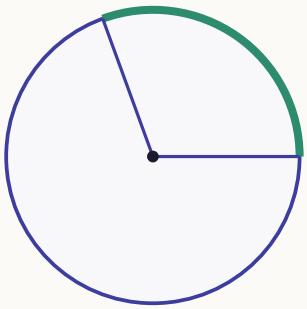
Circle Theorems Interactive Notebook Foldables

Chords · Tangents · Inscribed Angles
A SpEd-Scaffolded Unit for Grades 9–10

Aligned to Common Core Standards
HSG.C.A.2 — Chords, secants, tangents
HSG.C.A.3 — Inscribed & circumscribed angles

70	7	8	4
PAGES	FOLDABLES	THEOREMS	ANSWER SECTIONS

THIS PREVIEW CONTAINS



Color-Coding Legend & Universal Sentence Frames

This unit uses a consistent color-coding system across all 7 foldables. Print this page on card stock and keep it at the front of the student's interactive notebook as a reference. The colors are not decorative — they carry meaning. When a student sees red, they should think 'central angle.' When they see blue, they should think 'inscribed angle.' This becomes a rapid-retrieval cue that bypasses the verbal bottleneck many SpEd students experience.

Color	Means	Where you'll see it
Red	Central angle	Angle whose vertex is the center of the circle
Blue	Inscribed angle	Angle whose vertex is on the circle
Green	Arc	A piece of the circle's edge
Purple	Chord	A segment whose endpoints are on the circle
Orange	Tangent / Secant	A line that touches (tangent) or crosses (secant) the circle

Universal Sentence Frames

These five sentence frames appear on every practice page. Encourage students to use them until they can produce the explanation in their own words. The frames provide the syntactic structure so the student can focus on the mathematical reasoning.

Sentence frame: I know the angle is _____ because _____.

Sentence frame: The arc measures _____ because _____.

Sentence frame: I drew _____ to find _____.

Sentence frame: The theorem that applies is _____ because _____.

Sentence frame: I can check my answer by _____.

The 4-Step Problem-Solving Protocol

Every practice problem in this unit is structured around the same 4 steps. This protocol reduces cognitive load by giving students a predictable sequence. By the end of the unit, students should be able to recite the four steps from memory before beginning any circle problem.

1

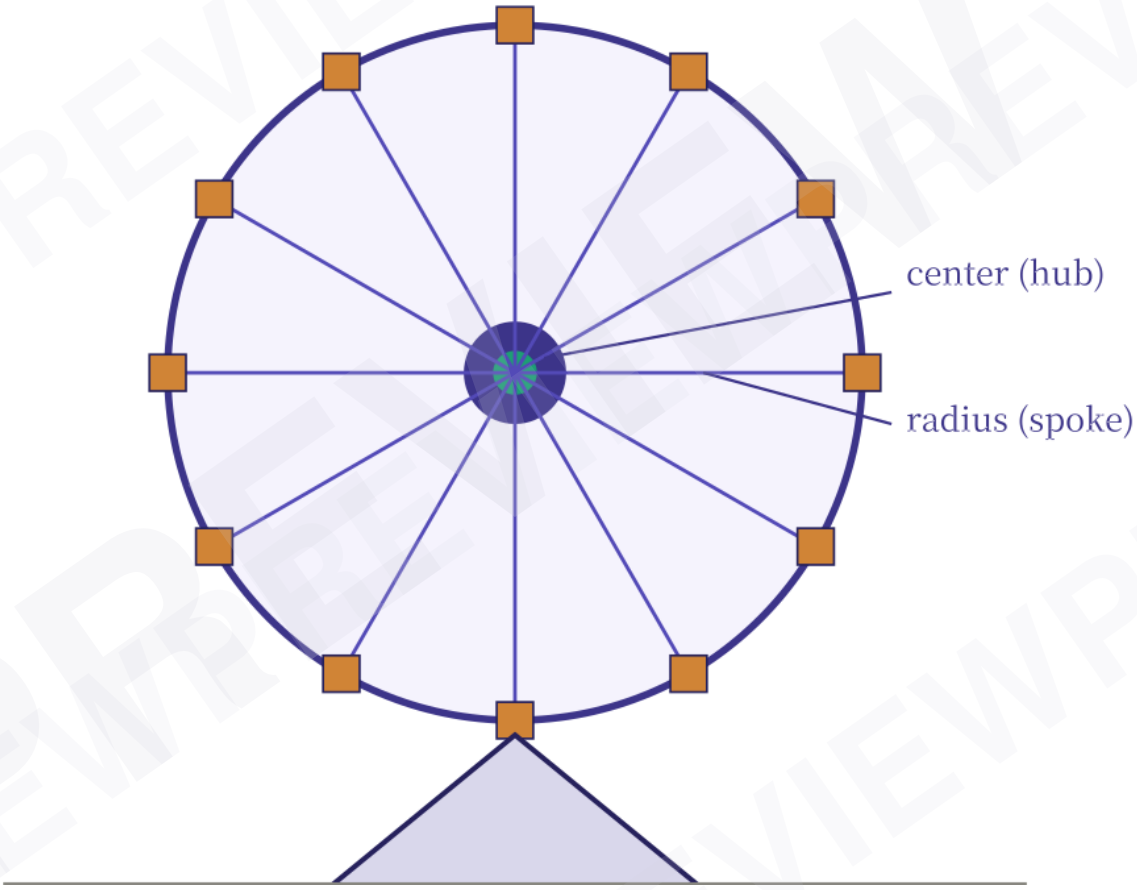
Identify
What kind of circle problem is this? Circle the key parts: chord, tangent, inscribed angle, arc.

