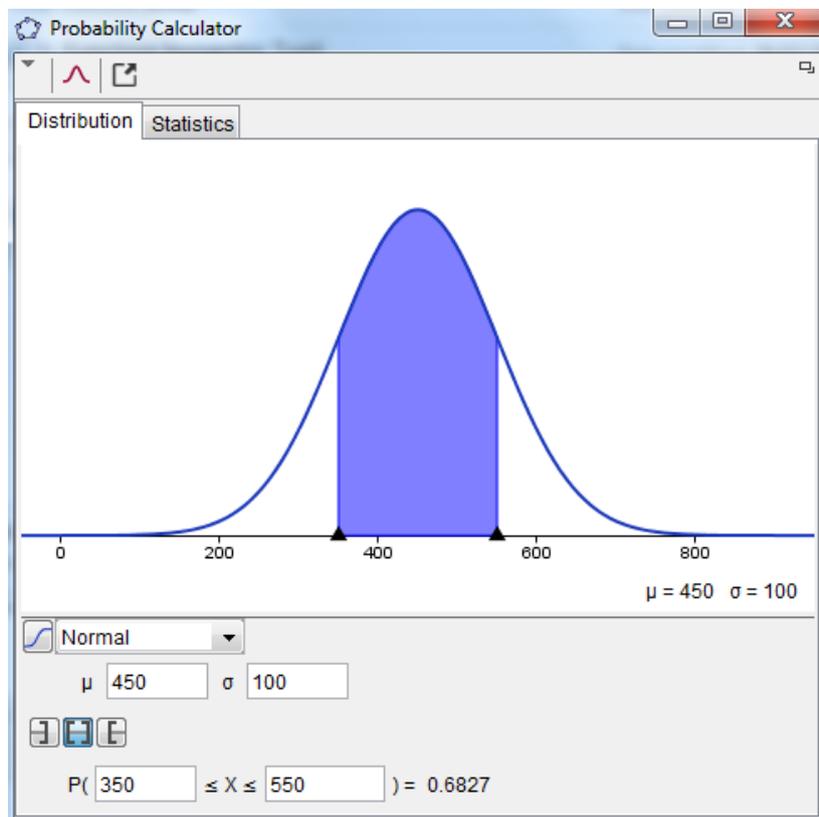


# GeoGebra Statistics and Probability

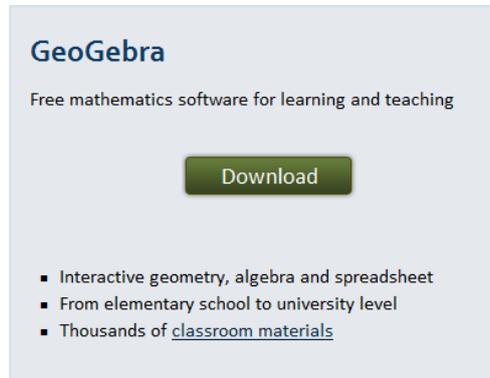


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## Activity 1: Introduction GeoGebra Statistics and Probability

To download GeoGebra go to [www.geogebra.org](http://www.geogebra.org) and the following window will appear.



Click Download and the following window will appear.

### WebStart

Install and start GeoGebra on your computer. You will get a desktop icon to use our software offline too.



### Applet Start

Open a fully functional GeoGebra applet in your web browser. Nothing will be installed on your computer.

[GeoGebra Web Application \(HTML5\)](#)



### E-Mail List

Type your e-mail address and press Enter to stay informed about GeoGebra.

### Offline Installers

You can also download an [offline installer](#) to give GeoGebra to students who don't have an Internet connection at home.

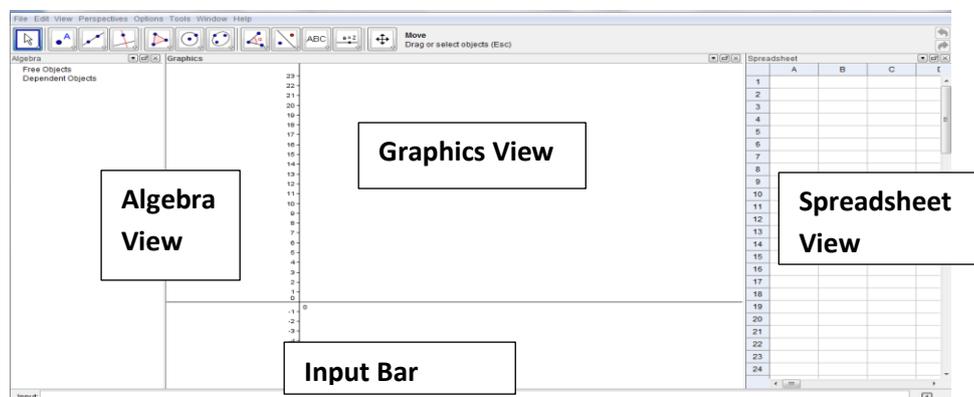
### GeoGebra License

You are free to copy, distribute and transmit GeoGebra for non-commercial purposes. Please see the [GeoGebra license](#) for details.

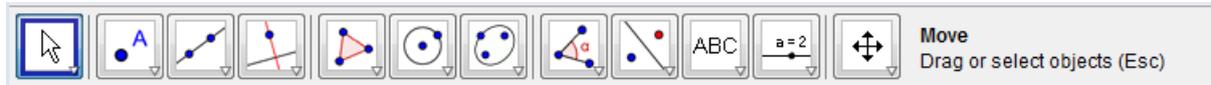
Click Webstart and follow the indicated steps to download GeoGebra.

Note in order to run GeoGebra it is essential that an up to date version of Java is available on your machine. This package is available at free at <http://www.java.com/en/>.

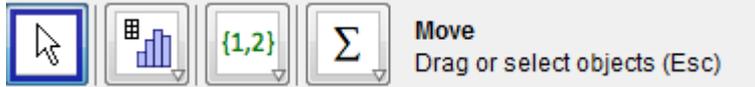
In GeoGebra there are three views, Algebra, Graphics and Spreadsheet. The bar containing File, Edit etc. is known as the Menu bar and depending if you have the cursor clicked in the Graphics View or the Spreadsheet View you get a different toolbar.



**Note** when you click on the Graphics View the following toolbar appears:



and when you click on the Spreadsheet View the following toolbar appears:



**Note if the Spreadsheet View is not visible go to View and click Spreadsheet and if the Graphics View is not visible go to View and choose Graphics.**

**Note:** When drawing a function use  $f(x) =$  rather than  $y =$ , because when  $y =$  is used some of the commands from the Input Bar do not work for the function.

