Big Idea(s)/ Topic(s)

- Solve problems involving geometric figures in the coordinate plane.

Standard(s) Alignment

- MGSE6.NS.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.
- MGSE6.G.3 Draw polygons in the coordinate plane given coordinates for the vertices; use coordinates to find the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving real-world and mathematical problems.

Diagnostic Assessment

This assessment task is used to diagnose students’ prerequisite knowledge and level of understanding of the big idea and standards addressed in this learning plan.

True/ False/ Justify

1. \(8 \times 6 = 48\)  
2. \(\frac{1}{2} \times 7 = 7 \frac{1}{2}\)  
3. \(\frac{1}{2} \times 7 = 7 \frac{1}{2}\)

4. Find the area and perimeter of the rectangle shown. Show all work.
### Instructional Design

**Desmos Activity:** [Grade 6: Polygons on a Coordinate Plane](#)

**Overview:** In this task, students will plot points on a coordinate grid. Students will find the distance around polygons distance on the coordinate plane. In addition, students will use that knowledge of distance in a real world context. Lastly, students will calculate the area of triangles and squares.

**Materials:**
- Digital or hard copy of the diagnostic assessment
- Digital or hard copies of the Desmos activity
- Graph paper
- Sticky notes
- Create a discussion board for this learning activity using platforms such as Kialo Edu or Yo Teach for asynchronous learners

**Engage**

**Teacher Moves**

Present the screen. Once students have responded have students share what points they used and why. Aid students who can not define the ordered pair needed to make appropriate eyes. Use snapshot to highlight students who used decimals.

**Sample Responses**

Answers will vary.

- **Synchronous:** After assigning the Desmos, click the pacing icon in the teacher dashboard and select screen 1. Next, click the orange option to restrict to screen one. Please note that the pages that students will be able to freely access will be highlighted in orange. The screen is a fun way to discover students' understanding of plotting points. Follow the guidance under Teacher Moves and use Desmos Snapshots to highlight student work.

- **Asynchronous:** Group students according to their diagnostic assessment. Use the Thumbs Mode and Overlay Mode in Desmos to determine students' knowledge of plotting points. Use Snapshots to create a discussion thread if many students have inappropriate answers.

- **Unplugged/Offline:** Provide the image and question from screen 1 and allow students time to answer the questions. Address any misconceptions with the drawing of the eyes. Students who are not in person should be provided with a key which displays several possibilities of where the eyes could be.
**Explore**

2 Mystery Shape Plot

- **Teacher Moves**
  
  After displaying the screen provide students time to plot the points. Assist students who struggle to plot the points. In particular, keep an eye out for line segments that cross each other, and for swapped $x$ and $y$-coordinates.

- **Sample Responses**
  
  Shaded shape appears on correct points plotted

3 Form this polygon.

- **Teacher Moves**
  
  Use the overlay in the teacher dashboard to identify students who may need additional support before completing the task.

- **Sample Responses**
  
  Rectangle

- **Synchronous**: Click the white plus sign within the orange pacing to allow students access to screen 2. Use the thumb mode or overlay mode to check students' work and restrict to screen 3.

- **Asynchronous**: Use the Thumbs Mode and Overlay Mode in Desmos teacher dashboard for accuracy in plotting polygons. Use Snapshots to create a discussion thread if many students have inappropriate answers. Ensure that enough time is provided for students to participate and respond to your feedback and edit responses as needed.

- **Unplugged/ Offline**: Provide paper/electronic versions of the images and questions presented on screens 2 and three. Allow students time to complete the work and submit the work. While providing feedback, share offline students work with online students and vice versa. For face to face students consider using your camera to showcase their work.

- **A**: $(2, 5)$
- **B**: $(4, 5)$
- **C**: $(4, -1)$
- **D**: $(2, -1)$

What polygon does this form?
Apply

4 Distance

Your polygon has these vertices:

\[ A: (2,5) \]
\[ B: (4,3) \]
\[ C: (4,-1) \]
\[ D: (2,-1) \]

What is the distance between A and B?

Are there any other vertices that are this same distance apart? If so, which ones?

Teacher Moves

Showcase the screen. Allow students time to work and address students who counted the lines and not the units.

Sample Responses

The distance between A and B is 2 units. C and D have the same number of units.

I know this because I counted with my finger.

I know this because I subtracted the y-coordinates.
Your polygon has these vertices:

\[ A: (2,5) \]
\[ B: (4,5) \]
\[ C: (4,-1) \]
\[ D: (2,-1) \]

What is the distance between B and C? How do you know?

