### Big Idea(s)/ Topic(s)

- Use spatial reasoning to analyze and classify geometric figures based on their properties, such as having parallel sides, perpendicular sides, particular angle measures.

### Standard(s) Alignment

**MGSE4.MD.5** Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement.

**MGSE4.MD.6** Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

**MGSE4.MD.7** Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol or letter for the unknown angle measure.

**MGSE4.G.1** Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.

**MGSE4.G.2** Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.
## Diagnostic Assessment

<table>
<thead>
<tr>
<th>Example or Non-Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>**Draw as many <strong><em>examples</em> of <strong>angles that are acute</strong> as you can:</strong></td>
</tr>
<tr>
<td>**Draw as many <strong><em>examples</em> of <strong>angles that are NOT acute</strong> as you can here:</strong></td>
</tr>
</tbody>
</table>

State the rule or reasoning you used to decide if something is an **example** or **non-example** of an acute angle.
Instructional Design

Desmos Activity: Measuring Angles

Overview: In this activity, students will be introduced to basic types of angles (e.g., right, acute, obtuse, straight), measuring angles with estimation and protractors, and indirect measurement of angles using additive reasoning.

Materials: Computer, paper, pencil. Offline students will need a protractor and a print-friendly version of the exercises on each screen from this lesson. [https://www.wikihow.com/Make-a-Protractor](https://www.wikihow.com/Make-a-Protractor)

Engage

**Teacher Moves**

Pause here and review the classification of angles with students before moving to screen 2. Ask students to define each angle type by degree range, which will set them up nicely for screens 2-4.

**Sample Responses**

See the key in the teacher dashboard.
Follow the steps below:

1) Enter a value in degrees to estimate the given angle measurement.

2) Click the "Check Estimation" button to see how close your estimate is.

3) Click on your answer to bring up a new angle.

4) Erase your previous answer and enter an estimate for the new angle.

5) Click the "Check Estimation" button to see how close your estimate is.

6) Repeat steps until you make at least 12 estimations.

**Please estimate the measure of at least 12 angles!**

**Teacher Moves**

Use teacher pacing so that students move to screen 3 together.

**Sample Responses**

Answers vary.

**Student Supports**

Ideally, students should have some concept of angle measurement before beginning this activity (e.g., knowing what a right angle looks like and that it measures 90 degrees).

**Teacher Moves**

Students will receive feedback in the form of a summary of their estimates and measurement error. "You estimated n angles. Your worst guess was x degrees off; your best guess was y degrees off. On average, you were within z of the correct answer."

**Sample Responses**

Feedback varies based on student inputs.
Here's how the whole class did. Your guesses are highlighted orange.

**Teacher Moves**

Because most students will not be familiar with a scatterplot, help them to make sense of this data display. Ask, "What do you notice? What do you wonder?" to get students thinking about the meaning of the graph.

The dots that are on the slanted line represent estimates that were perfect or very close to the actual measures. Dots that are far away from the slanted line represent estimates that were not close to the actual measures.

**Sample Responses**

NA

Drag the point to show how confident you are in your ability to estimate angle measures.

If you'd like, say more below.

**Teacher Moves**

Check the dashboard for students who may need more practice with estimating angle measures.

**Sample Responses**

Responses vary based on each student’s level of confidence.

- **Synchronous**: Follow recommended pacing and suggestions listed in the steps above.
- **Asynchronous**: This activity (especially screen 4) works best when students are completing the activity synchronously. Try to get all students on the lesson at the same time. If this is not possible, screen 4 may only show limited class data for the students who complete screen 2 first.
- **Unplugged/ Offline**: Have students draw angles using a straightedge or ruler, estimate the angle measures, and then use a protractor to measure each angle. Students should record their estimates and actual measures in a math journal.

**Explore**

**Teacher Moves**

Screen 7 will provide feedback to students based on how well they match the cards on this screen.

**Sample Responses**

See answer key in the teacher dashboard.
7 Check Yourself
Press the button to see how you did on the Card Sort.

Teacher Moves
Encourage students to reflect on their comfort with the content in the card sorting activity. This is an ideal time for students to set goals based on performance.

Sample Responses
See the key in the teacher dashboard.

8 Create the angles listed...

Use the RAY tool to create the following using your best estimate. Make sure to label the point on your new ray correctly.

1) Create ACUTE ∠CAB

2) Create RIGHT ∠DOG

After creating your angles, use the ANGLE tool to measure the two angles to see if your estimate were correct. Adjust angles as needed.

