How do I build it?
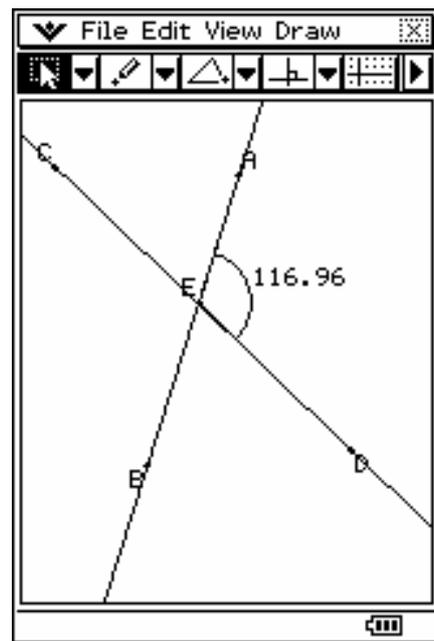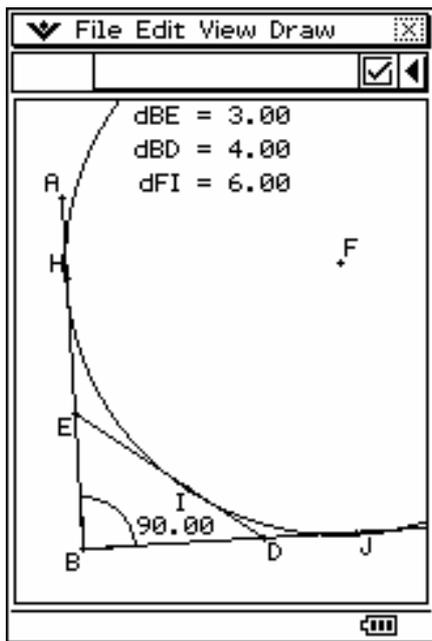# How do I measure it?
How do I animate it?

Using the Geometry application on the CP 300 (OS 3.0).

Tuesday, July 25, 2006

Compiled by Anthony Harradine
Director
**Noel Baker Centre for School Mathematics**

Introduction

The ClassPad 300 is the only hand-held device to be equipped with the unique *constraint-based* Geometry application. While you are able to make constructions in a manner similar to that employed by GSP or Cabri Geometre, setting constraints when forming objects is often far more expedient and saves a lot of construction getting in the way of the key learning point at hand.

This document focuses on building by setting constraints.

Drawing

The Draw menu contains many tools for both drawing and construction. Icon shortcuts exist for many of these options.
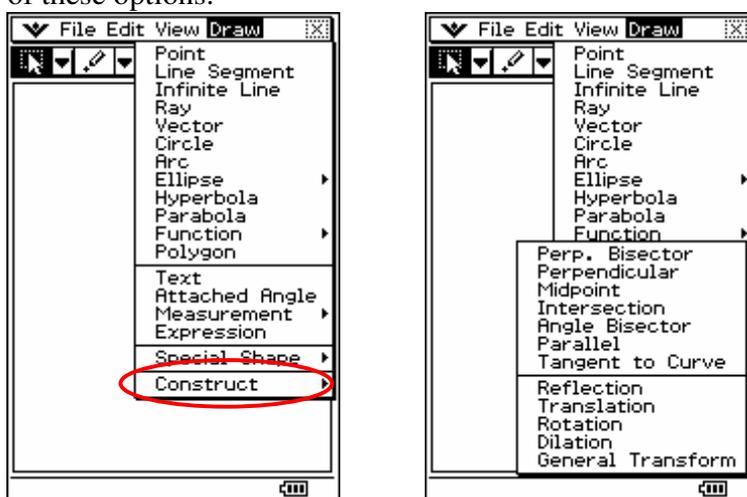
Select the Line Segment option. Note that the second icon shows a line segment icon "white on black". This means this tool is selected. A line segment is defined by two points; so, tap in two different places on the screen. Note that the line segment tool is still selected. Tap the selection tool (first) icon to activate the selection tool.
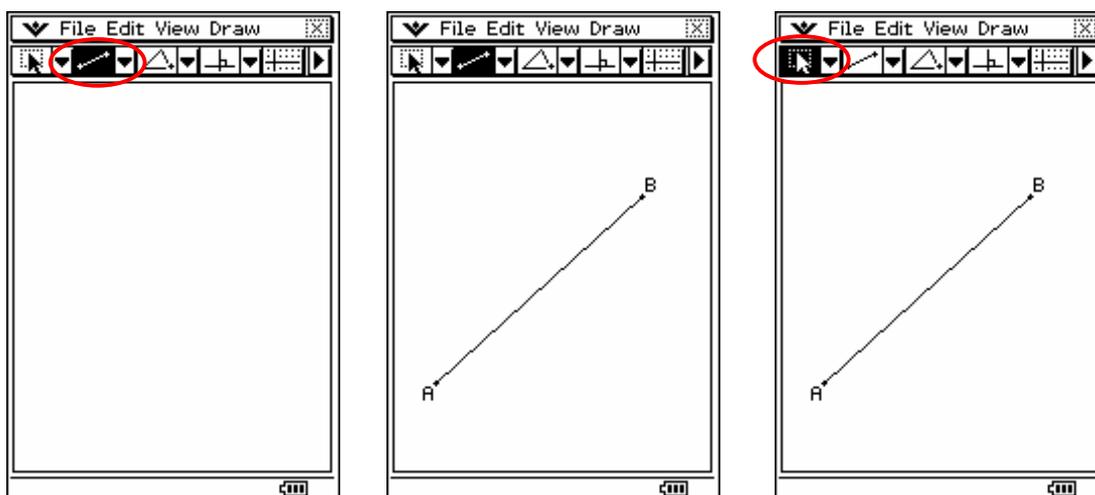
So, we now have drawn three objects, a line segment and two points. Each object has a set of properties that the CP 300 can measure.

