setting the **randomize=** option to no.

```
> ragit("Bill can mow a yard in 3 hours. Jim can mow the same yard in 5
  hours.  How many hours does it take Bill and Jim to mow the yard
  together, assuming they do not interfere with each other?",brak(),"
  Select the most nearly correct
  answer.",brak(),as˙([2.125,[1.875],4,"None of the
  others"],randomize=no));
  LATEX˙:=yes:
  ragit("Bill can mow a yard in 3 hours. Jim can mow the same yard in 5
  hours.  How many hours does it take Bill and Jim to mow the yard
  together, assuming they do not interfere with each other?",brak(),"
  Select the most nearly correct
  answer.",brak(),as˙([2.125,[1.875],4,"None of the
  others"],randomize=no));
  LATEX˙:=no:
```

QM˙[.05;1.875]

AH˙[0]

Bill can mow a yard in 3 hours. Jim can mow the same yard in 5 hours.
How many hours does it take Bill and Jim to mow the yard together,
assuming they do not interfere with each other?

˙brk˙

Select the most nearly correct answer.

˙brk˙

AS˙[2.125;1.875;4;None of the others]

SKIP˙

Bill can mow a yard in 3 hours. Jim can mow the same yard in 5 hours. How many hours does it take Bill and Jim to mow the yard together, assuming they do not interfere with each other?

Select the most nearly correct answer.

☐ **2.125** ☐ **1.875** ☐ **4** ☐ None of the others

◇ **2**

3.3.12 tr and special symbols

There is a large vocabulary of special math symbols in both latex and ascimath. tr will process many of these as latex or html depending on whether LATEX_ = yes. The vocabulary will be enlarged as time permits.

The help is

```
> tr(Help);
```

```
cat(tr(a1,a2,...) returns a  string formatted either with $ (if
LATEX=yes) or `.  The ai's can be regular expressions, strings, or
the terms

empty,oint,angle,pm,neq,del,cdots,-=,lt,infty,gt,-:,cap,sub,perp,tri,x
x,leq,geq,elt,grad,aleph,cup,cdot,int.

Note: The division  and  equivalent symbols `-:` and `-=` must be
backquoted.
```

Here are some sample problems:

```
> prob:=proc()
  global LATEX˙;
  local a,b,c,ans,A,B;
  paramvals([args],[[a,[{1,2,3},{4,5,7},{1,4,9}]],[b,[{6,10,3},
  {14,5,17},{21,4,9}]],[c,[2,3,4]]]);
  ragit("Given ",A=a,", ",B=b,".",brak(),
  "a)  How many members in ",tr(A, cup, B),"? Answer:",ac˙(nops(a union
  b)),brak(),
  "b)  How many members in ",tr(A, cap, B),"? Answer:",ac˙(nops(a
  intersect b)),brak(),
  "c)  How many members in ",tr(A, xx, B),"? Answer:",ac˙(nops(a)*nops(
  b)));
  LATEX˙:=yes:
  ragit("Given ",A=a,", ",B=b,".",brak(),
  "a)  How many members in ",tr(A, cup, B),"? Answer:",ac˙(nops(a union
  b)),brak(),
  "b)  How many members in ",tr(A, cap, B),"? Answer:",ac˙(nops(a
  intersect b)),brak(),
  "c)  How many members in ",tr(A, xx, B),"? Answer:",ac˙(nops(a)*nops(
  b)));
  LATEX˙:=no:
  NULL:
  end:

> prob(1);
```

current inputs are (1,[–1, 2, 3″,–4, 9, 21″,2])

QM˙[.05;6;0;9]

AH˙[0]

Given ‘A = –1,2,3″‘, ‘B = –4,9,21″‘.

˙brk˙

a) How many members in ‘A uu B‘? Answer:

AC˙[15]

AH˙[0]

˙brk˙

b) How many members in ‘A nn B‘? Answer:

AC˙[15]

AH˙[0]

˙brk˙

c) How many members in ‘A xx B‘? Answer:

AC˙[15]

SKIP˙

Given $\boldsymbol{A = \{1, 2, 3\}}$, $\boldsymbol{B = \{4, 9, 21\}}$.
a) How many members in $\boldsymbol{A \cup B}$? Answer:

b) How many members in $A \cap B$? Answer:

c) How many members in $A \times B$? Answer:

- ◇ **6**
- ◇ **0**
- ◇ **9**

```
> prob:=proc()
  global LATEX˙;
  local a,b,c,ans,A,B;
  paramvals([args],[[a,[{1,2,3,4},{4,5,7,11},{1,4,9,10}]],[b,[
  {6,10,3},{14,5,17},{21,4,9}]],[c,[2,3,4]]]);
  ragit("Given ",A=a,", ",B=b union a,".",brak(),
  "a)  Is ",tr(A, sub, B),"? Answer:",as˙([yes,no]),brak(),
  "b)  Is ",tr(c,elt,A),"?   Answer:",as˙([member(c,a),not
  member(c,a)]),brak(),
  "c)  How many members in ",tr("(",A, xx, B,")",cup,"(",B, xx,A,")"),"?
  Answer:",ac˙(2*nops(a)*nops( b)));
  LATEX˙:=yes:
  ragit("Given ",A=a,", ",B=b,".",brak(),
  "a)  Is ",tr(A, sub, B),"? Answer:",as˙([yes,no]),brak(),
  "b)  Is ",tr(c,elt,A),"?   Answer:",as˙([member(c,a),not
  member(c,a)]),brak(),
  "c)  How many members in ",tr("(",A, xx, B,")",cup,"(",B, xx,A,")"),"?
  Answer:",ac˙(2*nops(a)*nops( b)));
  LATEX˙:=no:
  NULL:
  end:
```

```
> prob(1);
```

```
current inputs are  (1,[–1, 4, 9, 10″,–5, 14, 17″,2])

QM˙[.05;yes;false;24]

AH˙[0]

Given ‘A = –1,4,9,10″‘, ‘B = –1,4,5,9,10,14,17″‘.

˙brk˙

a)  Is ‘A sub B‘? Answer:

AS˙[yes;no]

AH˙[0]
```

'brk'

b) Is '2 in A'? Answer:

AS'[false;true]

AH'[0]

'brk'

c) How many members in '(A xx B) uu (B xx A)'? Answer:

AC'[15]

SKIP'

