Chapter

9 GEOMETRY

Across-Grades Progression

Looking Back	Looking Here	Looking Ahead
Grade 3 Chapter 10 **Section 10A Angles and Shapes** • Angles and Triangles • Angles and Quadrilaterals	**Grade 4 Chapter 9** **Section 9A Points, Lines, Line Segments, Rays, and Angles** **Section 9B Acute Angles, Right Angles, and Obtuse Angles** **Section 9C Measure Angles** • Measure Angles • Draw Angles up to 180° • Find Unknown Angle Measures **Section 9D Perpendicular and Parallel Lines** • Draw Perpendicular and Parallel Lines • Properties of 2-D Figures **Section 9E Line of Symmetry**	**Grade 5 Chapter 10** **Section 10A Properties and Classification of Triangles** **Section 10B Properties and Classification of Quadrilaterals**

Across-Chapters STEAM Project Work

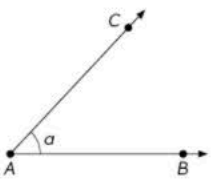
This project spans **Chapters 8 to 9**. Students are given an opportunity to research how the Hoover Dam was constructed, and to build a similar model that would hold back water using materials such as cardboard, containers, and craft sticks. They will draw a diagram of their model and label its measurements, including its area and perimeter using strategies learned in **Chapter 8**. Students will expand upon the diagram in **Chapter 9** to include angles and lines. They will then share their models and diagrams with their classmates using appropriate math terminology.

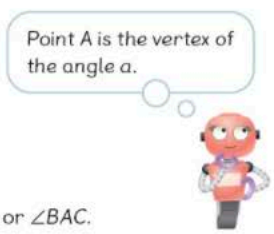
Chapter Overview

In this chapter, students will extend their understanding of angles and shapes to describe figures based on their specific types of angles and the types of lines present. Students will identify, name, and draw points, lines, line segments, rays, and angles. They will then use their understanding of lines and angles to find lines of symmetry in figures.

Key Ideas

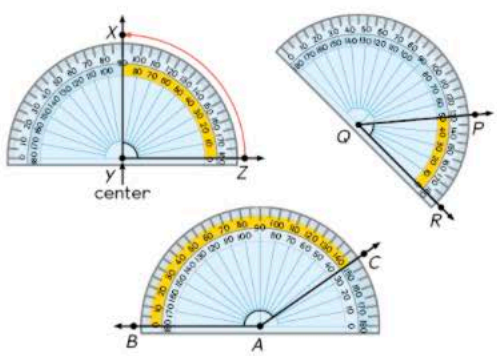
- Use letters to label points, lines, line segments, rays, and angles.



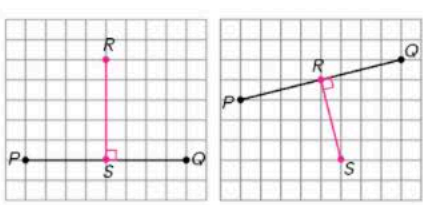


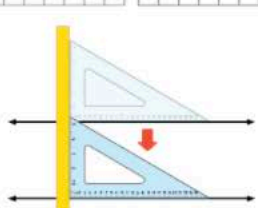
We write angle a as $\angle a$.
You can also call this angle $\angle CAB$ or $\angle BAC$.

- Understand that angles are measured in degrees. A protractor can be used to identify and measure right, acute, and obtuse angles. Unknown angles can be found using the additive properties of angles.

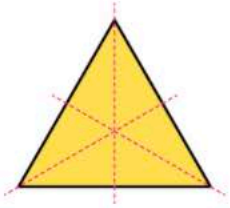


- Identify and draw perpendicular and parallel lines. Figures can be classified based on their line segments and angles.





- Understand that a line of symmetry divides a figure into halves, or two parts that are mirror images.

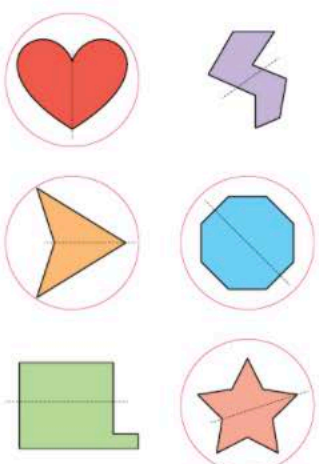


Concrete-Pictorial-Abstract Progression

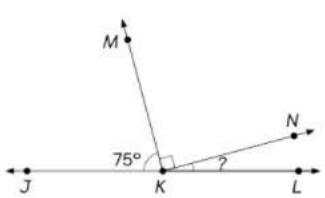
Throughout the chapter, students will have multiple experiences working with concrete materials such as rulers, protractors, and drawing triangles from their geometry sets to help them measure and draw lines and angles.

