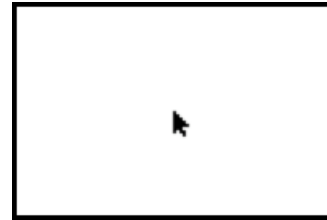
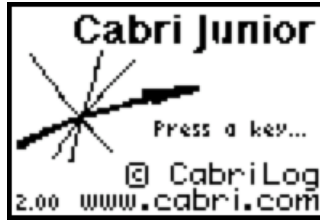
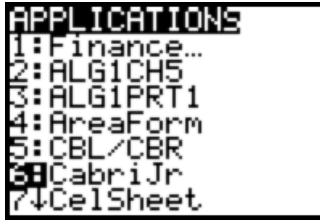


Using Cabri Junior for Introductory Trigonometric Explorations

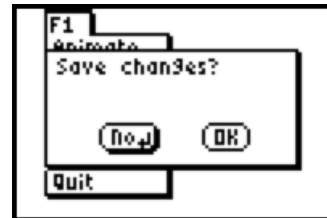
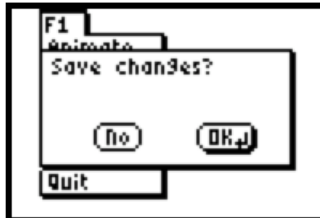
1. Start up Cabri Junior

To start Cabri Jr, press **[ON]** then **[APPS]**. Use the arrow keys to navigate to Cabri Jr and press **[ENTER]**.



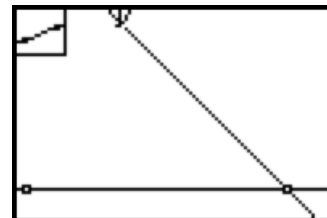
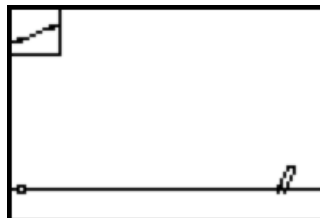
You should now see a blank screen with a black arrow, as shown. To access the menus, use the row of keys immediately below the screen. They are labelled in green F1, F2, F3, F4 and F5.

If there is anything else on the screen, press F1 (i.e., the **[Y=]** key) go down to **New** and press **[ENTER]**, as shown below. Use the arrow keys to select **No** and press **[ENTER]** again. Now the screen is blank.



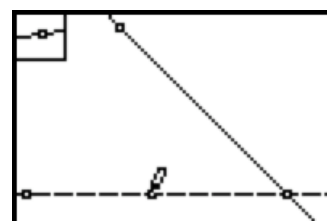
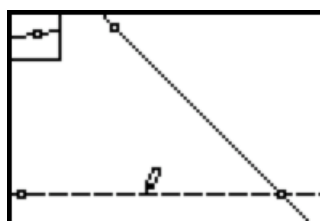
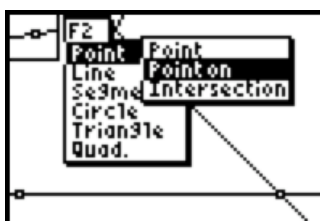
2. Construct a right-angled triangle

Press F2, select **Line** and press **[ENTER]**. A pencil appears, and an icon in the top left corner of the screen indicates that the line-drawing tool is selected. Use the arrow keys to go to a point near the bottom left of the screen and press **[ENTER]**. Use the right arrow key to move across to the bottom right corner and press **[ENTER]** again. This draws a horizontal line across the bottom of the screen.

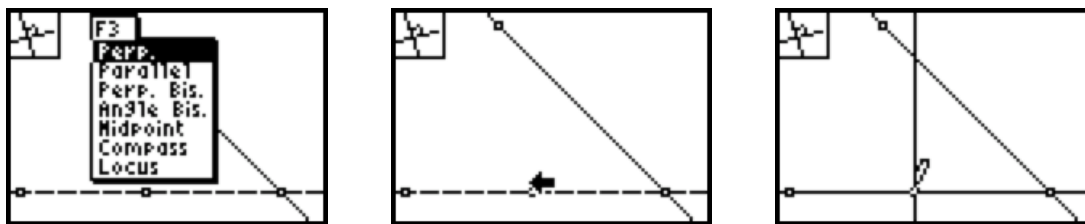


Now draw another line through the same point, angling up at about 45°. The line drawing tool is still selected. Notice that the point you have just drawn is blinking on and off, so press **[ENTER]** to select it again. Notice that the point flashes to indicate that you have chosen it as a point on the new line. Use the arrow keys to move near the top left of the screen and press **[ENTER]**.

