

# GeoGebra 4

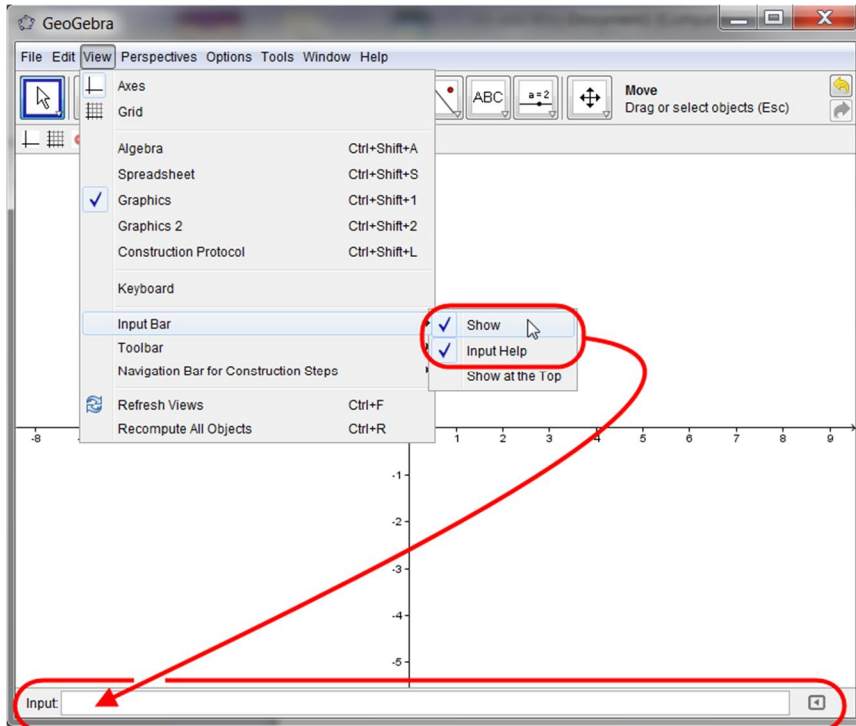
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# GeoGebra basics

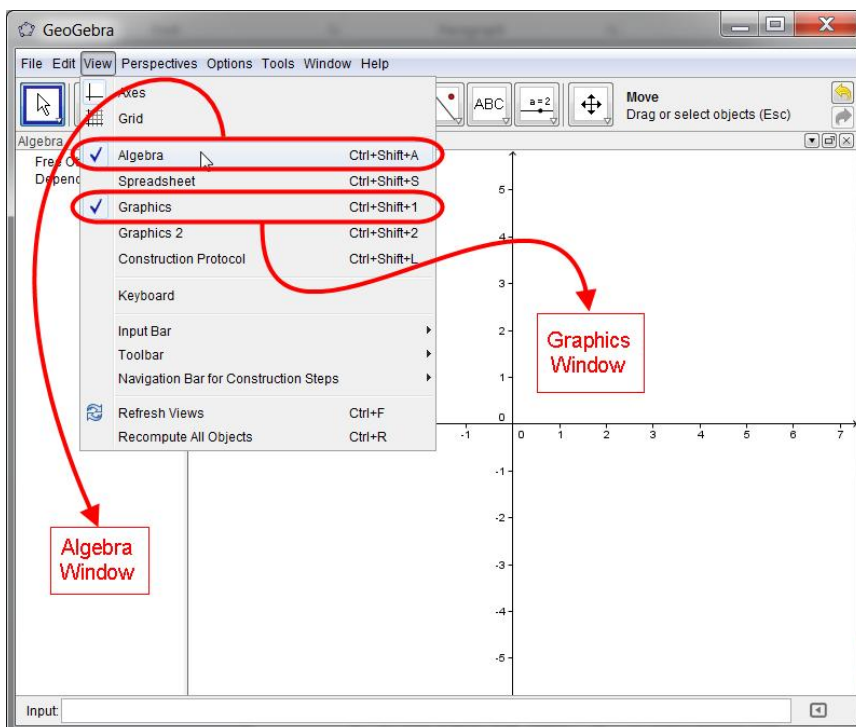
## Setting up the Interface

Steps required:

- If not visible then show the "Input Bar", through the "View" option on the Toolbar.