FOLDABLE 1

Parts of a Circle — Vocabulary Flip Book

Real-World Connection: Ferris Wheel

Look at the picture below. Where do you see circles in real life? This ferris wheel shows the same parts of a circle you will learn about in this foldable. When you can connect a math idea to something you already know, your brain remembers it better.



Real-world anchor: Ferris Wheel

Learning Objectives

- Identify and label 8 parts of a circle: center, radius, diameter, chord, secant, tangent, arc, sector.
- Explain the relationship between radius and diameter (d = 2r).
- Distinguish between a chord, a secant, and a tangent.
- Use color-coded diagrams to identify parts in a Ferris wheel diagram.

IEP Goal: Given a labeled circle diagram, [Student] will correctly identify 7 of 8 parts of a circle (center, radius, diameter, chord, secant, tangent, arc, sector) with 80% accuracy across 3 consecutive trials.

Cut-and-Fold Template: 8-Tab Vocabulary Flip Book

Cut out the large rectangle along the dotted line. Fold along each solid green line so the tabs fold UP toward you. Glue the back of the assembled foldable into your interactive notebook. Lift each tab to write the definition and an example inside.

CENTER	RADIUS	DIAMETER	CHORD
CENTER Definition: _____ _____ _____ Example: _____ _____ _____	**RADIUS** Definition: _____ _____ _____ Example: _____ _____ _____	**DIAMETER** Definition: _____ _____ _____ Example: _____ _____ _____	**CHORD** Definition: _____ _____ _____ Example: _____ _____ _____

Assembly:

1. Cut out the large rectangle along the dotted outer border.
2. Fold along each solid green vertical line so the tabs fold UP toward you (mountain fold).
3. Fold along the solid green horizontal line below the tab labels.
4. Glue the back of the assembled foldable into your notebook.
5. Lift each tab to write the definition and an example inside.
6. Color-code each tab using the SpEd color system (red = center/radius, green = arc/sector, purple = chord, orange = secant/tangent).

Discovery Activity: Inscribed vs. Central Angles

Before we tell you the rule, you are going to discover it yourself. Archimedes noticed this same pattern over 2,000 years ago — and you can see it too. Use a protractor to measure the central angle and the inscribed angle in each circle below. Record your measurements in the table. Then look for a pattern.