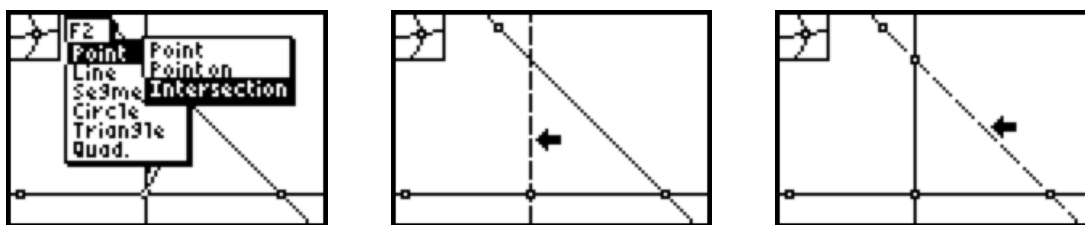
We will now create a point on the first line we drew. Press F2 again, use the arrow keys to select **Point** **[>] Point on** and press **[ENTER]**. Notice that the icon in the corner of the screen changes. Move the pencil down until it points to the horizontal line, and the line twinkles, and press **[ENTER]**.



Now we will draw a line through the new point, perpendicular to the base line. Press F3 and **[ENTER]** to choose **Perp**. A new icon appears in the corner. If the point you have just created is *not* blinking on and off, use the arrow keys to move closer until it *does* blink and press **[ENTER]** to choose it. If necessary, use the arrow keys again to move closer to the horizontal line, until it twinkles and a horizontal black arrow points to it, and press **[ENTER]** again. This constructs the perpendicular.



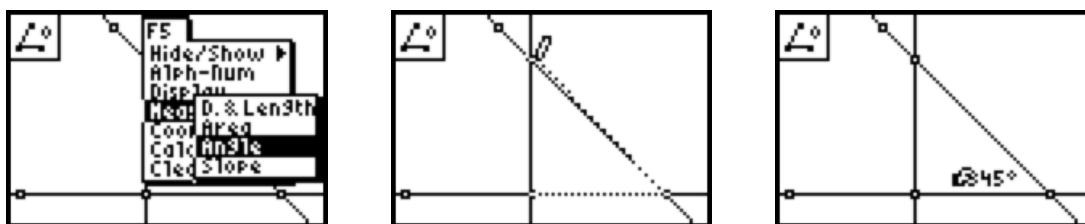
Now we need to construct the point of intersection to get the third vertex of the triangle. Press F2 and choose **Point** **[>]** **Intersection**, and press **[ENTER]**. Move the pointer away from the base line. Now, using the arrow keys, first point to the perpendicular and press **[ENTER]**, and then point to the sloping line, and press **[ENTER]** again. When an object is selected the pointer changes to a horizontal arrow and the object twinkles. Check that both lines are selected, and press **[ENTER]** to create the point where they intersect. You now have a right-angled triangle.



3. Measure the angle and the sides of the triangle

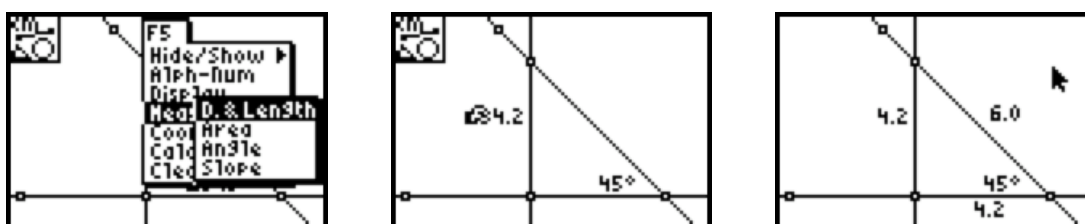
Press F5 and choose **Measure** **[>]** **Angle**. Now select three points in turn pressing **[ENTER]** after each. The vertex of the angle must be the middle one. Notice that when you select a point, it “flashes”.

Warning: if the pencil is not pointing exactly at the point you want to choose (it is not twinkling) you will create a new point when you press **[ENTER]**, and you won't be measuring the correct angle.