Measuring the properties of objects.

Tap the arrow pointing to the right at the end of the icon bar. This *takes you around the corner* to the measurement bar – it will be pretty empty to begin with.

Tap on the line segment (not one of the points, but in the centre of the line segment). Note that the first option is for the CP 300 to measure the length of the line segment. If you tap the small left-most drop down arrow you will see what else the CP 300 can measure. In order we have: length, slope, angle (from the positive *x*-axis), equation and the last option offers the chance to name the line.
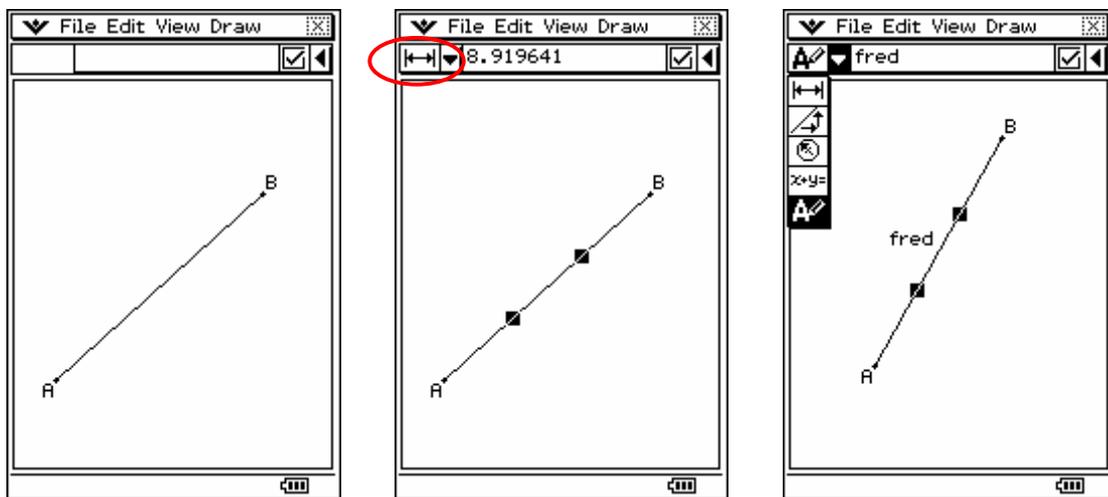
Tap in *free-space* and you will see that nothing is selected and so no measurements are shown. Now tap on a point and see what is measured.
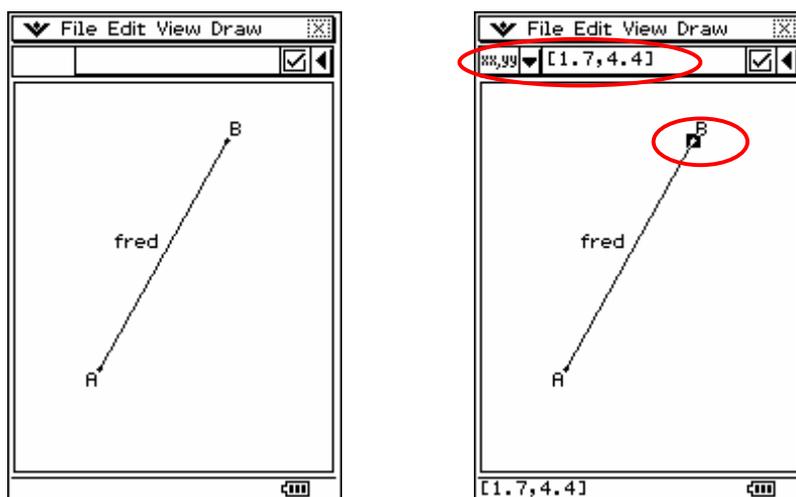
Moving objects around.