**Data can be copied and pasted from Excel and other Spreadsheet formats to the GeoGebra Spreadsheet View for example CensusatSchool data**

## Activity 2: To calculate the Sum, Mean, Count, Maximum and Minimum of a data set

1. Insert the data in the Spreadsheet View as follows:

Spreadsheet	
	A
1	23
2	12
3	45
4	32
5	2
6	15
7	45

2. Highlight the data.

3. In the toolbar  click on the arrow beside  and select the appropriate action in the drop down menu.

4. Depending on your choice of action the Sum, Mean, Count, Maximum or Minimum will appear in the next cell of the Spreadsheet View.

5. If you require the answer to appear on a different cell, click on the cell you require the

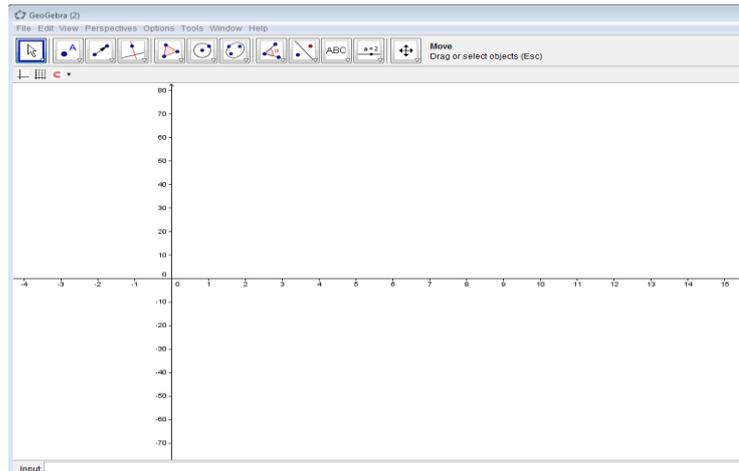
answer to appear on, click on , select the appropriate action and highlight the data you wish to use.

### Activity 3: To show the impact on the Mean of changing some of the data

1. Click on one of the data cells that were used to calculate the mean and change the data in this cell and see the cell that contains the value for the mean change accordingly.

### Activity 4: To draw a Stem and Leaf plot when the numbers are between 0 and 99

1. Click on the Input Bar at the bottom of the GeoGebra screen.



2. In the Input Bar type StemAndLeaf followed by the list of numbers that you wish to be represented in the stem and leaf plot in square brackets and press Enter on the keyboard.

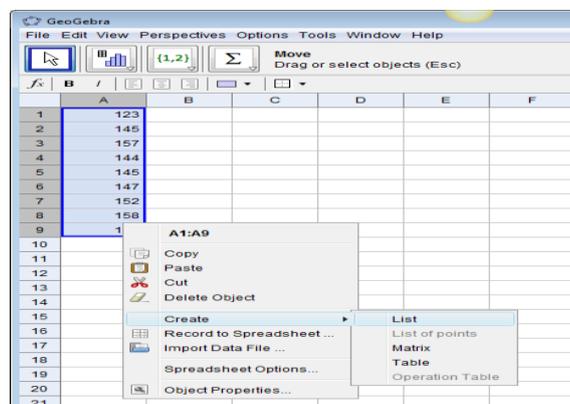
Input: `StemAndLeaf[ 1,2,12,6,23,21,31,25,23,35,19,3 ]`

```

0 | 1 2 3 6
1 | 2 9
2 | 1 3 3 5
3 | 1 5
  
```

Key : 3|1 means 31

3. Alternatively type your data into the Spreadsheet View, highlight the data, right click, choose Create and List.



4. In the Input Bar type StemAndLeaf followed by the name that was given to your list in [] brackets and you can find this name in the Algebra View section of the screen. The list created for the stem and leaf below was called list1. Press Enter.

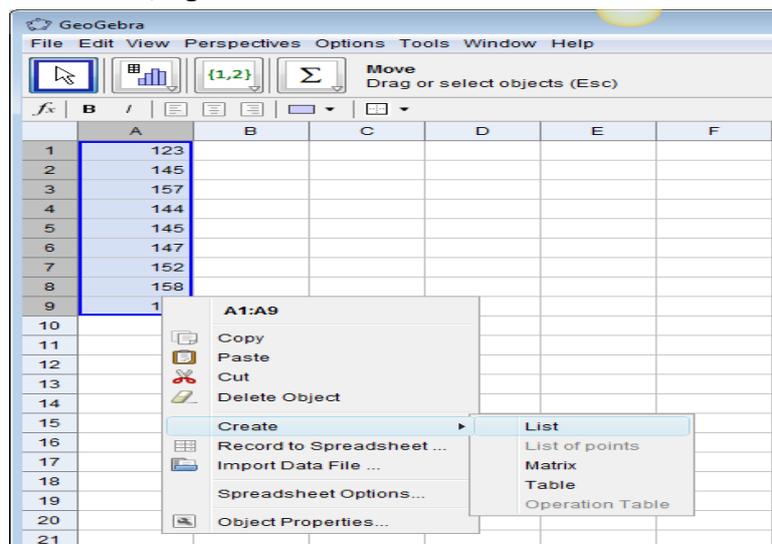
Input `StemAndLeaf[ list1]`

### Activity 5: To draw a Stem and Leaf plot when the numbers are between 100 and 999

1. In the Spreadsheet View, type the numbers as follows.

	A
1	135
2	145
3	157
4	144
5	145
6	147
7	152
8	158
9	160

2. Highlight the numbers, right click and choose List.



3. In the Input Bar type `Input StemAndLeaf[list1,-1]`. This means the default stem unit is divided by 10. Make sure your list of numbers was called list1 in your Algebra View and if not use the name it was given in your Algebra View.

```

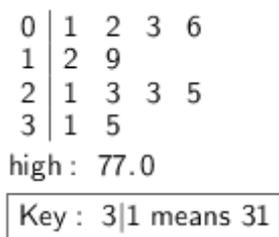
13 | 5
14 | 4 5 5 7
15 | 2 7 8
16 | 0

```

Key : 3|1 means 31

**Note 1:**

Outliers are not included in the stem and leaf plot, but listed separately.  
 For example if 77 is added to the above list we get:



In GeoGebra an outlier is defined as anything outside the interval  $[Q1 - 1.5(Q3 - Q1), Q3 + 1.5(Q3 - Q1)]$ , where Q1 is the first Quartile and Q3 is the third Quartile.

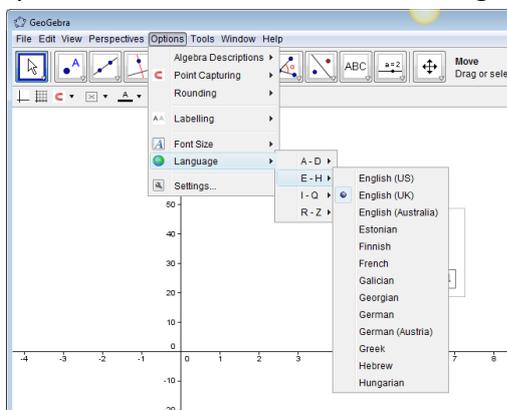
**Note 2:**

If you wish the default stem unit to be multiplied by 10, you insert 1 instead -1

**Input:** `StemAndLeaf[list1,-1]` in this command in the Input Bar.

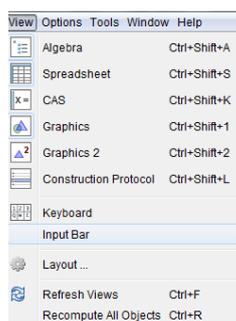
**Note 3:**

StemAndLeaf is replaced by StemPlot, if the language of the GeoGebra package is set to English (US). To change the language of the GeoGebra package, go to Options, Language and choose the language of your choice. These notes are for English UK.



