CIRCLE *THEOREMS*
Teacher Notes

References

Foundations	-
Foundations Plus	-
Higher	G2.5
Higher Plus	G1.1 and G1.2

Introduction

Students are able to explore the following circle theorems by moving lines and points around the TI-Nspire screen:

- the angle at the centre is twice the angle at the circumference;
- angles from the same arc in the same segment are equal;
- the angle in a semicircle is a right angle;
- opposite angles in a cyclic quadrilateral add up to 180°;
- the tangent to a circle at a point is perpendicular to the radius at that point.

These activities do not *prove* the circle theorems. Instead they give students the opportunity to get a sense of how the circle theorems work, as they move points and lines around and see what happens.

Resources

The TI-Nspire document ***CircleTheorems.tns*** is needed for this activity.

A 3-page student handout guides students in the use of the TI-Nspire document

TI-Nspire skills students will need

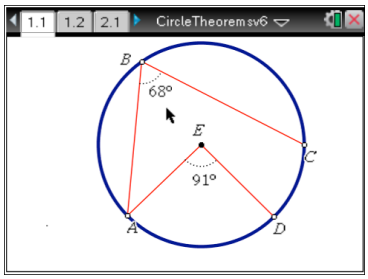
Transferring a document to the handheld
Opening a document on the handheld
Moving between pages of a document
Moving from one part of a split screen to another

The activity

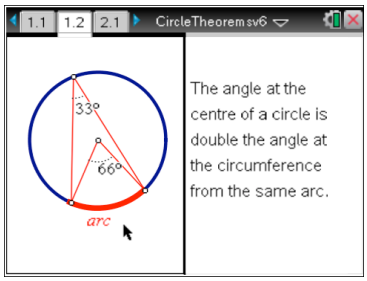
The activity is designed for use by students working individually on TI-Nspire handhelds. It can also be demonstrated on a screen using the TI-Nspire Navigator System, which also makes it easy to compare and discuss students' different results.
The student notes give guidance and instructions for using the TI-Nspire document. They are divided into six sections and there are notes on each section below

Throughout the activity all points marked with an empty circle may be dragged.

1. The angle at the centre of a circle is twice the angle at the circumference

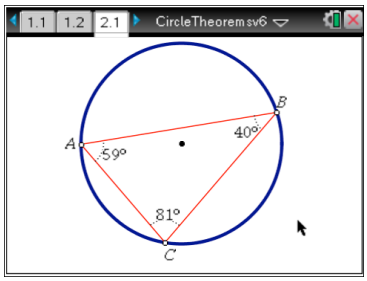


Students explore the diagram, moving the points A, B, C, or D around the circle. They aim to make the angle at the centre twice the angle at the circumference and find that this is only possible when the two angles are defined by the same arc.

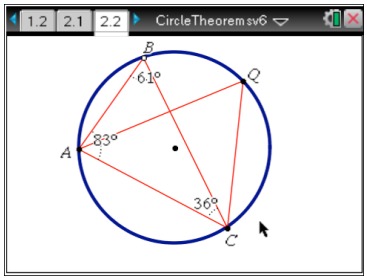


Page 1.2 gives this summary of the theorem. Points may be moved around the circle to further illustrate its veracity.

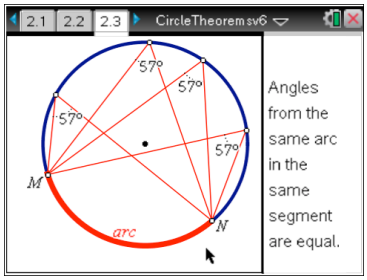
2. Angles from the same arc in the same segment are equal



Students choose points and drag them around the circle. They notice which angles change and which stay the same. They discover that the angle they drag will not change. This is because by dragging they are generating many angles from the same arc in the same segment.

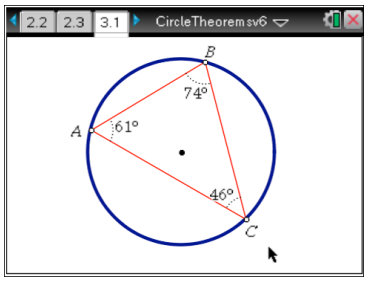


Students verify their understanding of the theorem by trying to measure the angle at Q (page 2.2). They can drag point B over point Q to show that the angles at B and Q are equal.

