

An Introduction to GeoGebra

Downloading and Installing

Acquiring GeoGebra

GeoGebra is an application for exploring and demonstrating Geometry and Algebra. It is an open source application and is freely available for non-commercial use. There are currently versions available for Windows, Mac OS X, Linux and other java-enabled platforms. To start GeoGebra go to <http://www.geogebra.org> where you will see links to *Webstart* or *Download*. The *Webstart* option downloads the necessary java files to your computer and starts the application immediately. The advantage of choosing this option is that the application is always up to date. The *Download* option downloads files to your computer which you must then install. The big advantage here is that you can continue to work off-line.

Installing

The installation process is very straightforward. After you have downloaded on a Windows machine or on a Mac just double-click the downloaded file. An Install Wizard will guide you through every step. I would strongly advise you to select the *typical* configuration when given a choice. Full instructions are given on the GeoGebra site.

Necessary Files

GeoGebra is a java application. You must have at least version 1.4.2 of Java. If you are using Windows or Linux you can get this from Sun's Java site at

<http://www.java.com/en/download/index.jsp>

On a Mac you can get it from Apple's site at

<http://developer.apple.com/java/>

Running GeoGebra

Launching

Double click the GeoGebra icon on your desktop to start the application. You will be presented with a launch screen as shown in Figure 1. The exact details may depend

on the type of Operating System that you are using but the buttons along the top, the clear space at the left, the drawing pad at the right, the input field, symbols ($^{\circ}$), Greek letters (α) and the Command menu will be common to all systems.

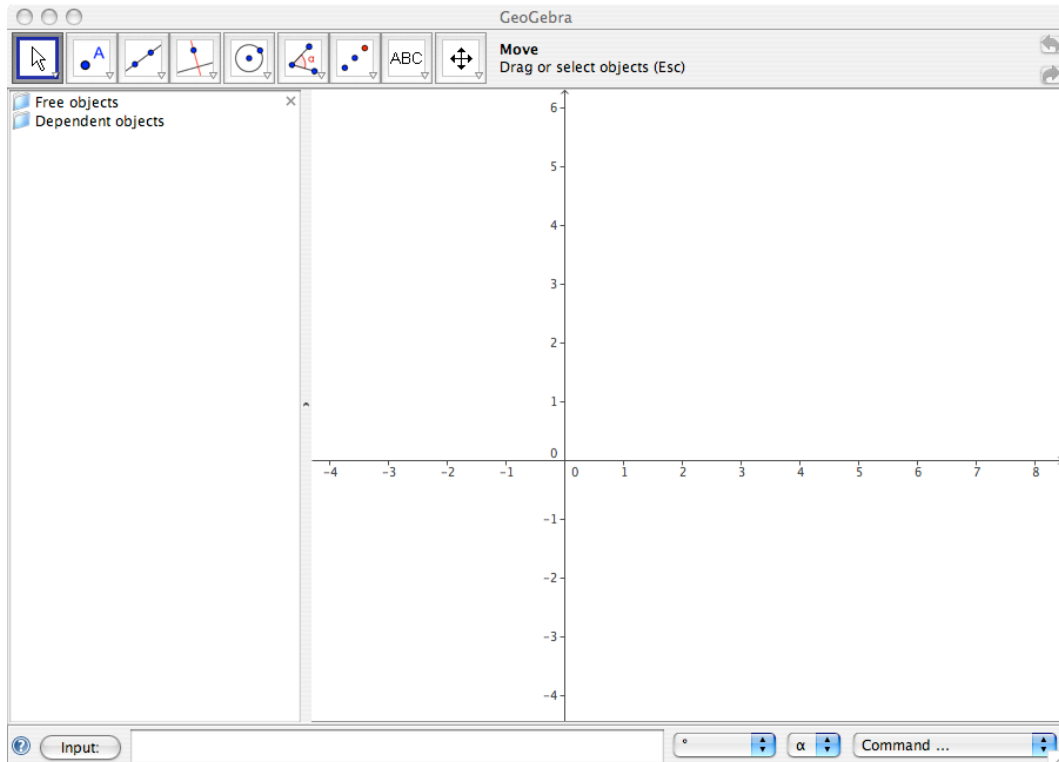


Figure 1: Launch Screen for GeoGebra

The button menu along the top (see Figure 2) contains a submenu of actions. By clicking on the down-pointing arrow at the bottom right corner of any of these buttons the submenu is displayed. The following section explains each of these submenus in more detail.