Given $A = \{1, 4, 9, 10\}$, $B = \{5, 14, 17\}$.
a) Is $A \subset B$? Answer:
☐ ***yes*** ☐ ***no***

b) Is $2 \in A$? Answer:
☐ ***false*** ☐ ***true***

c) How many members in $(A \times B) \cup (B \times A)$? Answer:
☐

- ◇ **1**
- ◇ **1**
- ◇ **24**

```
> prob:=proc()
  global LATEX˙;
  local a,b,c,ans,A,B,x;
  paramvals([args],[[a,[12,14,16]],[b,[3,4,5]],[c,[2,3,4]]]);
  ragit("From the given information about the arithmetic sequence
  ",tr(x[1],",",x[2],",",x[3],cdots,x[n],cdots),", find its ",nˆth,"
  term.",brak(),
  "a)  ",x[1]=a,", ",x[2]=a+b,".   ",tr(x[n]," =
  "),ae˙(a+(n-1)*b),brak(),
  "b)  ",x[4]=a,", ",x[6]=a+b,".   ",tr(x[n]," =
  "),ae˙(a-3/2*b+(n-1)/2*b),brak(),
  "c)  For some fixed positive integer ",A,", ",x[A]=a,",
  ",x[A+1]=a+b,".   ",tr(x[n]," = "),ae˙(a-(A-1)*b+(n-1)*b)):
  LATEX˙:=yes:
  ragit("From the given information about the arithmetic sequence
  ",tr(x[1],",",x[2],",",x[3],cdots,x[n],cdots),", find its ",nˆth,"
  term.",brak(),
  "a)  ",x[1]=a,", ",x[2]=a+b,".   ",tr(x[n]," =
  "),ae˙(a+(n-1)*b),brak(),
  "b)  ",x[4]=a,", ",x[6]=a+b,".   ",tr(x[n]," =
  "),ae˙(a-3/2*b+(n-1)/2*b),brak(),
  "c)  For some fixed positive integer ",A,", ",x[A]=a,",
  ",x[A+1]=a+b,".   ",tr(x[n]," = "),ae˙(a-(A-1)*b+(n-1)*b)):
  LATEX˙:=no:
  NULL:
  end:

> prob(1);

current inputs are  (1,[16,5,4])


QM˙[.05;11+5*n;6+5/2*n;16-5*A+5*n]

AH˙[0]

From the given information about the arithmetic sequence
‘x˙(1),x˙(2),x˙(3) cdots x˙(n) cdots ‘, find its ‘nˆ(th)‘ term.

˙brk˙

a)  ‘x˙(1) = 16‘, ‘x˙(2) = 21‘.  ‘x˙(n) = ‘

AF˙[15;n;6;.1;1]

AH˙[0]

˙brk˙

b)  ‘x˙(4) = 16‘, ‘x˙(6) = 21‘.  ‘x˙(n) = ‘

AF˙[15;n;6;.1;1]

AH˙[0]

˙brk˙

c)  For some fixed positive integer ‘A‘, ‘x˙(A) = 16‘, ‘x˙(A+1) = 21‘.
 ‘x˙(n) = ‘

AE˙[15;2;A;n;25;.1;1;.1;1]

SKIP˙
```

From the given information about the arithmetic sequence $x_1, x_2, x_3 \cdots x_n \cdots$, find its n^{th} term.

a) $x_1 = 16$, $x_2 = 21$. $x_n =$

b) $x_4 = 16$, $x_6 = 21$. $x_n =$

c) For some fixed positive integer A, $x_A = 16$, $x_{A+1} = 21$. $x_n =$

- $11 + 5\,n$
- $6 + \frac{5}{2}\,n$
- $16 - 5\,A + 5\,n$

```
> prob:=proc()
  global LATEX˙;
  local a,b,c;
  paramvals([args],[[a,[seq(10*i,i=1..5)]],[b,[seq(10*i+rand(2..6)(),i=1
  ..5)]],[c,[4,6,8,3,5]]]);
  ragit("Calculate:",tr("(",a,'-:',b,")+(",c,'-:',a,") =
  "),ac˙(a/b+c/a)):
  LATEX˙:=yes:
  ragit("Calculate:",tr("(",a,'-:',b,")+(",c,'-:',a,") =
  "),ac˙(a/b+c/a)):
  LATEX˙:=no:
  NULL:
  end:
```

```
> prob(1);
```

```
current inputs are  (1,[10,55,5])

QM˙[.05;15/22]

AH˙[0]

Calculate:'(10 -: 55)+(5 -: 10) = '

AC˙[15]

SKIP˙
```

Calculate:$(10 \div 55) + (5 \div 10) =$

◇ $\frac{15}{22}$

```
> prob:=proc()
  global LATEX˙;
  local a,b,c,x,y;
  paramvals([args],[[a,[seq(10*i,i=1..5)]],[b,[seq(10*i+rand(2..6)(),i=1
  ..5)]],[c,[4,6,8,3,5]]]);
  ragit("Calculate:",tr("(",a,cdot,b,")+(",c,'-:',x,") =
  "),af˙(a*b+c/x)):
  LATEX˙:=yes:
  ragit("Calculate:",tr("(",a,cdot,b,")+(",c,'-:',x,") =
  "),af˙(a*b+c/x)):
  LATEX˙:=no:
  NULL:
  end:
```

```
> prob(1);
```

current inputs are (1,[10,46,8])

QM˙[.05;460+8/x]

AH˙[0]

Calculate:'(10 * 46)+(8 -: x) = '

AF˙[15;x;6;.1;1]

SKIP˙

Calculate:$(10 \cdot 46) + (8 \div x) =$

◇ $\frac{460\,x+8}{x}$

```
> prob:=proc()
  global LATEX˙;
  local a,b,c,x,y;
  paramvals([args],[[a,[seq(10*i,i=1..5)]],[b,[seq(10*i+rand(2..6)(),i=1
  ..5)]],[c,[4,6,8,3,5]]]);
  ragit("a) Calculate: ",Lim(x^2/b+c,x=a),ac˙(a^2/b+c),brak(),
  "b) Calculate: ",Pdiff(x^3*sin(y*z)+y^4*x+ln(z),x^2,y)," Answer:
  ",ae˙(diff(x^3*sin(y*z)+y^4*x+ln(z),x,x,y))):
  LATEX˙:=yes:
  ragit("a) Calculate: ",Lim((1/b*x^2+c),x=a),ac˙(a^2/b+c),brak(),
  "b) Calculate: ",Pdiff(x^3*sin(y*z)+y^4*x+ln(z),x^2,y)," Answer:
  ",ae˙(diff(x^3*sin(y*z)+y^4*x+ln(z),x,x,y))):
  LATEX˙:=no:
  NULL:
  end:

> prob(1);
```

```
current inputs are  (1,[30,42,3])

QM˙[.05;171/7;6*x*cos(y*z)*z]

AH˙[0]

a) Calculate: 'lim˙(x to 30)" (1)/(42)" x^(2) + 3'

AC˙[15]

AH˙[0]

˙brk˙

b) Calculate: '"frac–del^(3)"– del x^(2) del y"" (x^(3)" text(sin)(y"
z) + y^(4)" x + text(ln)(z))' Answer:

AE˙[15;3;x;y;z;25;.1;1;.1;1;.1;1]

SKIP˙
```

a) Calculate: $\lim_{x \to 30} \frac{1}{42} x^2 + 3$

b) Calculate: $\frac{\partial^3}{\partial x^2 \partial y} (x^3 \sin(y\,z) + y^4\,x + \ln(z))$ Answer:

- $\frac{171}{7}$
- $6\,x\,\cos(y\,z)\,z$

```
> currentdir();
```

"c:\carl\latextools"

After we get the problems that we want, we will export to html and then create homework zipfile using the following zipit line.

```
> zipit("addpicandragit","c:/tmp/addpicandragit");
```

When we export the file to tex, we can use latexit to make a hardcopy mirror of the file, as shown below.

```
> latexit("latextools","c://carl/latextools",Purpose=amspaper);
```

But actually if we want a hardcopy version of the homework problems, we can use makexam as shown below.

```
> makexam("addpicandragit","c:/tmp/addpicandragit",
  Version=[[1],[seq(i,i=1..40)],[seq(i,i=1..40)]],
  Cover=cat(""textbf{""Large Math Test with pictures}""hfill
  Jan 31, 2009 ""hfill
  ""textbf{Name:}""rule[-.01in]{1in}{.01in}""""""" "),

  Spacing=[seq(vf,i=1..40)],
  ExtraPreamble=cat(""raggedright"n""textheight=9.3in" "));;
```

3.3.13 Another Example whs problems

Most often, the problems in a WHS worksheet will be parameterized and a problem generator will have been constructed so that different versions of the problem (with different values for the paramters) can easily be generated. Then when we get ready to generate some problems, we set the global variable LATEX_ to yes (or both if we want to install the homework on WHS also).

```
> LATEX_:=yes;
```

$$LATEX\_ := yes$$

Now the procedure f defined below is the problem generator. Below that we have a call to f.

3.3.14 Polynomial problem

```
> prob := proc()
  global LATEX˙:
  local a,b,c,p,di,qu,re,x,pr,pr1,pr2,pr3,q,r;
  paramvals([args],[[a,[2,3,4]],[b,[5,6,7]],[c,[1,2,3]],[p,perm,[1,2,3,4
  ]]]);
  di:=x-a:qu:=x^2+x-b:re:=c:
  pr := collect(expand(di*qu+re),x);
  pr1 := collect(qu+x,x); pr2:= collect(qu-2*x^2,x);
  ragit("We know by the remainder theorem that ",pr = q(x)*di +
  r(x),"for some polynomials ",q(x)," (the quotient) and ",r(x)," (the
  remainder), where ",r(x)=0," or the degree of ",r(x)," is less than
  the degree of ",di,".",brak(),"Find the quotient and remainder.","The
  quotient , ",tr(q(x)," = "),
  arq˙([qu,pr1,pr2,"none of the others"],Shuffle=p),brak(),
  "The remainder, ",tr(r(x)," = ") ,ar˙([re,re+x,re-2,"none of the
  others"],Numcols=4,Shuffle=p));
  LATEX˙:=yes:
  ragit("We know by the remainder theorem that ",pr = q(x)*di +
  r(x),"for some polynomials ",q(x)," (the quotient) and ",r(x)," (the
  remainder), where ",r(x)=0," or the degree of ",r(x)," is less than
  the degree of ",di,".",brak(),"Find the quotient and
  remainder.",brak(),"The quotient , ",tr(q(x)," = "),
  ar˙([qu,pr1,pr2,"none of the others"],Numcols=4,Shuffle=p),brak(),
  "The remainder, ",tr(r(x)," = ") ,ar˙([re,re+x,re-2,"none of the
  others"],Numcols=4,Shuffle=p));
  LATEX˙:=no:
  end:

> prob(1);

current inputs are  (1,[4,5,2,[2, 1, 4, 3]])


QM˙[.05;2;2]

AH˙[0]

We know by the remainder theorem that ‘x^(3) - 3“ x^(2) - 9“ x + 22 =
q(x)“ (x - 4) + r(x)‘for some polynomials ‘q(x)‘ (the quotient) and
‘r(x)‘ (the remainder), where ‘r(x) = 0‘ or the degree of ‘r(x)‘ is
less than the degree of ‘x - 4‘.

˙brk˙

Find the quotient and remainder.The quotient , ‘q(x) = ‘

lt˙table  gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-6126;1]

‘x^(2) + 2“ x - 5‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙
```

AR˙[-6126;1]

‘x^(2) + x - 5‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-6126;1]

none of the others

lt˙/td gt˙

lt˙/tr gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-6126;1]

AH˙[0]

‘-1“ x^(2) + x - 5‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙/table gt˙

˙brk˙

The remainder, ‘r(x) = ‘

lt˙table gt˙

lt˙tr gt˙

lt˙td gt˙

AR˙[-1249;1]

‘2 + x‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-1249;1]

‘2‘

lt˙/td gt˙

lt˙td gt˙

AR˙[-1249;1]

none of the others

lt˙/td gt˙

lt˙td gt˙

AR˙[-1249;1]

‘0‘

lt˙/td gt˙

lt˙/tr gt˙

lt˙/table gt˙

SKIP˙

We know by the remainder theorem that $x^3 - 3x^2 - 9x + 22 = q(x)\ (x-4) + r(x)$for some polynomials $q(x)$ (the quotient) and $r(x)$ (the remainder), where $r(x) = 0$ or the degree of $r(x)$ is less than the degree of $x - 4$.

Find the quotient and remainder.

The quotient , $q(x) =$

☐ $x^2 + 2x - 5$ ☐ $x^2 + x - 5$ ☐ none of the others ☐ $-1x^2 + x - 5$

The remainder, $r(x) =$

☐ $2 + x$ ☐ 2 ☐ none of the others ☐ 0

◇ 2
◇ 2

no

3.3.15 tangent problem: Putting diagrams in.