- Make sure that the Algebra Window and Graphics Window are both visible, again through the "View" option on the Toolbar.

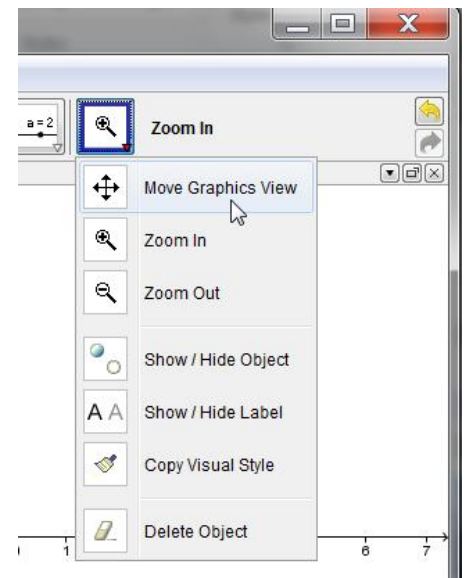


## Moving the Axes

The Slow method:

- If the “Move Graphics View” icon  is visible as the face on the last Icon set on the Toolbar then click on it to select it
- Next, click the Left Mouse Button anywhere on the Graphics Window, hold it down and then drag the mouse. You should see the axes moving around the screen as you drag the mouse

Notice that if you cannot see the “Move Graphics View” icon on the last icon set on the Toolbar then click on the little arrow at the bottom right of whichever icon picture is visible. You will notice that as you move the mouse towards this little arrow then it will change colour from white to red. Once it is red you can click the left Mouse Button to see the full set of GeoGebra Tools associated with this icon in the resulting drop-down menu.




The Quick method:

- Regardless of which Tool is currently selected from the icons in the Toolbar simply press and hold down the <CTRL> key and then click and hold down the Left Mouse Button whilst over the Graphics Window. Dragging the mouse will now drag the axes.

## Selecting or Dragging Objects using the “Move” Tool

The Slow method:

- If the “Move” icon  is visible as the face on the first Icon set on the Toolbar then click on it to select it. If another Tool is selected on this first icon then click on the white/red triangle and select the “Move” option from the resulting drop-down menu.

The Quick method:

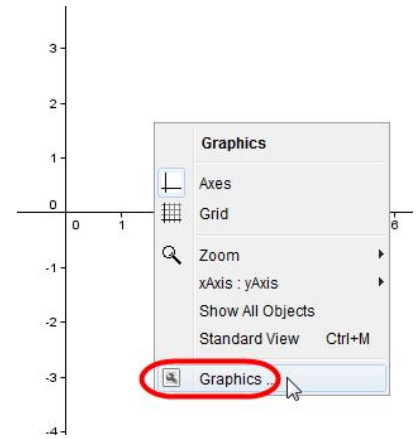
- Regardless of which tool is currently selected from the icons in the Toolbar simply press the Escape Key <esc>.