Teacher Moves
The instructions on this screen may be confusing to some students. Consider modeling how to use the tools for students.

Sample Responses
Student responses vary.
9 Create the angles list...

Use the RAY tool to create the following using your best estimate. Make sure to label the point on your new ray correctly.

1) Create OBTUSE ÒELF
2) Create STRAIGHT ÒHUT

After creating your angles, use the ANGLE tool to measure the two angles to see if your estimate were correct. Adjust angles as needed.

Teacher Moves

Check in with students who are struggling with the tools and/or content.

Sample Responses

Student responses vary.

10 Measuring Angles U...

Using a protractor is just like using a ruler for an angle.

Make sure that place one side of the angle on the bottom line and the vertex of the angle at the center point of the bottom line.

Teacher Moves

Allow students to self-pace for screens 10-12.

11 Two Scales

There are two scales on a protractor, this always confuses students.

To make sure you use the correct scale on your protractor. Use the scale where the angle goes through 0°.

In the example on the left, the angle measure is 35°. It does not measure 145°. This is because that the angle goes through the 0° on the inside scale.

12 Measure the angle

Use the green and red points to move and adjust the protractor.

Teacher Moves

Consider modeling how to use the protractor tool if students struggle.

Sample Responses

30 degrees
13 Measure the angle

Use the green and red points to move and adjust the protractor.

**Teacher Moves**

Monitor student progress and provide feedback as needed.

**Sample Responses**

75 degrees

14 Measure the angle

Use the green and red points to move and adjust the protractor.

**Teacher Moves**

Monitor student progress and provide feedback as needed.

**Sample Responses**

125 degrees

15 Where has Hussain …

Hussain says this angle measures 35 degrees. Where has he made a mistake?

**Teacher Moves**

Screen 15 provides a great opportunity for students to practice SMP 3 - this is also an ideal time to discuss common protractor measuring errors with the class.

**Sample Responses**

The student did not place the base, origin, or center mark of the protractor on the vertex of the angle.

The student did not align the base of the protractor with the base ray of the angle.

16 Measure the angle

Use the green and red points to move and adjust the protractor.

**Teacher Moves**

Allow students to self-pace for screens 16-18.

**Sample Responses**

175 degrees
17 Measure the angle

Use the green and red points to move and adjust the protractor.

**Sample Responses**

45 degrees

18 What error did the student...?

This student measured this angle to be 0 degrees.

What did they do wrong?

**Teacher Moves**

Highlight student responses in group discussion.

**Sample Responses**

The student read the wrong scale. This is a 180-degree angle.

19 Estimate #1

Enter an estimate in degrees for the measure of each angle.

**Teacher Moves**

Highlight the range of answers in the class. Ask students to justify their responses and critique each others’ reasoning.

Emphasize the value of estimating and thinking about the relationship between the angles. Students will have a chance to calculate the actual angle measures and reflect on their strategies on Screens 3 and 4.

Note: The sample answers show the exact angle measures. Students are only expected to provide estimates.

**Sample Responses**

- Angle $ABC$: 90°
- Angle $ABD$: 57°
- Angle $CBD$: 33°
Now given the actual measurement of one of the angles, find the measurement of the other two angles.

Enter the unknown angle measures into the table.

Press "Check My Work" when you are finished.

**Teacher Moves**

This is a great place to check student progress. Offer individual support where needed, or lead a whole-class discussion if enough students are struggling.

**Sample Responses**

- Angle $ABC$: 90°
- Angle $ABD$: 57°

Enter an estimate in degrees for the measure of each angle.

**Teacher Moves**

Highlight the range of answers in the class. Ask students to justify their responses and critique each others’ reasoning.

Emphasize the value of estimating and thinking about the relationship between the angles. Students will have a chance to calculate the actual angle measures and reflect on their strategies on Screens 7 and 8.

Note: The sample answers show the exact angle measures. Students are only expected to provide estimates.

**Sample Responses**

- Angle $ABC$: 180°
- Angle $ABD$: 125°
- Angle $CBD$: 55°
Now given the actual measurement of one of the angles, find the measurement of the other two angles.

Enter the unknown angle measures into the table.

Press "Check My Work" when you are finished.

**Teacher Moves**

This is a great place to check student progress. Offer individual support where needed, or lead a brief whole-class discussion if enough students are struggling.