Geometry Sets

Students will use figures to show angles and find the measure of unknown angles, classify 2-D shapes, and identify lines of symmetry.



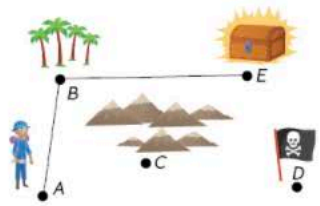
Students will then compute unknown angle measures based on the additive properties of angles.



$\angle NKL = 180° - 75° - 90°$
$= 15°$

Chapter Progression

In **Section 9A**, students learn to use letters to describe points, lines, line segments, rays, and angles. Students understand how to draw, label, and describe them.

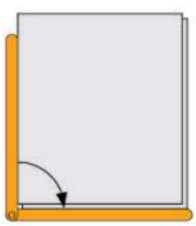


Eli is at Point *A*.

The treasure chest is at Point *E*.

$\overline{AB}$ and $\overline{BE}$ are examples of line segments.

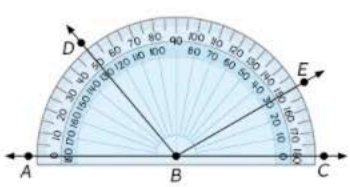
In **Section 9B**, students build upon their understanding from Grade 3 to identify acute angles, right angles, and obtuse angles. Students use a paper right angle to identify the different types of angles by determining if an angle is greater than, less than, or equal to a right angle.



A right angle is a special angle.

It is formed by making a $\frac{1}{4}$-turn.

In **Section 9C**, students learn to measure and draw angles using the protractor. Students see that angles are additive and unknown angles can be found by using the additive properties of angles.



$\angle ABD + \angle DBE + \angle EBC = \angle ABC$

$50° + 100° + 30° = 180°$

A straight angle measures 180°.

Readiness | Engagement | Mastery

Lesson 1

Chapter Opener (page 83) 20 minutes

The picture provides a familiar context for students to explore the properties of angles and lines in real life.

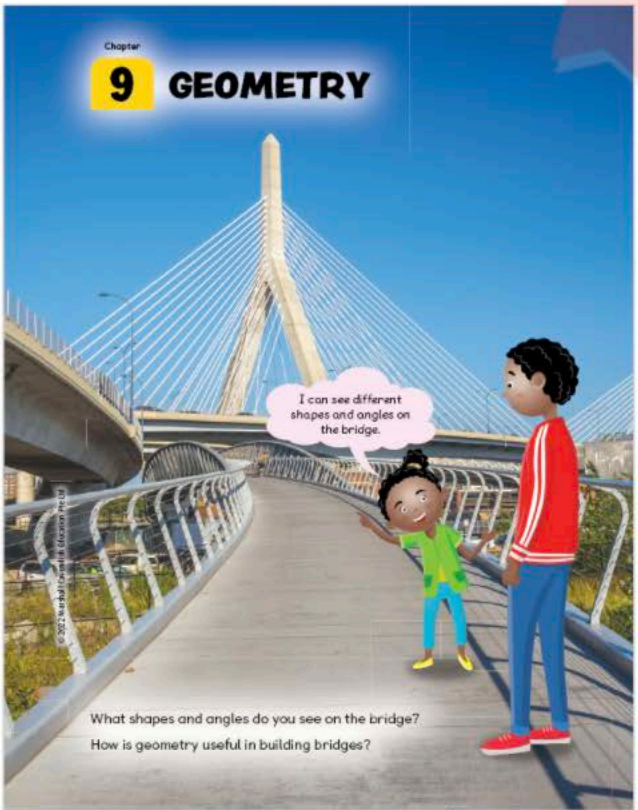
- You may use the Interactive Class Presentation to facilitate discussions and promote interactions.
- Display the picture. Invite students to share what they see. There is a bridge with boats passing under it. There are many lines on the bridge. A girl is with her father. She sees different shapes and angles on the bridge.
- Group students in pairs or small groups to talk about the picture.
- You may facilitate discussions with these questions. Observe student discussions and pay attention to the language they use.