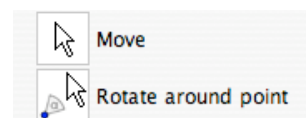


Figure 2: Buttons for GeoGebra

The GeoGebra Toolbar

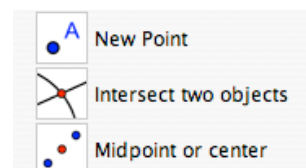
Move

The first button here allows you to select a previously drawn object and move it around the drawing area. The second button in this menu allows you to select a point as a centre of rotation and rotate any object around it.



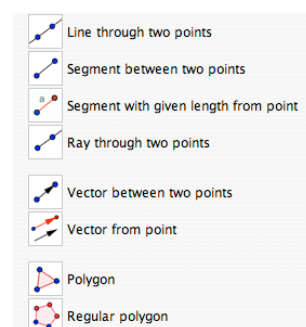
New Point

The three buttons in the next menu allow you to construct different types of points. The first button allows you to put a point anywhere in the drawing area. The second button allows you to select two different curves and find their point of intersection. The third button constructs the midpoint of a line segment.



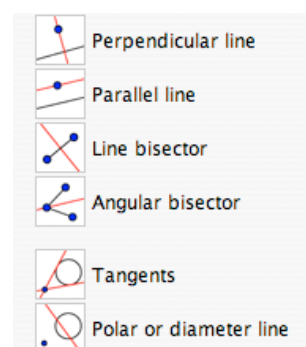
Line through two points

The next tool has eight different buttons. These construct different types of lines and polygons. The first button draws an infinite line through two selected points. The second button draws a line segment between two selected points. The third button draws a line segment of a given length from a specific point. The fourth button draws a ray through two points. The fifth button draws a vector between two points. The sixth button draws a vector from point. The seventh button allows you to draw a vector parallel to a given vector. The eighth button, the polygon tool, allows you to construct a closed polygon. The last button, the regular polygon tool, allows you to draw a regular polygon.



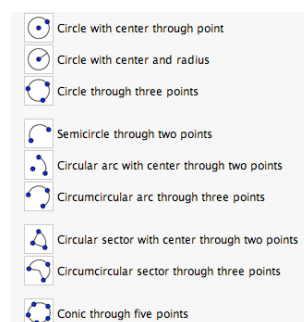
Perpendicular line

There are six buttons under the Perpendicular line tool. These allow you to draw specific types of lines. The first button allows you to draw a line perpendicular to a given line. The second button draws a line parallel to a previously constructed line. The third button, the **Line bisector**, is used to bisect a line segment. The fourth button, **Angular bisector**, bisects a previously constructed angle. The fifth button is **Tangents**. This button can draw tangents to a circle, a conic or the graph of a previously defined function. The sixth button is the **Polar or diameter line** button.



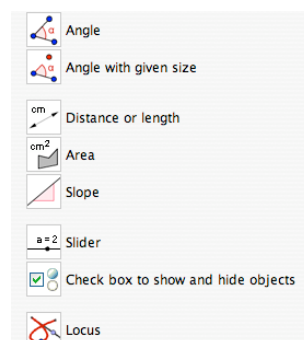
Circle with center through point

The nine buttons in the next menu allow you to construct circles, arcs, sectors and conics. The first button, **Circle with center through point**, works by either clicking on the point you want to be the centre of the circle or clicking on some blank space to create such a point. Release the mouse button. Move the mouse and you will see a circle in the process of construction. When you click the mouse again the circle is finished. The second button in this menu is **Circle with center and radius**. Click on the required centre. A menu appears asking you for the radius. Enter the required value and press the Return key. The desired circle is drawn. The third button is called **Circle through three points**. Select this tool and click on three different points. The circle through these points is constructed. The fourth button, **Semicircle through two points**, does exactly what it says. Click with it in two different places to construct the semicircle with that line segment as diameter. The fifth button here is **Circular arc with center through two points**. Click somewhere with this button to construct the centre of the circle. Click again to create the first point of the arc. If you move the mouse anti-clockwise you will see an arc being constructed. When you click again the arc is completed. The sixth button, **Circumcircular arc through three points**, draws an arc through any three points. To use this button click in three different places. Three points and the arc passing through them are constructed. The seventh and eighth buttons do for sectors what the fifth and sixth buttons do for arcs. The final button, **Conic through five points**, works by allowing you to select 5 different points on the screen. It then calculates and plots the conic section passing through all 5 points.



