

# GeoGebra Workbook 1

## Drawings Vs. Geometric Constructions

Paddy Johnson and Tim Brophy  
[www.ul.ie/cemtl/](http://www.ul.ie/cemtl/)

---

### Table of Contents

1.	Basic Use of GeoGebra	2
2.	Basic Drawings in GeoGebra	3
3.	Drawing Vs Construction	4
4.	Rectangle Construction	4
5.	Equilateral Triangle Construction	5
6.	The Properties Dialog	7
7.	Challenge: Isosceles Triangle Construction	7



# 1 - Basic Use of GeoGebra

## How to operate GeoGebra's geometry tools

- \* Activate a tool by clicking on the button showing the corresponding icon.
- \* Open a toolbox by clicking on the lower part of a button and select another tool from this toolbox.  
Hint: You don't have to open the toolbox every time you want to select a tool. If the icon of the desired tool is already shown on the button it can be activated directly.  
Hint: Toolboxes contain similar tools or tools that generate the same type of new object.
- \* Check the toolbar help in order to find out which tool is currently activated and how to operate it.

## How to save and open GeoGebra files

### Saving GeoGebra files

- \* Open the File menu and select Save.
- \* Select the folder you wish to save your file in.
- \* Type in a name for your GeoGebra file.
- \* Click Save in order to finish this process.

Hint: A file with the extension '.ggb' is created. This extension identifies GeoGebra files and indicates that they can only be opened with GeoGebra.

Hint: Name your files properly: Avoid using spaces or special symbols in a file name since they can cause unnecessary problems when transferred to other computers. Instead you can use underscores or upper case letters within the file name (e.g. First\_Drawing.ggb).

### Opening GeoGebra files

- \* Open a new GeoGebra window (menu File → New window)
- \* Open a blank GeoGebra interface within the same window (menu File → New)
- \* Open an already existing GeoGebra file (menu File → Open)
  - Navigate through the folder structure in the appearing window
  - Select a GeoGebra file (extension '.ggb') and click Open.

Hint: If you didn't save the existing construction yet GeoGebra will ask you to do so before the blank screen / new file is opened.

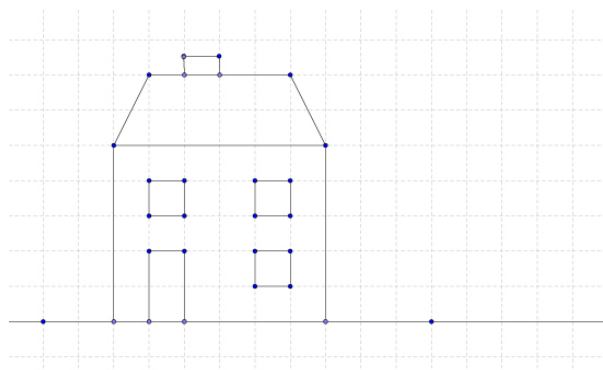


## 2 - Basic Drawings in GeoGebra

We will first see how to create simple drawings like the picture of the house shown below. The reason for doing this is to familiarise ourselves with some of the basic tools in GeoGebra.









### Preparations

- \* Hide the algebra window and coordinate axes (View menu).
- \* Show the coordinate grid (View menu).
- \* We are now ready to begin.



### Drawing a picture with GeoGebra

Use your mouse plus the following selection of tools to draw the picture of the house as displayed above.

	<b>New point</b> <u>Hint:</u> Click on the drawing pad or an object to create a new point	<i>New Tool!</i>
	<b>Move</b> <u>Hint:</u> Click on an object to move it with your mouse	<i>New Tool!</i>
	<b>Line through two points</b> <u>Hint:</u> Click on the drawing pad twice or on two already existing points	<i>New Tool!</i>
	<b>Segment between two points</b> <u>Hint:</u> Click on the drawing pad twice or on two already existing points	<i>New Tool!</i>
	<b>Delete</b> <u>Hint:</u> Click on an object to delete it	<i>New Tool!</i>
	<b>Move drawing pad</b> <u>Hint:</u> Click and drag the drawing pad to change your viewing region	<i>New Tool!</i>
	<b>Zoom In</b> <u>Hint:</u> Click on the drawing pad to zoom in	<i>New Tool!</i>
	<b>Zoom Out</b> <u>Hint:</u> Click on the drawing pad to zoom out	<i>New Tool!</i>