What shapes do you see in the picture? I see triangles and rectangles. **What types of angles and lines do you see?** **What is geometry?** It is the study of shapes, lines, and angles. **How might geometry be helpful in building bridges?**

- Encourage students to talk about other examples of angles and lines they see around them.

Extension

Ask students to look at other bridges and find other shapes and describe their angles.



Student Book Page 83

English Language Support

Encourage students to review shapes and angles in this chapter.

1. A _____ is a shape that has four equal sides. square or rhombus
2. Any 4-sided shape is called a _____. quadrilateral
3. A _____ angle is a square corner. right

Promoting Growth

Before discussing the chapter opener, have students explore geometry concepts using various shapes. Invite students to identify different shapes using the number of sides and angles shown in the Chapter Opener and compare them.

Readiness | Engagement | Mastery

Recall (page 84)

30 minutes

Have students complete the **Recall** questions to check their readiness for the chapter. After students have answered all the questions, go through each of them by facilitating the following class activities and/or discussions. You may refer to the **Transition Guide** for additional resources. As an option, you may refer students to the online **Recall** questions. These online questions will be auto-graded. For questions that require students to show their work, have them do so in the Student Book.

Material(s)

- 1 piece of paper per pair or small group (optional)

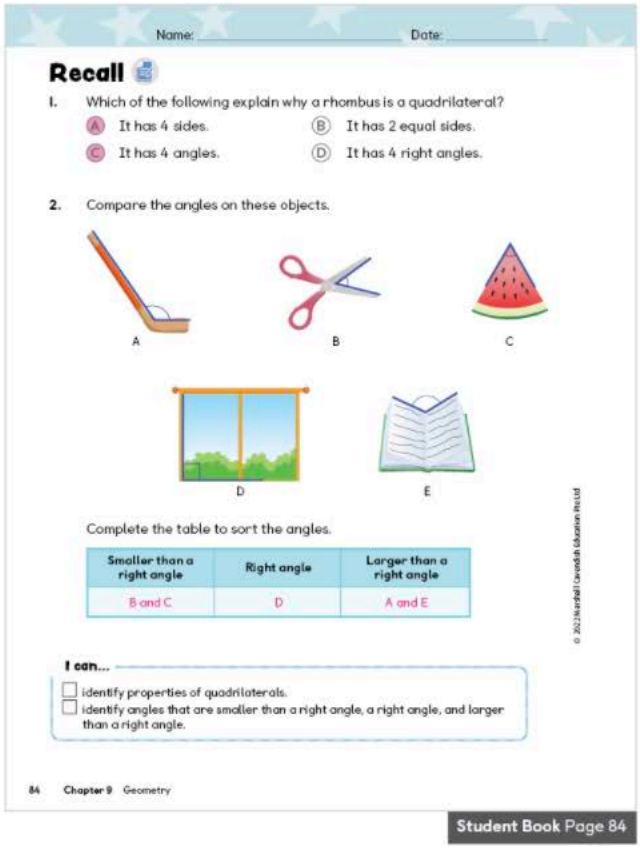
QUESTION 1 assesses students' ability to define a quadrilateral.

What is a quadrilateral? It is a 4-sided closed figure. **Why is a rhombus a quadrilateral?** It has 4 sides and 4 angles.

QUESTION 2 assesses students' ability to compare angles to a right angle.

- Provide students with a piece of paper to fold into a paper right angle to compare the angles, if needed.

What is a right angle? It is a square corner. **Which figure(s) shows right angles?** D **Which figure(s) show angles that are larger than a right angle?** A and E. **Which figure(s) show angles that are smaller than a right angle?** B and C.



Name: _____ Date: _____

Recall

1. Which of the following explain why a rhombus is a quadrilateral?
   (A) It has 4 sides. (B) It has 2 equal sides.
   (C) It has 4 angles. (D) It has 4 right angles.

2. Compare the angles on these objects.

A B C D E

Complete the table to sort the angles.

Smaller than a right angle	Right angle	Larger than a right angle
B and C	D	A and E

I can...