Selecting and dragging objects within the Graphics Window will now be possible

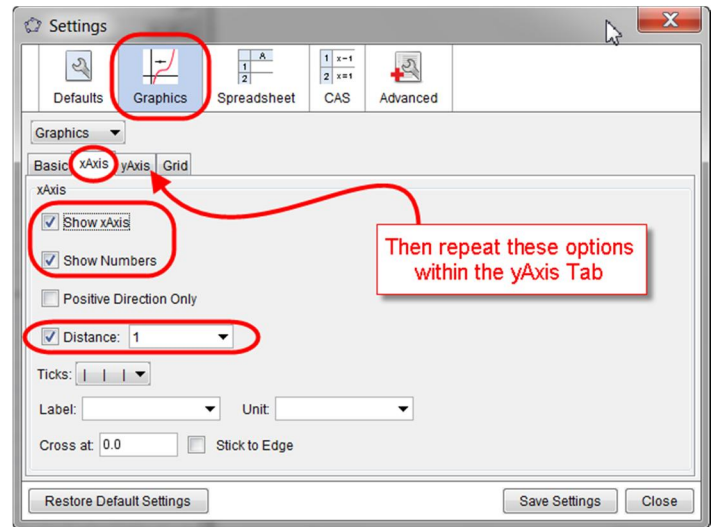
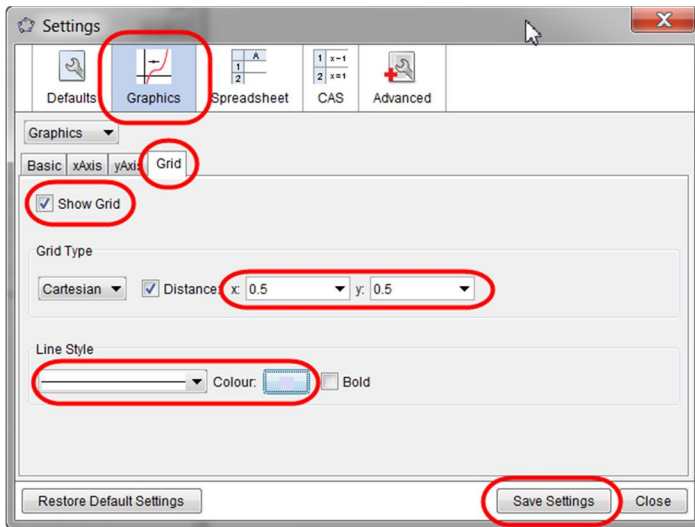
## Modifying the Axes Scales and Gridlines

Steps required:

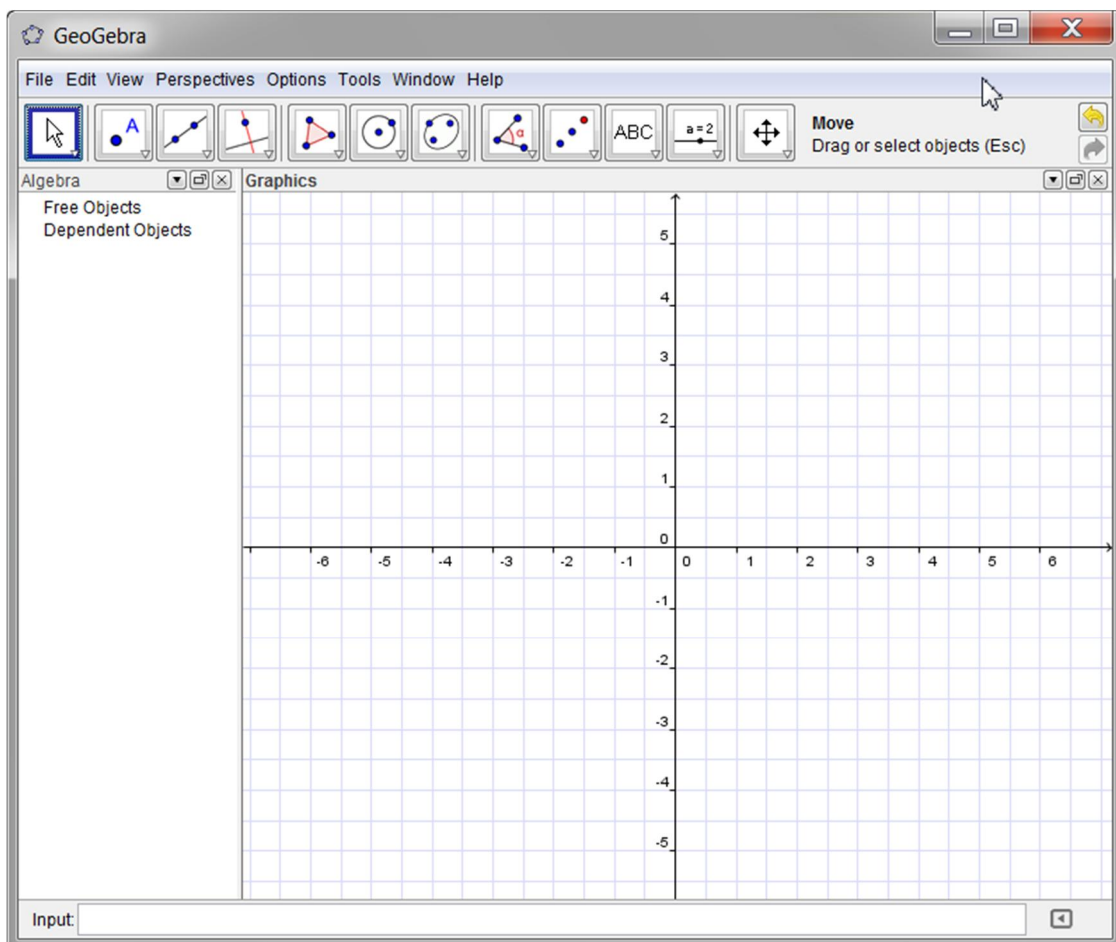
- Click the Right Mouse Button anywhere in the Graphics Window.
- From the drop-down menu select the “Graphics...” option