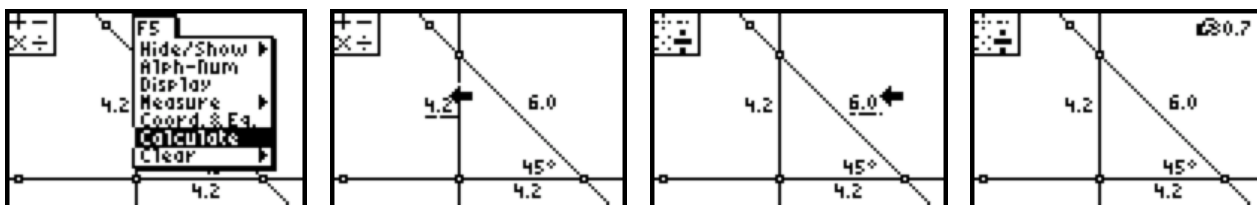
When you have chosen all three points, CabriJr shows the size of the angle and puts it near the vertex. A hand holds the label, and you can use the arrow keys to move it to a convenient location.

Press F5 again, and choose **Measure** **[>]** **D. & Length** to measure the sides of the triangle. To find the length of a segment, select each endpoint in turn and press **[ENTER]**. As before, you can move the measurement to a convenient place. Press **[CLEAR]** to get rid of the hand that drags the measurement around, and repeat for the other sides. Press **[CLEAR]** again to de-select the measurement tool.



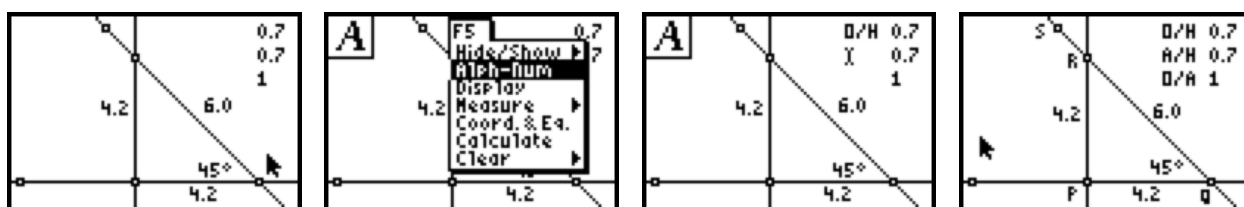
4. Calculate the ratios of the sides of the triangle

We can use CabriJr to find the trigonometric ratios. Press F5, choose **Calculate** and press **ENTER**. Point to the measurement of the side opposite the measured angle and press **ENTER**, then press the division key, then point to the measurement of the hypotenuse and press **ENTER** again.



Notice that when they have been selected, the measurements flash on and off. When the ratio appears, move it to a convenient spot. Press **CLEAR** to get rid of the dragging hand.

Repeat this to find Adjacent over Hypotenuse, and Opposite over Adjacent. If you like, use F5 **Alph-Num** to label the results of the calculations, and the vertices of the triangle, as shown below. Press **ENTER**, move the insertion point to where you want to enter text, and press **ENTER** again. Use the green **ALPHA** key to switch between letters and numbers or symbols. Press **ENTER** when done.



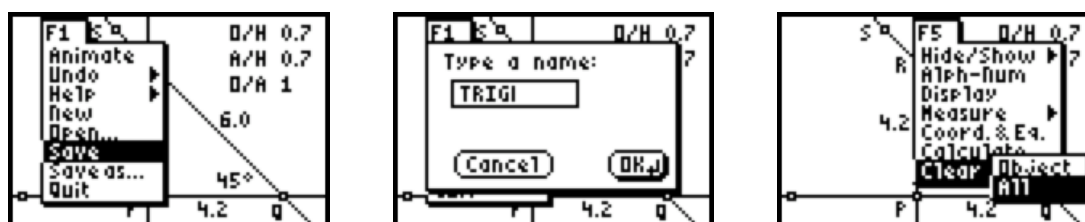
5. Investigate what happens when you make changes to the triangle.

First, drag the point P to different positions on the base line and note what happens to the ratios. To do this, first press **CLEAR** to get rid of the text entry tool, then move the cursor to the point P. Make sure that the point itself is flickering, not the label or the base line. The cursor turns from black to white when something is selected. Press **ALPHA** and use the arrow keys to drag P along the base line. The lengths of the sides change, but the ratios stay the same.

Next, change the size of the angle. Select the point S, and press **ALPHA** to pick it up and drag it. Notice how the ratios change, when the angle changes. For a new angle, move P again, and observe that the ratios stay the same as long as the size of the angle does.