Step 1: Measure

For each diagram below, measure (a) the central angle (the angle at the center O, shown in red) and (b) the inscribed angle (the angle at the vertex V on the circle, shown in blue). Use your protractor carefully — line up the center mark and the baseline.

Diagram 1

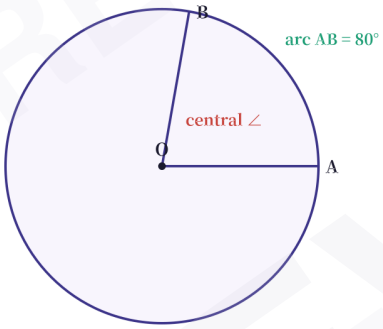


Diagram 2

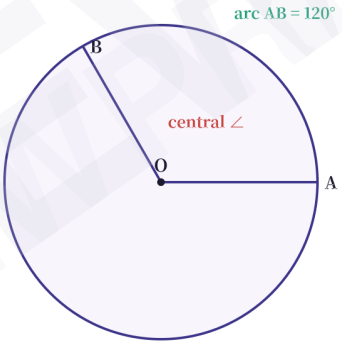


Diagram 3

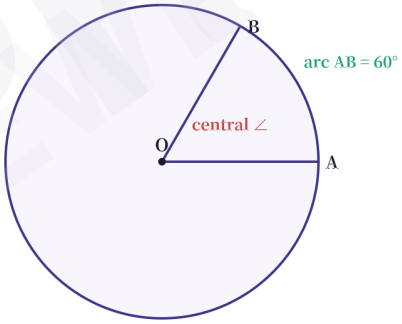
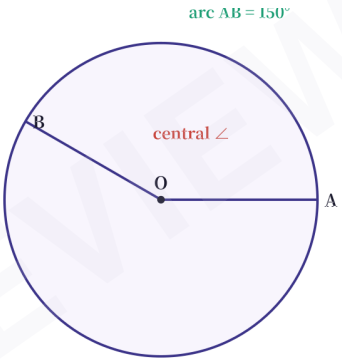


Diagram 4



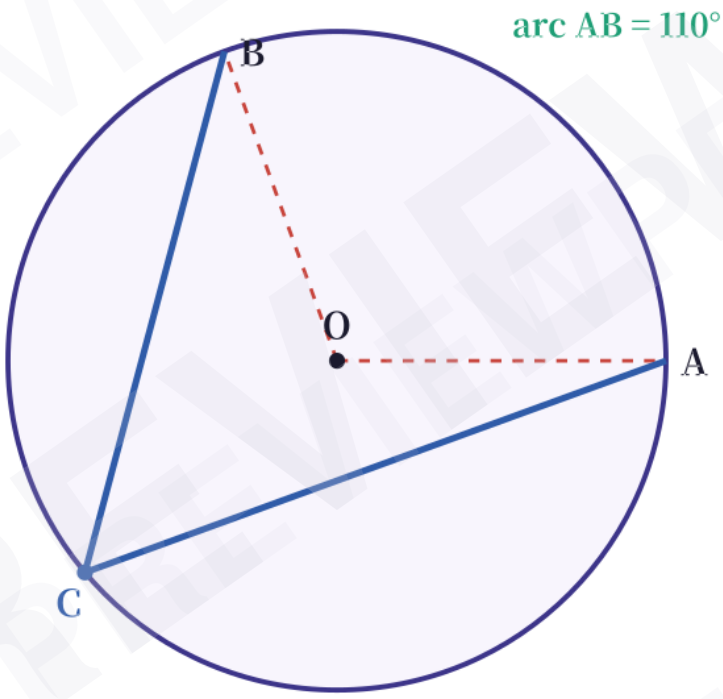
Step 2: Record Your Data

Fill in this table with your measurements. Then divide the central angle by the inscribed angle for each row. What do you notice?