**Note 4:**

If the Input bar is not visible go to View and click Input Bar.

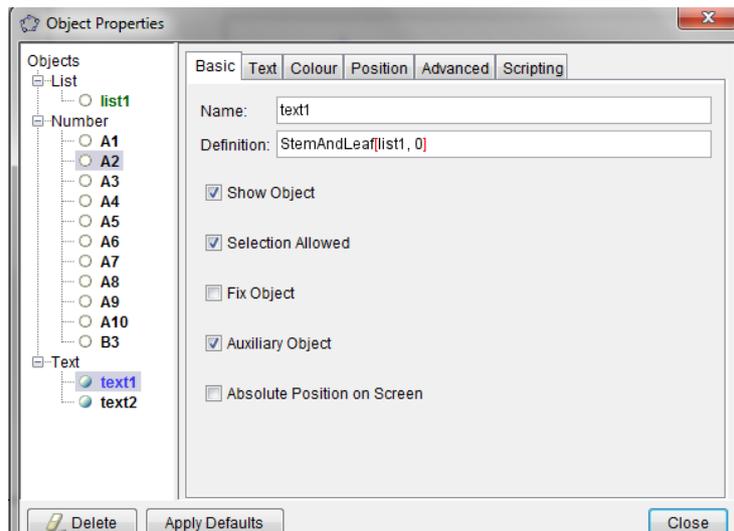


## Activity 6: To change the data displayed in a Stem and Leaf

1. Click on the cell in the Spreadsheet View whose data you wish to change, delete the old number and type in the new number and the stem and leaf will change accordingly. Note that you cannot change the number of data items without redrawing the stem and leaf.

## Activity 7: How to change text colour and size of a Stem and Leaf

1. Right click the stem and leaf and choose Object Properties. A new dialogue box appears.



2. Click on the Text tab to change the text and the Colour tab to change the colour.
3. Click Close.

Note the appearance of the stem and leaf can also be changed by selecting the stem and leaf, clicking on the arrow beside the word Graphics at the top of the Graphics View.



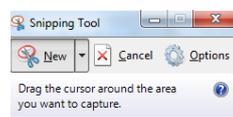
A new styling bar appears.



Use the tools on this styling bar to change the appearance of the stem and leaf.

## Activity 8: How to transfer a Stem and Leaf drawn using GeoGebra to Word or PowerPoint

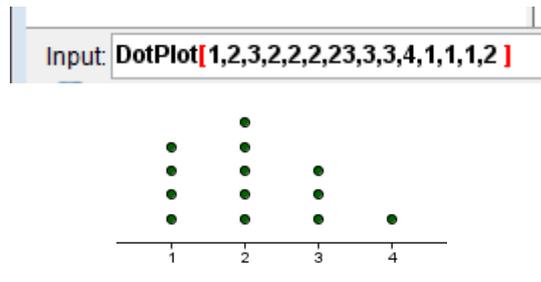
1. Locate the Snipping Tool program on your computer, normally found in Accessories. Open this program. Note: Snipping Tool is available in Windows 7.
2. A new dialogue box appears click New.



- Using the plus symbol outline the area of the screen that you require to be in your picture. The stem and leaf plot in this case.
- Open PowerPoint or Word and click paste.

### Activity 9: To draw a Line Plot

- In the Input bar type DotPlot followed by the list of numbers in square brackets and press Enter on the keyboard.



- Alternatively one can insert the data in the Spreadsheet View , create a list and in

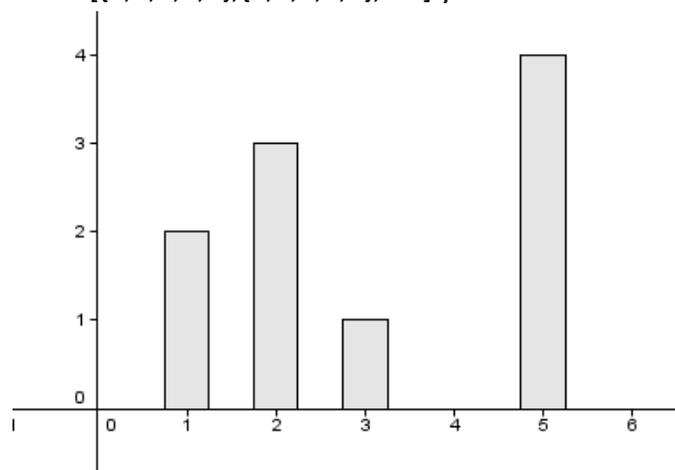
the Input bar type . This assumes your list was called list1.

**Note:** If the points appear as a line or appear too close to each other go to the Move

Graphics View tool , click on the  $x$  axis and drag to the left to reduce gaps between the numbers and drag to the right to increase the gaps between the numbers.

### Activity 10: How to draw a Bar Chart

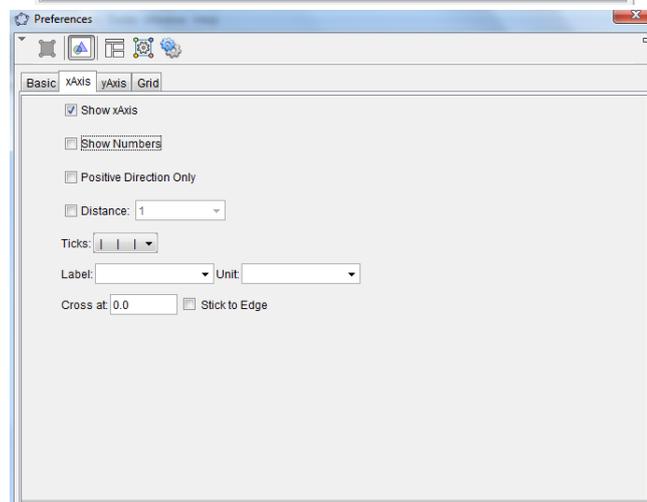
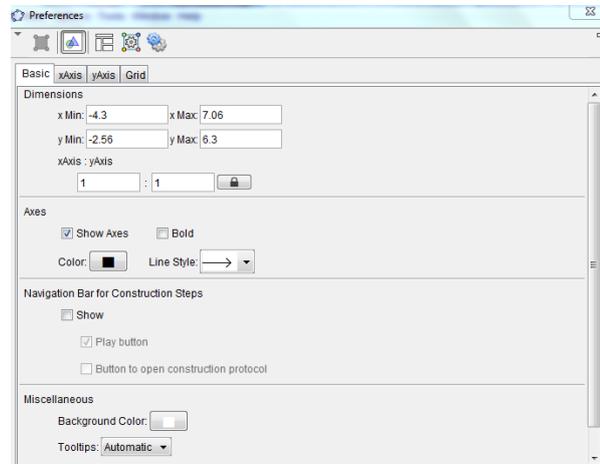
- In the Input bar type BarChart[ <List of Data>, <List of Frequencies>, <Width of Bars> ] for example BarChart[{1,2,3,4,5},{2,3,1,0,4},0.5] yields the following Bar chart.