Go *around the corner* and make sure the selection tool is highlighted. Tap in *fee-space*. Now tap on the line segment and then **put** the stylus back on the line, but this time leave the tip on the glass and then drag the stylus across the glass, the line segment should move.
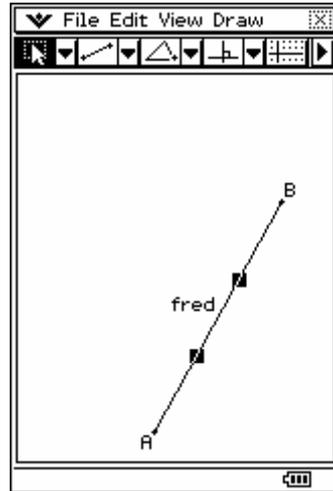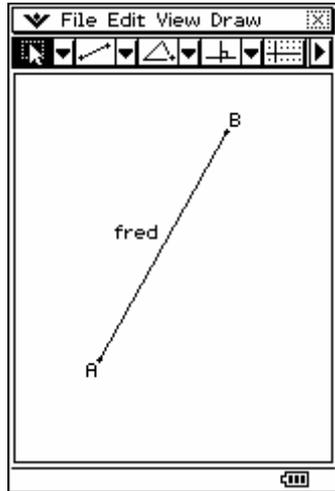
Tap in free space and then tap on a point. Then go back and put the stylus on the point, and drag across the glass. Note that the point stays highlighted and so you should be able to go back on it and move it again.

Tapping in *free-space* de-selects any object and allows you to re-select from scratch.
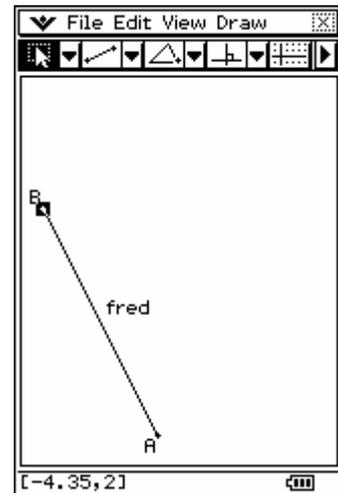
Setting a constraint.