Diagram	Central angle (red)	Inscribed angle (blue)	Central ÷ Inscribed
1	____°	____°	____
2	____°	____°	____

The Inscribed Angle Theorem — Statement & Examples

Inscribed Angle Theorem: The measure of an inscribed angle is half the measure of its intercepted arc.
m∠inscribed = (1/2) × m(arc)
m(arc) = 2 × m∠inscribed



Color-coded diagram: green arc, red central angle, blue inscribed angle. All three intercept the same arc.

Special Case: Inscribed Angle on a Diameter

If the intercepted arc is a semicircle (180°), then the inscribed angle that intercepts it must measure 90°. This is why **any angle inscribed in a semicircle is a right angle** — a fact that is incredibly useful in construction and engineering. Builders have used this property for thousands of years to check that corners are square.

Example 1 — Find the inscribed angle

Problem: An inscribed angle intercepts an arc that measures 80°. What is the measure of the inscribed angle?

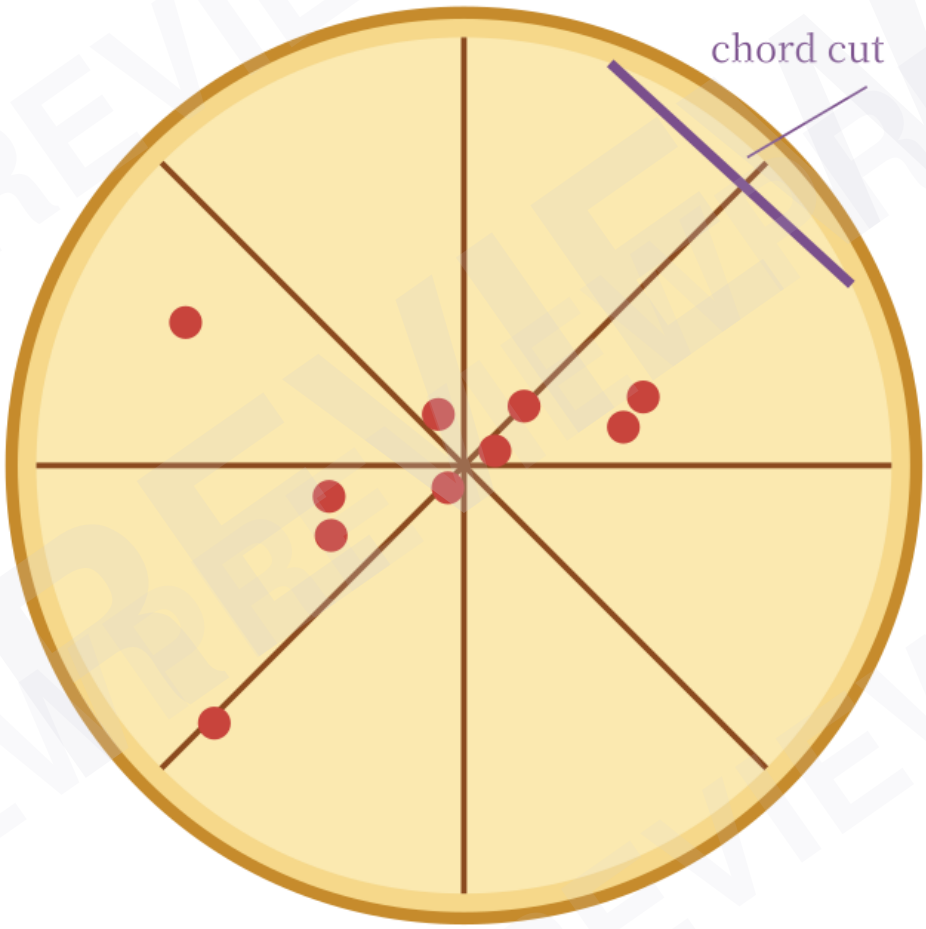
Step 1. Identify: We are given the arc (80°) and asked for the inscribed angle. Both intercept the same arc.

FOLDABLE 3

Chord Properties — 4-Tab Foldable

Real-World Connection: Pizza

Look at the picture below. Where do you see circles in real life? This pizza shows the same parts of a circle you will learn about in this foldable. When you can connect a math idea to something you already know, your brain remembers it better.



