Lesson 8.7 — Teacher Reference Notes

Review Day

Unit 8: Circles • Day 7 of 7

At a Glance

Pacing: Opening task — Satellite Problem (~15 min) • Self-assessment on the rubric (~5 min) • Self-directed practice from problem bank (~60 min) • Closing — 'One thing I still want to understand' (~5 min)

Materials: Vertical whiteboards • Self-assessment sheets (rubric with checkboxes for each row, basic/intermediate/advanced) • Problem bank packets (organized by rubric row and level, with answer keys) • Compasses, rulers, protractors, calculators

Nav instrument rows active: All six rows. This is the synthesis day. Students choose their entry points based on honest self-assessment of where they are on each row.

Key setup note: This is a review day, not a re-teaching day. The structure is deliberate: a single shared rich problem to warm up thinking and surface where groups are, then structured self-assessment, then self-directed practice. Your job during practice is to circulate and have brief targeted conversations, not deliver content.

OBJECTIVES

By the end of this lesson students can:

- Honestly locate themselves on each row of the unit rubric — basic, intermediate, or advanced — with evidence.
- Make and follow through on a specific practice plan based on their self-assessment, not on what feels comfortable.
- Apply circle theorems flexibly to a non-routine real-world context (the satellite problem) and recognize that multiple solution methods may exist.
- Articulate at least one specific gap they still want to close before the assessment.

Narrative Arc — Open class with this

"We have built a complete unit on circles. Six rows on the rubric. Six lessons of thinking. Today is the day you take honest stock of where you are. Not where you hope to be, not where you think you should be — where you actually are. And then you spend the rest of the period closing your real gaps, not the ones that feel comfortable to work on."

"We will start with a single rich problem together, to warm up the kind of thinking the assessment will ask for. Then you will assess yourselves. Then you will practice. And before you leave, every one of you is going to name one thing you still want to understand. That is part of being honest with yourself about what you know."

OPENING TASK — THE SATELLITE PROBLEM

Opening Task (≈15 min)

Groups work at vertical boards. Give the problem verbally and write it on the board:

“A communications satellite orbits Earth in a circular orbit. From the satellite, the angle subtended by Earth's diameter is 28°. Earth's radius is approximately 6370 km. How far above Earth's surface is the satellite?”

Give groups about 12 minutes. Do not hint. Then briefly consolidate — one group presents their method, others compare. Do not spend more than 3–4 minutes on consolidation. The point is to warm up thinking and surface where groups are, not to fully resolve every approach.

Solution — the elegant route is tangent lines

The satellite at point P sees Earth's edge (limb) tangentially. The lines of sight from P to the two endpoints of the visible diameter are tangent to Earth's surface. The tangent from P to the circle makes a right angle with the radius at the point of tangency — radius-tangent theorem from Lesson 8.5.

Let θ = half the subtended angle = 14°. Let OP = distance from Earth's center to the satellite, R = Earth's radius.

In the right triangle formed by O, P, and the point of tangency: $\sin 14° = R / OP$.

$OP = R / \sin 14° = 6370 / \sin 14° \approx 6370 / 0.2419 \approx 26{,}330$ km.

Height above surface = $OP - R \approx 26{,}330 - 6370 \approx 19{,}960$ km.

Why this problem is good for an opening task

The problem is deliberately open-ended with more than one entry point. Some groups will try the chord-sine route (treating the satellite as if it were on the circle); some will try the tangent-line route; some may get confused about whether the satellite is on the circle or outside it. The tangent approach is the elegant one for this problem because the satellite sees Earth's limb — the line of sight is tangent to Earth's surface. Both the chord-sine route and the tangent route can lead somewhere; comparing them is worth a few minutes of consolidation.

The point of the opening task is not to fully resolve every approach. It is to warm up thinking and let you see where groups are. Move to self-assessment while energy is still high.

SELF-ASSESSMENT — WHERE ARE YOU ON THE RUBRIC?

Students return to their seats individually. Hand out the self-assessment sheet (the six-row rubric with basic/intermediate/advanced checkboxes for each row). Give five minutes. Read the instructions aloud:

Self-Assessment Instructions — read aloud

“For each row, check the highest level you can do confidently — not the level you think you should be at, and not the level you hope to reach by tomorrow. Confident means: I could do a problem at this level on the assessment right now, without notes, and get it right. Then circle the one or two rows where you most need to improve before the assessment. That is what you practice today.”

SELF-DIRECTED PRACTICE — FROM THE PROBLEM BANK

Students choose problems from the bank based on their self-assessment. They may work at the boards or at their desks — their choice. Problems are organized by rubric row and level, with synthesis problems at the end for students solid across all six rows.

How to circulate effectively — brief, targeted conversations

Your job during practice is not to deliver content — it is to have brief diagnostic conversations. Try variations of these:

- "You marked Basic on inscribed angles. What's your evidence? Have you tried the Intermediate problem?"
- "What is this problem really asking? What rubric row does it live on?"
- "You got the answer. Can you explain why your method works — not just that it does?"
- "This problem connects two rows. Which two? What from each row are you using?"

A student who can answer one of these in their own words is doing exactly the metacognitive work the assessment will ask for.

CLOSING — ONE THING I STILL WANT TO UNDERSTAND

Five minutes before the end of class, stop the room. Go around (individually or by group) and ask each student to complete one sentence:

Closing prompt

"Before the assessment, I still want to understand _____."

Write the responses on the board. Group them by rubric row. This gives you real-time information about where the class is, and it gives students permission to name what they don't know without shame. If several students name the same gap, spend a minute addressing it before dismissal or flag it for the start of the next class.

Why the closing move is not optional

Students who can name what they don't understand are much better positioned to study effectively than students who leave with a vague sense of unease. The act of naming a specific gap is itself a metacognitive skill worth developing.

Common responses you will hear: 'I still don't understand why the proof of the inscribed angle theorem works for the case where the center is outside the angle'; 'I get confused about which arc the angle subtends'; 'I can't remember when to use the Law of Sines vs. the area formula.' Each of these is a specific, addressable gap. Treat them as such — not as evidence of weakness, but as evidence of self-awareness.

✎ **Students leave with:**

- Their completed self-assessment sheet — a record of where they were today and what they chose to practice.
- Their practice plan box, filled in — a commitment to what they will work on between now and the assessment.
- A specific, named gap they still want to close — written down before leaving the room.
- Worked problems from the bank, in their notebook, on whichever rows they targeted.