**Sample Responses**

- Angle $ABC$: 180°
- Angle $ABD$: 125°
- Angle $CBD$: 55°

Slide to the right if you feel confident.
Slide to the left if you don’t feel confident.

If you’d like, say more about your response below.

**Teacher Moves**

This is a self-assessment screen. Be sure to check student responses and follow up as needed.

**Sample Responses**

Student responses vary based on comfort level with the content in this lesson.

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- **Synchronous**: Follow suggested pacing recommendations as described in the steps above. Before moving on to the “APPLY” segment of the lesson, check in with students who are not feeling confident about their ability to estimate, measure, and classify angles.

- **Asynchronous**: It might be helpful to pre-record a video that models how to use some of the tools in this lesson, particularly for screens 8, 9, and 12.

- **Unplugged/ Offline**: Consider making an offline version of this lesson by giving students some guidance on how to use a protractor to measure angles, and how to classify angles based on size (e.g., acute, obtuse, right, straight). Students can make their own protractor in several different ways: [https://www.wikihow.com/Make-a-Protractor](https://www.wikihow.com/Make-a-Protractor)

**Apply**

Look for angles in your environment (home, classroom, outside, etc.). Take pictures or make drawings (in context) of angles you find. Classify each angle as acute, obtuse, right, or straight. Then estimate the measure of the angle. Be creative! You will probably find lots of right angles very easily, but try to find as many examples of acute and obtuse angles.
Conduct a virtual gallery walk of students’ work. Have students discuss what they see in groups.

- **Synchronous**: Conduct the gallery walk together, either face-to-face in a classroom, or virtually through a live class meeting.
- **Asynchronous**: Consider having students create a Powerpoint or Google Slides presentation to share virtually, or have students record their presentations using a smartphone/camera and Flipgrid.
- **Unplugged/ Offline**: Students should share findings with a peer or adult.

**Reflect**

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

- **In-person or offline**: Students can write their answers on a sticky note or in their math journals.
- **Online**: Students could share their responses on a shared document or an online bulletin board such as linoit.com.

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**Evidence of Student Success**

**Formative Assessment Questions:**

- What is an angle?
- What do we actually measure when we measure an angle?
- What does half rotation and full rotation mean?
- When would you use benchmark angles in your everyday life?
- How can you use fractions of a circle to help you measure and compare angles?
- How does a circle help with angle measurement?
- Into how many parts is the circle divided? What is 360 divided by 2? 360 ÷ 3? 360 ÷ 4? etc.
- How can angles be combined to create other angles?
- How can we use angle measures we know to find angle measures we don’t know?
- How do we measure an angle using a protractor?
- What are some common errors we can make when using a protractor to measure angles?
- How can we classify an angle based on its measurement? *(e.g., acute, obtuse, right, straight)*
- Does the orientation of an angle affect its angle measure? Why or why not?

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**Student Learning Supports**

**Establish mathematics goals to focus learning.**

- Make instructions and expectations clear for the activities.
- Make explicit connections between current and prior lessons or units.

**Facilitate meaningful mathematical discourse.**

- Explicitly model and teach good “discussion board” etiquette.

**Pose purposeful questions.**

- Predetermine when you will call on the student or use the pause feature within the activities.
● Break class into small discussion groups to work collaboratively and then have groups report back to the whole group.

**Support productive struggle in learning mathematics.**
- Offer outlines and other scaffolding tools and share tips that might help students learn.
- Provide feedback using the feedback feature within activities and offer corrective opportunities.
- Consider the pacing of the lesson.

**Elicit and use evidence of student thinking.**
- Anticipate any misconceptions or questions students might have about the task, materials or technology. Proactively address them with readily available and accessible resources.

**Additional Student Supports:** Look out for common misconceptions with measuring angles, such as incorrect use of a protractor, and believing that angles with longer rays are always wider or greater than angles with shorter rays.

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**Engaging Families**

- Play an angle estimation game. Using a straightedge or ruler, you and your child will draw 5 angles of various sizes. Trade papers and estimate the measure of each angle before measuring them with a protractor. Calculate the difference between the estimate and the actual measure and sum these differences up. The player with the lowest total score is the winner.
- Have your child draw 5-7 straight lines with several intersections. Then connect the endpoints of the lines. Mark the angles created within the design and color code them by right, acute, and obtuse angles. Color the rest of the design. See example below:

![Angle Design Example](image)

- Go on an "Angle Hunt." Have your child identify angles in architecture, machines, nature, etc., take pictures, and create a digital presentation/photo book of angles in the real world.