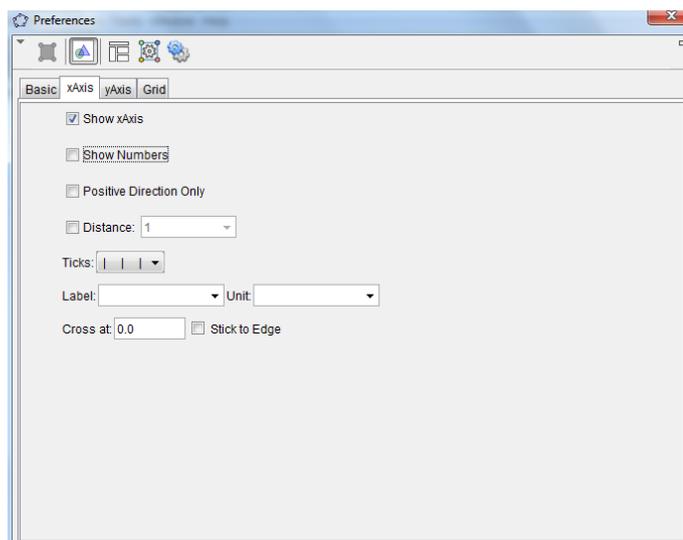
Note 1: always make the Width of the bars less than the interval between the bars.

Note 2: The list of data and the list of frequencies can both be inserted as lists from the Spreadsheet View.

- If one wishes to remove the numbers from the  $x$  axis, right click on the Graphics View and go to Graphics. Open the Graphics tab and the  $x$  axis tab. A new dialogue box appears.



- Uncheck Show Numbers and click Close.



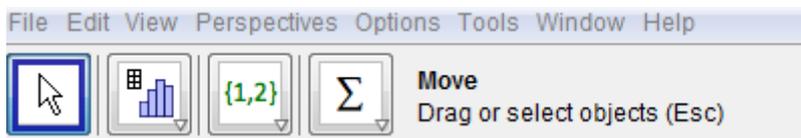
Exercise: Draw a line plot and a bar chart using the same data.

## Activity 11: One Variable Analysis Tool

1. Input your data in the Spreadsheet View in consecutive rows of a column as follows:

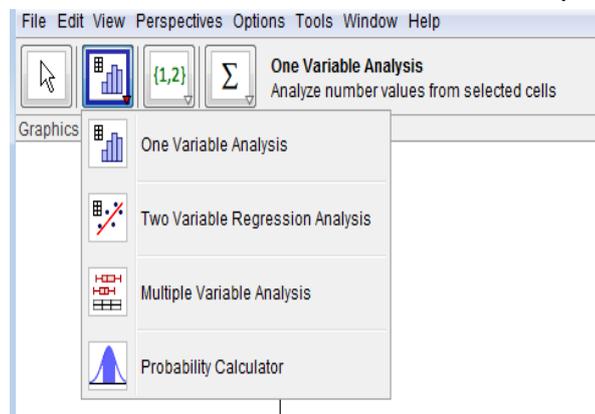
Spreadsheet	
	A
1	45
2	64
3	23
4	34
5	23
6	34
7	23

2. Click somewhere on the Spreadsheet View and notice new set of tools appears underneath the Menu bar.

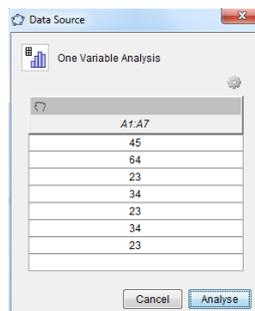


3. Highlight the data you want to investigate.

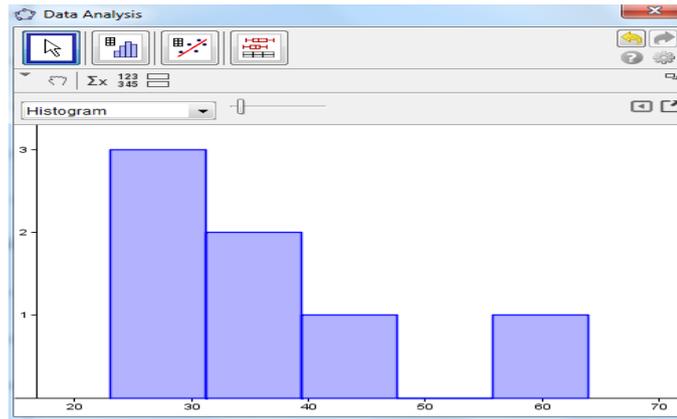
4. Click on the arrow beside  and select One Variable Analysis.



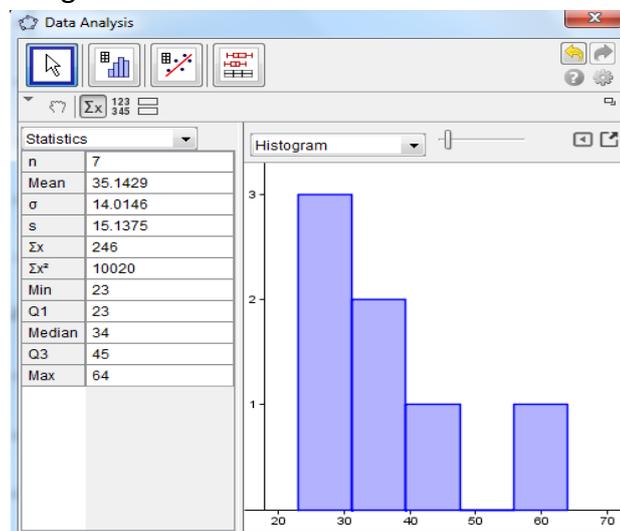
5. A new dialogue box appears.