- ☐ identify properties of quadrilaterals.
- ☐ identify angles that are smaller than a right angle, a right angle, and larger than a right angle.

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Lesson 2

9A Points, Lines, Line Segments, Rays, and Angles

Focus Question

How do you represent and describe points, lines, line segments, rays, and angles?

I CAN Statement(s)

- I can identify points, lines, line segments, rays, and angles.

Mathematical Practice(s)

- 4 Model
- 6 Use Math Language

Vocabulary

- point
- line segment
- line
- ray

Material(s)

- 1 ruler or straight edge per pair or small group (optional)
- 1 cork board or poster board per pair or small group (optional)
- 1 yarn and some push pins per pair or small group (optional)

POINTS, LINES, LINE SEGMENTS, RAYS, AND ANGLES
(pages 85 to 90)

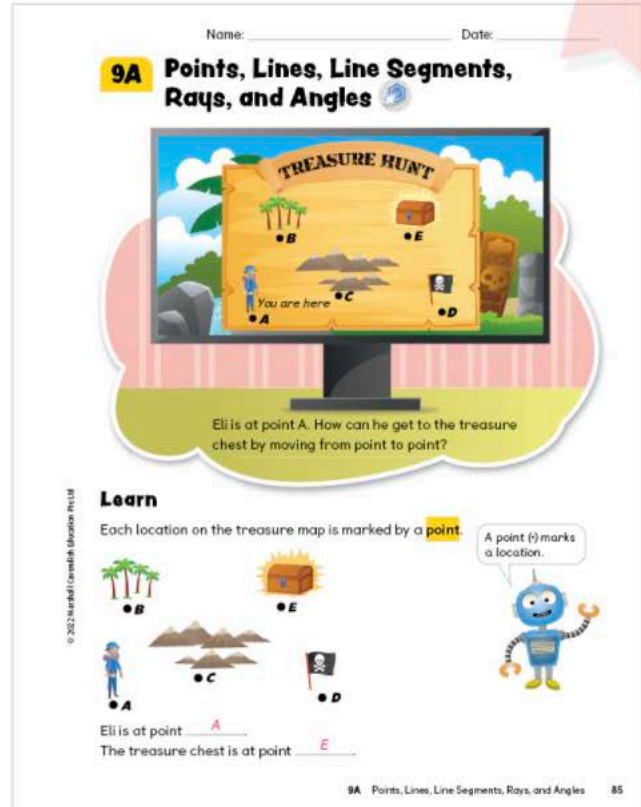
Lesson Opener

Task (page 85) 10 minutes

- You may use the appropriate digital manipulatives to support teaching and learning throughout the lesson(s) in Section 9A.
- Group students in pairs or small groups. Provide them with colored pencils.
- Have students work on the task. Observe student discussions.
- After students have attempted the task, use the following prompts to facilitate a class discussion. Pay attention to the language students use.

What do you notice about the map? Eli is at Point *A*. There are trees, mountains, treasure chest, and a pirate flag. Each item is labeled with a dot and a letter. **How would you describe the location of the treasure chest?** It is located at Point *E*. **How would you get to the treasure chest from Point *A* by moving from point to point?**

- Invite students to consider different ways to connect the points from Eli at Point *A* to the treasure chest at Point *E*. Ask students to mark out each way using a different color.
- Remind students that each point should only be passed once.



Name: _____ Date: _____

9A Points, Lines, Line Segments, Rays, and Angles

Eli is at point A. How can he get to the treasure chest by moving from point to point?

Learn

Each location on the treasure map is marked by a **point**.

Eli is at point A.
The treasure chest is at point E.

9A Points, Lines, Line Segments, Rays, and Angles 85

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Lesson Development

Learn (pages 85 and 86) 10 minutes

- Display the task.
- Ask students to consider how to connect the points to get Eli to the treasure chest.
- Point out that each location is labeled with a dot and a letter. Define this as a point and name each point using the appropriate letter.

How would you describe the location of the palm trees? Point *B*. **How would you connect Eli to the palm trees?** Draw a line from Point *A* to Point *B*.

- Highlight that when drawing a line from one point to another, it is called a line segment and this line segment can be labeled as Line segment *AB*. Write $\overline{AB}$ on the board to show the shorthand way to record a labeled line segment.

How would you describe the next link from the palm trees to the treasure? Connect Point *B* to Point *E* with Line segment *BE*.