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What is GeoGebra?

Abstract

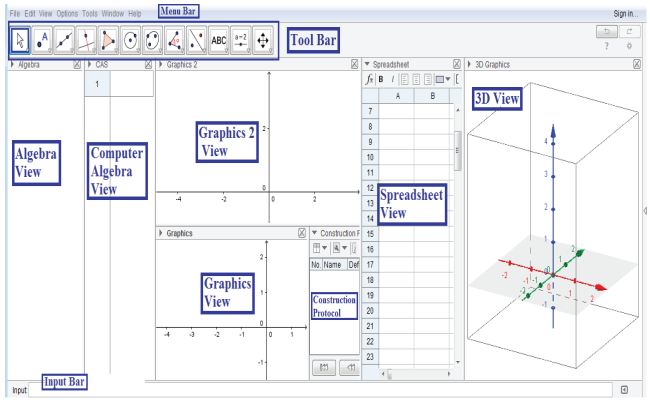
This paper is about the use of technology for explaining Mathematical ideas return in a simple structural manner this addressed these who want to began such explanation through Geogebra.

According to the website www.geogebra.org, "GeoGebra is dynamic Mathematics software for all levels of education that brings together geometry, algebra, spreadsheets, graphing, statistics and calculus in one easy-to-use package. GeoGebra is a rapidly expanding community of millions of users located in just about every country. GeoGebra supports Science, Technology, Engineering and Mathematics (STEM) education and innovations in teaching and learning worldwide."
It lists the Quick Facts as:

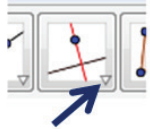
- Geometry, Algebra and Spreadsheet are connected and fully dynamic
- Easy-to-use interface, yet many powerful features
- Authoring tool to create interactive learning materials as web pages
- Available in many languages for millions of users around the world
- Open source software freely available for non-commercial users

GeoGebra 5.0 Interface

GeoGebra provides seven different views of mathematical objects as shown in the figure below. By default, GeoGebra displays Algebra view, Graphics view and Input bar when it is opened. The algebra view and graphics view allow us to display mathematical objects in two different representations: graphically (e.g. points, graphs) and algebraically (e.g. coordinates, equations). These two representations of the same object are linked dynamically and adapt automatically to changes made to any of the representations, no matter how they were initially created.

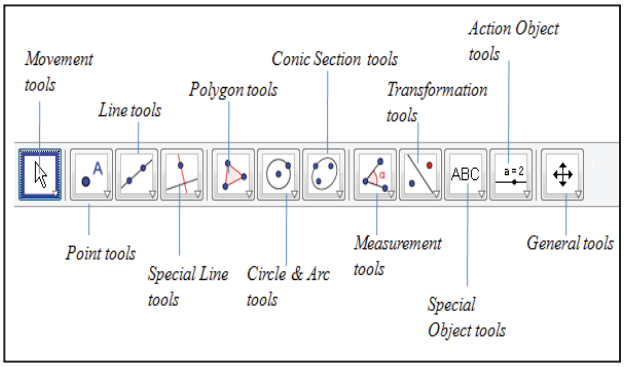


The toolbar at the top of the GeoGebra window consists of a series of toolboxes containing a collection of related tools. These tools can be used to create constructions in the Graphics View. Each View has its own Toolbar and therefore, gives access to a different set of tools. In the tool bar the active tool is highlighted by a blue border, see tool with arrow mark in above diagram. One can make a tool active by clicking on it.