Fill out the resulting dialogue box selecting the Tabs as shown below:




The result of these selections will look something like this:



## Creating a Slider

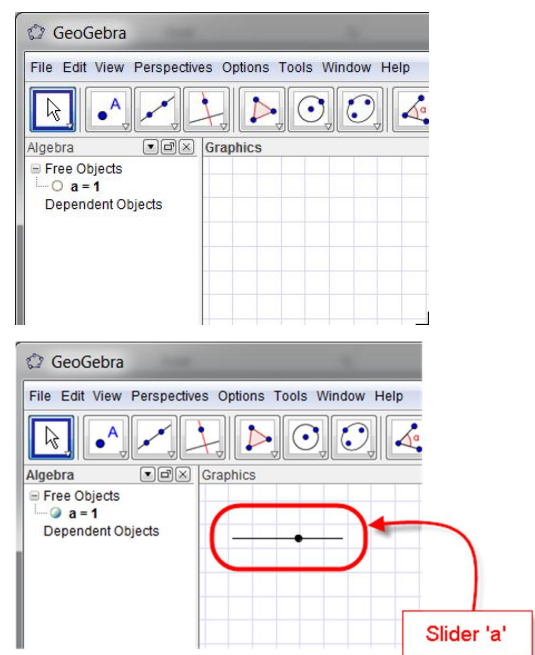
A Slider is a very useful Tool as it can be used to define and thereafter, vary, the value of a parameter that may be used within any construction/curve in GeoGebra.

### The Slow Method

- If the “Move” icon  is visible as the face on the penultimate Icon set on the Toolbar then click on it to select it. If another Tool is selected on this icon then click on the white/red triangle and select the Slider option from the resulting drop-down menu.
- Next, left mouse click within the Graphics Window at the point where you wish your slider to go

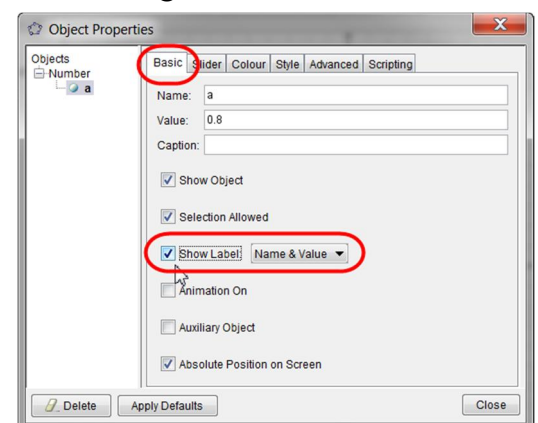
### The Fast Method

- In the Input Bar type  $a = 1$  and press the <RETURN> or <ENTER> key. You will then see the parameter ‘a’ defined in the Algebra Window as shown to the right here.
- Notice that there is a small, “open” circle just to left of  $a = 1$  in the Algebra Window.
- Left click the mouse on top of this “open” circle, this will have the effect of both colouring in the circle making it “closed” and more importantly, making it’s associated object – here the slider ‘a’ – visible within the Graphics Window, thus:



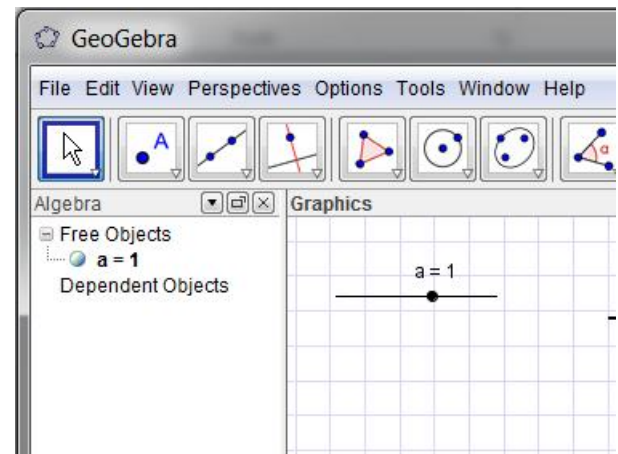
To see the name and value of your slider you need to open up the properties dialogue box for the slider control. This can be done by either of the following methods:

- Click the Right Mouse Button over the actual slider control in the Graphics Window and from the drop-down menu select “Object Properties”
- Click the Right Mouse Button over the “ $a = 1$ ” object in the Algebra Window and from the drop-down menu select “Object Properties”
- Using a Click of the Left Mouse Button select either the slider control in the Graphics Window or the “ $a = 1$ ” object in the Algebra Window (they will become highlighted in a clearly discernible manner), next press <CTRL> + e.



From the “Object Properties” Dialogue Box make sure the following items are checked from within the “Basic” Tab.

You will then see the Slider displayed thus:

