

**67-352/552 Computing Mathematics with Applications**  
**Spring 2014**  
**Swart Computer Lab 229: MWF 3:00-4:00**

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**Office Hours:** 9:00-10:20 MTWF and by appointment

**Required Texts and Material:**

1. *Getting Started with Maple* by D. Meade et al, 3<sup>rd</sup> Ed., Wiley.
  2. *Maple 17 User Manual* by Maplesoft.
  3. *Maple 17 Programming Guide* by Maplesoft.
- (These guides can be downloaded for free from the Maplesoft Website at:  
[http://www.maplesoft.com/documentation\\_center/](http://www.maplesoft.com/documentation_center/))

**Although UWO has a Maple Site license, students are strongly encouraged to purchase their own copy of the Student Version of Maple 17. I will provide the students enrolled in the class with a purchase code that will allow them to get a copy at a discounted price.**

**Other recommended texts:**

1. *Introduction to Maple* by A. Heck, Springer Verlag, 3<sup>rd</sup> Ed.
2. *Computing with Maple* by F. Wright, CRC Press.
3. *Introduction to MapleV* by Cornil and Testud, Springer Verlag.
4. *Introduction to Modern Mathematical Computing* by Borwein and Skerritt, Springer Verla.

**Topics:** We will be covering basic Maple **syntax**, **data types** and **structures**. More specifically we will learn how to compute with **integers**, **rationals**, **reals**, **floating-point** and other special numbers. We will learn how to define **functions**, assign names to **expressions**. We will cover the basic types of Maple objects such as **sequences**, **lists**, **sets**, **arrays**, **tables** and **strings**. We will learn how to manipulate expressions using the numerous Maple commands available. We will learn how to solve various equations (linear or nonlinear algebraic or differential), how to evaluate and simplify expressions. We will gain facility with using the extensive Maple **graphics package** to graph 2 or 3 dimensional objects in various coordinate systems. We will learn how to effectively navigate the extensive **online help system**. We will gain some familiarity with some of the built-in **Maple packages** such as the **Student**, **Calculus**, **Vector Calculus**, **Differential Equations**, **Statistics**, **Finance**, **Linear Algebra** Packages. Finally we will introduce the Maple **programming language** by defining and working with simple **procedures**. As we are learning Maple our examples will involve various mathematical topics from Algebra, Trigonometry, Geometry, Calculus, Combinatorics, Graph Theory, Probability & Statistics, Linear Algebra, Differential equations. See the attached table of contents to get a more precise idea of the topics the students will cover. **The students are responsible for reading the entirety of the "Getting Started with Maple" book**

and "Maple 17 User Manual" and the first 6 chapters of the " Programming Guide".

**D2L Website:** I will maintain a D2L website for this course. The site will contain the syllabus, homework assignments, solutions to tests, solutions to selected homework problems, Maple 17 worksheets, miscellaneous lecture notes and links to other interesting Maple sites.

**Exams and Grading:**

Your grade will be based on two in class exams, weekly homework and quizzes, and 1 class presentation.

2 Exams:	50% (25% +25%)
Homework	20%
5 Quizzes:	20%
1 Presentation:	10%

**Presentations:** Students in groups of 2 or 3 will be responsible for giving 1 presentation. The purpose of the presentation is to allow the student to showcase their level of understanding, proficiency and expertise in the software Maple. The topics of the presentations will be on Maple itself or the use of Maple in an area of mathematics chosen by the student or suggested by the instructor. In a previous offering of this course, students developed complete lessons in various areas of mathematics such as Algebra, Calculus, Financial Math, Dynamical Systems and Scientific Visualization. Some students even developed their own maplets (A GUI environment) to teach certain topics in undergraduate mathematics. Other students developed and solved mathematical models of various problems in science and engineering. As inspiration for the presentations, the students can refer to the treasury of information that can be found at Maplesoft Inc Website: [www.maplesoft.com](http://www.maplesoft.com).