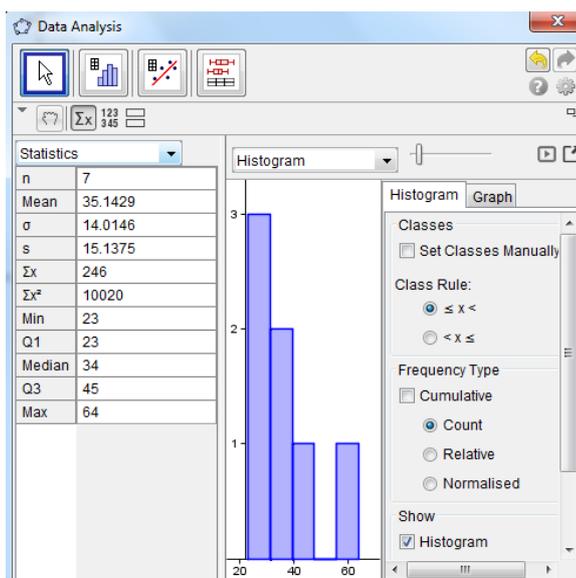
6. Click Analyse.



7. Click on the show Statistics tool  at the top of this dialogue box to show the statistics of the data being investigated.



8. In the statistics view of this dialogue box notice the Mean, Standard Deviation, Min, Max, Median and Q1 and Q2.
9. Without adjustments notice the minimum value in the histogram is the minimum value in the data and the maximum value is the maximum value of the data.
10. Move the slider to change the number of intervals.
11. Notice if the data in the Spreadsheet view is changed the graph changes accordingly provided it is one of the original cells that were selected. To change the cells that are being graphed one needs to restart the above steps.
12. To make further adjustments to the diagram click on the  at the top of the screen.
13. A new dialogue box appears.

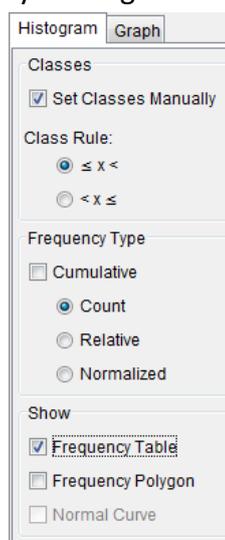


14. Click on Set Classes Manually and the toolbar at the top of the diagram changes to



15. Then pick the starting point and width of interval that you require.

16. The frequency table can be shown by clicking on Frequency Table.



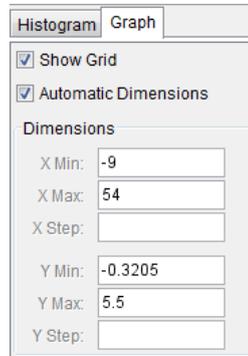
17. Frequency Type and Class Rule can all be adjusted accordingly.

18. Follow the arrow under Histogram to change to a different diagram.

19. By going to Show 2nd Plot tool  at the top left hand side of the dialogue box, a second diagram of the same data can be drawn. By following the arrow beside the name of the diagram being shown an alternative type of diagram can be selected. Adjustment can also be made to the second diagram as can be done to the first diagram.

20. To remove the second diagram unclick the Show 2nd Plot tool .

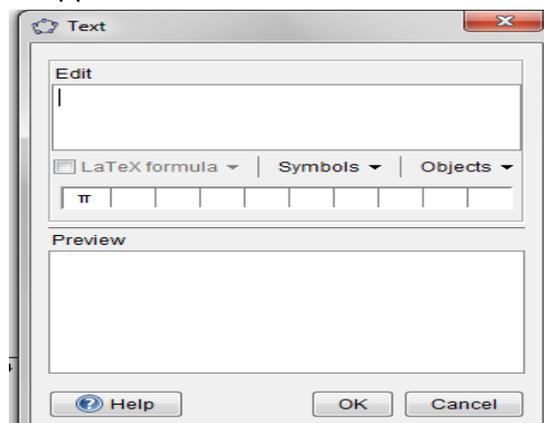
21. If you wish to show the data in the diagram go to the Show Data tool . By clicking the arrow beside one or more data items you can see the impact on the data set and the diagram of removing these data item(s).
22. By clicking on the Graph tab at the top right hand side of the window when a Histogram is being displayed one can show the grid and make adjustments to the Dimensions.



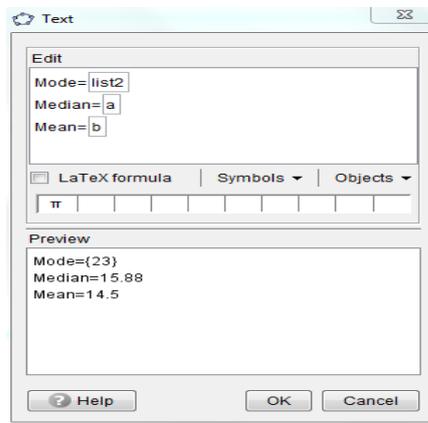
## **Activity 12: How to calculate the Mode, Median and Mean of a set of data and represent these in a textbox**

1. Type the list of data being investigated in a column in the Spreadsheet View.
2. Highlight the data, right click and choose Create and List.
3. To get the Mode in the Input bar type Mode[list1]. Provided list1 is the name of your list. Note this answer will be given as a list.
4. Your answer will appear in the Algebra View.
5. To get the Median in the Input bar type Median[list1]. Provided list1 is the name of your list.
6. Your answer will appear in the Algebra View.
7. To get the Mean in the Input bar type Mean[list1]. Provided list1 is the name of your list.
8. Your answer will appear in the Algebra View.

9. Click on the Text tool  and click on the Graphics.
10. A new dialogue box will appear.



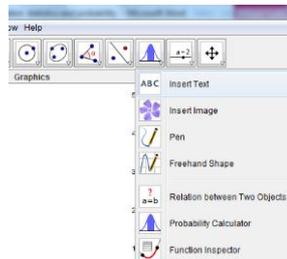
- In the Edit section type Mode = and where it states Objects follow the arrow until the object that represented the Mode appears. Repeat for Median and Mean. Note it is not sufficient to type Median=a.



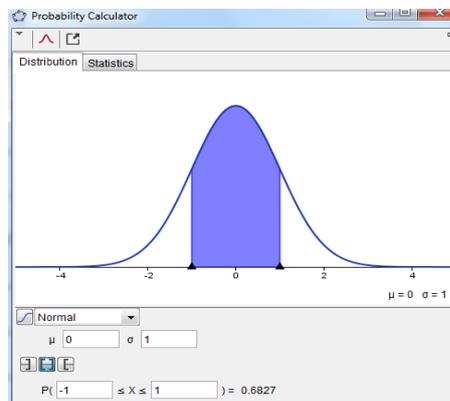
- Press OK.
- Now change some of the data in the Spreadsheet View and see the Mode, Median and Mean change.
- To change the size, colour etc. of the text right click on the text and choose Object Properties.

## Activity 13: Probability Calculator to demonstrate the Normal distribution

- Click on the Probability Calculator tool . (See below for location of this tool.)