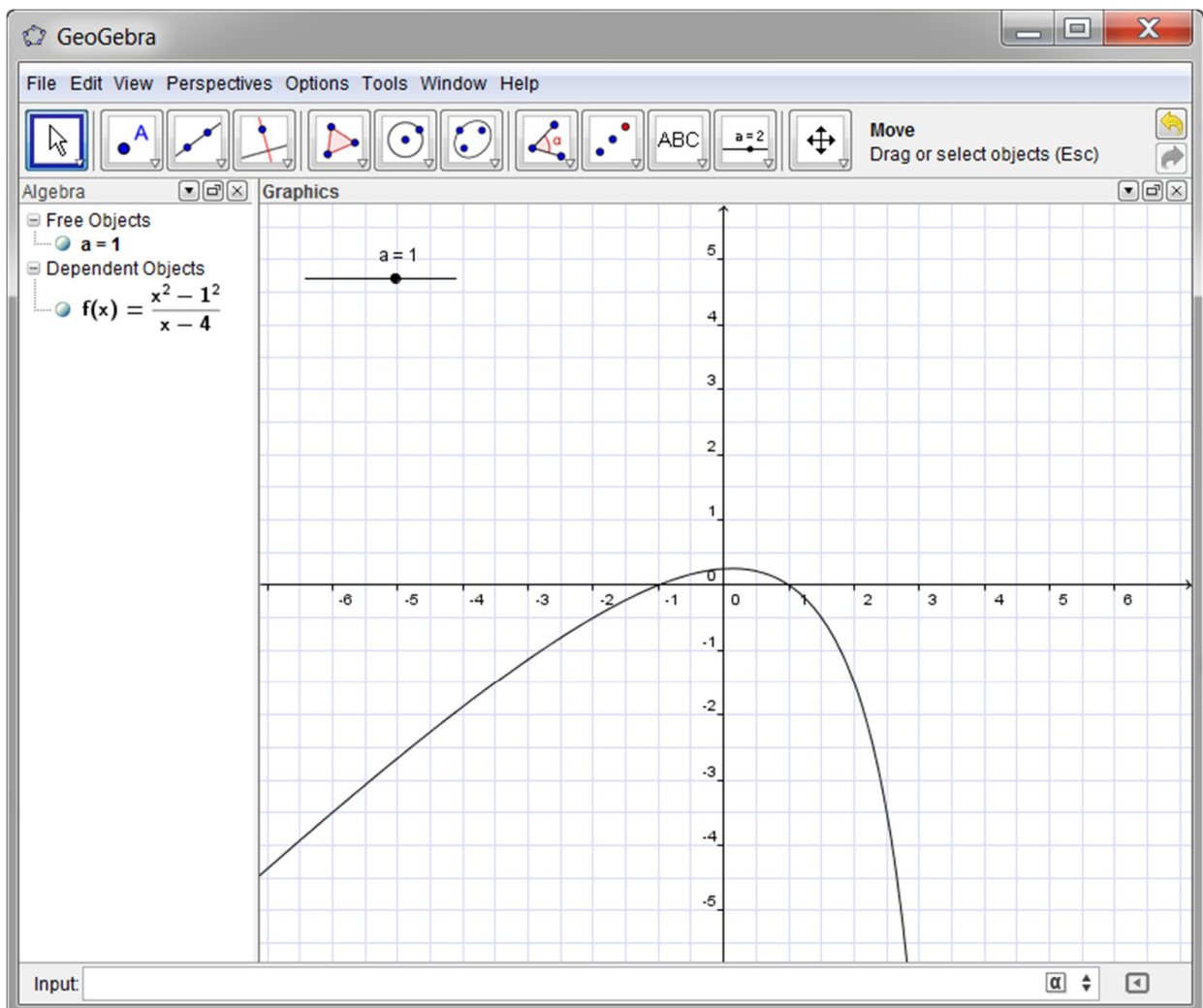


## Plotting a Graph that depends upon a slider

Given that the Slider 'a' has already been created as above, type the following equation into the Input Bar and press the <RETURN> or <ENTER> key.

