## Contents

| Introduction  | iv  |
| How to Use This Book | viii  |
| Walk Through a Lesson | x  |
| Correlations to NCTM Standards | xiv  |

### Number and Operations Contents

- Understanding Number and Operations | 1 |
- Number and Operations Skill Checklist | 4 |

#### Lesson 1
- Numbers 1–3 | 6 |

#### Lesson 2
- Numbers 4–6 | 10 |

#### Lesson 3
- Numbers 7–10 | 14 |

#### Lesson 4
- 1 as Sum and Minuend | 18 |

#### Lesson 5
- 2 as Sum and Minuend | 22 |

#### Lesson 6
- 3 as Sum and Minuend | 26 |

#### Lesson 7
- 4 as Sum and Minuend | 30 |

#### Lesson 8
- 5 as Sum and Minuend | 34 |

#### Lesson 9
- 6 as Sum and Minuend | 38 |

#### Lesson 10
- 7 as Sum and Minuend | 42 |

#### Lesson 11
- 8 as Sum and Minuend | 46 |

#### Lesson 12
- 9 as Sum and Minuend | 50 |

#### Lesson 13
- 10 as Sum and Minuend | 54 |

#### Lesson 14
- Adding Two-Digit Numbers | 58 |

#### Lesson 15
- Counting Up to 30 | 62 |

#### Lesson 16
- Counting Back from 30 | 66 |

### Algebra Contents

- Understanding Algebra | 72 |
- Algebra Skill Checklist | 73 |

#### Lesson 17
- Skip Counting by 10s | 74 |

#### Lesson 18
- Ordinals: First | 78 |

#### Lesson 19
- Ordinals: Second | 82 |

#### Lesson 20
- Ordinals: Third | 86 |

#### Lesson 21
- Ordinals: Fourth | 90 |

#### Lesson 22
- Ordinals: Fifth | 94 |

#### Lesson 23
- Extend a Pattern by Attributes | 98 |

### Geometry Contents

- Understanding Geometry | 103 |
- Geometry Skill Checklist | 104 |

#### Lesson 24
- Two-Dimensional Shapes | 106 |

#### Lesson 25
- Three-Dimensional Shapes | 110 |

#### Lesson 26
- Three-Dimensional Shapes II | 114 |

### Measurement Contents

- Understanding Measurement | 119 |
- Measurement Skill Checklist | 120 |

#### Lesson 27
- Measuring with Nonstandard Units | 122 |

#### Lesson 28
- Measuring with Standard Units | 126 |

### Data Analysis Contents

- Understanding Data Analysis | 131 |
- Data Analysis Skill Checklist | 132 |

#### Lesson 29
- Tally Charts | 134 |

#### Lesson 30
- Bar Graphs | 138 |

### School/Home Connection Contents

- Blackline Master 1–30
  - English | 144–173 |
  - Spanish | 174–203 |
- Materials List | 204 |
Introduction to Early Mathematics Development

The Assessment and Intervention Handbook: Math provides you with the right tools to put students on the path to success with mathematics. The handbook features assessments based on the foundational National Council of Teachers of Mathematics standards of Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability and follow-up intervention at points of difficulty. The handbook is designed to meet the needs of all students, including English language learners and students with special needs. This clear and concise resource introduces children to the joys of mathematics, and supplements the core curriculum with easy-to-use lessons for new and experienced teachers alike.

Assessment and Intervention Handbook: Math also includes:

• Explicit instruction;

• Hands-on materials readily found in most classrooms;

• Flexible lesson planning;

• 5-Minute pre- and post-assessments that assess math skills and effects of the intervention;

• 20–30 Minute intervention activities for students who need remediation; and

• School/Home Connection Blackline Masters in English and Spanish for additional skill reinforcement.

The path to mathematical understanding begins with Number and Operations, which is an early predictor of children’s success with mathematics. During this critical stage, children develop an understanding of numbers and their connections to other numbers, numerical representations and word names. They learn that numbers are building blocks for fluent addition, subtraction, division and multiplication skills.

Children can then begin to strengthen their understanding of the patterns and relationships between numbers. Children start using Algebra skills to create and extend patterns, classify objects, and create patterns with objects and numbers. They can then extend the patterning process to skip counting with numbers and understanding ordinal positions of objects, essential skills for later success with algebra.

Children’s Geometry skills grow through recognizing and identifying shapes. At a fundamental level, identifying shapes leads to the ability to build, draw, compare, and sort
shapes. Early shape identification also provides children with the critical geometry skills necessary to describe attributes of two- and three-dimensional shapes.

