# *Unit 5 Circles

Content Area: **Mathematics**
Course(s): **Geometry CP, Geometry Honors**
Time Period: **February**
Length: **10 Blocks**
Status: **Published**

## Transfer Skills

Previous coursework: very little has been done with circles in the past

By the end of this unit: Students should feel comfortable describing circles in many ways and using properties of circles to find arc and angle measures and segment lengths.

Instructional Strategies:

- Focus on vocabulary! One of the biggest problems students have with this unit is using appropriate vocabulary. If they can identify the scenario exactly, it helps them solve the problems more easily.
- Discover or prove theorems first, then apply them.
- This unit is full of theorems, it can be very confusing for students. Consider helping them create a reference sheet of some sort to help keep everything organized.
- (+) = denotes Honors only skill

## Enduring Understandings

All circles are similar, so circles have many measurements that can be applied no matter what size the circle is.

The circle has many specialized properties and relationships and the knowledge of them help us to determine more relationships in the circle.

## Essential Questions

How do circles compare to one another?

Why are circle properties helpful?

## Content

Circle Similarity

Circle Properties

Circle Constructions

Construct Tangent Line (+)

Radians, Arc Length, Area

Definition of a Conic

Equation of a Circle

Completing the Square

Equation of a Parabola

Opportunities for Algebra Review:

- Solving Equations (specifically quadratics with circle properties)

## Skills

Describe a single or sequence of similarity transformation between two circles.

Prove that two circles are similar.

Determine angle values for all angles formed in the exterior, interior and on the circle.

Apply knowledge of arcs, angles and chords to solve circle related problems.

Determine lengths of intersecting chords and secants.

Construct the circumcenter and circumcircle of a triangle.

Construct the incenter and the incircle of a triangle.

Prove that opposite angles of an inscribed quadrilateral in a circle are supplementary.

Construct a tangent line from a point outside a given circle to the circle. (+)

Explain what a radian is (radian measure = arc length/radius)

Convert between degrees and radians.

Derive and use the formula for arc length in terms of radians.

Derive and use the formula for area of a sector in terms of radians.

## Resources

Online Resources:

http://www.shmoop.com/common-core-standards/math-geometry-circles.html

http://mr-stadel.blogspot.com/2012/07/elmos-microwave-travel.html

http://map.mathshell.org/materials/lessons.php?taskid=441&subpage=concept

http://map.mathshell.org/materials/lessons.php?taskid=403&subpage=problem

http://threeacts.mrmeyer.com/luckycow/

Pearson Resources:

10-6, CB 10-6, 12-2, 12-3, 5-3, 10-6, 10-7

## Standards

**NJSLS 2016**

**Geometry**

**CONGRUENCE**

**A. Experiment with transformations in the plane**

1. Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the

undefined notions of point, line, distance along a line, and distance around a circular arc

## CIRCLES

### A. Understand and apply theorems about circles

1. Prove that all circles are similar.

2. Identify and describe relationships among inscribed angles, radii, and chords. Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.

3. Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.

4. (+) Construct a tangent line from a point outside a given circle to the circle.

### B. Find arc lengths and areas of sectors of circles

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.

## Mathematics | Standards for Mathematical Practice

### 1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

**4 Model with mathematics.**

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

**5 Use appropriate tools strategically.**

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

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| MA.K-12.1 | Make sense of problems and persevere in solving them. |
| MA.G-CO.A.1 | Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc. |
| MA.K-12.4 | Model with mathematics. |
| 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. |