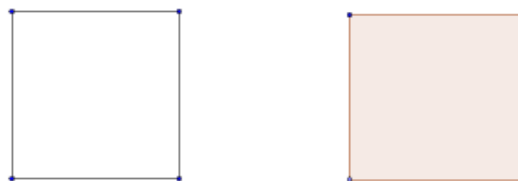
### Things to remember/practice

- \* Don't forget to read the toolbar help if you can't remember or don't know how to use a tool.
- \* Make sure that you are able to select an already existing object on the drawing pad.  
Hint: When the mouse pointer hovers above an object (point, line, etc.), the object highlights and the mouse pointer changes its shape from a cross to an arrow. Clicking selects the corresponding object.
- \* There is an Undo and a Redo button in the top right hand corner of GeoGebra. Mistakes can be corrected quite quickly by pressing the Undo button.

## 3 - Drawing Vs Construction

It is quite easy to draw a rectangle using the tools that we encountered in the previous section. If we were to draw a rectangle in this way then the next thing that we will be asking ourselves is “Do I actually have a rectangle or do I just have something that looks like a rectangle?”

A simple way to test whether or not your rectangle is in fact a “real” rectangle is to use the “drag test”. Open the file [rect-angles.html](#) and use the drag test to see whether both rectangles are in fact “real” rectangles.



## 4 - Rectangle Construction

### Preparations

- \* Open a new GeoGebra file.
- \* Hide the algebra window, input field and coordinate axes (View menu).
- \* Change the labelling setting to “New points only” (menu Options → Labelling).



### Introduction of new tools

	<p><b>Perpendicular line</b></p>	<p><i>New Tool!</i></p>
<p><u>Hint:</u> Click on an existing point and then a line to create a perpendicular line through this point</p>		
	<p><b>Parallel line</b></p>	<p><i>New Tool!</i></p>
<p><u>Hint:</u> Click on an existing point and then a line to create a parallel line through this point</p>		



	<p><b>Intersect two objects</b>  <u>Hint:</u> Click on any two objects to find their intersecting point</p>	<i>New Tool!</i>
	<p><b>Polygon</b>  <u>Hint:</u> Click on the drawing pad or already existing points in order to create the vertices of a polygon. Connect the last and first vertex to close the polygon!</p>	<i>New Tool!</i>
	<p><b>Show/hide object</b>  <u>Hint:</u> Highlight all the objects that are to be hidden, then switch to another tool in order to apply the visibility changes</p>	<i>New Tool!</i>

Hints: Don't forget to read the toolbar help if you don't know how to use a tool. It might be helpful to try out all the new tools before you start the construction.

### Step-by-step Instructions

1.		Create the segment AB that joins the points A and B
2.		Create a perpendicular line to the segment AB passing through the point B
3.		Create a new point (point C) on the perpendicular line passing through point B
4.		Create a parallel line to segment AB passing through the point C
5.		Create a perpendicular line to the segment AB passing through the point A
6.		Calculate the intersecting point (point D) of the parallel line through C and the perpendicular line from Step 5
7.		Create the polygon ABCD by clicking on each of the vertices - remember to click on the first vertex again to close the polygon
8.		Hide all the objects (lines, points etc.) that are not needed at this stage of the construction
9.		Apply the drag test to check if the construction is correct

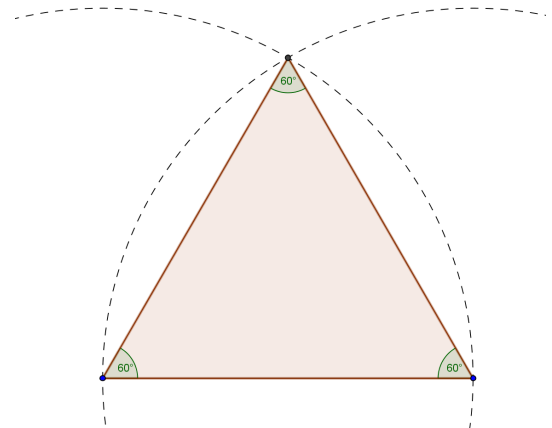


## 5 - Equilateral Triangle Construction

The next thing that we shall demonstrate is how to construct an equilateral triangle. An equilateral triangle is a triangle in which all three sides have equal lengths. In traditional or ‘Euclidean’ geometry, equilateral triangles are also equiangular; that is, all three internal angles are also equal to each other and are each  $60^\circ$ .