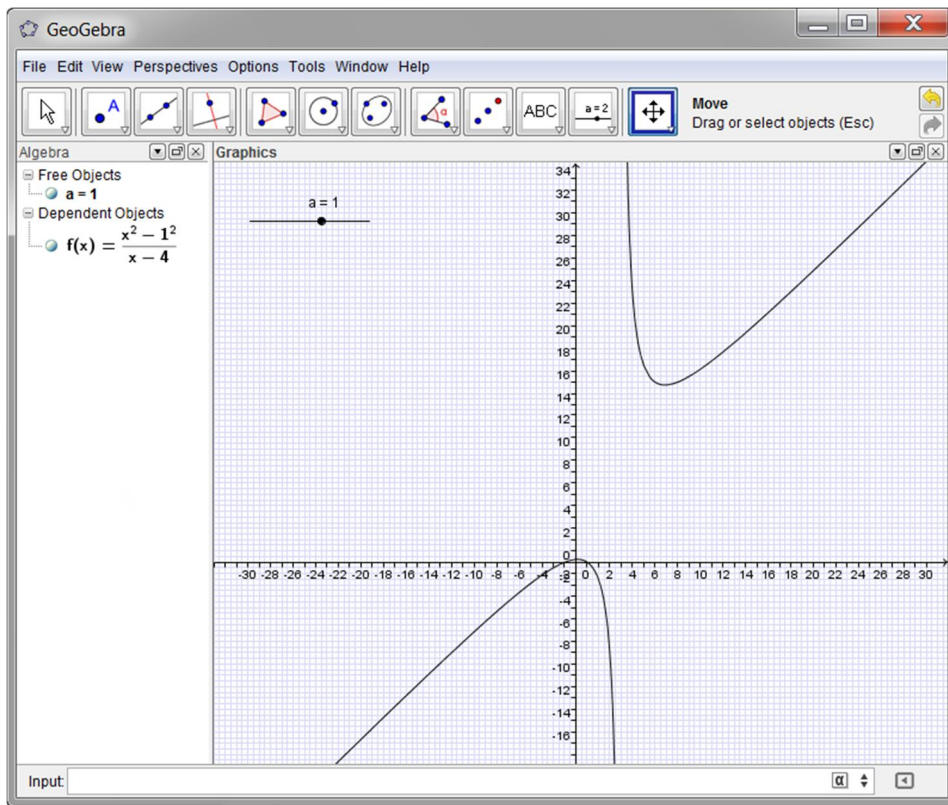
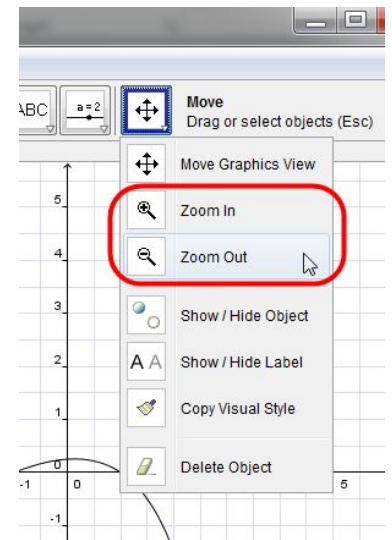
$$y = (x^2 - a^2)/(x - 4)$$

You should see a picture like the one below:



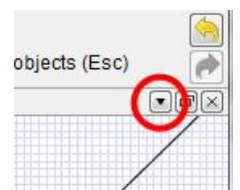
However, only part of the graph is shown here. To see more use the scroll button on your mouse – rotating it will zoom us in or out of the graph. Alternatively, from the last Toolbar icon you may select magnifying or reducing glasses as shown to the right thus:

Your graph will now appear to have two separate parts to it as shown below:

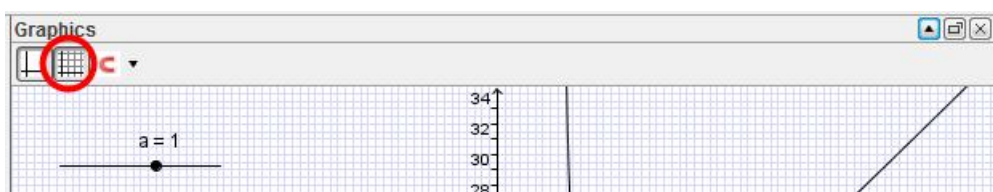


You may notice that on zooming out the grid now appears quite dense. Rather than Right-clicking the mouse within the Graphics Window to switch on (or off) the grid from the Graphics menu, as before, there is a quicker way to switch off the grid.

To the top-right of the Graphics Window you will see the following cluster of small icons. Select the down-arrow option as shown here to the right.



This will have the effect of introducing a thin bar immediately above the Graphics Window and at the left of this new bar is another small-icon set.



Selecting the icon as shown above will clear the underlying grid.

Now try moving the Slider control and make some observations about your graph.

Notice that even though we typed a 'y' into the equation of our curve as we entered it into the Input Bar - as we would normally do when writing it down – when we look at the object (the curve) as displayed in the Algebra Window it has automatically been given the name 'f'. More precisely it has been put into functional notation for us, that is:

$$f(x) = \frac{x^2 - a^2}{x - 4}$$


This is now in correct mathematical form and is describing the curve  $y = f(x)$ . This form has many advantages, and is helpful when values (of x) have to be substituted into the curve to find the corresponding values of y (the height of the curve for the given value of x).

For example, when  $x = 14$  then the height of the curve is found by substituting  $x = 14$  into the equation of the curve, that is:  $y = f(14)$ .