Understanding **Measurement** is critical to children’s success in mathematics. Measurement with nonstandard units is an important precursor to measurement with standard units and encompasses an understanding of attributes such as length, volume, and weight, ordering objects according to these attributes, and selecting appropriate tools to measure these attributes.

Understanding **Data Analysis** is essential to children connecting math to their everyday lives. Children’s abilities to pose questions and gather data about themselves and their surroundings lead to the development of critical skills, such as organizing data and using tally charts, graphs, and pictures to represent data.

Once children understand numbers and their relationships, they begin to link important ideas, such as making the connection between numbers and computation, patterns, shapes, measurement, and data analysis. These connections are enhanced in a mathematically rich environment, both at home and in the classroom.

**The Importance of Assessment**
Early experiences with mathematics guide children through the stages of mathematical development until they reach competency. As with any goal, it is important to monitor progress along the way and make adjustments as needed. In early mathematics development, progress monitoring is best achieved through the kind of systematic approach found in *Assessment and Intervention Handbook: Math*.

This book helps you assess children’s progress in **Number and Operations**, **Algebra**, **Geometry**, **Measurement**, and **Data Analysis** as children move through various levels of mathematics instruction. The assessments focus on specific concepts, skills, and strategies. Their straightforward approach to evaluating and scoring makes them easy to use for teachers, classroom aides, and other staff members. Each assessment offers key information about a child’s level of understanding and enables you to pinpoint the child’s specific strengths and areas of difficulty. Form a clear picture of a child’s needs in only minutes.

You may use the information gathered through these assessments as opportunities to implement alternative methods of instruction, such as the intervention activities provided in this handbook. Ongoing assessment ensures that children’s mathematics learning is progressing in an organized and systematic way while allowing you to monitor and measure each child’s individual math achievement.
The Importance of Intervention

Early math skills are believed to be one of the best predictors of a child’s math achievement. *Assessment and Intervention Handbook: Math* provides you with a clear, concise, and systematic approach to assess difficulties and implement interventions.

Ongoing assessments provide you with the information you need to determine if, when, and to what degree mathematics intervention should take place. Intervention at the point of difficulty is the most effective means of ensuring that children master the necessary concepts to develop successful math skills.

Intervention should be implemented promptly, before math problems are compounded. The activities should be targeted and brief. Of key importance in the effectiveness of intervention is whether the child is actively engaged. Children in need of additional instruction often benefit from hands-on activities in which they practice math skills in direct and concrete ways. *Assessment and Intervention Handbook: Math* provides skills-focused, hands-on interventions that can be implemented easily and used with individuals or small groups as needed.

Finally, intervention should continue at home. You can communicate with parents and caregivers about specific math skills using the school/home connections in *Assessment and Intervention Handbook: Math*. These blackline masters provide simple games and engaging activities that parents and caregivers can use to reinforce their children’s math skills.

Research Foundation

*Assessment and Intervention Handbook: Math* is based on a solid research foundation. The National Council of Teachers of Mathematics (NCTM) has demonstrated the importance of five mathematics strands that are essential to children’s success with math:

- Number and Operations
- Algebra
- Geometry
- Measurement
- Data Analysis and Probability
Assessment and Intervention Handbook: Math features one unit devoted to each of these five strands. Further, each lesson in the handbook is correlated to the National Council for Teachers of Mathematics strands. The NCTM strands are prioritized within the Common Core State Standards for Mathematics (2010), with particular emphasis on the Number and Operations strand for students in grades K–2. This intervention handbook stresses number sense and computation skills with many lessons focused on understanding numbers and performing basic computation. The Geometry and Measurement strands are also emphasized in the Common Core Standards and in lessons in this handbook.

The National Mathematics Advisory Panel (2008) also emphasizes the importance of students developing mastery with key foundational concepts, including an understanding of numbers and computation. Research (Gersten, Jordan, & Flojo, 2005) confirms that early math difficulties are predicted when children have weak counting skills and cannot identify and compare numbers.

Intervention is necessary when students have not mastered basic skills and assessment is crucial to a comprehensive intervention approach. Lauer (2004) demonstrates that struggling students need a structured framework with assessments to identify problem areas and to guide instruction. Assessment and Intervention Handbook: Math provides structured pre- and post-assessments to determine areas where students need intervention and to guide instruction.

This handbook provides you with tools to pinpoint the math skills with which students struggle and provides explicit instruction for intervention activities that target these skills and enhance the existing curriculum. With the explicit instruction model, teachers assess what students know and provide specific instruction based on the pre-assessment of a student’s skills (Swanson, 2001). Research (Kroesbergen & Van Luit, 2003) demonstrates that explicit instruction is especially useful for students who have difficulty with a specific or isolated skill.