Suppose we want to make 'fred' 5 units long and have a gradient of 0 such that these properties are fixed. Tap in free space and then go around the corner. Highlight the line segment and measure its length. Change the length to 5 and tap the tick or press EXE. Not the tick becomes white on black, indicating the constraint has been set and the length is fixed to be five units.
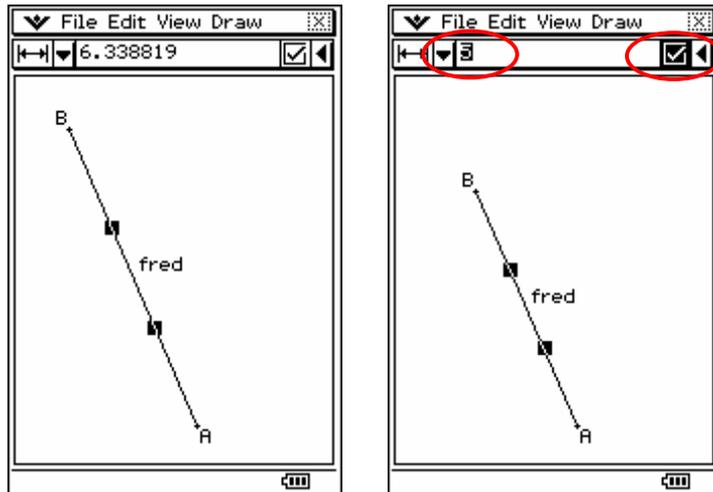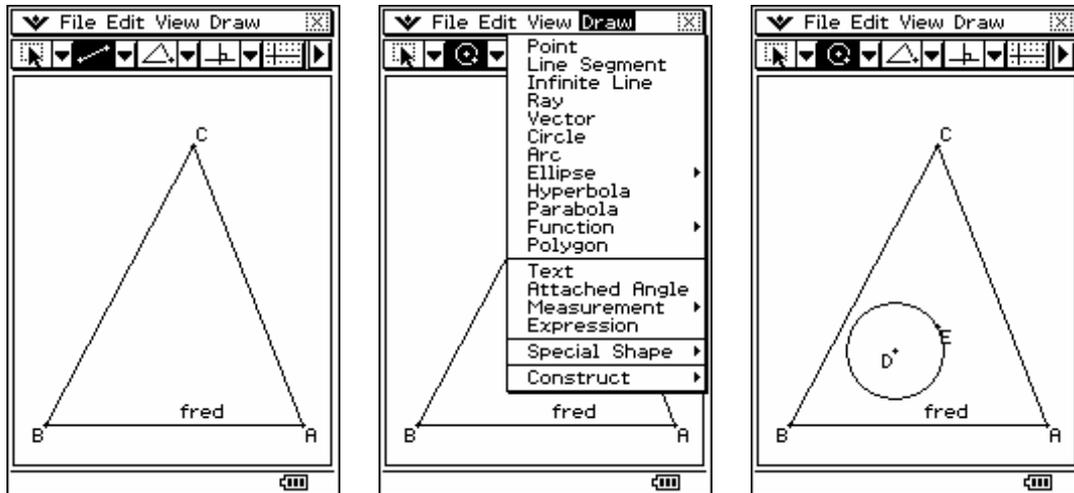

Now measure the line segments slope. Note the tick is black on white, indicating the slope is changeable (not constrained). Now change the value to 0 and tap the tick (or press EXE).
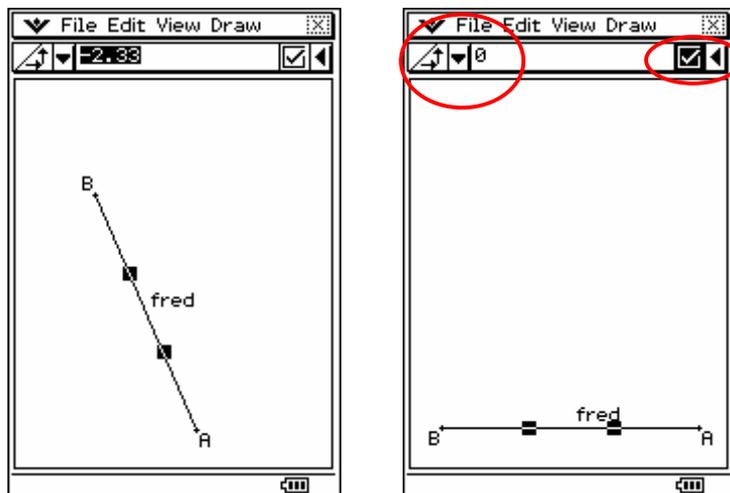
Drawing other objects.

Draw two other line segments to form a triangle. Then draw a circle within the bounds of the triangle.