This problem has a parameterized diagram which is inserted into the problem. You can define the diagram right in the problem generator, or do it the way we have: build the digram generator first and call it from the problem generator.

```
> solve(a^2=x*(x+b),x);
```

$$-\frac{b}{2} + \frac{\sqrt{b^2 + 4a^2}}{2}, -\frac{b}{2} - \frac{\sqrt{b^2 + 4a^2}}{2}$$

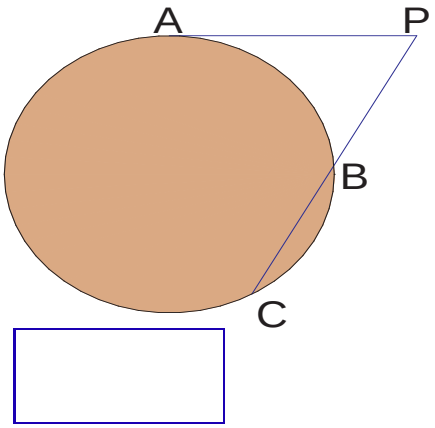
```
> currentdir("c:/carl/latextools");
```

"C:\Program Files\Maple 12"

```
> diag :=
(P,A,B,C,clrs)-¿plots[display]([plottools[disk]([0,0],4,color=clrs[1])
,
plot([[0,4],[6,4],[4*cos(-Pi/3),4*sin(-Pi/3)]],thickness=2,color=clrs[
2]),
PT([0,4.5],A),PT([6,4.5],P),PT([4*cos(-Pi/3)+.5,4*sin(-Pi/3)-.5],C),PT
([4.5,0],B)],axes=none,scaling=constrained):
```

```
> tanprob:=proc()
  global LATEX`:
  local P,A,B,C,PC,PA,BC,PB,a,b,c,clrs;
  paramvals([args],[[a,[10,11,12]],[c,[2,3,4]],[clrs,[[tan,blue],[yellow
  ,tan],[green,red]]]]);
  b:=a+c:
  ragit("A theorem from plane geometry tells us that if from a point
  ",P," outside a circle a tangent ",PA," and a secant ",PC," is drawn,
  then ",PA^2=PB*PC,", where ",B," is the point in the interior of
  ",PC," which is on the circle:  see the diagram below (not drawn to
  scale).  Find ",PC," when ",PA = a," and ",BC = b,".  Give the answer
  to within .05",
  addpic(diag(P,A,B,C,clrs),cat("circtan",convert(args[1],string))),ac`(
  evalf(1/2*b+1/2*sqrt(b^2+4*a^2)))):
  LATEX`:=yes:
  ragit("A theorem from plane geometry tells us that if from a point
  ",P," outside a circle a tangent ",PA," and a secant ",PC," is drawn,
  then ",PA^2=PB*PC,", where ",B," is the point in the interior of
  ",PC," which is on the circle:  see the diagram below (not drawn to
  scale).  Find ",PC," when ",PA = a," and ",BC = b,".",brak(),
  addpic(diag(P,A,B,C,clrs),cat("circtan",convert(args[1],string))),ac`(
  evalf(1/2*b+1/2*sqrt(b^2+4*a^2)))):
  LATEX`:=no:
  end:


> tanprob(1);

current inputs are  (1,[12,3,[tan, blue]])


QM`[.05;21.65097170]

AH`[0]

A theorem from plane geometry tells us that if from a point `P`
outside a circle a tangent `PA` and a secant `PC` is drawn, then
`PA^(2) = PB" PC`, where `B` is the point in the interior of `PC`
which is on the circle:  see the diagram below (not drawn to scale).
Find `PC` when `PA = 12` and `BC = 15`.  Give the answer to within .05

lt`img src="circtan1.gif" alt="MaplePlot" /gt`

AC`[15]

SKIP`
```

A theorem from plane geometry tells us that if from a point P outside a circle a tangent PA and a secant PC is drawn, then $PA^2 = PB\,PC$, where B is the point in the interior of PC which is on the circle: see the diagram below (not drawn to scale). Find PC when $PA = 12$ and $BC = 15$.



◇ **21.65097170**

no

The idea would be to convert an entire homework with say 5 versions of each problem to latex. We can use latexit with the WHSprobs=only option to monitor the look of the problems. But we would use **extractlatex** to generate a homework version in a manner mirroring WHS versions.

3.3.16 Generating homeworks with extractlatex.

Suppose you have processed all of the problems in a WHS homework with latexit. Then you can extract a selection of problems, by setting the appropriate options. These are listed in the help message from extractlatex

```
> extractlatex(Help=yes);
version 2/5/2009 extractlatex("worksheet","path") where

   worksheet is the name of a WHS worksheet

   you have exported to tex and path is the location of the directory
which

   contains the export.

   It creates a file worksheet'la.tex in the same directory which
contains

   all the extracted problems. Process this with latexit.


   Then export the worksheet to latex.  Then execute extractlatex.

   Options:

    Probs=[seq(i,i=1..400)]   set to the list of problems to be
extracted.

    Number=400   set to the maximum number of problems in a homework.
```

```
    Multiplicity=1   set to the multiplicity of the homework.

    Version="-1"  set to any string to get a version.

    Randomize=no  set to yes to change the ordering of the extracted
problems

     or to a specific permutation

    PPP=""  set to 3 to get 3 evenly spaced problems on a page or to a
list

     of the problem numbers you want newpages after or to a list of
latex

     spacing strings.

    Head=""  set to a homework Title string if wanted.

    Name=""  set to the name you want for the extracted tex file.

    Key=no   set to yes if you want a key (and have provided one)
```

Examples of homeworks which have been prepared in the manner described above can be found in source at

https://www.msc.uky.edu/carl/communicating_math/Examples_page.htm

triangles.mws is a standards based geometry homework prepared by Lee Roher, a teacher at West Jessamine High School.

polynomials.mws is a more modest homework on polynomial arithmetic used in Ma 109 College Algebra.

Exercise: Get the source for one or both of these homeworks and extract a 5 question quiz from it.

3.4 Generating versioned exams from WHS homework: an example

To create an exam from a collection of WHS problems.

1. open MCtools/latextools and execute, then close;
2. export the worksheet to latex in a directory.
3. modify the cover sheet bill defined in makewhstest to fit your exam
4. modify the calls to extractlatex and latexit in **makewhstest** to suit your needs.
5. Bring up ghostview and examine the postscript file. When you like it, convert to pdf using pdfwrite in ghostview or better yet adobe distiller.