Assessment and Intervention Handbook: Math also includes School/Home Connections that reinforce concepts beyond the classroom. Henderson & Berla’s research (1994) demonstrates that student achievement improves when parents and caregivers are actively involved in their children’s education. Liontos (1991) also shows that low-performing children have the most to gain from the involvement of parents and caregivers, and that parents care deeply about their children’s success but may need instruction about how to help students at home. This handbook provides parents with a multitude of ideas to enhance children’s math skills at home, in the grocery store, in the car, or at the park.
References


How to Use This Book

How do I use Assessment and Intervention Handbook: Math?

The Assessment and Intervention Handbook: Math program gives you tools to quickly identify math skills with which students are struggling and intervention activities to remediate those skills.

The handbook can be used by any teacher—the classroom teacher, paraeducator, or parent volunteer—and with any students, including proficient readers, struggling students, ELLs, and special needs students. The 5-minute pre-assessment enables you to quickly pinpoint areas where students are struggling and need intervention. When intervention is necessary, guided, step-by-step interventions walk you through activities designed to scaffold students’ math skills.
Assessment and Intervention Handbook: Math is organized in units using the five NCTM strands:

- Number and Operations
- Algebra
- Geometry
- Measurement
- Data Analysis

Each unit features an easy-to-follow format, with a short overview of the math skill and the key competencies that students should master within it, along with a checklist for tracking students’ achievement throughout the unit.

Within each unit, lessons are formatted for ease of use:

- Objectives covered and materials needed for every lesson are described in the left-hand yellow sidebar. Materials include manipulatives commonly found in classrooms, such as pattern blocks, base ten rods and cubes, and attribute blocks, and;
- NCTM Standards are correlated to each lesson.

The 4-Step Assessment Procedure

1. The Assessment Procedure describes exactly how to administer the 5-Minute pre-assessment and the point at which you should proceed to intervention. A reproducible Score Sheet is used for tracking student progress through the pre- and post-assessment.

2. 20–30 Minute Intervention Activities are geared for individuals or small groups, depending on the class’s needs. Step-by-step instructions for managing the activities follow a brief introduction, along with directions for continued learning at home at the bottom of each intervention.

3. The School/Home Connection directs teachers to a Blackline Master (BLM) to be photocopied and sent home with students. Blackline Masters are letters to parents and caregivers with suggestions for follow-up activities. Blackline Masters are in English and in Spanish.

4. A 5-Minute post-assessment provides you with information on a student’s progress, enabling you to see if a student has mastered the skill or needs additional intervention.
Walk Through a Lesson

Teacher Background
An introductory paragraph for the teacher that describes the mathematics skill addressed in the lesson.

Objectives
Summarizes the skill(s) students will learn throughout the intervention lesson.

Materials
Lists the items needed to complete the pre- and post-assessment and intervention activity.

Blackline Master
References the corresponding reproducible activity by BLM number and page number.

NCTM Correlation
Lists the correlation between the lesson objectives and NCTM standards.

Assessment Procedure
Explicit instruction that walks the teacher through the pre-assessment, post-assessment, and intervention procedure. Includes direct instruction on how to conduct pre- and post-assessments, as well as criteria for the teacher to use in deciding when to administer the intervention to students.
Instructions

Scripted instructions for the teacher to administer the pre- and post-assessment to students. Includes practice items for use before the pre-assessment is administered.

Numbers 1–3

Read and discuss the scripted summary below with each child. For the assessment, use whiteboard, counters, number line and three sets of index cards one with the words one, two, and a three, one with the numerals 1, 2, and 3, and one with dots representing 1, 2, and 3.

The numbers 1, 2, and 3 are important numbers to learn. We can count one, two, or three things, read the words one, two, or three, and write the numbers 1, 2, and 3.

Practice Items

Provide guidance for each child by reviewing and clarifying his or her responses to the practice questions below.

Place six counters on the table. Say: Show me 1 counter. Ask: How did you find 1 counter?

Repeat with two and three counters. Then point to a number line.

Ask: Which number is the number 1?

Repeat for 2 and 3. Finally, write the number 1. Show the child the written words one, two, and three. Say: Point to the word that matches the number 1. Repeat for numbers 2 and 3.

Pre-Assessment

Do not provide feedback during the pre- and post-assessments.

1. Write the words one, two, and three on a whiteboard. Show each child a dot pattern index card showing two dots. Say: Point to the word on the board that matches the number of dots.