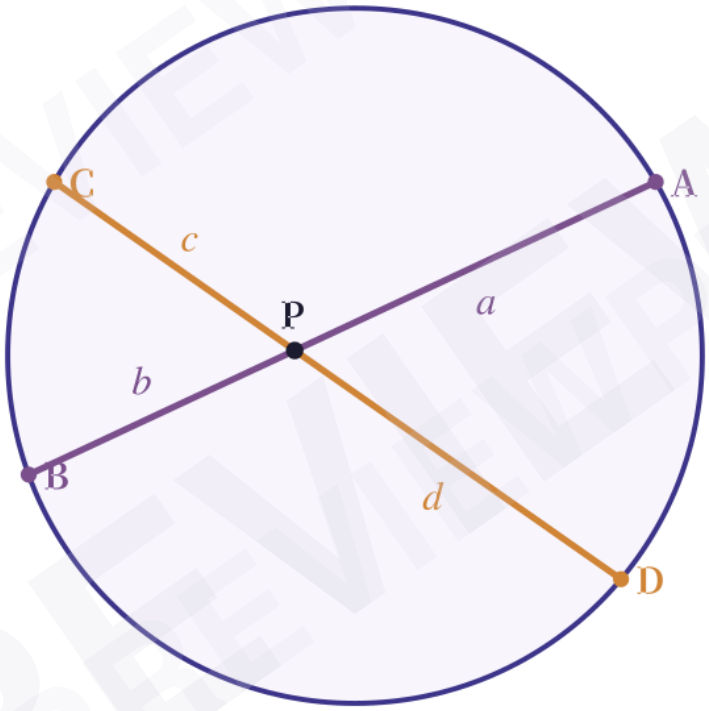
Real-world anchor: Pizza

Learning Objectives

- Apply the perpendicular bisector theorem: a perpendicular from the center to a chord bisects the chord.
- Apply the equidistant chords theorem: chords equidistant from the center are congruent.
- Apply the intersecting chords theorem: $a \times b = c \times d$.
- Use the chord length formula: chord $= 2\sqrt{(r^2 - d^2)}$.

Tab 3 — Intersecting Chords (Segment Products)

Theorem: If two chords intersect inside a circle, then the products of the lengths of their segments are equal.
a × b = c × d



Two chords intersect at P. The products of the segment lengths are equal: a·b = c·d.

This is one of the most powerful theorems in circle geometry because it turns a geometry problem into an algebra problem. Once you write a × b = c × d, you can substitute the numbers you know and solve for the one you don't.

Example — Find the missing segment

Problem: Two chords intersect inside a circle. The four segment lengths are 6, 8, 12, and x. Find x.

Step 1. Identify: We have 4 segments. Three are known (6, 8, 12) and one is unknown (x).

Step 2. Label: Mark the chord with segments 6 and 8 in **purple**. Mark the chord with segments 12 and x in **orange**.

Step 3. Apply: Intersecting chords theorem: a × b = c × d. So 6 × 8 = 12 × x.

