Center of Attention

Writing the Equation of a Circle

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Grade Level	9th – 10th Grade	**Time Frame**	65 minutes
Subject	Mathematics	**Duration**	1-2 class period(s)
Course	Geometry		

Essential Question

How are triangles and circles related?

Summary

In this geometry lesson, students will recall vocabulary about a circle, use their knowledge of midpoint and distance formulas to write the equation of a circle, and explore the connection between the equation of a circle and the Pythagorean Theorem. This is a multimodality lesson, which means it includes face-to-face, online, and hybrid versions of the lesson. The attachments also include a downloadable Common Cartridge file, which can be imported into a Learning Management System (LMS) such as Canvas or eKadence. The cartridge includes interactive student activities and teacher's notes.

Snapshot

Engage

Students recall what they know about circles.

Explore

Given points on a circle, students use their knowledge of the distance formula to find the radius and/or diameter.

Explain

Students complete guided notes with the class and/or watch a video to learn about the properties of a circle. These properties relate to the equation of a circle, how to write the equation of a circle given the endpoints of a diameter, and how to identify the center and radius from a given equation.

Extend

Students write the equation of a circle from a graph and investigate the relationship between the Pythagorean Theorem and the equation of a circle.

Evaluate

Students match equations with circles that have different characteristics.

Standards

Oklahoma Academic Standards Mathematics (Geometry)

G.C.1.2: Use the distance and midpoint formula, where appropriate, to recognize and write the radius r, center (h,k), and standard form of the equation of a circle (x - h) 2+ (y - k) 2 = r 2 with and without graphs.

Attachments

- Circle Characteristics—Center of Attention.docx
- Circle Characteristics—Center of Attention.pdf
- Common Cartridge—Center of Attention.zip
- Exit Ticket—Center of Attention.docx
- Exit Ticket—Center of Attention.pdf
- Guided Notes (Teacher Guide and Model Notes)—Center of Attention.docx
- Guided Notes (Teacher Guide and Model Notes)—Center of Attention.pdf
- Guided Notes—Center of Attention.docx
- Guided Notes—Center of Attention.pdf
- Lesson Slides—Center of Attention.pptx
- Writing Equations—Center of Attention.docx
- Writing Equations—Center of Attention.pdf

Materials

- Common Cartridge (attached)
- Desmos account
- Pencils
- Paper
- Student devices with internet access

10 minutes

Engage

Teacher's Note: Desmos Activity Preparation

Before starting the activity, assign student pairs. In an asynchronous setting, advise students to schedule a time to meet with their partners.

To use this Desmos Classroom activity, select the following link: "Center of Attention: Asynchronous." Create an account or sign in under the "Activity Sessions" heading. After you log in, the green "Assign" dropdown button will be active. Click the arrow next to the word "Assign," then select "Single Session Code." After making some setting selections, select "Create Invitation Code" and give the session code to students. For more information about previewing and assigning a Desmos Classroom activity, go to https://k20center.ou.edu/externalapps/using-activities/.

For more detailed information about Desmos features and how-to tips, go to https://k20center.ou.edu/externalapps/desmos-home-page/.Provide students with your session code. Then, have students go to student.desmos.com and enter the session code.

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Teacher's Note: Sign-in Options

If students sign in with their Google or Desmos accounts, then their progress is saved, and they can resume the activity or view their work later. If students continue without signing in, they can complete the activity, but they must do so in one sitting. It is strongly recommended that students sign in; otherwise, they risk losing their work.

On **screen 1**, students learn how to use the Desmos sketch tools. On **screen 2**, students use the Tell Me Everything strategy to label the picture of the circle, both with numbers and with words. Beside the picture, students should write anything else they know about circles that they did not label.

On **screen 3**, students are prompted to input their answers from the previous screen—specifically, the location of the circle's center and the lengths of the radius and diameter. As screen 3 has a built-in self-check function, students receive immediate feedback about their answers.

10 minutes

Explore

Screen 4 prompts students to work in pairs. Collaboratively, students must identify the center, radius, and diameter of a circle that has a center at (3, 5) and passes through (6, 9).

Teacher's Note: Purpose

The purpose of this activity is to activate students' prior knowledge of using the distance formula, which is applied here to find the radius of the circle.

As screen 4 has a built-in self-check function, students receive immediate feedback about their answers.

10 minutes

Explain

Have students select the link on **screen 5** to watch the "Center of Attention" video.

Embedded video

https://youtube.com/watch?v=nBpWyHBVr_M

In this video, students learn about the properties of a circle that relate to the equation of a circle, how to write the equation of a circle given the endpoints of a diameter, and how to identify the center and radius from a given equation.

15 minutes

Extend

On **screens 6–7**, students must find the equations of two different circles, given graphs of each. The graphs are of circles with the centers at lattice points, but the lattice points on each circle are not vertical or horizontal of the center.

Teacher's Note: Scaffolding

This activity is scaffolded through having two diameters drawn in the first circle's graph, with each diameter connecting two lattice points. Students should follow the model of this first picture to imagine or draw their own diameter(s) on the second graph.

Students also are asked to explain their thinking on screens 6–7. As both screens have a built-in self-check function, students receive immediate feedback about their equations.

Teacher's Note: Things to Consider

Think about how you want students to explain their reasoning. Do you want students to write a sentence or two to explain the general process, or do you expect to see lines of algebraic reasoning?

Both options are valid—however, keep in mind the amount of time it takes to type lines of mathematical notation. If that is your preference, it might be beneficial to give students the option to take a picture of their work on scratch paper and submit that as their reasoning. Students can submit pictures of their scratch work through a Canvas assignment, through email, etc.

Screen 8 prompts students to leave the Desmos activity and go to the provided link to the GeoGebra activity: geogebra.org/m/a4sm8fc6. In this activity, students are expected to read about and interactively explore the relationship between the Pythagorean Theorem and the equation of a circle.

When students return to the Desmos activity, they must write what they learned from the GeoGebra activity on screen 8. Students' responses are shared with the class upon submission.

5 minutes

Evaluate

On **screen 9**, students complete a Card Matching activity to assess their learning individually.

Students are asked to match an equation of a circle with each of the following circles:

- A circle with a radius of 2 and a center at (–2, 3).
- A circle with a center at (2, –3) and passes though (2, –1).
- A circle with a given graph.
- A circle with endpoints of a diameter at (2, 7) and (2, –1).

Use student responses to see which misconceptions persist.

Resources

- K20 Center. (n.d.). Bell ringers and exit tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Card matching. Strategies. https://learn.k20center.ou.edu/strategy/1837
- K20 Center. (n.d.). Center of attention [Video]. YouTube. https://www.youtube.com/watch?v=nBpWyHBVr_M
- K20 Center. (n.d.). Collective brain dump. Strategies. https://learn.k20center.ou.edu/strategy/111
- K20 Center. (n.d.). Tell me everything. Strategies. https://learn.k20center.ou.edu/strategy/107
- K20 Center. (n.d.). Desmos classroom. Tech tools. https://learn.k20center.ou.edu/tech-tool/1081
- K20 Center. (n.d.). GeoGebra. Tech tools. https://learn.k20center.ou.edu/tech-tool/2352
- Pixabay. (2016, August 30). Black ceiling wall [Photograph]. Pexels. https://www.pexels.com/photo/black-ceiling-wall-161043/