2. Make two sets of index cards: write the words one, two, and three on three cards in one set, and the numerals 1, 2, and 3 on three cards in the other set. Lay out the word cards on the tabletop. Give the child the other set of cards. Say: Match each card you have with the correct numeral.

3. Write the numerals 1, 2, and 3 on the board. Show each child two counters. Say: Point to the number that shows how many counters I am holding. Then, point to a different number on the board. Say: Show me this number of counters.

Post-Assessment

1. Write the words one, two, and three on a whiteboard. Show each child a dot pattern index card showing one, two, or three dots. Say: Point to the word on the board that matches the number of dots.

2. Write the numerals 1, 2, and 3 on a whiteboard. Show each child three counters. Say: Point to the number that shows how many counters I am holding. Then point to 1 on the whiteboard. Say: Show me this number of counters.

3. Make three sets of index cards: write the words one, two, and three on three cards in one set, make dot patterns for 1, 2, and 3 on three cards in another set, and write the numerals 1, 2, and 3 on three cards in the third set. Lay out the numeral cards on the tabletop. Give the child the other two sets of cards. Say: Match each card you have with the correct dot pattern.
Score Sheet
Individual score sheet for each student, with instructions on how to score the pre- and post-assessment.

Criteria for when to administer the intervention activity. Provides teachers with a quick and easy if/then understanding of when to intervene.

Score Sheet

Number and Operations

Score Sheet

Student Name: __________________ Date: ______________

Each individual response equals one point.

Numbers 1–3

Pre-Assessment
1. Word the child points to __________________ [two]
2. Child correctly matches cards __________________ [yes/no]
3. Number the child points to __________________ [two]
   Number of counters the child shows __________________ [answer varies]
Score: _______ points out of 4 total points

Apply intervention if score is 2 out of 4 or lower.

Post-Assessment
1. Word the child points to __________________ [answer varies]
2. Number the child points to __________________ [three]
   Number of counters the child shows __________________ [one]
3. Child correctly matches cards __________________ [yes/no]
Score: _______ points out of 4 total points
Hands-on interventions incorporate manipulatives, books, and other materials readily available in classrooms. The interventions target reinforcement of key math skills for each lesson.

**Intervention Activity**
Highlights student skills used for the intervention activities. Also includes suggested grouping and length of time for the activities.

---

**Numbers 1–3 Intervention**

**Viewing, Speaking, Writing**

30 minutes | Pairs
When a child struggles to identify different representations of the numbers 1–3, supplement the curriculum with these hands-on interventions:

**Mix ‘N Match**
1. Have children work in pairs. Have each pair make one set of index cards, each with one of the words one, two, and three on them and one set of index cards, each with one of the numerals 1, 2, and 3 on them.
2. Give each pair three counters. Have one child place one, two or all three counters on the desktop or tabletop.
3. Have the other child choose the cards with the correct numeral and the correct word that matches the number of counters.
4. Have the first child verify that the cards are correct. Then have the children switch roles.

**Pair Them Up**
1. Have children work in pairs to make four sets of index cards: one set with one of the words one, two, and three on each card, two sets with one of the numerals 1, 2, and 3 on each card, and one set with a dot representation for each number on each card.
2. Have children mix the cards and spread them out facedown on a desk or table. The first child turns over two cards.
3. If they represent the same number, it is a match, and the child gets to keep those two cards and take another turn.
4. If the two cards do not match, both get turned facedown again and the other player gets a turn.
5. Continue until all the cards have been matched.

**School/Home Connection**
Provide parents/caregivers with BLM 1. Encourage them to continue numbers 1–3 activities at home for additional skill reinforcement.
<table>
<thead>
<tr>
<th>Lesson Number and Sub Skill</th>
<th>Objective</th>
<th>NCTM Standard(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson 1: Numbers 1–3</td>
<td>Students will explore relationships between the numerals 1–3, the quantities 1–3, and the written words one, two, and three.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
</tr>
<tr>
<td>Lesson 2: Numbers 4–6</td>
<td>Students will explore relationships between the numerals 4–6, the quantities 4–6, and the written words four, five, and six.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
</tr>
<tr>
<td>Lesson 3: Numbers 7–10</td>
<td>Students will explore relationships between the numerals 7–10, the quantities 7–10, and the written words seven, eight, nine, and ten.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
</tr>
<tr>
<td>Lesson 4: 1 as Sum and Minuend</td>
<td>Students will compose and decompose 1.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
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<td></td>
<td></td>
<td>Compute fluently and make reasonable estimates</td>
</tr>
<tr>
<td>Lesson 5: 2 as Sum and Minuend</td>
<td>Students will compose and decompose 2.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
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<td></td>
<td>Compute fluently and make reasonable estimates</td>
</tr>
<tr>
<td>Lesson 6: 3 as Sum and Minuend</td>
<td>Students will compose and decompose 3.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
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<td></td>
<td>Compute fluently and make reasonable estimates</td>
</tr>
<tr>
<td>Lesson 7: 4 as Sum and Minuend</td>
<td>Students will compose and decompose 4.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
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<td></td>
<td>Compute fluently and make reasonable estimates</td>
</tr>
<tr>
<td>Lesson 8: 5 as Sum and Minuend</td>
<td>Students will compose and decompose 5.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</td>
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<td>Compute fluently and make reasonable estimates</td>
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### Correlations to NCTM Standards