An example exam can be found at

https://www.msc.uky.edu/carl/communicating_math/Examples_page.htm

The exam here has 10 questions each with five instances.

Here we are defining three versions of the exam: the first item is the version number, the third item is the list of absolute numbers in ascending order of the problems used in the exam, and second item is the list of the order in which the problems occur. Thus in the first version 100, problem 21 occurs 3rd in the exam.

```
> versions := [[[100], [1,2,5,4,3,6,7,8,9,10], [1, 6, 11, 16, 21, 26,
  31, 36, 42,46], "test3"],
  [[110], [10,9,8,7,6,5,4,3,2,1], [2, 7, 12, 17, 22, 27, 32, 37, 43,47],
  "test3"],
  [[120], [3,1,5,7,9,2,4,6,10,8], [3, 8, 13, 18, 23, 28, 33, 38, 44,48],
  "test3"]];
```

$$versions := [$$

$$[[100], [1, 2, 5, 4, 3, 6, 7, 8, 9, 10], [1, 6, 11, 16, 21, 26, 31, 36, 42, 46], \text{“test3”}],$$

$$[[110], [10, 9, 8, 7, 6, 5, 4, 3, 2, 1], [2, 7, 12, 17, 22, 27, 32, 37, 43, 47], \text{“test3”}],$$

$$[[120], [3, 1, 5, 7, 9, 2, 4, 6, 10, 8], [3, 8, 13, 18, 23, 28, 33, 38, 44, 48], \text{“test3”}]]$$

The current state of makewhstest file is the name of the worksheet (without suffix) path is the path to the folder containing the exported latex

ver is the version we want. we will call it below with ver set to versions[1].

```
> makewhstest := proc(file,path,ver,spcing)
  local defaults,opts,help,head,bill,j,v,getperm,abrv;
  defaults:=Help=no,Head = file;
  opts:= subs([ op(select(type,[args],‘=‘)),defaults],
  [Help,Head]);
  help:=opts[1]:
  head:=”Test 3 version ”:
  #needed to get the index permutation for the problems
  getperm := proc(l)
  local p,i,j;
  p:= NULL:
  for i from 1 to nops(l) do
  for j from 1 to nops(l) do
  if l[j]=i then p := p,j; fi;
  od od; [p] end:
  #modify this to suit your task.  Use cover(Help=yes); for additional
  help
  bill:=cover(Title=”Test 3“““Ma 310 002“““Problem Solving for
  Teachers”,
  Date=cat(”May 6 2004, ”,cat(”version ”,convert(ver[1][1],symbol))),
  Instructions=cat(”There are ”,nops(ver[2]),” questions on this exam,
  each worth 11 points.  Please work each problem in the space alloted.
  In case you need extra room, please use the back of the preceeding
  page.  You may use a calculator, but you must show your work in such a
  way that it is clear how you obtain your answer. Unsupported answers
  will receive little or no credit. You may ask about the statement of a
  problem, but please do not ask me about your answer.”),
  Posspts=[seq(11,i=1..nops(ver[2]))],
  Bottom=”““noindent““textbf{Name: }““rule{2in}{.01in}”):
  abrv:=[[”{““tt ‘f ’‘}”,”$f^{““prime}$”],
  [”{““tt ‘g ’‘}”,”$g^{““prime}$”],
  [”{““tt ‘k ’‘}”,”$k^{““prime}$”],
  [”{““tt ‘p ’‘}”,”$p^{““prime}$”],
  [”{““tt ‘f(x)‘}”,”$f(x)$”],
  [”{““tt ‘f ’(x)‘}”,”$f^{““prime}(x)$”],
  [”{““tt ‘h ’‘}”,”$h^{““prime}$”],
  [”““frac ”,”““Frac ”],
  [”““lim ‘”,”““Lim ‘”],
  [”““int ‘”,”““Int ‘”],
  [”““int ““!”,”““Int ”]];
  #modify this to suit your need. Use extractlatex(Help=yes) for
  additional help
  extractlatex(file,path,
  Number=16,
  Key=yes,
  Head=bill,
  PPP=spcing,
  Probs=ver[3],
  Randomize=getperm(ver[2]),
  Name=cat(”ver”,convert(ver[1][1],symbol)));
  v := cat(head,convert(ver[1][1],symbol));
  #modify this to suit your need.  latexit has Help also.
  latexit(cat(”ver”,convert(ver[1][1],symbol),”‘la”),path,
  GenAbbrevs=abrv,
  ExtraPreamble=cat(” ““raggedright“n““topmargin=0.5in“n“
  ““pagestyle{myheadings}“n““markright{”,”}”),
  Dvips=” -r* ”,
  Docstyle=”[titlepage]{article}”) end:
```

Now here is a call to the test generator to make a hardcopy version of the WHS version. If you want more versions, you have to repeat the process of retrieving the WHS version, saving it to a txt file somewhere, then running getnums on it.

```
> makewhstest("test3","c:/carl/test3",versions[1],
  ["""newpage","""vspace{2.5in}",
  """newpage","""vspace{2.5in}",
  """newpage","""vspace{.5in}",
  """newpage","""vspace{.5in}",
  """newpage",""]);

 The test3 eps files are already recolorized.

ver100'la.tex created: 10 problems

index words duplicated

ver100'lawhs.tex created

ver100'lawhs.dvi created.

fixed eps files (removed their borders and recolored if Color=yes is
set)

ver100'lawhs.ps created sucessfully.

finished
```

4 Troubleshooting, bugs, fixes, and improvements

The two html words htmlit and htmlrootwork ought to work right 95 percent of the time, since there are only limited options, and there are no external programs called to process the html. The two latex words latexit and rootwork are a different story. Each one has a lot of options, so you must expect to encounter problems each time you try a new option. Also, each word makes calls to latex and dvips to produce the dvi and postscript files. So you will need to examine the error messages carefully to determine whether the problem occurs in Maple or in those external programs. In either case the problem should be fixed in the source worksheet, if at all possible.

If a problem occurs with executing a bit of Maple code, I can usually discover the source by setting printlevel:=10 and re-executing. You get a peek at the background computations. Setting printlevel to a higher number gives a bigger peek. Set it back to 1 when you are done peeking.

A common error is to fail to execute the MCtools/latextools packages at the start of a session. If Maple does not know the definition of a procedure, such as latexit, then it will just spit your input back at you.