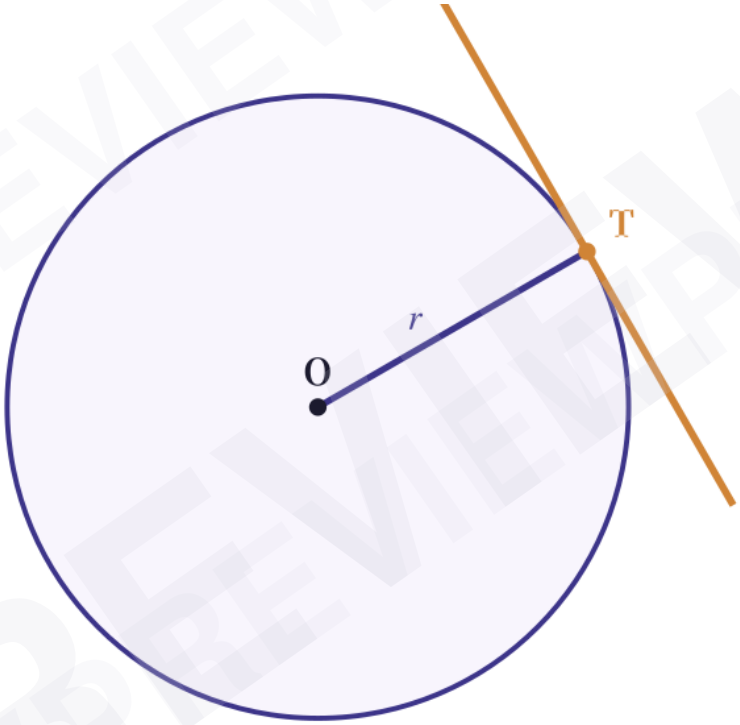
Step 4. Solve: 48 = 12x. Divide both sides by 12. x = 4. Check: 6 × 8 = 48, and 12 × 4 = 48. The products match, so x = 4 is correct.

FOLDABLE 4

Tangent Properties — Tri-Fold Foldable

Real-World Connection: Bicycle Wheel on Road

Look at the picture below. Where do you see circles in real life? This bicycle wheel on road shows the same parts of a circle you will learn about in this foldable. When you can connect a math idea to something you already know, your brain remembers it better.



Real-world anchor: Bicycle Wheel on Road

Learning Objectives

- Apply the tangent-radius perpendicularity theorem: the radius to a point of tangency is perpendicular to the tangent.
- Identify common tangents (internal and external) for two circles.
- Apply the tangent segments theorem: tangent segments from a common external point are congruent.
- Use the Pythagorean theorem to solve problems involving tangents and radii.

IEP Goal: Given a circle with a tangent and a radius, [Student] will identify the right angle at the point of tangency and use the Pythagorean theorem to find a missing length in 4 of 5 trials with 80% accuracy.

Tangent Properties Tri-Fold Template + Practice

Cut-and-Fold Template

⊥ TANGENT	COMMON TAN.	SEGMENTS
⊥ TANGENT Radius ⊥ tangent at point of tangency. Use Pythagorean theorem in the right triangle.	**COMMON TAN.** External: doesn't cross centers. Internal: crosses centers.	**SEGMENTS** PA = PB Two tangents from same external point are congruent.

Assembly:

1. Cut out the rectangle along the dotted border.
2. Fold along the solid green vertical lines (mountain fold) to make a tri-fold (like a brochure).
3. Glue the back panel into your notebook.
4. Color-code each panel: orange for tangents, navy for radii, mark all right angles.
5. Add a worked example inside each panel using the 4-step protocol.

Practice Problems

- **1.** A circle has radius 8. A tangent from external point P has length 15. Find the distance from P to the center.
- **2.** From point P, two tangent segments PA and PB are drawn. PA = 19. Find PB.
- **3.** A circle has radius 6. The distance from external point P to the center is 10. Find the length of the tangent from P to the circle.
- **4.** Explain in your own words why PA = PB when both are tangent segments from external point P.

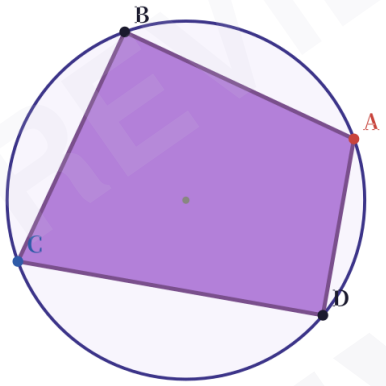
Sentence frame: The tangent segment is _____ because _____.

