CONSTRUCTING TRIANGLES
Teacher Notes

References

Foundation	-
Foundation Plus	G6.2 Constructing triangles
Higher	G6.2 Constructing triangles
Higher Plus	-

Introduction

Students use TI-Nspire to construct triangles of the four forms given in the OUP texts: SSS, SAS, ASA and RHS. Because they are easily able to move points and sides on the screen they can gain a conceptual understanding of *why* there is only one possible triangle in each case.

Resources

The TI-Nspire document ***TriConstructions.tns*** is designed for use by students with the handheld and needs no further paper-based support.

TI-Nspire skills students will need

Transferring a document to the handheld.
Opening a document on the handheld.
Moving from one page to another in a document.
Grabbing and dragging points and rays.
Entering text on a Notes page.

The activity

The document is designed for use by students working individually on TI-Nspire handhelds and is particularly powerful when used with TI-Nspire Navigator system: not only can the constructions be demonstrated on a large screen but each individual student's construction can be displayed and discussed.

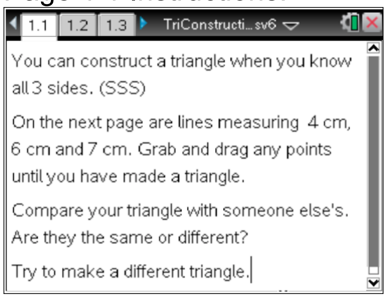
The four problems of the TI-Nspire document provide four challenges for students. Each problem has a page of instructions followed by pages where the geometrical constructions can be carried out. Finally, in each case, there is a notes page entitled "What I found out" where students can summarise what they have found.

There are comments on each of the four problems below.

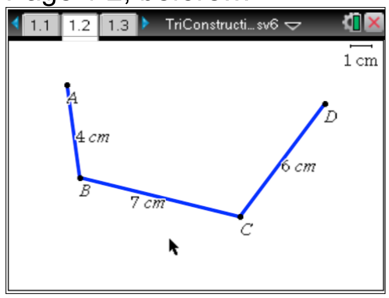
1. SSS triangles

The first challenge for students is to construct a triangle using three known sides and to consider whether the triangle is unique.

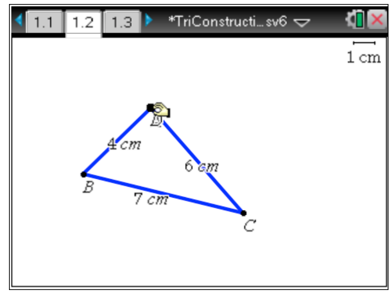
Page 1.1 Instructions:



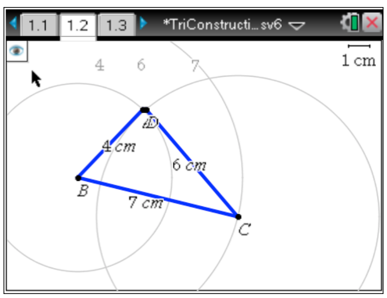
Page 1.2, before….

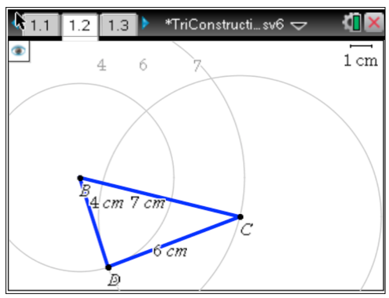


…… and after.



Any of the points may be moved around and doing so will reinforce the compasses construction method, since points can only move around circles. As shown below, it is possible to see the hidden constructions by pressing menu 1 3, something you may wish to demonstrate and discuss with students.