Another useful device is to toggle the Show invisible characters button in the View Menu. Sometimes you will introduce control characters into the worksheet, particularly into the text cells. These show up as empty square boxes when invisible characters are turned on. Get rid of these.

If a problem occurs with Latexing the files, you will see a black command window hang there with a question mark at the bottom. Just above that is a line number and some context (so that you can tell where in the file to look), together with a latex error message. Put an x into the command line and press enter. This will close the command window. Alternatively, if you put an e in the command

line and press enter, your editor may open the file containing the offending line for editing. It may even open it at the line where the offense occurs.

If you can figure out how to change the source worksheet so as to avoid that message (such as a document style is missing), do so. Otherwise, you will need to open the tex file (remember, it has a whs appended) in a text editor and go to that line and take a closer look. If you still can't decipher the problem, it just may be a bug in latextools. Drat. But report it to me (carl@ms.uky.edu) and I will try to fix it.

The latextools package has been used extensivel by me and a few brave souls. It has been used to produce this Manual, the Manual for WHS authors, and many other documents. It has been most consistently used to produce versioned exams from mathclass homework sets, and that has provided the impetus for nearly all of the developement and maintenance I have given it over the years. Please report any bugs you discover in the process of using latextools to me (carl@ms.uky.edu), and I will attempt to fix them. Or, if you can read my Maple code, feel free to fix them yourself, and send me a copy of your fix. The same goes for any suggested improvements you might dream up. I know of plenty, and plan future versions.

References

[1] Helmut Kopka and Patrick W. Daly, *A Guide to LaTex 2e* sec. ed., Addison-Wesley

A Appendix

A.1 manual creation commands

Here are the commands that were used to create the postscript and html versions of this manual. To make a pdf file of the postscript, load it into gsview and convert it to pdfwrite.

Each time the worksheet latextools.mws is exported latextools.tex execute this command.

```
> latexit("latextools","c://carl/latextools");
```

```
index words duplicated

latextoolswhs.tex created

latextoolswhs.dvi created.

fixed eps files (removed their borders and recolored if Color=yes is
set)

latextoolswhs.ps created sucessfully.

finished
```

This command is only executed when you want to extract the tagit generated latex problems in the worksheet.

```
> latexit("latextools","c://carl/latextools",WHSprobs=only,Head="WHS
  Problems from Latextools.");
```

```
1 of the latextools eps files were recolorized.

latextools˙la.tex created: 6 problems

 The latextools eps files are already recolorized.

index words duplicated

latextools˙lawhs.tex created

latextools˙lawhs.dvi created.

latextools˙lawhs.ps created sucessfully.

finished
```

This command creates the manual from the two files latextoolswhs.tex and latextools_la.tex generated. A frontpiece picture was chosen from the diagrams in the manual.

```
> rootwork("latextools˙manual","c://carl/latextools",
  Newroot=yes,
  Files=["latextoolswhs","latextools˙lawhs"],
  Title="Latextools Manual",
  Author="Carl Eberhart, carl“@ms.uky.edu“““Department of
  Mathematics, University of Kentucky",
  Mkindex=yes,
  Frontpiece=[3,4,"shakespere.eps"],Fonts=sanserif);
```

```
rootfile created

latextoolswhs.tex rootified.

finished rotorootering.

latextools˙lawhs.tex rootified.

finished rotorootering.

added the files["latextoolswhs", "latextools˙lawhs"]

latextools˙manual.dvi created

pass 2 to resolve references completed.

postscript file created.
```

This command creates a titlepage for the html version of the manual.

A.2 Predefined Docstyles, Preambles, Abbrevs, etc

These can be found in the latextools module. You can experiment with modifying them there. Or you can use the options provided to modify them.

DOCSTYLE:="[11pt]{article}":

```
DOCSTYLEAMS:="[11pt]{amsart}":

PKGS := {maple2e,color,latexsym,graphicx}:
PKGSAMS := {maple2e,amsthm,amsfonts,color,latexsym,graphicx}:

PSTYLE:= [["\\DefineParaStyle{prob }","\\DefineParaStyle {prob}"]]:
PSTYLEAMS := [["\\DefineParaStyle{prob }","%DefineParaStyle{prob}"],
["\\DefineParaStyle{lem }","%DefineParaStyle{lem}"],
["\\DefineParaStyle{thm }","%DefineParaStyle{thm}"]]:

SSFONTS:= "\\renewenvironment{Text Output}{\\small \\ttfamily\\mdseries}{}
\\renewcommand{ \\ttdefault}{courier}
\\renewcommand{ \\familydefault}{cmss}
\\mathversion{bold}":

FONTS:="":

LENGTHS:="% tweak these to taste.
\\AboveMapleSkip1 pt%- space above an environment
\\BelowMapleSkip 1 pt%- space bow an environment
\\AboveMaplePlot = 1\\AboveMapleSkip
\\BelowMaplePlot= 1\\BelowMapleSkip
% \\MaplePlotHeight- vertical space reserved for a plot
% \\MaplePlotWidth- width reserved for a plot
% \\MaplePlotAngle- angle of rotatation
% \\LeftMapleSkip - the amount of left indentation
% \\MapleFont - The Maple font
\\def\\MapleFont{\ \ttfamily}
% \\MapleSize - The size of the Maple font in mapleinput and
\\def\\MapleSize{\ \scriptsize}
% maplettyout
% \\MapleLatexSize- The size of the Maple fonts in maplelatex
\\def\\MapleLatexSize{\\small}
% \\MapleFirstLine- controls ingoring first line feed
% \\MaplePrompttrue - controls insertion of prompt char
% \\MaplePromptString= {\\raise 1pt \\hbox{\$\\scriptstyle >\$\ \space}}
\\MaplePromptSecondary = {\\space\\space}
% \\MaplePromptSecondary- defines the secondary prompt string
% \\MapleSkip- amount of glue before and after
%displayed text
% \\MapleTab- number of spaces per tab (8)
\\def\\emptyline{\ \vspace{6pt}}
\\setlength{\\oddsidemargin}{0in} \\setlength{\\evensidemargin}{0in}
\\textwidth 6.5in
\\topmargin 0in
\\textheight 8.5in
% You may need to add your own paragraph styles.
\\DefineParaStyle{Bullet Item}
```

```
\\DefineParaStyle{Heading 1}
\\DefineParaStyle{Heading 2}
\\DefineParaStyle{Heading 3}
\\DefineParaStyle{Heading 4}
\\DefineParaStyle{Comment }
\\DefineParaStyle{Problem }
\\DefineParaStyle {Definition}
\\DefineParaStyle{List Item}
\\DefineParaStyle{Dash Item}
\\DefineParaStyle{Title}
\\DefineParaStyle{Author }
\\DefineParaStyle{Warning }
\\DefineParaStyle {Mapleplot}
\\DefineParaStyle{Error}
\\DefineParaStyle {Diagnostic}
\\DefineParaStyle{Maple Output}
\\DefineCharStyle{2D Comment}
\\DefineCharStyle{2D Math}
\\DefineCharStyle{Help Heading}
\\DefineCharStyle {Hyperlink}":

MACROS:= "\\newcommand{ \\Int}{\\displaystyle\ \int}
\\newcommand{\\Lim}[2]{\ \displaystyle\\lim}
\\newcommand{\\Frac}[2]{\ \frac{\\textstyle #1}{\\textstyle #2}}":

PREAMBLE:= cat(LENGTHS,MACROS,"\n\ \begin{document}");

AMSMACROS:=
"%\\swapnumbers
\\newtheorem{thm}{ }[section]
\\newtheorem{lem}[thm] {Lemma}
\\newtheorem{cor}[thm] {Corollary}
\\theoremstyle{definition }
\\newtheorem{defn} {Definition}[section]
\\newtheorem{example} {Example}[section]
\\newtheorem{prob} {Problem}
\\theoremstyle{remark}
\\newtheorem*{rem} {Remark}
\\newtheorem*{note} {Note}":

PREAMBLEAMS:= cat(LENGTHS,MACROS,AMSMACROS,"\n\\begin{document}"):
ABBREVSAMS :=
[["\\_thm","\\begin{thm}"],["\\_mht","\ \end{thm}"],
["\\_lem","\\begin{lem}"],["\\_mel","\ \end{lem}"],
["\\_mf","\\mathfrak "],["\\_mc","\\mathcal "],
["\\_prf","\\begin{proof}"],["\\_frp","\ \end{proof}"],
["\\TEXTsymbol{ \\backslash}","  \\"],["\\$","$"],
```

```
["\\_\\{","_{"],["\\TEXTsymbol{<}"," <"],["\\TEXTsymbol{>}",">"],
["\\}","}"],[" \\{","{"],
["\_wlt","\\prec\\! \\prec"],["\\frac ","\\Frac "],
["\\symbol{94}"," ^"],["\\lim _","\\Lim _"],
["\\symbol{126}"," ~"],["\\int _","\\Int _"],
["\\emptyline"," "]];
```