**Grading:**

$A$  : [90,100],  $A^-$  : [88,90),  $B^+$  : [86,88),  $B$  : [80,86),  $B^-$  : [78,80),  $C^+$  : [76,78),  $C$  : [70,76)  
 $C^-$  : [68,70),  $D^+$  : [66,68),  $D$  : [62,66),  $D^-$  : [60,62),  $F$  : [0,60).

**Course Objectives:** This course involves learning a very user friendly but also very sophisticated and complex scientific software. The student is expected to learn the Maple language to a degree where he/she is able to use the software to solve various mathematical and scientific problems that involve algebra, calculus, dynamical systems, statistics, etc.... In addition, the student is expected to master the rudiments of the Maple programming language to the extent that he/she is able to write his/her own procedures and or maplets to solve complex, realistic problems that arise in Mathematics and its applications to other physical sciences. Finally this course allows the aspiring math or science teacher to acquire a very powerful teaching tool. The creative use and exploitation of maple's computational, symbolic and graphical engine in a high school classroom will definitely enhance math and science education. This course is equivalent

in depth and breadth to a computer science course such as "Object Oriented Programming in C++ with applications" or "Visual Basic Programming" or "Introduction to Java Programming with Applications in Science".

**Graduate Students**: The students enrolled in 552, will be expected to demonstrate a deeper understanding of the course material. More specifically:

1. Homework sets, quizzes and tests will include a number of more challenging theoretical and/or applied problems.
2. Their class presentations are expected to be at a higher level both in terms of the mathematics presented, originality and also the quality of delivery.

### **What is Maple? (From the Introduction to Maple Guide)**

Maple is a Symbolic Computation System or Computer Algebra System. Maple manipulates information in a symbolic or algebraic manner. Other conventional mathematical programs require numerical values for all variables. In contrast, Maple maintains and manipulates the underlying symbols and expressions and expressions, and evaluates numerical expressions.

You can use these symbolic capabilities to obtain exact analytical solutions to many mathematical problems, including integrals, systems of equations, differential equations, and problems in linear algebra. Complementing the symbolic operations are a large set of graphics routines for visualizing complicated mathematical information, numerical algorithms for providing estimates and solving problems where exact solutions do not exist, and a complete and comprehensive programming language for developing custom functions and applications.

Maple's extensive mathematical functionality is most easily accessed through its advanced worksheet-based graphical interface. A worksheet is a flexible document for exploring mathematical ideas and for creating sophisticated technical reports. Users of Maple have found countless ways to utilize the Maple language and worksheets.

Engineers and professionals in industries as diverse as agriculture and aerospace use Maple as a productivity tool, replacing many traditional resources such as reference books, calculators, spreadsheets, and programming languages such as FORTRAN. Researchers in many fields find Maple to be an essential tool for their work. Maple is ideal for formulating, solving, and exploring mathematical models. Its symbolic manipulation facilities greatly extend the range of problems you can solve.

Instructors use Maple to present lectures. Educators in high schools, colleges, and universities have revitalized traditional curricula by introducing problems and exercises that use Maple's interactive mathematics. Students can concentrate on important concepts, rather than tedious algebraic manipulations.

There are two prevalent modes of using Maple. The first mode is as an interactive problem-solving environment. When you work on a problem in a traditional manner, attempting a particular solution method can take hours and many pages of paper. Maple allows you to undertake much larger problems and eliminates your mechanical errors. The interface allows documentation of the steps involved in finding your result. It allows you to easily modify a step or insert a new one in your solution method. With minimal effort you can compute a new result.

The second mode in which you can use Maple is as a system for generating technical documents. You can create interactive structured documents that contain mathematics in which you can change an equation and update the solution automatically. Maple's natural mathematical language allows easy entry of equations. You can also compute and display plots. In addition, you can structure your documents by using modern tools such as styles, outlining, and hyperlinks, creating documents that are not only clear and easy to use, but also easy to maintain. You can also easily translate your work to other formats, such as HTML, RTF, LATEX, and XML.