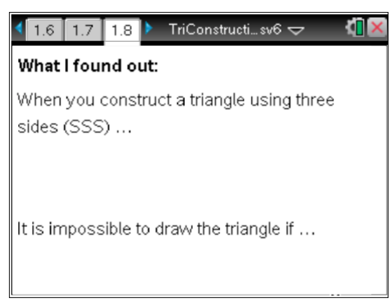


Another key issue for discussion is whether reflected (and rotated) triangles are different. For example, are these two triangles the same or are they different? You certainly cannot rotate one to fit on the other.

Measuring the angles may help to establish the uniqueness of the triangle in students' minds. (Press menu 8 4, and define the angle to be measured by visiting three points, pressing [click] after each point.)

Pages 1.4 to 1.7 present four more similar constructions:

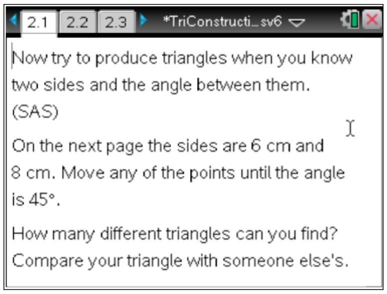
1.4 An isosceles triangle (pink)
1.5 A right-angled triangle (green)
1.6 An equilateral triangle (orange)
1.7 These three (brown) lengths cannot produce a triangle. It is worth discussing why this has occurred and ask students to produce a general rule for determining whether or not a triangle can be formed from three sides. (If the sum of the lengths of any two sides is less than or equal to the length of the third side, no triangle can be constructed.)

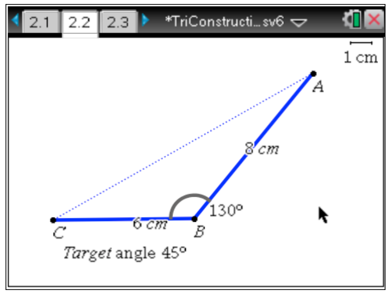


If you wish it is possible to change the three lengths that determine the triangle on pages 1.2 to 1.7. The steps required are:
a) reveal the hidden constructions as described above (press menu 1 3).
b) click on each of the three hidden lengths at the top of the page
c) press esc to remove the Hide/Show tool.
d) double-click on any of the lengths, press del, and enter the new length.
The displayed lines change automatically.

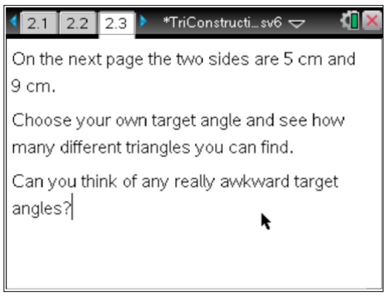
2. SAS triangles

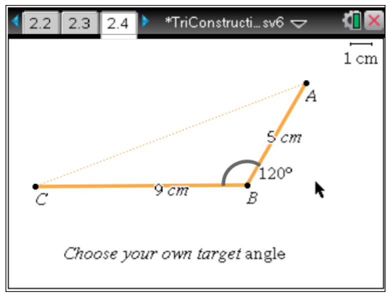
In this problem students can rotate two sides about a point until the angle between them reaches a target value, so constructing a SAS triangle.





Points A and C can be dragged (along circles) around point B. Dragging B allows the whole triangle to be translated.



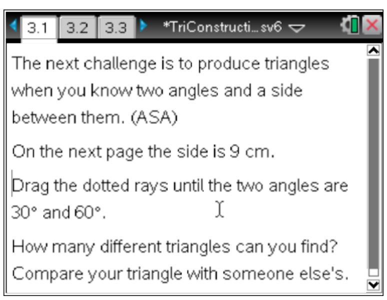


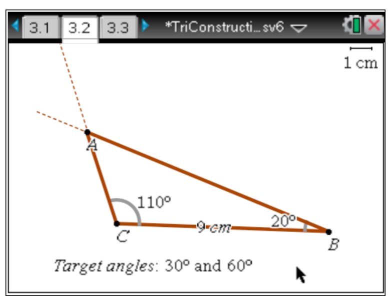
A unique triangle can be constructed with any target angle between 0° and 180°.