ABBREVS:= ABBREVSAMS:

B Problems from latextools

1. All triangles are scalene. ☐ $\boldsymbol{True}$ ☐ $\boldsymbol{False}$

2. Check the number which is a multiple of three.

   ☐ $\mathbf{2}$ ☐ $\mathbf{5}$ ☐ $\mathbf{7}$ ☐ $\mathbf{9}$

3. Check each number which is negative.

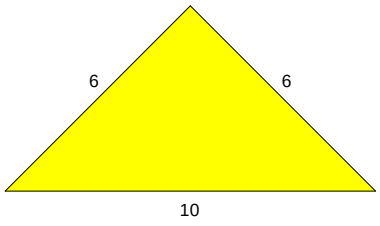
   ☐ $\mathbf{-88}$ ☐ $\mathbf{10}$ ☐ $\mathbf{-3}$ ☐ $\mathbf{9}$

   ☐ $\mathbf{99}$ ☐ $\mathbf{-44}$ ☐ $\mathbf{-62}$ ☐ $\mathbf{88}$

   ☐ $\mathbf{-59}$ ☐ $\mathbf{26}$ ☐ $\mathbf{-83}$ ☐ $\mathbf{95}$

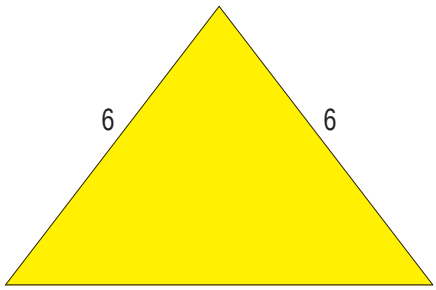
4. Compute: $\sum_{i=1}^{25} i$. Answer: ☐

5. Classify the triangle shown below.



   ☐ isosceles ☐ right ☐ equiangular

6. Classify the triangle shown below.

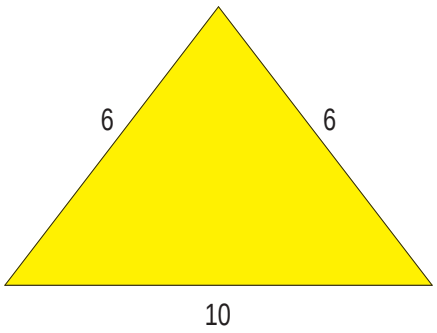


☐ isosceles ☐ right ☐ equiangular

7. Estimate the age of the person in the picture below.

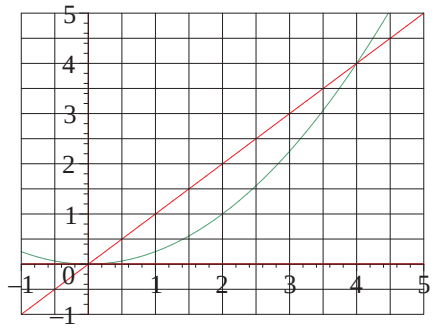
☐ 40-49 ☐ 50-59 ☐ 60-69 ☐ 70-79 ☐ 80-89 ☐ 90-99

8. Find the area of the isosceles triangle shown below. Answer: ☐

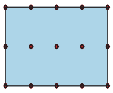


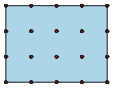
9. Find the area between the graphs of $y = \frac{1}{4}x^2$ and $y = x$, for $0 \leq x \leq 4$ shown below.

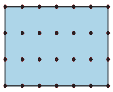
Answer:



10. For each rectangle below, count the number B of boundary nails, the number I of interior nails, and also compute the area of the rectangle, assuming that adjacent horizontal or vertical pairs of nails are 1 unit apart.