**Teacher Moves**

Have students elaborate on how they know they lines are the same length.

**Sample Responses**

The distance between B and C is 6 units. A and D have the same number of units.

I know this because I counted with my finger.

I know this because I subtracted the y-coordinates.

What is the perimeter of the polygon?

\[ A: (2,5) \]
\[ B: (4,5) \]
\[ C: (4,-1) \]
\[ D: (2,-1) \]

**Teacher Moves**

Present the screen and reiterate the need to explain how they got their answer.

Address students who do not use the correct operation or add up all of the sides.

**Sample Responses**

The perimeter is 16 units.

\[ 6 + 6 + 2 + 2 = 16 \]
\[ (2*6) + (2*2) = 14 \]
7 Area

What is the area of the polygon?

**Teacher Moves**

Display the screen and remind students to explain how they got their answer.

Address students who do not use the correct operation or add units.

**Sample Responses**

The area is 12 square units

\[ 2 \times 6 = 12 \]

8 Squares and Triangles

Interact with the graphic. What is one true statement about a triangle and squares area? How do you know?

**Teacher Moves**

Have student overlap shapes, before typing their statement.

**Sample Responses**

I notice a square is composed of two triangles. This means a triangle is half of the area of a square.

9 Form this new polygon.

Drag the green points to form a triangle with vertices at:

\[
A: (0, 6) \\
B: (5, -1) \\
C: (0, -1)
\]

**Teacher Moves**

Use the teacher dashboard to identify students who may need additional support. In particular, keep an eye out for swapped x and y-coordinates.
Your polygon has these vertices:

A: (0, 6)
B: (5, -1)
C: (0, -1)

What is the height of the triangle and how did you find it?

What is the base of the triangle and how did you find it?

**Teacher Moves**

Display the screen.

Keep an eye out for students who use the hypotenuse.

**Sample Responses**

The height of the triangle is the distance from A and C, which is 7 units.
The base of the triangle is the distance from C and B, which is 5 units.

I know this because the lines AB and BC form a $90^\circ$ angle.

What is the area of the polygon?

**Teacher Moves**

Display the screen.

Start with informal math language and reasoning (e.g. counting squares and partial squares), then move to more formal responses (e.g. formulas and precision).

**Sample Responses**

17.5 square units

Drag the green points to form a triangle with vertices at:

A: (-2, -3)
B: (-2, 5)
C: (3, 0)

**Teacher Moves**

Use the teacher dashboard overlay to identify students who may need additional support.
Trace and label the base and height of this triangle.
Enter the measurements of these dimensions below.

**Teacher Moves**

Use the teacher dashboard to identify students who may need additional support. In particular, the orientation of this triangle may challenge some students.

Look for the relationship between the base each student chooses and the height they draw in.

**Sample Responses**

Answers may vary

Most Common:
- height = 8 units
- base = 8 units

What is the area of this triangle?

How do you know?

**Teacher Moves**

Highlight several student responses for the class.

**Sample Responses**

- 20 units because it is half of the product of the height and base.

What is the area of this polygon? *Every square is 1 square unit of area.*

**Teacher Moves**

Allow productive struggle before encouraging students to travel backwards in the Desmos for guidance on finding area and decomposing the shape.

A ✅ will appear for correct answers on the dashboard.

**Sample Responses**

- 42.50 square units
What is the area of this polygon?
(every square is 1 square unit of area)

Teacher Moves
Encourage students to use the sketch tool to answer the screen's question. A ☑️ will appear for correct answers on the dashboard.

Sample Responses
82 square units

Here is a map of part of Downtown Salt Lake City.

You are starting at the corner of S 700 E and E 700 (on the star)

1. If you walk **West to 500 E, North to Hwy 186, East to S 700 E** and then **South to your starting point**, how many blocks will you have walked in total? Describe the shape of your path.

Teacher Moves
Inform students what a block means in this context.

Sample Responses
You have walked 10 blocks in a rectangular shape

In two different colors draw using the sketch tool, and describe in words at least two different ways that you can walk exactly 12 blocks and end up where you started.

Teacher Moves
Display screen.
Discover if students are making connections between perimeter and area.

Sample Responses
Answer may vary

Screens 4 through 18 gradually evolve from plotting points → finding perimeter → finding area → discovering triangles are half the area of square → finding area of composite shapes → real world application. Screen 15 through 18 allow students to apply their knowledge in a novel situation; these screens can be used to formatively assess student understanding.

