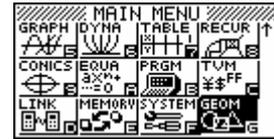


Dynamic Geometry in the palm of your hand.

Add-in geometry to your CASIO 9860 with a visit to:

http://world.casio.com/edu/product/fx9860g/geo_9860.html

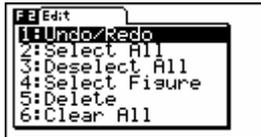
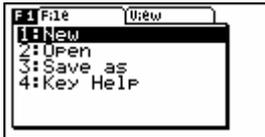


Getting to know the geometry package.

Open **GEOM** and you may see a blank screen with an arrow cursor or possibly a **current image** if previous work has been done. In either case,

Discover the function menus

Press **F1** plus the Arrow Pad (and/or **F2 F3 F4 F5 F6 OPTN**) to explore these function menus



Using these menus you can find pretty much every geometry command you will ever need!

Some very useful keys.

- EXE** Select / Execute
- AC/ON** Deselect All (Delete All if pressed twice)
- X,θ,T** Grab
- VAR** Open the Measurement Box
- EXIT** Exit
- DEL** Delete

For a full key map see page 4.

Let's do some geometry!

Use **File: Open** to open a file called **Line Int**

Do the infinite lines CD and FE meet? If so, where?

Can we make it so they don't? What will that mean?



Choose a point to manipulate. Move the cursor until a box appears around this point, using the Arrow Pad.

Grab the point, move to its new location with the Arrow Pad and then press **EXE**. Repeat as required.

Once you have finished moving points use **File: Scroll** and the Arrow Pad to see whether or not the two lines still meet.

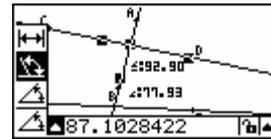
Manipulating measurements

If you would like to manipulate angles instead of points, select the two lines that define an angle and *Open the Measurement Box*.

You can enter values for the displayed (in blacked box) measurement just by using the key pad.

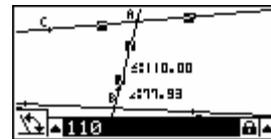


You can change exactly what is being measured (i.e. acute angle, obtuse angle etc) by moving into the pop up menu on the left hand side of the Measurement Box (access via the Arrow Pad).



When you enter a measurement the construction is adjusted and that measurement is locked/constrained.

To unlock, use the pop up menu on the right hand side of the Measurement Box.



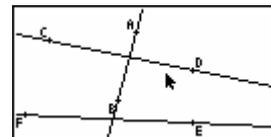
Now can you make it so the lines don't meet?
 What does this mean about the lines?
 What property of the lines could you measure to support this?

Building this geometry construction.

Use **File: New** to start with a blank slate (clear the current image).

Select the **Draw: Infinite Line** tool

Use the Arrow Pad and **EXE** to draw the two points that define an infinite line. Repeat this twice.



Adding Measurements.

Select the two lines that define the angle of interest.

Open the Measurement Box with **VAR**.

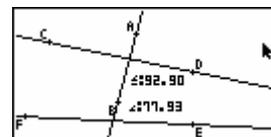
Use the Arrow Pad (**▶** and **▲**) to **Paste** this measurement.



Exit the Measurement Box and **Deselect All**.

Use the **Grab** tool to move your measurement to an appropriate position.

Repeat this for the second angle. You may need to use the Arrow Pad (**◀** and **▲**) to adjust the Measurement Box so that it measures the obtuse angle between the two lines.



To 'clean up' the measurements, select them and then go to **Option: Number Format** and choose **Fix2** (or similar).

Now that your construction is built, use **File: Save As** to keep it for posterity.

Lets do some dynamic geometry!

Open **Tack 30**.

This is a diagram of a boat at point A that wants to sail east, but due to wind direction, has to sail on a tack of 30 degrees, causing it to be a certain distance off course.