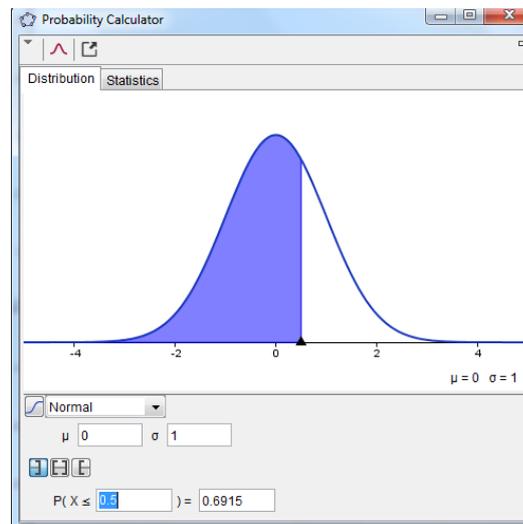
- A new dialogue box appears.



- If not already set to Normal with the Distribution tab open, follow the arrow for Normal.
- As the standard Normal distribution has mean= $\mu=0$  and standard deviation( $\sigma$ ) =1 insert 0 in the box beside Mean and press Enter on the keyboard and insert 1 in the box beside  $\sigma$  and press Enter on the keyboard.

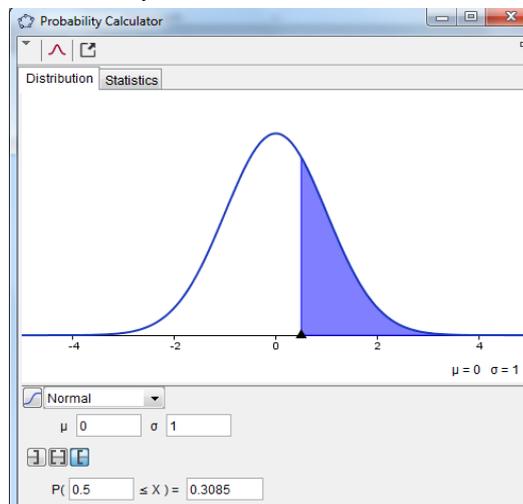
### Activity 13a: To demonstrate $P(X \leq 0.5)$

- Click on the Left Sided tool , insert 0.5 in the box beside the  $P(X \leq$  and press enter on the keyboard. The answer will appear in the box to the right of the Probability section.



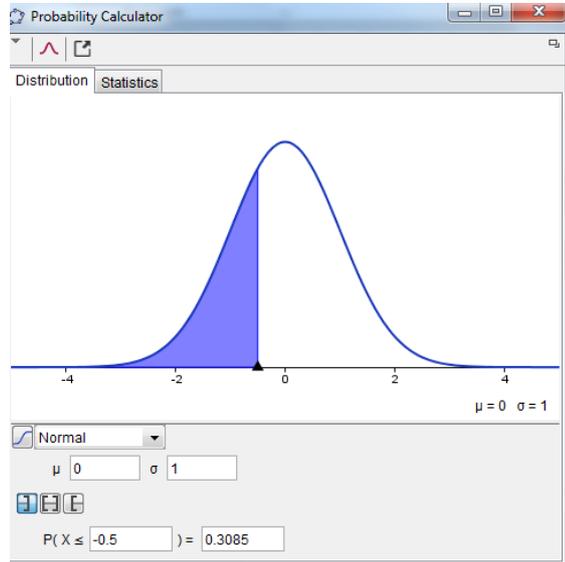
### Activity 13b: To demonstrate $P(X \geq 0.5)$

- Click on the Right Sided tool , insert the 0.5 in the box beside the  $P(0.5 \leq X)$  and press Enter on the keyboard. The answer will appear in the box to the right of the Probability section.



### Activity 13c: To demonstrate $P(X \leq -0.5)$

1. Click on the Left Sided tool , insert the  $-0.5$  in the box beside the P  $P(-0.5)$  and press Enter on the keyboard. The answer will appear in the box to the right of the Probability section.

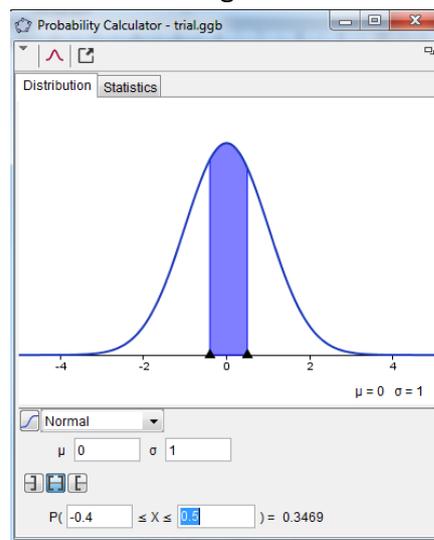


### Activity 13d: To demonstrate $P(-0.4 \leq X \leq 0.5)$

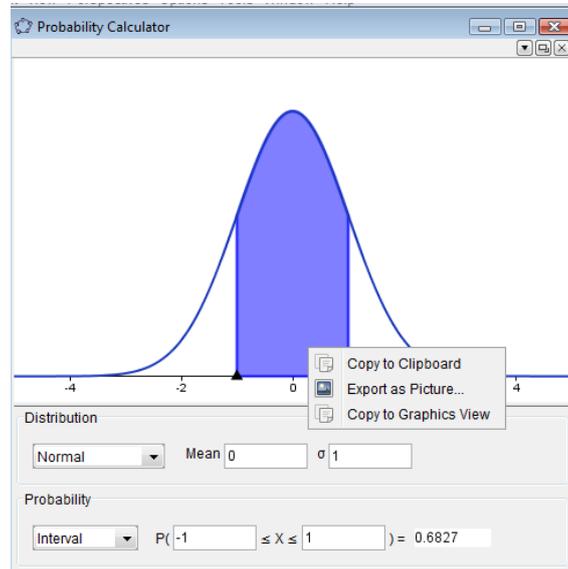
1. Click on the Interval tool , insert the  $-0.4$  in the first box after P and press Enter on the keyboard and in the second box type  $0.5$  and press Enter on the keyboard.

$$P(-0.4 \leq X \leq 0.5) = 0.3469$$

The answer will appear in the box to the right of the Probability section.