You may also want to introduce or reiterate the concept of absolute value when the polygons have negative coordinates. This can be a prerecorded video showcasing a similar example or using a slide completed as a think aloud.
● **Synchronous**: Restrict pacing to screen 14. Note that because some students may work faster than others. Use the teacher dashboard to determine small groups and follow guidance under *Teacher Moves*. Address any major concerns before restricting to screens 15 through 18.

● **Asynchronous**: Follow student work to determine what Snapshots will be in the discussion post. If possible pause activity so students can respond to post. Use correct and incorrect work as a discussion subject on any controversial screens (see *Sample Responses*). Allow students to work independently on screens 15 through 18.

● **Unplugged/Offline**: Provide students with access to graph paper and allow students to engage in the questions presented on screens 4 through 15. Ask students to complete the questions and have them submit responses. While providing feedback, share offline students work with online students and vice versa. For face-to-face students consider using your camera to showcase their work. Allow students to work independently on screens 15 through 18. Make sure to read *Teacher Moves* and *Sample Responses* before engaging in the task, get familiar with what students are finding and calculating. This will help with providing immediate feedback.

**Reflect**

![3-2-1:](image)

List **three** things you learned in this lesson, **two** things you want to know more about, and **one** thing you are confused about.

**Teacher Moves**

Consider editing the graph and change either of the questions to your learning targets.

Have students share out their 3-2-1 summarizer or customize and allow students to see each other’s responses.

**Ticket out the Door: 3-2-1** (on Desmos screen): Three things you learned in this lesson, two things you want to know more about, and one thing you are confused about.

- **Synchronous**: Make sure pacing has stopped and allow students time to type and read each other’s responses.
- **Asynchronous**: If possible, make sure pacing has stopped. Students will type and read other responses on screen 12.
- **Unplugged/Offline**: Students can write their answers on a sticky note or in their math journals if you do not want to provide a hard copy of screen 19.
Evidence of Student Success

Screens 15 through 18 can be used to formatively assess student understanding. For example, students can demonstrate understanding that distance can not be negative, find the area of polygons, and apply these concepts to a map. Additional formative assessments could include:

Renee said the path she took on her walk enclosed a polygon that had an area of 14 square blocks. Draw some possible shapes that her walk could have taken. Was her path necessarily rectangular? Write an equation to justify your thinking.

Source: https://tasks.illustrativemathematics.org/content-standards/6/G/A/3/tasks/1997

Student Learning Supports

At all grades, the mathematics big ideas encourage students to reason mathematically, to evaluate mathematical arguments both formally and informally, to use the language of mathematics to communicate ideas and information precisely, and to make connections among mathematical topics and to other disciplines. The following strategies are intended to support students who are struggling to progress towards this goal:

- **Conceptual Processing**: Utilize the Concrete-Representational-Abstract instructional sequence to support students in making connections among mathematical ideas, facts and skills, and reflecting upon and refining one’s own understanding of relationships, generalizations and connections.
- **Language**: Strategically select language routines to support students in describing strategies, explaining their reasoning, justifying solutions and making persuasive arguments.
- **Visual-Spatial Processing**: Provide opportunities for students to engage with visual representations and manipulatives (virtual or concrete) as they solve problems, explore concepts and communicate ideas.
  - Plotting Polygons Applet
- **Organization**: Teach problem-solving strategies and problem types, as seen in the Mathematics Glossary: K – 12, in order to support students in figuring out how to get started, carrying out a meaningful sequence of steps while solving problems, keeping track of the
information from prior steps, monitoring their own progress and adjusting strategies accordingly.

- **Memory:** Focus on conceptual strategies, providing a scaffold for students who struggle with multiplying, and grasping the difference between area and perimeter.

Here are some activities and tasks that can be incorporated to support students on their learning journey:

- [Collect the Coconuts](#) for students who struggle finding the distance.
- [Area and Perimeter of Rectangles, Squares, and Composite Rectangles](#) for students struggling with area and perimeter on the coordinate plane.

## Engaging Families

- Students can deepen their understanding of geometric figures on a coordinate plane by watching these videos:
  - [plotting points](#), [points on the coordinate plane examples](#)
  - [geometric figures on a coordinate plane](#)
  - and completing this task [polygons on a coordinate plane](#).

- Students may find it helpful to review the concepts alongside their parents, siblings, or friends at home. Additional supports are also in the “Student Learning Supports” section.