Now, to make this triangle an *incircle* we can use the 'tangency' property. Go around the corner, select the circle and one side of the triangle. Not that the tangency property says No. to make it say yes and constrain it to be so, tap the tick. Tap in free space, select the circle and one other side of the triangle and repeat. Repeat again for the third side and an incircle is created.
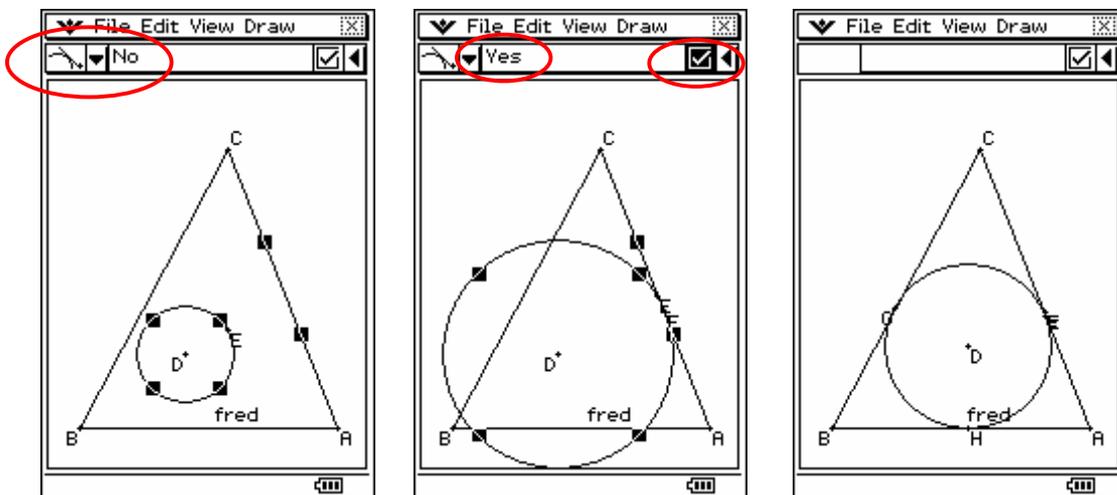
You can now move the triangles vertices around and you will see the circle is constrained so the sides of the triangle are always tangential to it.

How do I animate?

Suppose I want to have point C move long a line segment. First draw the line segment. Then constrain C to the line segment. Then click in free-space.
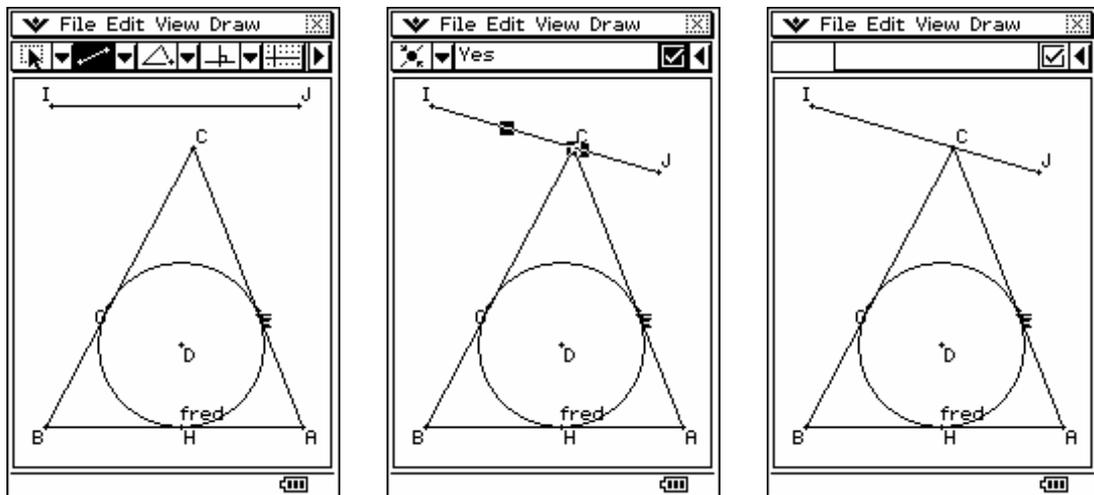

Any point can be made to move along any curve provided the curve has a start and end. Hence, an infinite line is of no use to us when making an animation.

