Using a Compass

Objectives To review compass skills and explore angles formed by intersecting lines.

Key Concepts and Skills
- Investigate vertical, opposite, and adjacent angles. [Geometry Goal 1]
- Use angle relationships to determine angle measures. [Geometry Goal 1]
- Copy, measure, and construct line segments using a compass, straightedge, and ruler. [Measurement and Reference Frames Goal 1]
- Explore the relationship between radius and diameter measurements. [Measurement and Reference Frames Goal 2]

Key Activities
Students use a compass to draw circles, copy line segments, and estimate lengths. They measure vertical and adjacent angles formed by intersecting lines.

Ongoing Assessment: Recognizing Student Achievement
Use Mental Math and Reflexes. [Operations and Computation Goal 2]

Ongoing Assessment: Informing Instruction See page 180.

Key Vocabulary
radius ◆ diameter ◆ vertical (or opposite) angles ◆ adjacent angles

Materials
Math Journal 1, pp. 72 and 73
Student Reference Book, pp. 139, 164, and 165 (optional)
Study Link 3-4
Geometry Template ◆ compass ◆ one 2 ft by 2 ft sheet of paper ◆ chalk ◆ per partnership: 5 ft length of string or rope ◆ ruler

Playing High Number Toss: Decimal Version
Student Reference Book, pp. 32, 33, and 321
Math Masters, p. 511
per partnership: 4 each of number cards 0–9 (from the Everything Math Deck, if available)
Students practice reading, writing, and comparing decimals.

Math Boxes 3-5
Math Journal 1, p. 74
Students practice and maintain skills through Math Box problems.

Study Link 3-5
Math Masters, p. 83
Students practice and maintain skills through Study Link activities.

READINESS
Reading a Ruler
Math Masters, p. 84
ruler
Students review the divisions and marks on an inch ruler and measure line segments.

ENRICHMENT
Inscribing a Regular Hexagon in a Circle
Student Reference Book, p. 168
Math Masters, p. 85
compass ◆ straightedge ◆ crayons or colored pencils
Students inscribe a regular hexagon in a circle, reproduce a design, and make their own designs.

ELL SUPPORT
Building a Math Word Bank
Differentiation Handbook, p. 142
Students add the terms radius and diameter to their Math Word Banks.

Advance Preparation
For Part 1, prepare a 2 ft by 2 ft square of paper and prearrange playground use for the students’ large compass drawings.

Getting Started

Mental Math and Reflexes ★
Use slate procedures and write all problems on the board or Class Data Pad so students can visually recognize the patterns.

\[
\begin{align*}
7 \times 8 & = 56 \\
70 \times 8 & = 560 \\
700 \times 8 & = 5600 \\
7 \div 7 & = 1 \\
42 \div 7 & = 6 \\
420 \div 7 & = 60 \\
4200 \div 7 & = 600 \\
560 \div 70 & = 8 \\
5600 \div 700 & = 8 \\
56000 \div 7000 & = 8
\end{align*}
\]

Math Message
Draw the largest and the smallest circle you can draw with your compass. What is the radius of the largest circle?

Study Link 3-4 Follow-Up
Allow students five minutes to compare their answers and resolve any differences. Survey students for important things to remember when measuring with the half-circle or full-circle protractors.

Ongoing Assessment:
Recognizing Student Achievement
Use the Mental Math and Reflexes problem sets to assess students’ ability to solve extended multiplication facts mentally. Students are making adequate progress if they correctly respond to the multiplication problems. Some students may also be successful with the division problems.

[Operations and Computation Goal 2]

1 Teaching the Lesson

Math Message Follow-Up

Review the following definitions. To support English language learners, write the definitions along with labeled drawings on the board or Class Data Pad.

- The radius of a circle is any line segment from the center of the circle to any point on the circle.
- The diameter of a circle is any line segment that passes through the center of the circle and has its endpoints on the circle.
- In any circle, the length of a diameter is twice the length of a radius.
- Radius and diameter are also used to name length. For example, the radius of the circle is 2 inches and the diameter is 4 inches. Ask volunteers to use these terms to explain their solution strategies.
Copying Line Segments and Finding Lengths

1. Use your compass and straightedge to copy line segment \( AB \). Do not measure the line segment with a ruler. Label the endpoints of the new line segment as points \( M \) and \( N \). Line segment \( MN \) should be the same length as line segment \( AB \).

2. Three line segments are shown below: Use your compass and straightedge. Construct one line segment that is as long as the three segments joined together end to end. Label the two endpoints of the long line segment \( X \) and \( Y \).

Use your compass to find the lengths of different parts of the Geometry Template. Example: Find the length of the longer side of the rectangle on the Geometry Template.

Step 1: Open the compass to the length of the longer side.

Step 2: Don’t change the opening on your compass. Hold the compass against the inch ruler with the anchor at 0. Read the length. The length is about 1 inch.

Three line segments are shown below:

Using your compass and straightedge, construct one line segment that is as long as the three segments joined together end to end. Label the two endpoints of the long line segment \( X \) and \( Y \).

Part Measured Length

<table>
<thead>
<tr>
<th>Part Measured</th>
<th>Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
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</table>

Math Journal 1, p. 72

Copying Line Segments

(Math Journal 1, p. 72)

Ask volunteers to explain the difference between a ruler and a straightedge.