### Preparations

- \* Open a new GeoGebra file.
- \* Hide the algebra window, input field and coordinate axes (View menu).
- \* Change the labelling setting to “New points only” (menu Options → Labelling).



### Introduction of new tools






	<b>Circle with centre through point</b>	<i>New Tool!</i>
<p><u>Hint:</u> Your first click creates the centre of the circle, your second click determines the radius of the circle</p>		
	<b>Angle</b>	<i>New Tool!</i>
<p><u>Hint:</u> Click on three points to determine the angle between them. GeoGebra always creates angles with mathematically positive orientation (measured counter-clockwise)</p>		

Hints: Don't forget to read the toolbar help if you don't know how to use a tool. It might be helpful to try out all the new tools before you start the construction.

### Step-by-step Instructions

1.		Create the segment AB that joins the points A and B
2.		Create a circle with center A which passes through B
3.		Create a circle with center B which passes through A



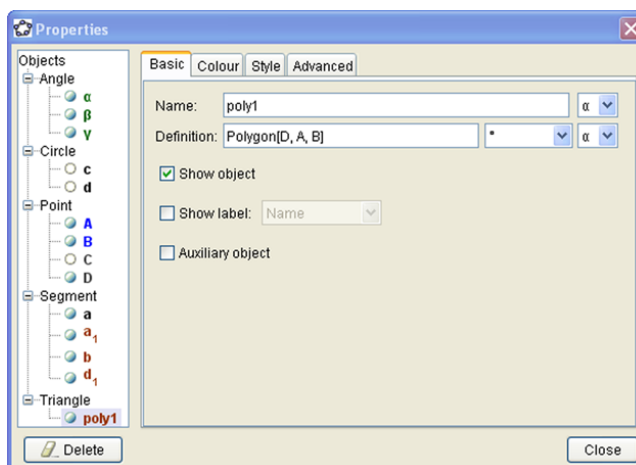
4.		Find the intersection point of both circles (point C)
5.		Create the polygon ABC - remember to click on the first vertex again to close the polygon
6.		Hide the circles as they are not essential
7.		Calculate the interior angles of the polygon ABC
8.		Apply the drag test to check if the construction is correct

## 6 - The Properties Dialog

### How to access the Properties dialog

You can access the properties menu on a Microsoft windows machine using any of the following approaches:

- \* Right click on any object or
- \* Select properties from the Edit menu  
or
- \* Double click on any object when in Move mode



Once you can access the Properties dialog the following is a list of things to try out.

- \* Select different objects from the list on the left hand side and explore the available properties tabs for different types of objects.
- \* Select several objects in order to change a certain property for all of them at the same time.  
Hint: Hold down the Ctrl-key and select all the desired objects.
- \* Select all objects of one type by clicking on the corresponding group heading.
- \* Try out different label styles to display the name, name & value or your selected object.
- \* Change the properties of certain objects (e.g. colour, style, etc.)









## 7 - Challenge: Isosceles Triangle Construction

Construct an isosceles triangle (two sides of equal length and two angles of equal measure) whose length of the base and height can be modified by dragging corresponding vertices with the mouse.

Hints: Don't forget to read the toolbar help if you don't know how to use a tool. Try out all the new tools before you start the construction.

To complete this challenge you will need to use the following tools.

	<b>Segment between two points</b> <u>Hint</u> : Click on the drawing pad twice or on two already existing points	
	<b>Midpoint or centre</b> <u>Hint</u> : Click on an object (line, arc, etc.) to calculate its midpoint	<i>New Tool!</i>
	<b>Perpendicular line</b> <u>Hint</u> : Click on an existing point and then a line to create a perpendicular line through this point	
	<b>New point</b> <u>Hint</u> : Click on the drawing pad or an object to create a new point	
	<b>Polygon</b> <u>Hint</u> : Click on the drawing pad or already existing points in order to create the vertices of a polygon. Connect the last and first vertex to close the polygon!	
	<b>Move</b> <u>Hint</u> : Click on an object to move it with your mouse	

### Things to remember

- \* Don't forget to read the toolbar help if you don't know how to use a tool.
- \* Try out all new tools before you start the construction.