Select point C and the segment IJ. Then go to the Edit menu and the Animate sub-menu and choose to Add Animation. Then return to the same menu and choose on of the Go options and the animation should start.
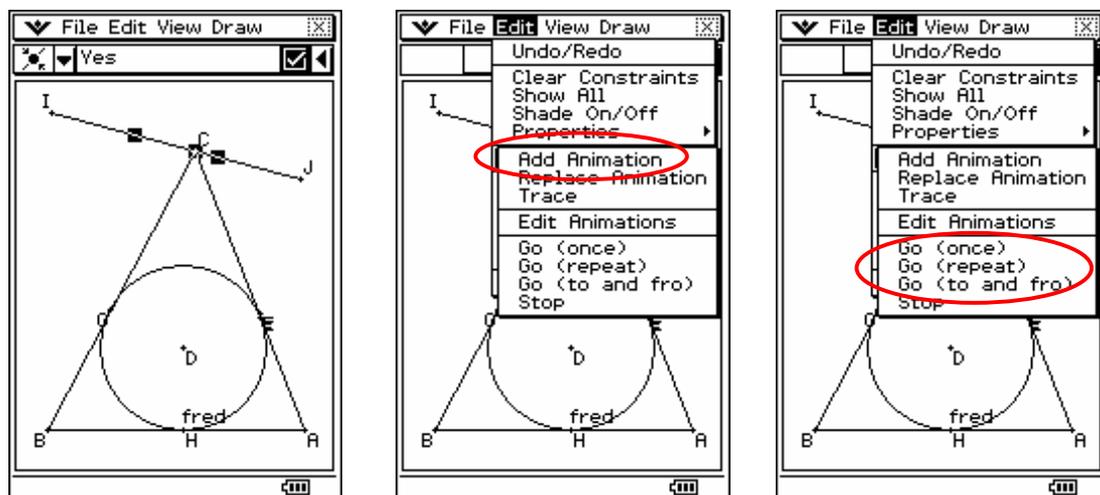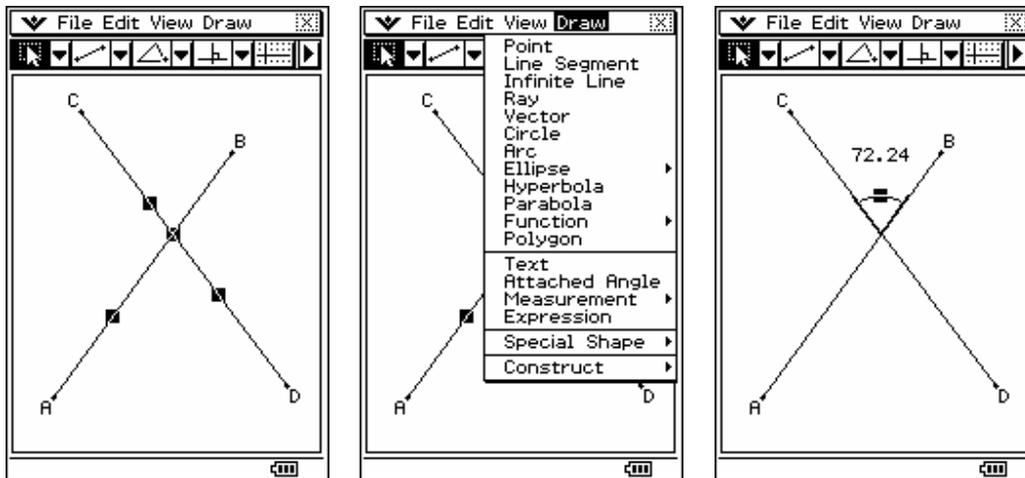
How do display measurements?