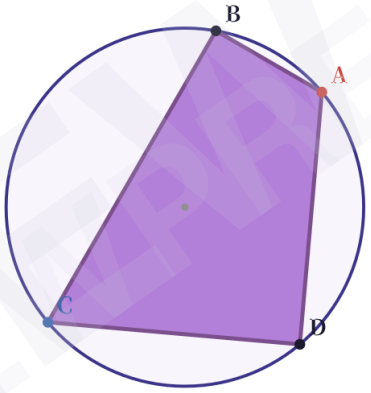
Discovery Activity: Opposite Angles of an Inscribed Quadrilateral

Just like Foldable 2, you are going to discover the rule yourself before we tell you. Use a protractor to measure all 4 angles of each inscribed quadrilateral below. Then add the opposite angles and look for a pattern.

Step 1: Measure

Quadrilateral 1	Quadrilateral 2





Step 2: Record Your Data

For each quadrilateral, measure all 4 angles. Then add the opposite pairs A + C and B + D.

Quad	∠A	∠B	∠C	∠D	∠A + ∠C	∠B + ∠D
1	____°	____°	____°	____°	____°	____°
2	____°	____°	____°	____°	____°	____°

Step 3: Make a Conjecture

Sentence frame: I notice that ∠A + ∠C is always _____ and ∠B + ∠D is always _____.

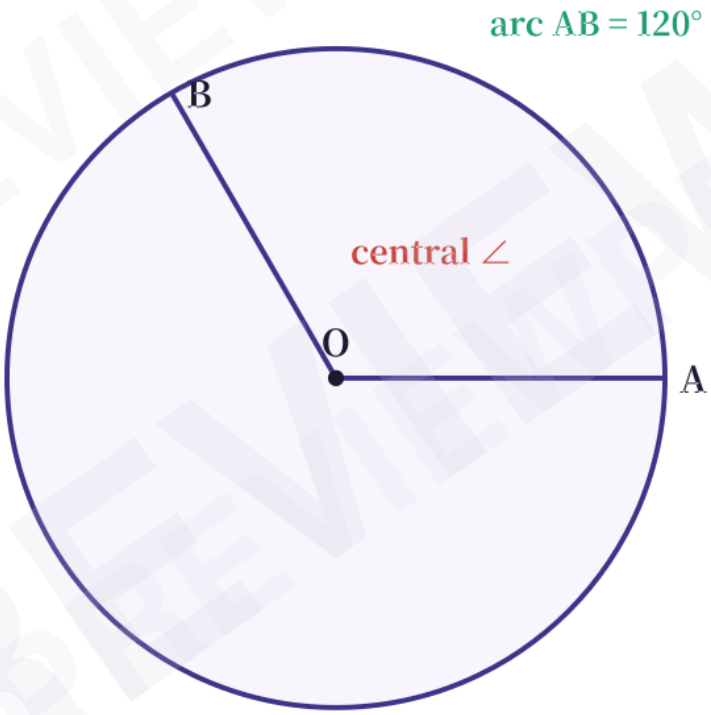
Sentence frame: So opposite angles of an inscribed quadrilateral are _____.

FOLDABLE 6

Angle-Arc Relationships — Pocket Sort

Real-World Connection: Wheel and Spoke Patterns

Look at the picture below. Where do you see circles in real life? This wheel and spoke patterns shows the same parts of a circle you will learn about in this foldable. When you can connect a math idea to something you already know, your brain remembers it better.



Real-world anchor: Wheel and Spoke Patterns

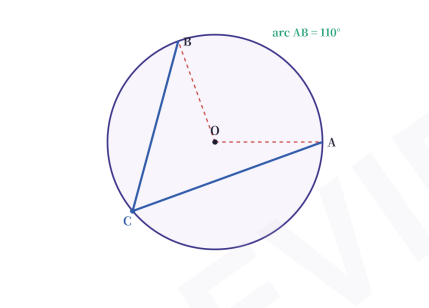
Learning Objectives

- Identify the four types of angle-arc relationships: central, inscribed, interior (intersecting chords), exterior (secants/tangents).
- Sort 16 cards into the 4 categories based on diagram and formula.
- Apply the correct formula to find a missing angle or arc.

IEP Goal: Given 16 angle-arc cards, [Student] will correctly sort them into the 4 categories (central, inscribed, interior, exterior) with 75% accuracy (12 of 16 correct).