On page 2.5, "What I found out", students are asked to complete the sentence: "When you construct a triangle using two sides and the angle between them (SAS)…"

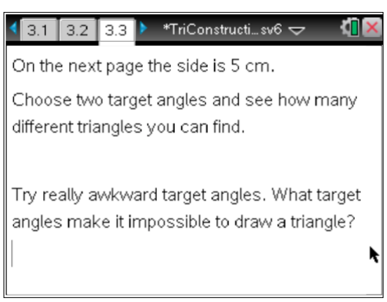
3. ASA triangles.

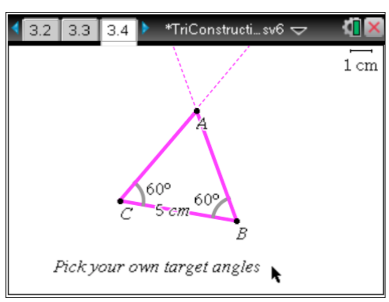
The third challenge involves using a fixed length with two target angles at the ends.





Here students drag rays rather than points until both the target angles are reached. If necessary, points B and C can be moved but not point A.



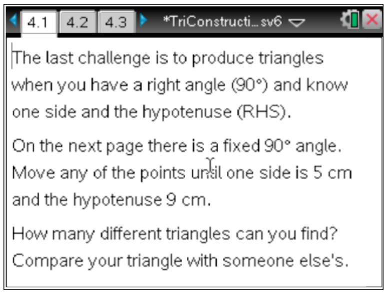


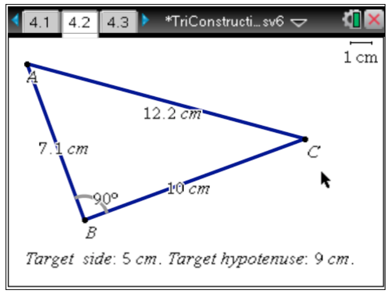
A unique triangle can be drawn using any positive target angles as long as their sum is less than 180°. If the rays are dragged so that they no longer intersect, the two angle measurements are undefined and they disappear from the screen.

Page 3.5 again asks students to summarise what they have found.

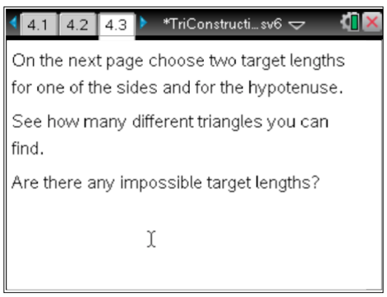
4. RHS triangles

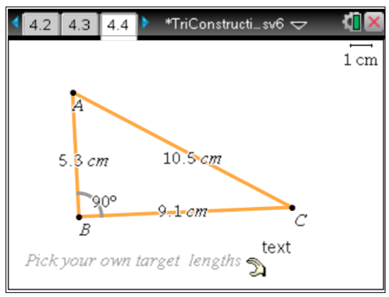
The final investigation concerns the uniqueness of a right-angled triangle with a known hypotenuse and one other side.



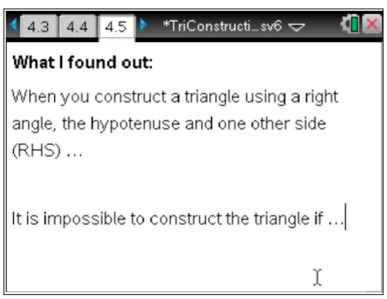


Note that the term *hypotenuse* may not be familiar to all students. The 90° angle is fixed but any of the points may be moved.





Either AB or BC can be used for the target length of 5 cm. The third side will be 7.4 cm (or, because of rounding errors, 7.5 cm.)



A unique triangle can be constructed for any pair of target lengths as long as the hypotenuse is longer than the side.