06 Circles

Content Area: **Math**
Course(s):
Time Period: **Full Year**
Length: **4 weeks**
Status: **Published**

General Overview, Course Description or Course Philosophy

[NJSLS Geometry Overview](#)

In this unit, students analyze relationships between segments and angles in circles. This will require that students develop and understanding of arc measure, arc length and the interplay among chords, secants, and tangents. This allows for the exploration of properties of figures inscribed in a circle. Also addressed is the area of a sector and an introduction to radian measure. This unit also continues to develop the connection between equations of circles and equations of other conic sections.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

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Essential Questions:

- How is the measure of an arc related to the angle that intercepts the arc?
- How is the length of an arc related to the angle that intercepts the arc?
- What do the properties of inscribed angles tell us about particular polygons?
- How are the equations of conic sections developed?

Enduring Understandings:

- Radii, chords, secants and tangents all interact with each other and circles in specific ways.
- The measure of an arc is directly connected to the measure of the angle that intercepts that arc.
- A radian is the ratio of the arc length to the radius of the arc.
- Specific conic sections have specific equations based on the features of the conic.

CONTENT AREA STANDARDS

G.C

A. Understand and apply theorems about circles

B. Find arc lengths and areas of sectors of circles

G.CO

A. Experiment with transformations in the plane

B. Understand Congruence in terms of rigid motions

C. Prove geometric theorems

D. Make geometric constructions

G.GMD

A. Explain volume formulas and use them to solve problems

B. Visualize relationships between two-dimensional and three-dimensional objects

G.GPE

A. Translate between the geometric description and the equation for a conic section

B. Use coordinates to prove simple geometric theorems algebraically

G.MG

A. Apply geometric concepts in modeling situations

G.SRT

A. Understand similarity in terms of similarity transformations

B. Prove theorems involving similarity

C. Define trigonometric ratios and solve problems involving right triangles

D. Apply trigonometry to general triangles

MA.K-12.1   Make sense of problems and persevere in solving them.

MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.G-C.A.1	Prove that all circles are similar.
MA.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords.
MA.G-C.A.3	Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.
MA.G-C.A.4	Construct a tangent line from a point outside a given circle to the circle.
MA.G-C.B.5	Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector.
MA.G-GPE.A.1	Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.
MA.G-GPE.A.2	Derive the equation of a parabola given a focus and directrix.
MA.G-GPE.A.3	Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

LA.RST.9-10.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks, attending to special cases or exceptions defined in the text.
LA.RST.9-10.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
CS.K-12.2.d	Evaluate and select technological tools that can be used to collaborate on a project.
CS.K-12.3.a	Identify complex, interdisciplinary, real-world problems that can be solved computationally.
CS.K-12.3.b	Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures.
CS.K-12.3.c	Evaluate whether it is appropriate and feasible to solve a problem computationally.
WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- all circles are similar
- specific relationships exist among the various types of angles associated with a circle and the measure of the arc intercepted
- properties of inscribed angles provide insight into inscribed polygons.
- arc length and area of sector are found through proportional relationships
- conic sections have specific equations that describe them based on specific features.

Procedural Knowledge

Students will be able to:

- Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant. Knowledge Utilization
- Derive the equation of a circle of given center and radius using the Pythagorean Theorem. Knowledge Utilization
- Derive the equation of a parabola given a focus and directrix. Knowledge Utilization
- Derive the formula for the area of a sector. Knowledge Utilization
- Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius. Knowledge Utilization
- Prove properties of angles for a quadrilateral inscribed in a circle. Knowledge Utilization
- Prove that all circles are similar. Knowledge Utilization
- Construct the inscribed and circumscribed circles of a triangle. Analysis
- Complete the square to find the center and radius of a circle given by an equation. Comprehension
- Identify and describe relationships among inscribed angles, radii, and chords. Comprehension

EVIDENCE OF LEARNING

Benchmark Assessments

Benchmark Assessments conducted three times per year, using Pear Assessment (Standards Based Assessments)

Alternate Assessments

- Portfolios

- Verbal Assessment (instead of written)

- Multiple choice

- Modified Rubrics

- Performance Based Assessments

Formative Assessments

- Student feedback/questioning/observation
- Exit Ticket
- Error analysis
- Specific skill assessment/questions
- Survey/polling
- Reflection questions
- Scored/evaluated class work or homework
- Task completion

Summative Assessments

Lesson Quizzes
Unit Test
Performance Tasks

RESOURCES (Instructional, Supplemental, Intervention Materials)

Core Instructional Materials

Envisions Geometry

Kuta Software

Supplemental Materials

NJ DOE Model Curriculum unit: [Circles and Expressing Geometric Properties through Equations](#)

Illustrative Mathematics unit: [Circles](#)

Khan Academy unit: [Circles](#)

NJCTL unit: [Circles](#)

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are frequently addressed through modeling and application problems whereby students solve and analyze situations taken from business, physics, engineering, biology, statistics, geography, and numerous other fields. Examples can be found in topic specific textbook problems and digital resources.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.