

Unit 4: Circles and Constructions

Content Area: **Mathematics**
Course(s): **Geometry**
Time Period: **4th Marking Period**
Length: **11 weeks**
Status: **Published**

Unit Overview

Through this unit, students will investigate circles. During the beginning portion of the unit, students will learn about circles—their equations, areas, related vocabulary, and properties. At the conclusion of the unit, students will study and make formal geometric constructions, recognizing the foundation that congruence provides for these.

By the end of the year, administer the Link It NJSLs Geometry Form C TEI

Transfer

Students will be able to independently use their learning to...

- Use the equation of a circle to identify its center and radius, or derive the equation when these values are given.
- Use the relationships between the angles, arcs, and segments of circles to solve applied problems.
- Create formal geometric constructions.

Meaning

Understandings

Students will understand that...

- The equation of a circle is derived from the Pythagorean Theorem.
- Relationships exist between the angle and arc measures of circles.
- Angles can be measured in degrees or radians.
- Sectors and arcs are portions of circles.
- Geometric constructions are precise drawings made with only a compass and a straightedge.

Essential Questions

Students will keep considering...

- How can geometric concepts and figures be described by careful use of geometric language?
- How can various geometric properties be verified by using the coordinate plane?
- How can geometric concepts and figures be used to model real-world phenomena?
- How are the relationships between the angles, arcs, and segments of circles applied in solving problems?
- How should I decide what method to use when solving problems involving circles?
- How can formal geometric constructions be created using a variety of tools?

Application of Knowledge and Skill

Students will know...

- That equations can be written to describe circles in the coordinate plane.
- The definitions of the terminology related to circles.
- That the relationships that exist between the angles, segments, and arcs associated with circles can be used to solve for unknown measures.
- How to make basic formal geometric constructions.

Students will be skilled at...

- Writing and graphing equations of circles in the coordinate plane.
- Using the relationships between angles, arcs and segments of circles to solve for unknown measures.
- Calculating arc lengths and areas of sectors of circles.
- Creating basic formal geometric constructions and explaining why they work.

Academic Vocabulary

- arc
- arc length
- central angle
- circumscribed
- chord
- common tangent

- compass
- concentric circles
- congruent
- congruent arcs
- congruent circles
- construct
- construction
- equation of a circle
- equidistant
- exterior of a circle
- inscribed
- inscribed angle
- intercepted arc
- interior of a circle
- linear equation
- major arc
- minor arc
- point of tangency
- point-slope form
- secant
- sector of a circle
- segment of a circle
- semicircle
- slope
- slope-intercept ofrm
- straightedge
- tangent
- tangent circles
- tangent of a circle
- tangent segment

Learning Goal 4.1

Students will understand and apply theorems and formulas relating circles and their measures.

Daily Target 4.1.3 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT identify, describe, and solve problems using relationships among angles, radii, and chords of circles, including:

- the radius of a circle is perpendicular to the tangent at the point of tangency
- the relationships between central, inscribed, and circumscribed angles and their intercepted arcs
- angles inscribed in a semi-circle are right angles

- the measures of angles and arcs defined by secants, chords and tangents of circles

MA.K-12.2	Reason abstractly and quantitatively.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords.

Daily Target 4.1.4 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)

SWBAT define inscribed angles and use their properties to solve problems.

MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-C.A.2	Identify and describe relationships among inscribed angles, radii, and chords.

Daily Target 4.1.5 (Level of Difficulty: Comprehension, DOK: 2-Skill)

SWBAT find arc lengths and areas of sectors of circles.

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.
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Daily Target 4.1.6 (Level of Difficulty: Knowledge Utilization, DOK: 4-Extended Thinking)

SWBAT write and graph equations of circles, and use them to solve problems.

MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
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 an equation.

Learning Goal 4.2

Students will make formal constructions using a variety of tools and methods.

(Tools may include compass and straightedge, string, reflective devices, paper folding, dynamic geometry software, etc.)

Daily Target 4.2.1 (Level of Difficulty: Comprehension, DOK: 2-Skill)

SWBAT perform formal constructions using a variety of tools and methods including:

- copying a segment
- copying an angle
- bisecting a segment
- bisecting an angle

Instructions for bisecting an angle: <https://www.illustrativemathematics.org/content-standards/HSG/CO/D/12/tasks/1083>

Angle bisection and midpoints of line segments: <https://www.illustrativemathematics.org/content-standards/HSG/CO/D/12/tasks/1320>

MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Daily Target 4.2.2 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT formally construct a line parallel to a given line through a point not on the line.

MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Daily Target 4.2.3 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT formally construct:

- perpendicular lines
- perpendicular bisectors of given line segments

MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).

Daily Target 4.2.4 (Level of Difficulty: Analysis, DOK: 3-Strategic Thinking)

SWBAT construct each of the following:

- an equilateral triangle
- a square
- a regular hexagon inscribed in a circle

(Note: See activity on pages 392 - 393 of the textbook.)

Inscribing an equilateral triangle in a circle: <https://www.illustrativemathematics.org/content-standards/HSG/CO/D/13/tasks/1557>

MA.K-12.5	Use appropriate tools strategically.
MA.K-12.6	Attend to precision.
MA.K-12.7	Look for and make use of structure.
MA.G-CO.D.12	Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.).
MA.G-CO.D.13	Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.

21st Century Life and Careers

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.
CAEP.9.2.12.C.1	Review career goals and determine steps necessary for attainment.

Technology

TECH.8.1.12.A.CS1	Understand and use technology systems.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.

TECH.8.1.12.E.CS2	Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
TECH.8.1.12.E.CS3	Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
TECH.8.2.12.D.CS2	Use and maintain technological products and systems.

Formative Assessments and Performance Opportunities

- Academic Games
- Albert
- Carousel Activities
- Class Discussions
- Classwork
- Closure Activities
- Concept Sorting Activities
- Desmos Activities
- Do Nows
- Edpuzzle
- Edulastic
- Exit Tickets
- Four Corners Activities
- Graphic Organizers
- Homework
- Kahoot! Games
- Placemat Activities
- Question-All-Writes
- Quizizz Activities
- Quiz-Quiz-Trade Activities
- Station Activities
- Student Interviews
- Student Self-Rating
- Teacher Observation
- Teacher Questioning
- Think, Pair, Share Discussions
- Thumbs Up/Down
- Turn and Talk Discussions
- Whip Around
- Whiteboard Use

Summative Assessments

- Projects
- Quizzes
- Tests
- Unit Exam

Accommodations and Modifications

- 504 Accommodations
- Challenge Problems
- Graphic Organizers
- Guided Notes
- IEP Modifications
- Learning Centers/Stations
- Leveled Practice Opportunities
- Projects
- Scaffolding Questions
- Small Group Instructions
- Student Companion Website Resources
- Technology
- Use of Manipulatives (Paper Strings, Exploragons, etc)

Unit Resources

- Albert
- Desmos
- Geometer's Sketchpad
- Google Classroom
- Kahoot!
- Kuta Software
- Loom
- Quizizz
- Textbook: Geometry, Common Core Ed. (Holt McDougal, 2012)
- Textbook Resource Kit & Companion Website: <https://my.hrw.com/>
- Youtube

Additional Websites:

- Albert: albert.io
- Dan Meyer's 3-Act Math
Tasks: <https://docs.google.com/spreadsheet/pub?key=0AjIqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE&output=htmlG>
- Engage NY: Geometry Lesson Notes & Handouts: <https://www.engageny.org/resource/high-school->

[geometry](#)

- Geometry Teacher Mike Patterson's Common Core Teaching Notes: <http://www.geometrycommoncore.com/>
- Khan Academy: <https://www.khanacademy.org/>
- NCTM Illuminations Website: Resources for Teaching Math: <http://illuminations.nctm.org/Default.aspx>
- PARCC Educator Resources: <http://www.parcconline.org/for-educators>
- The Geometer's Sketchpad Resource Center: <http://www.dynamicgeometry.com/>

Interdisciplinary Connections

- Construction Art
- Origami

VA.9-12.1.5.12prof.Cr1a	Use multiple approaches to begin creative endeavors.
VA.9-12.1.5.12prof.Cr1b	Shape an artistic investigation of an aspect of present-day life using a contemporary practice of art and design.
VA.9-12.1.5.12prof.Cr3a	Apply relevant criteria from traditional and contemporary cultural contexts to examine, reflect on and plan revisions for works of art and design in progress.
VA.9-12.1.5.12prof.Pr4a	Analyze, select and curate artifacts and/or artworks for presentation and preservation.
VA.9-12.1.5.12prof.Pr5	Developing and refining techniques and models or steps needed to create products.