Cheat-Sheet Page 1 — Theorems 1–4

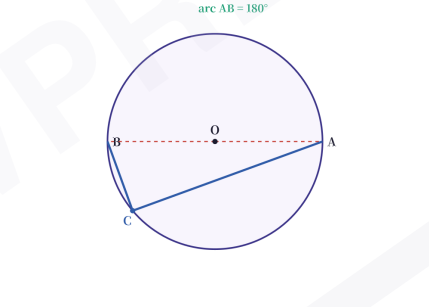
This is your one-stop reference for all 8 circle theorems. Color-code each diagram using the SpEd system: red = central angle, blue = inscribed angle, green = arc, purple = chord, orange = tangent. Keep this page at the front of your interactive notebook.



Theorem 1: Inscribed Angle Theorem

An inscribed angle is half its intercepted arc.

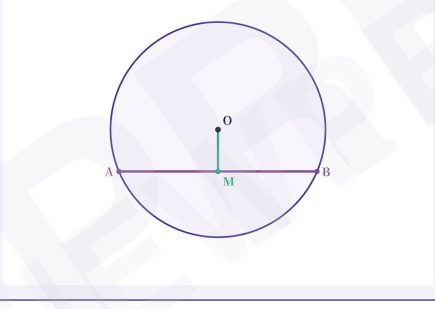
Formula: m∠inscribed = (1/2) × m(arc)



Theorem 2: Diameter / Semicircle (Thales)

An inscribed angle that intercepts a semicircle (diameter) is a right angle.

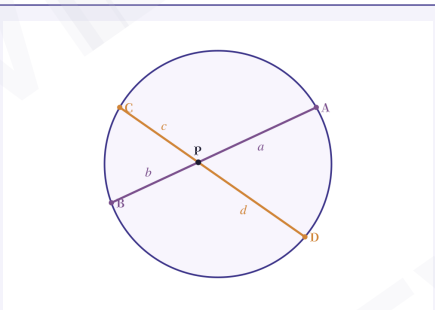
Formula: If arc = 180°, then m∠inscribed = 90°



Theorem 3: Perpendicular Bisector of a Chord

A radius (or diameter) perpendicular to a chord bisects the chord and its arc.

Formula: If OM ⊥ AB, then AM = MB



Theorem 4: Intersecting Chords

When two chords intersect inside a circle, the products of their segment lengths are equal.

Formula: a × b = c × d

What's Inside the Full Resource

The complete 70-page unit includes everything below — premium SpEd-scaffolded circle geometry for Grades 9–10.

FOLDABLE 1

Parts of a Circle

8-tab vocabulary flip book, 8 Frayer cards, practice, exit ticket, reflection

FOLDABLE 2

Inscribed Angles

Discovery activity, theorem, 3 worked examples, accordion template, practice, exit ticket

FOLDABLE 3

Chord Properties

4-tab foldable: perpendicular bisector, equidistant chords, intersecting chords, chord length formula

FOLDABLE 4

Tangent Properties

Tri-fold: radius-perp-to-tangent, common tangents, tangent segments. Practice + exit ticket

FOLDABLE 5

Inscribed Quads

Discovery activity, theorem with proof, 4-panel foldable template, practice, exit ticket

FOLDABLE 6

Angle-Arc Sort

16 sorting cards, pocket template, recording sheet, practice covering all 4 angle-arc relationships

FOLDABLE 7

Cheat-Sheet

3-page one-pager: 8 theorems with diagrams + decision tree for problem-solving

EXTRAS

Reflection Journal

5-section cumulative reflection journal with metacognitive prompts

TEACHER

Answer Key

4-section answer key with lucid 4-step worked solutions for all practice problems

TEACHER

Notes & Scaffolds

Teacher notes, pacing guide, IEP goal alignment, SpEd assembly tips, color-coding legend, sentence frames, 4-step protocol

70	7	8	4	16
PAGES	FOLDABLES	THEOREMS	ANSWER KEY SECTIONS	SORTING CARDS

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