SOUTH CAROLINA SUPPORT SYSTEMS INSTRUCTIONAL GUIDE

Content Area	**2nd Grade Math**
Recommended Days of Instruction	**3rd Nine Weeks**

Standard 2-2: The student will demonstrate through the mathematical processes an understanding of the base-ten numeration system; place values; and accurate, efficient, and generalizable methods of adding and subtracting whole numbers.
2-2.10 Analyze the magnitude of digits through 9,999 on the basis of their place value.

Standard 2-4: The student will demonstrate through the mathematical processes an understanding of basic spatial reasoning and the connection between the identification of basic attributes and the classification of three-dimensional shapes.
2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)
2-4.2: Identify multiple lines of symmetry. (B1)
2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)

Standard 2-5: The student will demonstrate through the mathematical processes and understanding of the value of combinations of coins and bills and the measurement of length, weight, time, and temperature.
2-5.3 Use appropriate tools to measure objects to the nearest whole unit: measuring length in centimeters, feet, and yards; measuring liquid volume in cups, quarts, and gallons; measuring weight in ounces and pounds; and measuring temperature on Celsius and Fahrenheit thermometers.
2-5.4: Generate common measurement referents for feet, yards, and centimeters. (B6)
2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)
2-5.6: Predict whether the measurement will be greater or small when different units are used to measure the same object. (B2)
2-5.7 Use analog and digital clocks to tell and record time to the nearest quarter hour and to the nearest five-minute interval.
2-5.8 Match a.m. and p.m. to familiar situations.
2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)

* These indicators are covered in the following 5 Modules for this Nine Weeks Period. Teaching time should be adjusted to allow for sufficient learning experiences in each of the modules.			
Module 3-1 Year Long Indicators			
Indcator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**
Module 1-1 Lesson A 2-2.10 Analyze the magnitude of digits through 9,999 on the basis of their place values. (B4)	**STANDARD SUPPORT DOCUMENT** http//:www.ed.sc.gov/apps/cso/standards NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM)	See Instructional Planning Guide Module 1-1 Introductory Lesson A See Instructional Planning Guide Module 1-1, Lesson A Additional Instructional Strategies	See Instructional Planning Guide Module 1-1 Lesson A Assessing the Lesson
Module 1-1 Lesson B 2-5.3: Use appropriate tools to measure objects to the nearest whole unit: measuring length in centimeters, feet, and yards; measuring liquid volume in cups, quarts, and gallons; measuring weight in ounces and pounds; and measuring		See Instructional Planning Guide Module 1-1 Introductory Lesson B	See Instructional Planning Guide Module 1-1 Lesson B Assessing the Lesson

temperature on Celsius and Fahrenheit thermometers. (C3) 2-5.7 Use analog and digital clocks to tell and record time to the nearest quarter hour and to the nearest five-minute interval. (C3) 2-5.8 Match *a.m.* and *p.m.* to familiar situations. (A2)			
Module 1-1 Lesson C 2-5.3: Use appropriate tools to measure objects to the nearest whole unit: measuring length in centimeters, feet, and yards; measuring liquid volume in cups, quarts, and gallons; measuring weight in ounces and pounds; and measuring temperature on Celsius and Fahrenheit thermometers. (C3)		See Instructional Planning Guide Module 1-1 Introductory Lesson C See Instructional Planning Guide Module 1-1, Lesson C Additional Instructional Strategies	See Instructional Planning Guide Module 1-1 Lesson C Assessing the Lesson

Module 3-2 Geometric Shapes			
Indcator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**
Module 3-2 Lesson A 2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)	**STANDARD SUPPORT DOCUMENT** http//:www.ed.sc.gov/apps/cso/standards NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM)	See Instructional Planning Guide Module 3-2 Introductory Lesson A	See Instructional Planning Guide Module 3-2 Lesson A Assessing the Lesson
Module 3-3 Putting Together and Taking Apart Shapes/Lines of Symmetry			
Indicator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**

Module 3-3 Lesson A 2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)	**STANDARD SUPPORT DOCUMENT** http//:www.ed.sc.gov/apps/cso/standards NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series	See Instructional Planning Guide Module 3-3 Introductory Lesson A See Instructional Planning Guide Module 3-3, Lesson A Additional Instructional Strategies	See Instructional Planning Guide Module 3-3 Lesson A Assessing the Lesson