The question is, how far off course is the boat, relative to its distance sailed?

Grab and drag point N – what do you notice?

Animated geometry – many cases seen, recorded and analysed.

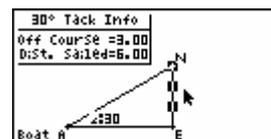
Go to **Animate: Go(once)**. Watch and enjoy!

The values used in an animation (i.e. the distances etc at each step along the way) can be tabulated in the following way:

Select the line segment representing *Off Course*

Go to **Animate: Add Table**

Exit to return to the geometry window. *Deselect* the line segment and repeat the process for the line segment representing *Dist. Travelled*.



Length	Length
0	0
0.2627	0.5254
0.5254	1.0509
0.7882	1.5764
1.0509	2.1019
1.3137	2.6274

Storing tables as lists.

To store this table in  choose the column representing distance *Off Course* and press **STO** **(F1)** then **LIST 1**. Repeat this, storing the column representing *Dist. Sailed* in **List 2**.

Moving now to  we should see,

The conclusion that the length *Off Course* is half of the length *Dist. Travelled* can be checked by dividing **List 1** by **List 2**.

Before this can be done the zeros at the top of the lists need to be deleted with the **DEL** key.

Perform the calculation by moving the cursor into the heading row of **List 3** and entering the calculation **List 1** \div **List 2**.

(Press **OPTN** **LIST** **(F1)** **List** **(F1)** **1** \div **OPTN** **LIST** **(F1)** **List** **(F1)** **2**).



	List 1	List 2	List 3	List 4
SUB:	Len3th	Len3th		
1	0	0		
2	0.2627	0.5254		
3	0.5254	1.0509		
4	0.7882	1.5764		



	List 1	List 2	List 3	List 4
SUB:	Len3th	Len3th		
1	0.2627	0.5254		
2	0.5254	1.0509		
3	0.7882	1.5764		
4	1.0509	2.1019		
List 1 \div List 2				
List [L \rightarrow M] Dim Fill Seq				

But... can we build it?

To build an animated geometry construction like this one we need to think about

What is fixed / locked?

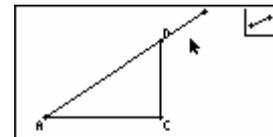
What can move / is animated?

Firstly, draw it...

Draw an oblique line segment (bottom to top – thus determining the direction of the animation).

Draw a horizontal line segment from the bottom of this segment.

Draw a vertical line segment (see left).

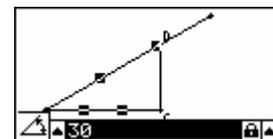
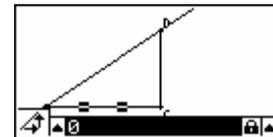


Now, to constrain it...

Select the horizontal line, *open the measurement box* and constrain/lock the slope as zero.

Now select the vertical and horizontal lines and constrain the angle between as 90 degrees.

Now select the oblique and horizontal lines and constrain the angle between as 30 degrees.



Now, to animate it...

Select (only) the oblique line segment and point that we want to move on this line.

Go to **Animate: Add Animation** then **Animate: Go (once)** – and it is done!

Now, a bit of cleaning up...

To hide the oblique line, select it and go to **Option: Hide**.

Replace this with a line segment, making up the third side of the triangle.

In a similar way, hide the points to 'clean up' the triangle a bit.

And now for some measurements...

Select the hypotenuse, *Open the Measurement Box* and **Paste** the length measurement.

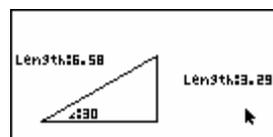
Use *Grab* to position this measurement.

Select the measurement and go to **Option: Number Format** and change it to **Fix2** or similar.

Repeat for the opposite side, and for the 30 degree angle.

Your finished construction should look like this.

Don't forget to **File: Save As**.



(P.S. With a bit of window dressing this construction becomes **Tack 30**)