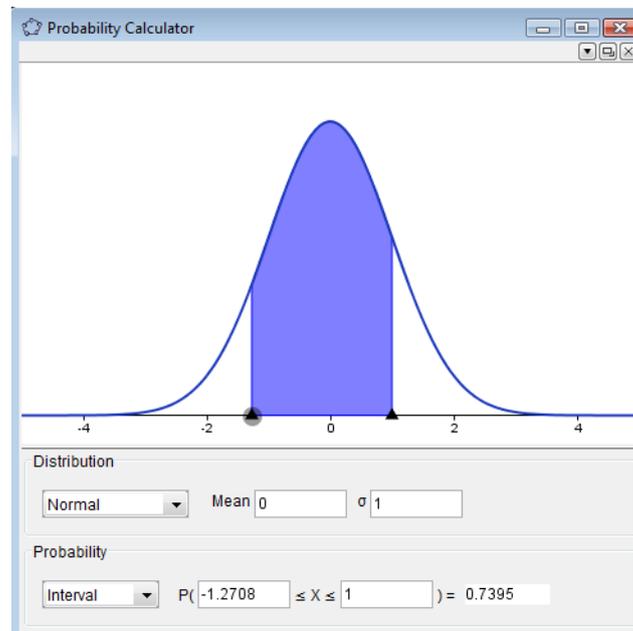


**Note:** By right clicking on the probability Calculator or clicking on  one can Copy to Clipboard, Export as a Picture or Copy to Graphics View. If it is copied to Graphics View by right clicking one can change colour, line widths etc.



To revert back to the Probability Calculator showing in the Graphics View click beside the  and a new tool  will appear and click this tool.

Note: If you change the black arrows underneath the curve the data in the Probability section will change accordingly.



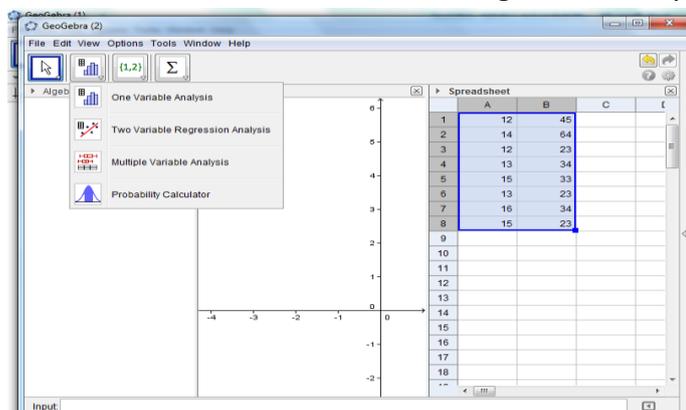
The Empirical Rule can also be demonstrated using this tool.

## Activity 14: Two Variable Regression Analysis Tool to draw a Scatter plot and Line of Best Fit

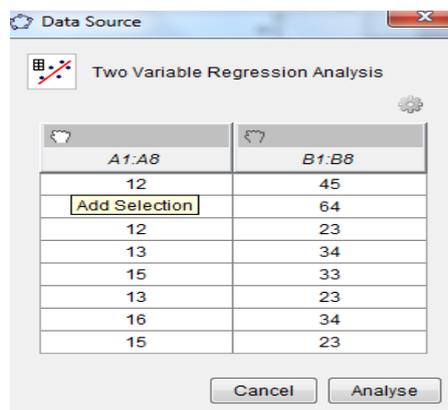
1. Input one set of the data in column A and the other set of the data in column B.

Spreadsheet		
	A	B
1	12	45
2	14	64
3	12	23
4	13	34
5	15	33
6	13	23
7	16	34
8	15	23

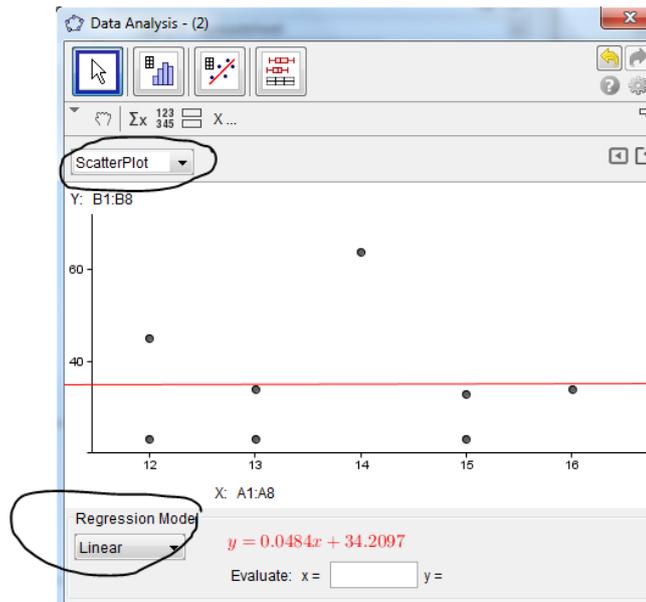
2. Highlight both sets of data and choose Two Variable Regression Analysis.

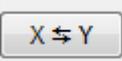


3. A new dialogue box appears.



4. Click Analyse.
5. Choose Scatter Plot and under Regression Model choose Linear to get the line of Best Fit. See the equation of the Line of Best Fit below the plot.



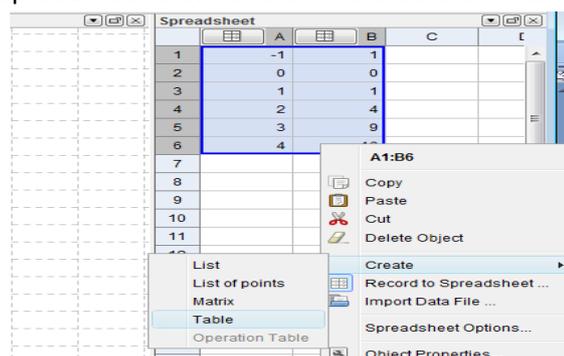
6. If you insert an X value beside Evaluate and press Enter on the keyboard it will predict a corresponding Y value.
7. Note the  $r$  statistic gives the correlation.
8. Clicking on the  button reverses the x and y values.
9. The original data can be changed on the Spreadsheet View and the scatter plot and line of best fit will be changed accordingly.

### **Activity 15: To demonstrate the impact on the Scatter plot, Line of Best Fit and the calculations of removing some of the original data**

1. Click on the Show Data tool . The impact of removing some of the data can be shown by un-clicking the arrow beside the appropriate data.
2. If the statistics table is not being shown click on the Show Statistics tool .

### **Activity 16: To create a table of data**

1. Select the data in the Spreadsheet View and choose Create and Table.



2. Move the table to the location you require on the Graphics View.
3. To change the data size, colour etc. Right click the table and choose Object Properties and change as appropriate.