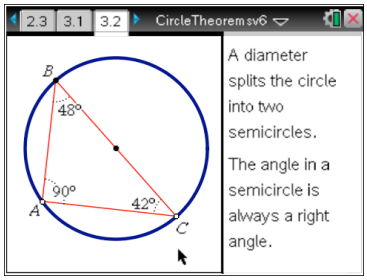


This is the summary of the theorem on page 2.3.
Moving points M and N provides a very vivid illustration of the theorem.

3. The angle in a semicircle is a right angle

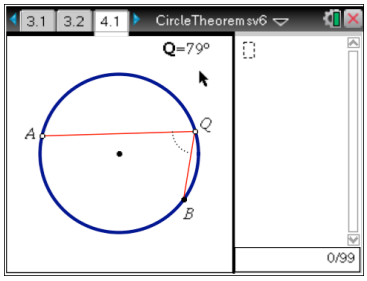


In this section, by moving the vertices of a triangle around a circle, students try to make each of the three angles in turn equal to 90°. Through the activity they recognise that, for an angle to be 90°, one of the three sides of the triangle must become a diameter, splitting the circle into two semicircles. It follows that the angle in a semicircle must always be a right angle.

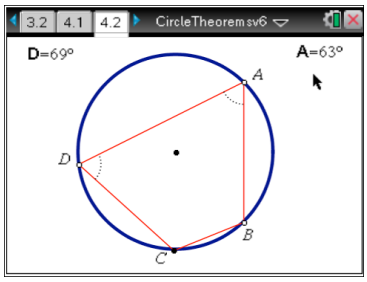


This statement of the theorem appears on page 3.2.

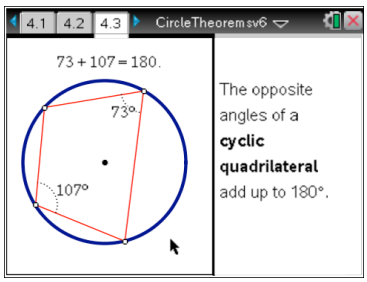
4. Opposite angles of a cyclic quadrilateral add to 180°



Students move point Q around the circle. They find that when the angle remains in the same segment it does not change (since angles in the same segment are equal). However, when the point Q moves to the opposite segment, the angle at Q instantly changes.
Students discover that the sum of the two angles is 180° and then apply this to a cyclic quadrilateral.

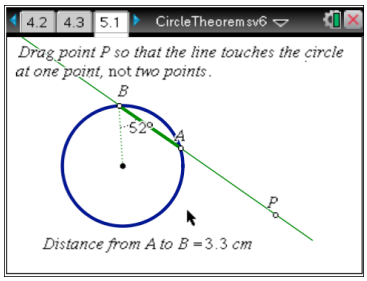


On page 4.2 the fact that angles in opposite segments add to 180° allows missing angles in the quadrilateral to be found.



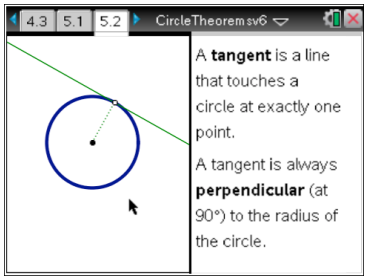
On page 4.3 there is this summary of the theorem.
Points may be moved around the circle.

5. Tangents are perpendicular to radii



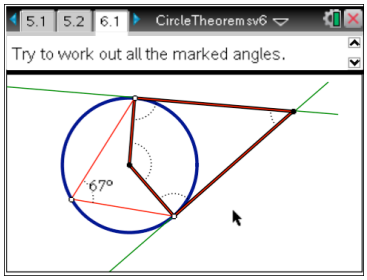
The aim here is for students to recognise that a line touches a circle at exactly one point if and only if the angle between the line and the radius is 90°.

Students move the line until the two intersection points A and B coincide. When they do so, a message appears pointing out that the angle is now 90°.



There is a statement of the theorem on page 5.2.

6. An angle puzzle



Finally students face a problem involving two tangents meeting at a point. They need to use the circle theorems to find the marked angles of the blue kite.

Answers can be checked by revealing the hidden values, using the Hide/Show tool.