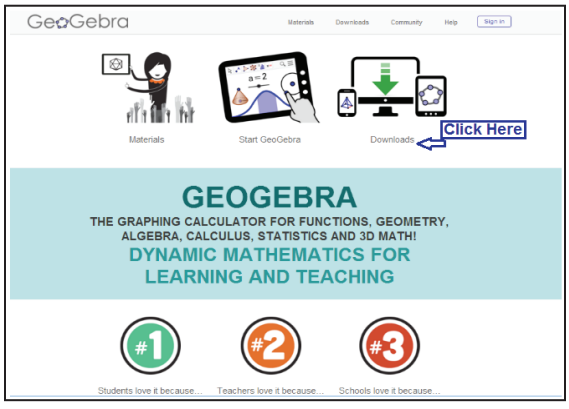
At the bottom right corner of each tool there is an inverted arrow, user can click that arrow to see similar tools in that group (Drop down menu)

The Input Bar at the bottom of the GeoGebra window is used to directly enter coordinates, equations, commands, or functions.



How to get GeoGebra

GeoGebra can be downloaded from the website www.geogebra.org. GeoGebra is available for various operating systems and can be used on tablets and android phones. All the downloads of GeoGebra can be obtained from the download page of the website. The web-start version of GeoGebra is also available on the home page. Otherwise one start an online Geo Gebra session without downloading and installing.



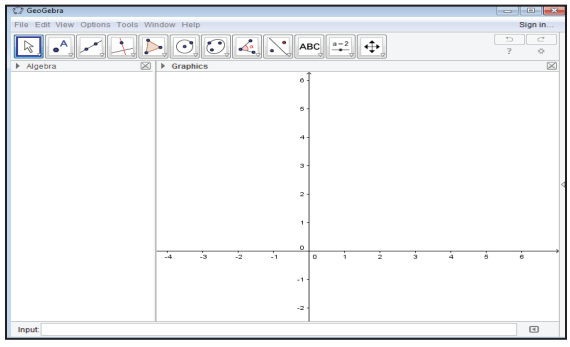
(GeoGebra Home Page)

(GeoGebra Download Page)

GeoGebra also have a large collection of material contributed from teachers around the world. It is maintained at tube.geogebra.org or www.geogebra.org/material . One can easily access these materials and contribute own material for the benefits of the others.

How to use GeoGebra

After the successful installation of GeoGebra on computer one gets the following icon on computer. To start the application double click on the icon then following launch screen with algebra view, graphics view, tool bar, input bar and menu bar will be presented.



Use of some of the tools presented

The Point Tool allows to put a point anywhere in the graphics view.

The Intersect tool allows to select two different curves and find their point of Intersection.

The Midpoint or Center tool is used to construct the midpoint of a line segment or to locate the center of a circle.

The Line tool draws an infinite line through two selected points.

The Segment tool is used to draw a line segment between two selected points.


The Perpendicular Line tool draws a perpendicular line to a given line.


The Parallel Line tool draws a line parallel to a previously constructed line.


The Polygon tool is used to construct a closed polygon on graphics view.

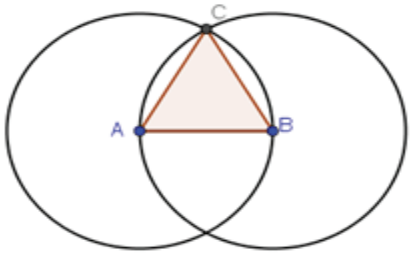

The Circle with Center through Point works by either clicking on the point one want to be the center of the circle or clicking on some blank space to create such a point. Release the mouse button. Move the mouse and you will see a circle in the process of construction. When click the mouse again, the circle is finished.


The Angle tool is used to construct and measure the angle between three points.

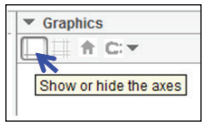
Let us see how to use some of the tools available in the toolbar by taking an activity of construction of an equilateral triangle.

Construction of Equilateral Triangle

In this construction we will use circle tool to demonstrate the work we do using straight edge and compass of Geometry Box. The idea is to use the two centers and the intersections of two circles to form a triangle as shown below.

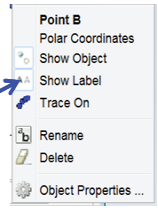


Here we will construct a triangle, display interior angles and length of segments. For the purpose of our construction, we don't need Algebra Window and Coordinate Axes, so we will hide them. To hide the *Algebra window*, click *View* then click *Algebra window*. To hide the *Coordinate axes*, you can click on the 'Show or Hide the Axes' key under the toggle Graphics Style Bar.

