



School of Education

Senior Mathematics Curriculum and Methodology A

Mathematics	Topic: Geometry
SACE Stage 1	Term 2 2018

Lesson Plan

Week : 5 Monday (50 mins)

Topic Details: Introduction to Properties of Angles in Circles.	Previous lesson (prior knowledge): New topic, but will draw on some previous knowledge including the properties of isosceles triangles. ✓
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Also
 * How to label angles using $\angle ABC$ format
 * When to use upper case or lower case
 * Angle sum of triangle

Learning Intentions

Students will:

- Know some properties of Angles in Circles (Angles at the circumference subtended by the same arc are equal, the angle subtended at the centre is twice the angle subtended at the circumference by the same arc).
- Have some experience playing with angles in circles using GeoGebra, and be able to form hypotheses about properties these angles might have based on such experimentation.
- Have some idea about how one might go about proving such properties.

These are good intentions -
 They could be expressed more succinctly

Time (mins)	Teacher Activity	Student Activity	Resources
5min	Greet individual students, then call for attention.	Gradually settling down.	None
10min	Introduce new topic, define "Arc" and "Subtend".	Watching, Listening, asking questions.	Whiteboard.

Would it take this long?
 If so, more detail needed here

10min	Walking around, giving encouragement and feedback.	Playing with Geogebra worksheet, forming hypotheses, (on task) discussion amongst each other encouraged.	Printed out worksheet, and also GeoGebra worksheet.
10min	Directing Discussion	Guessing properties of angles in circles.	Whiteboard, and GeoGebra worksheet.
15min	Go through how to prove the angle at the centre property (using isosceles triangles and sum of angles). Then explain why this also explains the angles at the circumference property.	Listening, Watching. Copying the proof.	Whiteboard.

← How would students be grouped?

Evaluation/Assessment

No summative assessment for this lesson, but keep track of how difficult the students are finding the concepts --- how easily do they produce correct answers to the worksheet questions --- and see how the discussion goes when asking the class for what they think properties of angles in circles might be, to judge the level of the class and inform how to design the next lesson.

How will this be documented?

Teacher Notes

- This is a new topic, and it might be quite a tough one, so patience and repetition will likely be needed. This is a tough topic both because it is very abstract, and because it involves an introduction to proof.
- There are some special cases the students might notice in the GeoGebra worksheet. Specifically, if they move the point at which the angle is being subtended onto the arc, the angle will flip. This is interesting --- let them explore it if they find it on their own, see if they can form a hypothesis. The angle subtended there is supplementary to the angle subtended in the normal way, and so if the angle subtended the normal way is A , it would be $180 - A$, so the angle shown on GeoGebra would be $360 - (180 - A) = 180 + A$. If the students don't notice this on their own though, there is no need to point it out. Just an interesting Easter Egg. If they do notice it, and figure it all out, link them to the quadrilaterals video I made (<https://youtu.be/zUL2OBqF-qQ>) and see if they can find the connection between the property discussed in the video, and the property they just discovered.
- Leave the explanations of the words "Arc" and "Subtend" up on the board, may need to come back to this to remind the students about them.
- Hopefully most of the students should be able to answer the worksheet questions relatively easily after playing with the GeoGebra worksheet, but if they don't that's ok --- just explain the properties we are looking for (angles subtended at the circumference by the same arc are equal, and the angle subtended at the centre is twice that subtended at the circumference), and let them use those facts to answer the worksheet questions.
- If a lot of time was used doing classroom management and there isn't time for the proof at the end, that's ok.
- On the other hand if the students are already familiar with circle geometry from previous years (it's possible they covered some of this already), then skip through what they seem to already know and focus on first using the GeoGebra worksheet to develop some intuition for these properties, and then to the proof. If you get through all that and still have time left over, ask them to prove the other property (that angles subtended by the same arc are equal), and allow them to use the property we just used. If they still need more point them towards the special cases in the GeoGebra worksheet and the connections to the quadrilaterals video.

This was fun.
I enjoyed playing
with that on geometry.

← Could grouping of
students assist here?

Is there scope for
discussing the nature
of proof? Comparing the
inductive approach with
the more formal proof by
deduction.

Additional Resources

- An "arc" is a section of the circumference of a circle.
- If you connect the two endpoints of an arc to a point with straight lines, the angle those two lines make at that point is said to be "subtended" by the arc.
- The second example at this website: <https://www.mathsdoctor.co.uk/revision-help/gcse/geometry-and-measures/proof/> shows how to prove the double angle property.
- Quadrilaterals Video: <https://youtu.be/zUL2QBqF-qQ>
- GeoGebra worksheet: <https://ggbm.at/kpREkaRQ>
- Physical worksheet should be attached (in the same folder as this file).

← good to include your video
— worthwhile extension

You made a nice worksheet here.
This provides a meaningful use of technology
with active student involvement