- A ruler has a scale along at least one edge and is used to measure lengths.
- A straightedge is a tool for drawing straight lines but is not used for measuring.
- A ruler can be used as a straightedge, even when you’re not using it to measure something.

Assign partners to complete Problems 1 and 2 on the journal page. Circulate and assist.
Adjacent and Vertical Angles

Angles that are “next to” each other are called adjacent angles. Adjacent angles have the same vertex and a common side.

When two lines intersect, four angles are formed. The angles opposite each other are called vertical angles or opposite angles.

1. a. Angles $\angle ABD$ and $\angle CBE$ are vertical angles. Name another pair of vertical angles.
   
   Sample answers: $\angle CBE$ and $\angle EBD$; $\angle DBA$ and $\angle ABC$

   b. Angles $\angle ABC$ and $\angle CBE$ are adjacent angles. Name two other pairs of adjacent angles.

   Sample answers: They are the same.

   They total $180^\circ$.

   Sample answer: The adjacent angles form a straight angle, which always measures $180^\circ$.

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Finding Lengths with a Compass

(Math Journal 1, p. 72)

For Problems 3–6 on the journal page, students measure lengths and distances with a compass and a ruler. Work through the example with the class and make sure students understand what they are to do. Each measurement is a two-step operation.

1. Set the compass opening to the length that will be measured.
2. Hold the compass against the inch ruler with the anchor at 0. Measure the length of the compass opening. This is the desired length.

Circulate and assist.

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Ongoing Assessment: Informing Instruction

Watch for students who solve the problems by measuring. Emphasize that they should use their rulers only as straightedges for these problems.

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Measuring Angles Formed by Intersecting Lines

(Math Journal 1, p. 73)

Have students work with partners to complete the journal page. Circulate and assist.

Bring the class together to share results. Survey the class for true statements about the angles formed by two intersecting lines.

When two lines intersect, the measures of the angles opposite each other are equal and are called vertical or opposite angles (See Figure 1); angles that are next to each other and have a common side are called adjacent angles. (See Figure 2.)

For Problem 6, point out that when two lines intersect, the sum of the measures of two adjacent angles is $180^\circ$. Ask students how they might confirm this without measuring the angles. When two lines intersect, two adjacent angles form a straight angle, and the measure of a straight angle is $180^\circ$.

To review parallel and perpendicular lines, ask students to identify examples of parallel and perpendicular lines found in the classroom. Write students’ responses on the board.
Adjusting the Activity
Discuss the example of angles formed by intersecting lines on page 139 of the Student Reference Book and the Check Your Understanding problems.

**Ongoing Learning & Practice**

**Playing High Number Toss:** Decimal Version
(Student Reference Book, pp. 32, 33, and 321; Math Masters, p. 511)

*High Number Toss: Decimal Version* provides students with the opportunity to apply their knowledge of place value and standard notation to form, write, read, and compare decimals. Provide students with a reminder box on the board noting that < means is less than and > means is greater than.

After each round, ask students to record the decimals they formed on Math Masters, page 511, and use <, >, and = to compare them. If necessary, refer students to Student Reference Book, pages 32 and 33 to review comparing decimals.

**Math Boxes 3-5**
(Math Journal 1, p. 74)

**Mixed Practice** Math Boxes in this lesson are paired with Math Boxes in Lesson 3-7. The skills in Problems 5 and 6 preview Unit 4 content.

**Writing/Reasoning** Have students write a response to the following: In Problem 5, will there be an even or an odd number of factors? Sample answer: There will be an even number of factors because 48 is not a square number.

**Study Link 3-5**
(Math Masters, p. 83)

**Home Connection** Students identify acute, obtuse, right, vertical (or opposite), and adjacent angles. They measure the angles in a triangle.
3 Differentiation Options

**READINESS**

† Reading a Ruler

(*Math Masters, p. 84*)

To explore measuring with a ruler, have students find equivalent measures and measure line segments in different ways. When students have finished the page, discuss how they solved Problem 5.

**ENRICHMENT**

† Inscribing a Regular Hexagon in a Circle

(*Student Reference Book, p. 168; Math Masters, p. 85*)

Art Link To further explore straight-edge constructions, have students follow the steps on page 168 of the Student Reference Book to inscribe a regular hexagon in a circle. Then follow the directions to complete Math Masters, page 85. Invite students to create their own designs with inscribed hexagons, hexagrams, and coloring patterns for display in the classroom.

**ELL SUPPORT**

† Building a Math Word Bank

(*Differentiation Handbook, p. 142*)

To provide language support for properties of circles, have students use the Word Bank Template found on Differentiation Handbook, page 142. Ask students to write the terms diameter and radius, draw pictures relating to each term, and write other related words. See the Differentiation Handbook for more information.
Circle the winning number for each round. Fill in the Score column each time you have the winning number.

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<th>Round</th>
<th>Player 1</th>
<th>&lt;, &gt;, =</th>
<th>Player 2</th>
<th>Score</th>
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<tbody>
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<td>&lt;</td>
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<td>0.753 - 0.654 = 0.099</td>
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<td>Total Score</td>
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