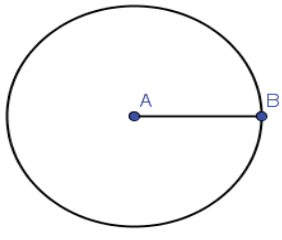


Now click the Segment between two points tool  , and click two distinct points on the graphics view to construct a segment AB.

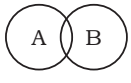
If the new points are not labeled then click on Move Button tool  then right click on each point and select Show Label from the context menu. (The *context menu* is the pop-up menu that appears when right click an object.) A and B should appear as label for two points.



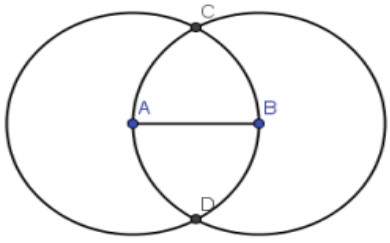
Now we will construct circle with center A and passing through B using the Circle with Centre through point tool  . Select that tool first and click point A and then click point B. After this step, the drawing should look like as shown below:



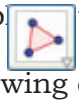
With same tool, now construct another circle with center B passing through A, click first on point B and then on point A.

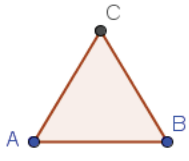


Next we will locate points of intersection of two circles. We will locate these points using Intersect two Objects tool  . Select the tool and click anywhere on the circumference of two circles. You will see that two points will appear at the intersection of two circles. Label them as explained above. After this step, the drawing should look like as shown below:



We need only three non-collinear (not in a line) points to form a triangle. Now hide the two circles, segment AB and point D. For this, right click on each object (circles, segment AB and point D) and select the toggle Show Object option from the context menu. Make sure not to click on points A or B.

Now, with only three points on graphics view , select (click) Polygon tool  and click the points in the following order : Point A, Point B, Point C and then Point A to close the polygon. After this step, the drawing should look like as shown below:

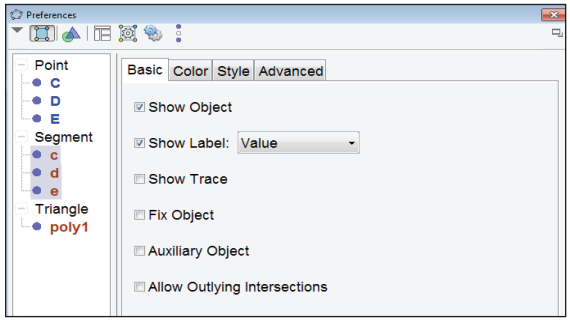


Next, using the Move Tool  try to move the vertices of triangle ABC. What do you notice, you will be able to move vertices A and B but not C. This is because vertex C is a dependent object, it is the intersection of two circles and thus depends on the length of segment AB.

In the next stage, we have to verify that triangle ABC is an equilateral triangle. Note that a triangle is equilateral if all its interior angles are equal (60° each) or all its sides are of same length. Let us verify the interior angles.

Click on Angle Tool  and click anywhere inside the polygon (Triangle ABC). Note the measurement of interior angles.

Now let us verify the lengths of sides of triangle AB , BC and CA. This can be achieved using Property window. Right click on any of the sides, select Object Properties from the context menu. In the Object Properties window, select the Basic tab. Check Show Label box and choose Value from the Show Label drop down list.



Select the other two sides of the triangle under Segment section of Object list located at the left side of Object Properties window and change the Show Label to Value. Close the window when you are done. After this step, the drawing should look like as shown below: (You may have other values of length of sides of triangle.) Now try to drag points A or B , you will see that for every position of points A and B , the interior angles always remains 60° and the length of three sides are always equal. This proves that the above steps always results in construction of an equilateral triangle.