

# Once Over Lightly

The 3D-XplorMath Consortium

*Let us help one another to see things better*

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This is a short description of the 3D-XplorMath program, giving minimal, once over lightly, instructions on how to use it. It should take you only a few minutes to read, and even if you hate to read user manuals please at least skim these few pages.

## 1 What Is 3D-XplorMath?

3D-XplorMath is a tool for visualizing different types—or “Categories”—of mathematical objects and related processes. The Categories that the current version of 3D-XplorMath knows about are: Plane Curves, Space Curves, Surfaces, Polyhedra, Conformal Maps, Waves, Sound, Fractals, and several Categories of ordinary and partial differential equations. While it started out as a research tool written by mathematicians for mathematicians, it has gradually morphed into a program that we have tried to make of interest to all those who have an interest in mathematics and enjoy exploring and learning about mathematical ideas.

## **2 System Requirements**

The program is designed for Macintosh computers running Mac OS X, up to Mountain Lion (version 10.8), but it should also run on Macs running the older “Classic” OS down to version 9 (even on PowerPC Macs). To use the stereo vision features you will also need a pair of red/green or red/blue stereo glasses.

## **3 Content is Number One**

Unlike programs such as Mathematica, Maple, Matlab, GeomView, Grape, and Oorange, that concentrate on providing programming tools, 3D-XplorMath emphasizes content. There are some two hundred seventy named mathematical objects built into the program, and the visualization of each one has been carefully customized. The user can see these objects and carry out many transformations on them simply by pulling down menus or entering a few numbers. These pre-programmed objects are arranged by Category, and with each category the program also provides facilities for the user to enter the representation of new user defined objects that can then be visualized by methods built into the program. One way to think of 3D-XplorMath is as a modern day replacement for the cases of plaster models of surfaces one finds in many mathematical departments and institutes around the world—but with some differences: it can display many more varieties of mathematical objects than just surfaces, and it is completely interactive. In fact the program is a kind of interactive museum or Mathematical Exploratorium, the various Categories play-

ing the role of the galleries in this museum. As just remarked above, each of these galleries contains many pre-programmed objects that you can choose from and you can in addition also create your own objects by choosing one of the various User Defined objects at the bottom of the Category Main menu. Defining such a new object of your own entails entering a few algebraic formulas, and the sophistication of the objects you can create is limited only by your mathematical imagination.

## **4 Emphasis on Processes**

Another distinctive feature of 3D-XplorMath is its emphasis on the visualization of mathematical processes, not just isolated objects. The concept of a mathematical process used here is somewhat vague, but roughly speaking we mean an animation that shows a related family of mathematical objects, or else an object that arises by some procedure naturally associated to another object. One kind of process that is particularly stressed in 3D-XplorMath is what we call a morph or a morphing animation. Morphs illustrate relationships between similar mathematical objects by showing one transforming gradually into the other in a mathematically meaningful way. When you select a new object from the Main menu and are trying to become familiar with it, it is usually a good idea to check out the default morph of the object by choosing Morph from the Animation menu.

## 5 Flexibility with Ease of Use

A basic design goal of 3D-XplorMath is flexibility. A user can vary many parameters from the Action menu, the Settings menu, the View menu, and various other menus. This will change many things about how objects are displayed by the program. But a second equally important goal is ease of use, and to this end all of the parameters have reasonable default values that are set automatically when a user chooses an object from the Main menu. Usually you will want to first try these default values and then perhaps modify them to suit your needs, as explained in the more detailed documentation.

## 6 Quickstart

Don't let all the pages of the full documentation intimidate you! There is definitely no need to read through them all before you start to use the program. The menu user interface of 3D-XplorMath follows the Mac guidelines pretty faithfully, so using the program should be fairly intuitive for Macintosh users. Note however that the program permits a second, alternative mode for switching between Categories and Objects—called the “Click-Image” mode—and the user can switch back and forth between these modes by selecting “Toggle Menu and Images” in the 3D-XplorMath menu. In Click-Image mode, switching between Categories or selecting an object is accomplished by clicking on any one of a page full of images that represent (and “look like”) the desired Category or Object. While Click-Image mode was designed for use in mathemati-

cal museums having large touch-screens, some users will find it more to their taste for use on desktop computers.

Don't hesitate to just start up the program and play around with various menu selections, to see what happens—usually they do pretty much what their name suggests. Then as you get familiar with the basic operation of the program you can look at the more complete documentation to see how to use some of the program's more sophisticated and less obvious features. This documentation will always be available to you in your default Web browser while the program is running by choosing “Local HTML Documentation” from the bottom of the Documentation menu.

The basic steps in using the program are simple: first choose a category to work with from the Category menu (“Surfaces” is the default category at program startup), and next choose a particular object of that Category from the Main menu (the one with the name of the currently chosen Category). This will produce a default view of the selected object, and you can take it from there—you can modify this default view by using various menus (Action, Settings, View), or you can watch various animations of the object using the Animate menu. In particular, it is usually a good idea to try out the default morph. To learn about mathematically interesting features of a new and unfamiliar object that you have selected from the Main menu, and to get some hints and suggestions concerning how to experiment with it, you should get in the habit of selecting About This Object (ATO) from the Documentation menu.

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