$B =$ $I =$ $Area =$ 

$B =$ $I =$ $Area =$ 

$B =$ $I =$ $Area =$ 

11. Compute: $\sum_{i=1}^{50} i$. Answer:

12. Compute: $\sum_{i=1}^{25} 3\,i + 2$. Answer:

13. Compute: $\sum_{i=1}^{25} r\,i + s$. Answer:

14. Compute: $\sum_{i=1}^{30} 2\,i + 20$. Answer:

15. Which of the numbers $\mathbf{2281883}$ and $\mathbf{2200229}$ is larger? Answer: ☐

16. What is the value of the cell in row $\mathbf{1}$ and column,$\mathbf{3}$ of $\begin{pmatrix} \mathbf{78} & \mathbf{-2} & \mathbf{33} & \mathbf{-58} & \mathbf{98} \\ \mathbf{-8} & \mathbf{-69} & \mathbf{-17} & \mathbf{75} & \mathbf{5} \\ \mathbf{-90} & \mathbf{17} & \mathbf{58} & \mathbf{-31} & \mathbf{-23} \\ \mathbf{-81} & \mathbf{-87} & \mathbf{-21} & \mathbf{-30} & \mathbf{19} \\ \mathbf{-43} & \mathbf{37} & \mathbf{15} & \mathbf{-50} & \mathbf{-93} \end{pmatrix}$?

☐

17. Evaluate the function $\boldsymbol{f\,(x,y) = 3\,\ln(x^2 + 8\,y^2 + 8)}$ at $(x,y) = (1, \frac{1}{2})$ ☐

Consider the function $\boldsymbol{f\,(1,y)}$ of $\boldsymbol{y}$: Decide if it is increasing, decreasing or neither over its natural domain. ☐ increasing ☐ neither ☐ decreasing

18. Solve for θ, θ in [0,$2\,\pi$): $\mathbf{2\sin(\theta)^2 - \sin(\theta) = 3}$ ☐ $\frac{3}{2}\,\pi$ ☐ $\mathbf{0}$ ☐ $\frac{1}{3}\,\pi$ ☐ $\frac{1}{2}\,\pi$ ☐ π ☐ $\frac{5}{4}\,\pi$ ☐ All reals ☐ No solution

19. Solve for θ, θ in [0,$2\,\pi$): $\mathbf{2\sin(\theta)^2 - \sin(\theta) = 3}$ ☐ $\frac{1}{2}\,\pi$ ☐ No solution ☐ $\frac{5}{4}\,\pi$ ☐ π ☐ $\frac{1}{3}\,\pi$ ☐ $\frac{3}{2}\,\pi$ ☐ $\mathbf{0}$ ☐ All reals

20. Bill can mow a yard in 3 hours. Jim can mow the same yard in 5 hours. How many hours does it take Bill and Jim to mow the yard together, assuming they do not interfere with each other? Select the most nearly correct answer. ☐ $\mathbf{1.875}$ ☐ $\mathbf{2.125}$ ☐ $\mathbf{4}$ ☐ None of the others

21. Bill can mow a yard in 3 hours. Jim can mow the same yard in 5 hours. How many hours does it take Bill and Jim to mow the yard together, assuming they do not interfere with each other? Select the most nearly correct answer.

☐ $\mathbf{2.125}$ ☐ $\mathbf{1.875}$ ☐ $\mathbf{4}$ ☐ None of the others

22. Given $\boldsymbol{A = \{1, 2, 3\}}$, $\boldsymbol{B = \{4, 9, 21\}}$.

a) How many members in $\boldsymbol{A \cup B}$? Answer: ☐

b) How many members in $\boldsymbol{A \cap B}$? Answer: ☐

c) How many members in $\boldsymbol{A \times B}$? Answer: ☐

23. Given $\boldsymbol{A = \{1, 4, 9, 10\}}$, $\boldsymbol{B = \{5, 14, 17\}}$.

a) Is $\boldsymbol{A \subset B}$? Answer: ☐ $\boldsymbol{yes}$ ☐ $\boldsymbol{no}$

b) Is $\boldsymbol{2 \in A}$? Answer: ☐ $\boldsymbol{false}$ ☐ $\boldsymbol{true}$

c) How many members in $\boldsymbol{(A \times B) \cup (B \times A)}$? Answer: ☐

24. From the given information about the arithmetic sequence $\boldsymbol{x_1, x_2, x_3 \cdots x_n \cdots}$, find its $\boldsymbol{n^{th}}$ term.

a) $\boldsymbol{x_1 = 16}$, $\boldsymbol{x_2 = 21}$. $\boldsymbol{x_n =}$ ☐

b) $\boldsymbol{x_4 = 16}$, $\boldsymbol{x_6 = 21}$. $\boldsymbol{x_n =}$ ☐

c) For some fixed positive integer $\boldsymbol{A}$, $\boldsymbol{x_A = 16}$, $\boldsymbol{x_{A+1} = 21}$. $\boldsymbol{x_n =}$ ☐

25. Calculate:$\boldsymbol{(10 \div 55) + (5 \div 10) =}$ ☐

26. Calculate:$\boldsymbol{(10 \cdot 46) + (8 \div x) =}$ ☐

27. a) Calculate: $\lim_{x \to 30} \frac{1}{42} x^2 + 3$ ☐

b) Calculate: $\frac{\partial^3}{\partial x^2 \partial y} (x^3 \sin(y z) + y^4 x + \ln(z))$ Answer: ☐

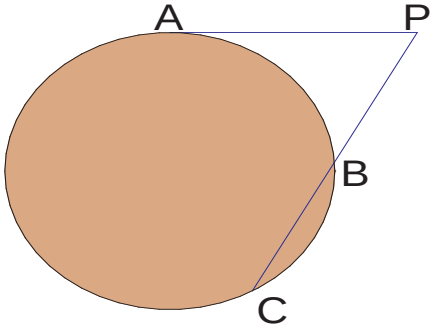
28. We know by the remainder theorem that $x^3 - 3x^2 - 9x + 22 = q(x)(x - 4) + r(x)$for some polynomials $q(x)$ (the quotient) and $r(x)$ (the remainder), where $r(x) = 0$ or the degree of $r(x)$ is less than the degree of $x - 4$.

Find the quotient and remainder.

The quotient , $q(x) =$ ☐ $x^2 + 2x - 5$ ☐ $x^2 + x - 5$ ☐ none of the others ☐ $-1x^2 + x$

The remainder, $r(x) =$ ☐ $2 + x$ ☐ 2 ☐ none of the others ☐ 0

29. A theorem from plane geometry tells us that if from a point P outside a circle a tangent PA and a secant PC is drawn, then $PA^2 = PB\,PC$, where B is the point in the interior of PC which is on the circle: see the diagram below (not drawn to scale). Find PC when $PA = 12$ and $BC = 15$.



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