### **Activity 17: To plot data in the Spreadsheet View to the Graphics View**

1. Highlight two columns of data in the Spreadsheet View, right click, chose Create and List of points.

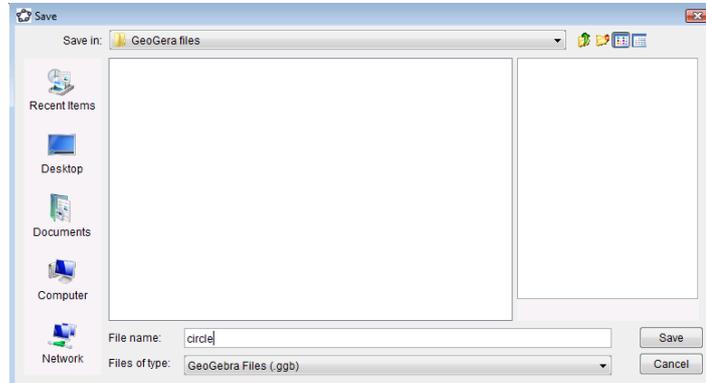
### **Activity 18: To fit a graph to a list of points that are shown on the Graphics View**

1. In the Input bar type `Fitpoly[list1,2]`, if the list is list1 and you require a polynomial of degree 2 for example.

## Appendix A

### A1: How to save a file as a GeoGebra file

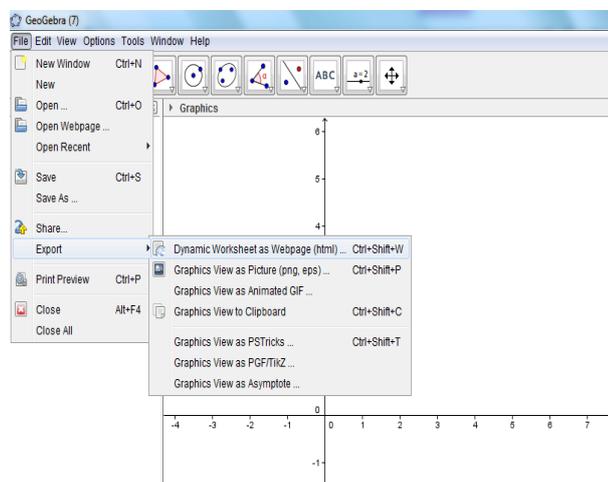
1. Go to the **Menu** and choose **Save as** from the **drop down menu**. A new dialogue box appears.

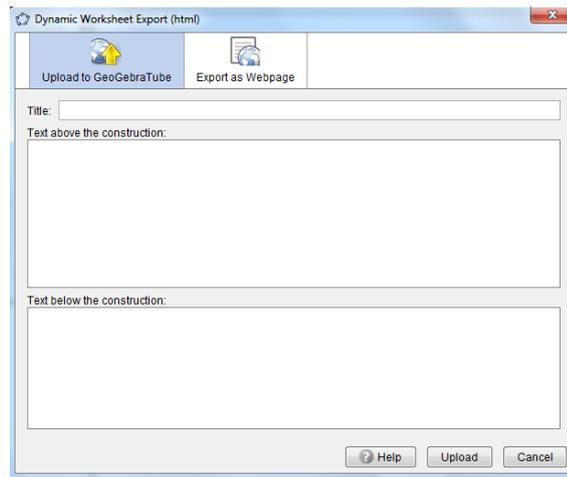


2. For **Save in**, **navigate to** the folder that you wish the file to be saved in.
3. For **File name** select the name you wish to give your file.
4. **Click Save**. A file with the **.ggb extension** is created. This extension identifies the file as a **GeoGebra file** and it can be opened again and adjustments made using the **GeoGebra application**.

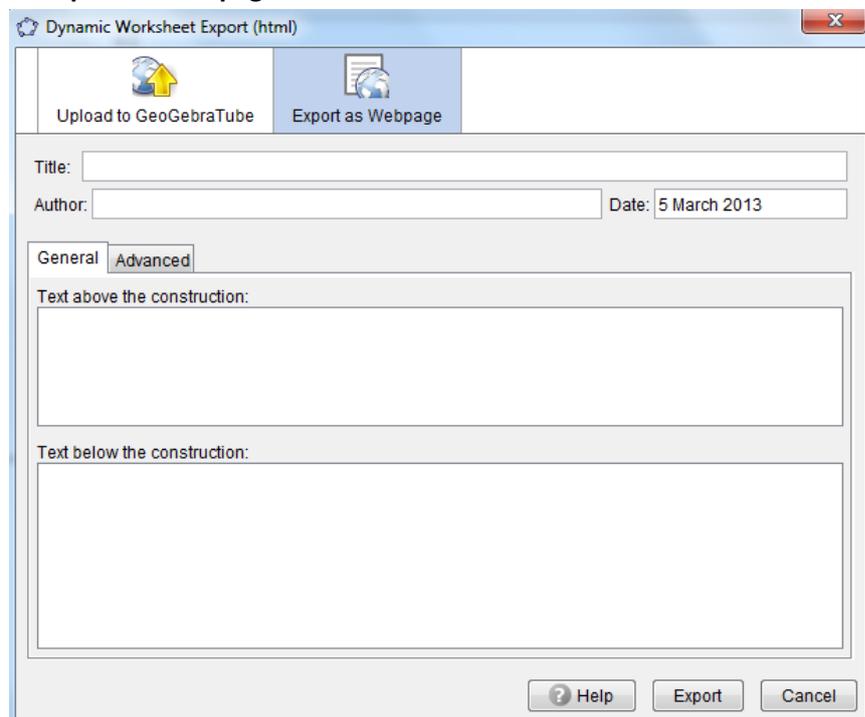
### A2: How to save a file as an interactive web page

1. First **save** your file as a **GeoGebra file**.
2. Go to **File**, from the **drop down menu select Export** and from the **further menu select** the option **Export Dynamic Worksheet as Webpage (html)**. A new dialogue box appears.

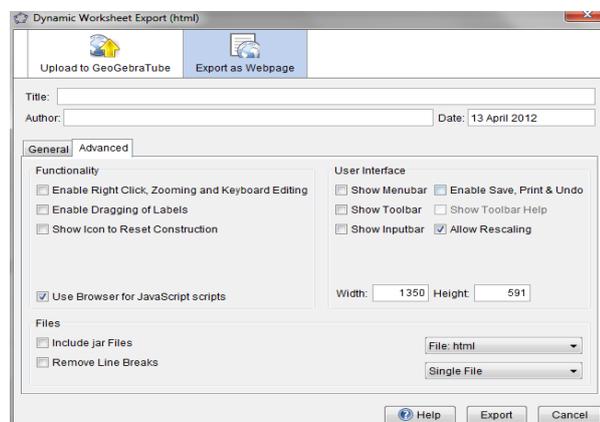




3. Click on the **Export as Webpage** tab.



4. Add Title, Author, etc. Then click on the **Advanced** tab and a new dialogue box appears.



It is recommended that one clicks the **Show Icon to reset construction** button.

5. Click **Export**.

6. **Navigate** to the **folder you want to save your file in**. **Give** it the name of your choice.  
Note: This file will have a **.html extension** and will be viewed using an **Internet browser** such as **Internet Explorer 8**.
7. **Click Save** and your **default Internet browser** will open.
8. When the webpage comes up you the following message will normally appear at the top of the screen.



To help protect your security, Internet Explorer has restricted this webpage from running scripts or ActiveX controls that could access your computer. Click here for options...

9. **Click on Click here for options** and **choose Allow Blocked Content...** and **click Yes**.