Three ways exist to display measurements. Once you drawn an object you can select it, display the measurement bar (tap the right most arrow if you can see all the tools in the tool bar. Not that the CP 300 can measure different properties of an object. For a line segment, it can measure length, gradient, angle from the positive *x* axis, equation and finally you can attach text to the object.
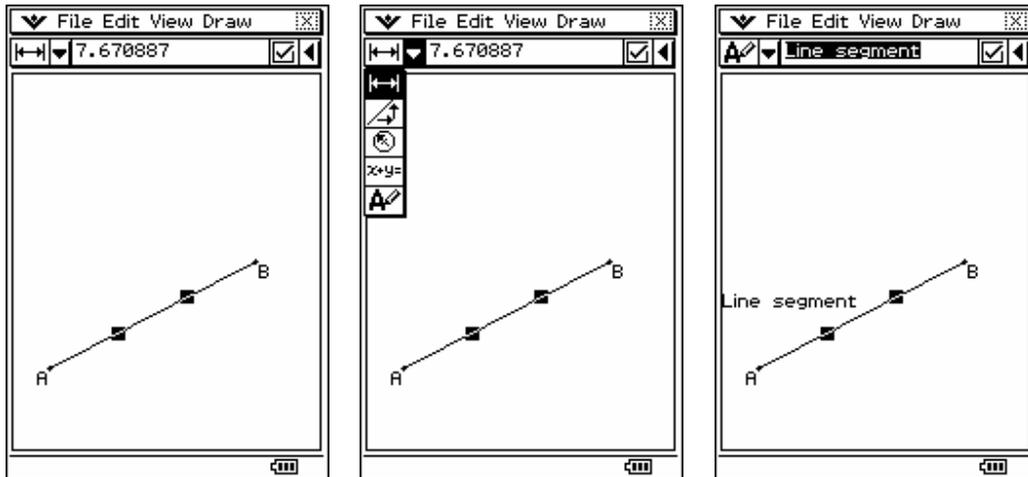
You can take any measurement and drag it onto the working area. This allows you to watch the measurements change as you move or animate the structure. You can edit the default word 'length' to make it what you like.
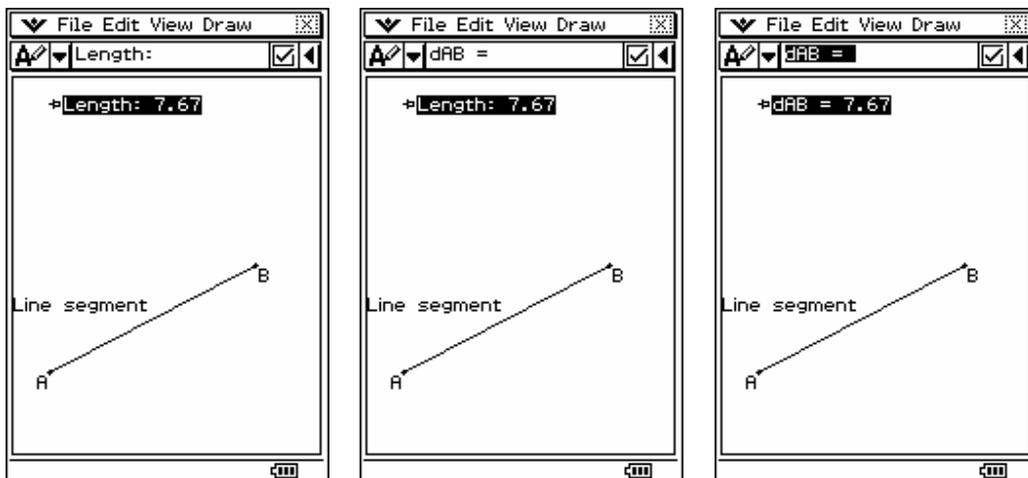
You can also attach a measure to an angle. Use the 'Attached Angle' command. The angles measure will change as you change the construction by dragging or while animating.
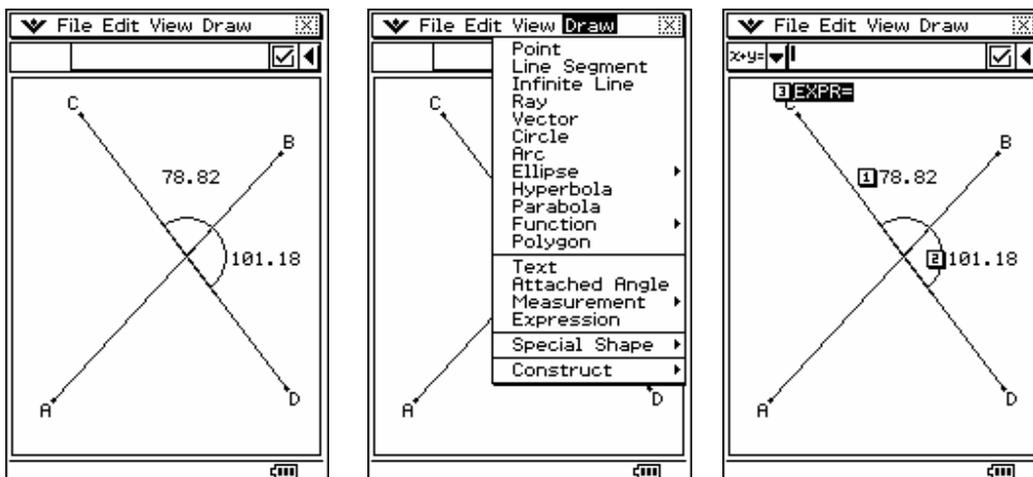

How do I do a calculation?
You can perform a calculation using the measurements you have displayed.

Be sure the measurement bar is visible (as opposed to all the drawing tools) and then use the 'Expression' command from the Draw menu.

This will result in the third screen below. The cursor is flashing in the measurement bar waiting for inoput.

To add the two angles together, tap on the number that precedes the measure (1 and 2) in this case, putting a plus in between. Pressing EXE results in the calculation being performed. You can edit the test EXPR= to be what ever you like. The calculation will change in response to the construction being changed by dragging or animation.