Use this diagram to make up a table showing approximate values of the ratios O/H, A/H and O/A for angles of different sizes: 10°, 20°, 30°, 40°, 50°, 60°, 70°, 80°.

When you have finished, save the diagram, so that if you want to use it again, you don't have to repeat the construction. Press F1, choose **Save** and press **ENTER**. Type a name and press **ENTER** again. Now you can clear the whole figure. When you want it again, press F1 and select **Open**.

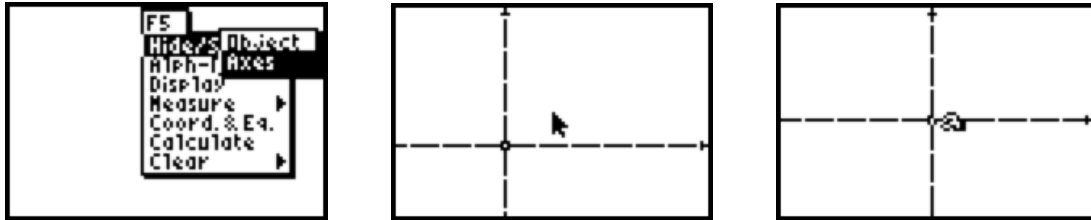


A diagram like this can be transferred very quickly from one calculator to another. So if your students know how to use the link cables, you can prepare a diagram in advance and they can start on an investigation as soon as they have transferred it. When selecting what to transmit, you will find the name of the diagram under **AppVars**.

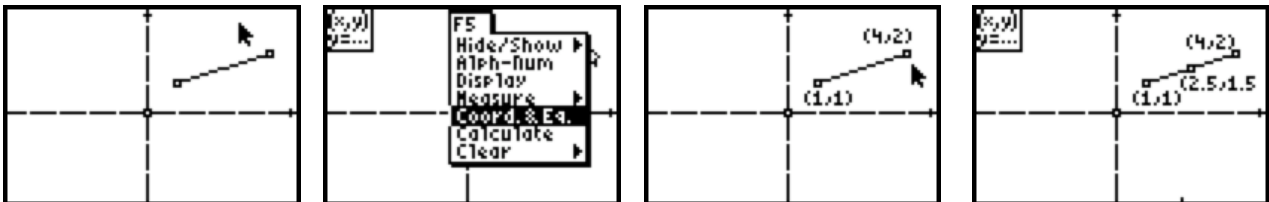
Using Cabri Junior for Coordinate Geometry

Explorations of coordinate geometry explorations using graphics calculators usually begin with the equation of a line or curve, and go from that to the properties of its graph. Using Cabri Junior, we can move in the opposite direction — beginning, for example, with the graph of a line and finding out about its equation.

To see the axes, press F5, select Hide/Show \square Axes, and then press \square ENTER. You can move the origin to the centre of the window if you want: select it, press \square ALPHA and use the hand to drag it.



Now draw a line segment: Press F2, select Segment, and press \square ENTER. Press F5, select Coord. & Eq. Point the arrow at one endpoint and press \square ENTER. Use the hand to drag the coordinates to a convenient position and press \square CLEAR to get rid of the hand. Repeat for the other endpoint.



Some things to investigate:

- Construct the mid-point of the segment (F3 > Midpoint), and find its coordinates. How are these related to the coordinates of the two endpoints? Drag the endpoints of the segment around, and note the changes to the coordinates of the mid-point. Make a list showing the coordinates of the endpoints and of the midpoint in different configurations, and look for a pattern.
- Find the slope of the segment (F3 > measure > slope). How is it related to the coordinates of the endpoints?
- Construct a point on the y-axis (F2 > Point > Point on) and a line through it. Note the coordinates of the point on the y-axis and another point on the line (F5 > Coord. & Eq.). Then find the equation of the line and its slope. Drag the point on the y-axis up and down. How does the equation change? Drag the line around, and note the changes to its slope and its equation. How are they related?
- Construct a line parallel to the line you have already drawn (F3 > Parallel) and find its equation. What do the equations of the two lines have in common?
- Construct a perpendicular to the line (F3 > Perp.), and find its slope. How are the slopes of the two lines related?
- Clear the screen, and draw a circle (F2 > circle). Find its equation, and the coordinates of its centre. How are they related? Can you explain why? How can you tell from the equation what the radius of the circle is?