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<tbody>
<tr>
<td><strong>Lesson 9:</strong> 6 as Sum and Minuend</td>
<td>Students will compose and decompose 6.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 10:</strong> 7 as Sum and Minuend</td>
<td>Students will compose and decompose 7.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 11:</strong> 8 as Sum and Minuend</td>
<td>Students will compose and decompose 8.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 12:</strong> 9 as Sum and Minuend</td>
<td>Students will compose and decompose 9.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 13:</strong> 10 as Sum and Minuend</td>
<td>Students will compose and decompose 10.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 14:</strong> Adding Two-Digit Numbers</td>
<td>Students will add two-digit numbers.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 15:</strong> Counting Up to 30</td>
<td>Students will count up from 1 to 30.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
</tr>
<tr>
<td><strong>Lesson 16:</strong> Counting Back from 30</td>
<td>Students will count back from 30 to 1.</td>
<td>Understand numbers, ways of representing numbers, relationships among numbers, and number systems. Compute fluently and make reasonable estimates.</td>
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</table>
## Correlations to NCTM Standards

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<tr>
<td><strong>Lesson 17:</strong> Skip Counting by 10s</td>
<td>Students will skip count by multiples of 10 up to 50 and learn word names ten, twenty, thirty, forty, and fifty.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
<tr>
<td><strong>Lesson 18:</strong> Ordinals: First</td>
<td>Students will understand first using word name and position.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
<tr>
<td><strong>Lesson 19:</strong> Ordinals: Second</td>
<td>Students will understand second using word name and position.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
<tr>
<td><strong>Lesson 20:</strong> Ordinals: Third</td>
<td>Students will understand third using word name and position.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
<tr>
<td><strong>Lesson 21:</strong> Ordinals: Fourth</td>
<td>Students will understand fourth using word name and position.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
<tr>
<td><strong>Lesson 22:</strong> Ordinals: Fifth</td>
<td>Students will understand fifth using word name and position.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
<tr>
<td><strong>Lesson 23:</strong> Extend a Pattern by Attributes</td>
<td>Students will extend a pattern by attributes.</td>
<td>Understand patterns, relations, and functions</td>
</tr>
</tbody>
</table>
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<tr>
<td><strong>Geometry</strong></td>
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</tr>
<tr>
<td><strong>Lesson 24:</strong> Identifying Two-Dimensional Shapes</td>
<td>Students will identify 2-dimensional shapes, including triangle, square, circle, hexagon, and rectangle, and the word name for each shape.</td>
<td>Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships</td>
</tr>
<tr>
<td><strong>Lesson 25:</strong> Identifying Three-Dimensional Shapes</td>
<td>Students will identify 3-dimensional shapes, including rectangular prism, triangular prism, and cylinder.</td>
<td>Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships</td>
</tr>
<tr>
<td><strong>Lesson 26:</strong> Identifying Three-Dimensional Shapes II</td>
<td>Students will identify 3-dimensional shapes, including cone, sphere, and pyramid.</td>
<td>Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships</td>
</tr>
<tr>
<td><strong>Measurement</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Lesson 27:** Measuring with Nonstandard Units | Students will measure with nonstandard units of measurement. | Understand measurable attributes of objects and the units, systems, and process of measurement  
Apply appropriate techniques, tools, and formulas to determine measurements |
| **Lesson 28:** Measuring with Standard Units | Students will measure with standard units of measurement. | Understand measurable attributes of objects and the units, systems, and process of measurement  
Apply appropriate techniques, tools, and formulas to determine measurements |
| **Data Analysis**           |           |                  |
| **Lesson 29:** Tally Charts | Students will gather data and create tally charts. | Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them |
| **Lesson 30:** Bar Graphs   | Students will translate tally data to bar graphs. | Formulate questions that can be addressed with data and collect, organize and display relevant data to answer them |