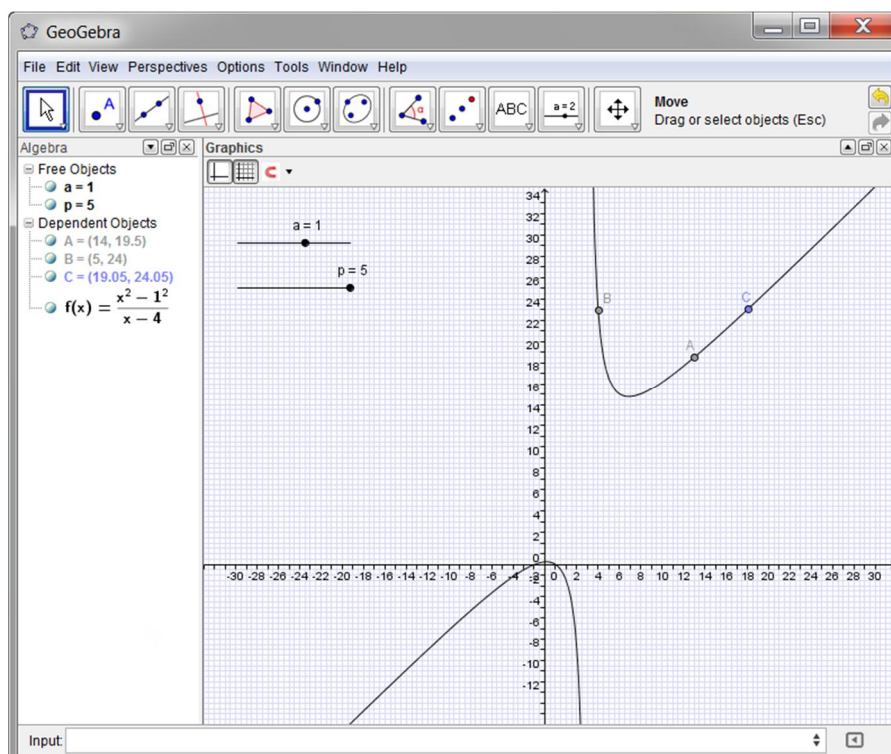
In the Input Bar, type  $(14, f(14))$ . Note that you must use round brackets for GeoGebra to recognise that it is a point to be plotted. What do you notice?

Now create another Slider control 'p' in a manner similar to your first Slider control 'a'.

In the Input Bar, type  $B = (p, f(p))$ . Vary the values of your Slider p, what do you notice?

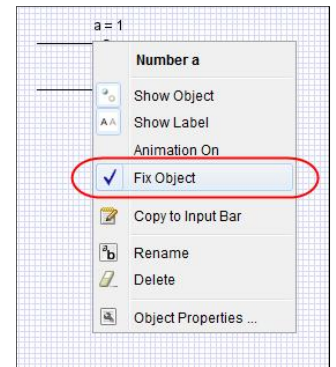
Finally, from the 2<sup>nd</sup> icon set on the Toolbar select the Point Tool Icon . With this selected click anywhere on the curve. You will know that you are ready to do this correctly because as the mouse pointer gets close to, or over, the curve (or indeed any object) it become highlighted (emboldened). Click the left hand Mouse Button now. What do you notice?

You should have something similar to the picture below:





If you wish to move a Slider Control around the screen, perhaps to move it out of the way of the graph, then Left-mouse click on it, and whilst holding down the mouse button simply drag them to where you want to place them on the screen. If, when you try this, they alter their value instead of moving then they may be “Fixed” on the screen. In this case, Right-mouse click on the slider and you will see a tick on the “Fix Object” option. Select this option to remove the tick and the Slider can then be dragged to a new position.



Save your GeoGebra file as “limit curve.ggb”

## Investigation

When  $x = 4$  what can you say about the value of the expression  $\frac{x^2 - 16}{x - 4}$  ?