Angle

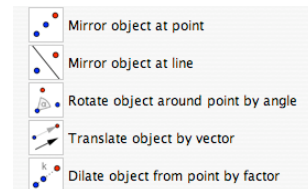
The eight buttons in this menu deal mainly with measurement. The first button, **Angle**, is used to construct and measure the angle between three points. The second button is **Angle with given size**. Select this tool and click to create the vertex of the arm of an angle. The next click gives the point at the angle. At this point a menu appears where you will be asked to select angle size and direction. The third button, **Distance or length**, has several functions. If you use this button and click on two previously constructed points it will give you the distance between them. The function of this button is to measure the length of a line segment. The fourth button is called **Area**. Use this button on a polygon, circle or conic to display the area of the figure. The fifth button, **Slope**, will display the slope of a selected line or line segment. The sixth button, **Slider**, allows us to construct variables which can be changed in Dynamic worksheets. The seventh button, **Check box to show and hide objects**



objects, is another button to control what is displayed on the screen. The final button in this section is called **Locus**. This tool allows you to select a point, B, that depends in some way on a previously created point, A. Using the locus tool on B first and then A will construct the locus of B subject to the given conditions.

Mirror object at point

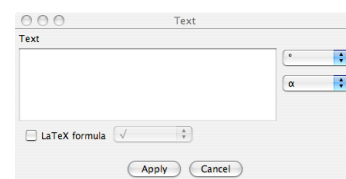
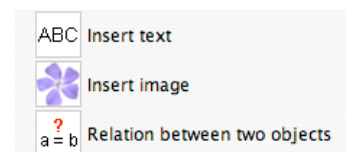
These five buttons are concerned with geometric transformations. The first button, **Mirror object at point**, performs a central symmetry. Select the object that you want to perform the symmetry on, choose the centre of symmetry, the mirror image is then constructed. The button, **Mirror object at line**, works the same way for an axial symmetry. The next button, **Rotate object around point by angle**, needs you to select the object to be rotated and the centre of rotation. A menu will then appear asking for the size of the angle. You can enter a number or the variable name of a previously constructed angle. The default rotation is anti-clockwise. **Translate object by vector** performs the translation of an object while **Dilate object from point by factor** performs a dilation.



Insert text

There are three buttons in this menu. The first, **Insert text** allows you to place text anywhere on the page. When you select this tool and click on the drawing pad a menu like the one on the bottom right appears. The button with the degree symbol helps you to enter mathematical symbols while the button with α on it contains the Greek alphabet. These two allow you to enter most things that you will need. The **Insert image** button allows you to import various types of images into your worksheet.

Once the image is imported it is treated as an ordinary object and you can use various tools on it. In particular, all the geometric transformation tools will work. This allows you to prepare an image in your favourite drawing application and then use it in GeoGebra. The **Relation between two objects** button tells you the relation between a limited set of objects. It will let you find out if two objects are equal, if a point lies on a line or a conic, or if a line is tangent or secant to a conic.



Move drawing pad

Most of the buttons under this tool are self explanatory. The **Move drawing pad** button allows you to drag the whole drawing pad wherever you like. The **Zoom in** button zooms in on portions of your drawing. The **Zoom out** button zooms out on portions of your drawing. The **Show / hide object** is a little more complicated. Use the button to click on the object that you want to show or hide. Nothing appears to happen. Now select any other tool. At this point the change you wanted occurs. If you click on an object with the **Show / hide label** button the label will disappear or appear. The **Copy visual style** button is a very convenient one. Suppose that you have drawn a diagram where you assigned a particular colour to an object. Later you may want to use the

same colour on another object, maybe a descriptive piece of text. If you use this style to click on the first object it will apply that object's style to the object you click on next. **Delete object** deletes any object you click on when using it. Be very careful before you use this tool. It will delete not only the object you select but also any objects that depended on the selected object during their construction. Unless you are sure that you want to delete an object it is usually a much safer option to hide it.