Module 3-3 Lesson B 2-4.2: Identify multiple lines of symmetry. (B1)	Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM)	See Instructional Planning Guide Module 3-3 Introductory Lesson B See Instructional Planning Guide Module 3-3, Lesson B Additional Instructional Strategies	See Instructional Planning Guide Module 3-3 Lesson B Assessing the Lesson
Module 3-4 Measurement			
Indicator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**

Module 3-4 Lesson A 2-5.4 Generate common measurement referents for feet, yards, and centimeters. (B6)	**STANDARD SUPPORT DOCUMENT** http//:www.ed.sc.gov/apps/cso/standards NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM)	See Instructional Planning Guide Module 3-4 Introductory Lesson A	See Instructional Planning Guide Module 3-4 Lesson A Assessing the Lesson
Module 3-4 Lesson B 2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)		See Instructional Planning Guide Module 3-4 Introductory Lesson B	See Instructional Planning Guide Module 3-4 Lesson B Assessing the Lesson
Module 3-4 Lesson C 2-5.6: Predict whether the measurement will be greater or small when different units are used to measure the same object. (B2)		See Instructional Planning Guide Module 3-4 Introductory Lesson C See Instructional Planning Guide Module 3-4, Lesson C Additional Instructional Strategies	See Instructional Planning Guide Module 3-4 Lesson C Assessing the Lesson

Module 3-5 Recalling Measurement Facts			
Indicator	**Recommended Resources**	**Suggested Instructional Strategies**	**Assessment Guidelines**

Module 3-5 Lesson A 2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)	**STANDARD SUPPORT DOCUMENT** http//:www.ed.sc.gov/apps/cso/standards NCTM's Online Illuminations http://illuminations.nctm.org NCTM's Navigations Series Teaching Student-Centered Mathematics Grades K-3 and Teaching Elementary and Middle School Mathematics Developmentally 6th Edition, John Van de Walle NCTM's Principals and Standards for School Mathematics (PSSM)	See Instructional Planning Guide Module 3-5 Introductory Lesson A	See Instructional Planning Guide Module 3-5 Lesson A Assessing the Lesson

MODULE

3-1

Year Long Math Indicators

This module addresses the following indicators:

2-2.10: Analyze the magnitude of digits through 9,999 on the basis of their place values. (B4)

2-5.3: Use appropriate tools to measure objects to the nearest whole unit: measuring length in centimeters, feet, and yards; measuring liquid volume in cups, quarts, and gallons; measuring weight in ounces and pounds; and measuring temperature on Celsius and Fahrenheit thermometers. (C3)

2-5.7: Use analog and digital clocks to tell and record time to the nearest quarter hour and to the nearest five-minute interval. (C3)

2-5.8: Match *a.m.* and *p.m.* to familiar situations. (A2)

These indicators were first introduced in Module 1-1, 1st nine weeks. These indicators should be revisited all year long. **See notes for revisiting in this module. There will not be actual lessons in this module, rather teachers should read the teacher notes and refer to module 1-1 as the building blocks.** These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

2-2.10 Analyze the magnitude of digits through 9,999 on the basis of their place value.

- In kindergarten, the students analyze the magnitude of digits through 99 on the basis of their place values. (K-2.6). In first grade, students analyze the magnitude of digits through 999 on the basis of their place values. (1-2.9)
- In second grade, students analyze the magnitude of digits through 9,999 on the basis of their place values. (2-2.10)
- In third grade students, analyze the magnitude of digits through 999,999 on the basis of their place values. (3-2.12)

2-5.3 Use appropriate tools to measure objects to the nearest whole unit: measuring length in centimeters, feet, and yards; measuring liquid volume in cups, quarts, and gallons; measuring weight in ounces and pounds; and measuring temperature on Celsius and Fahrenheit thermometers.

- Kindergarten students use nonstandard units to explore the measurement concepts of length and weight. (K-5.3). In first grade, students use whole inch units to measure the length of an object (1-5.4).
- Second grade students use appropriate tools to measure objects to the nearest whole unit measuring length in centimeters, feet, and yards; measuring liquid volume in cups, quarts, and gallons; measuring weight in ounces and pounds; and measuring temperature on Celsius and Fahrenheit thermometers. (2-5.3)
- Third grade students use appropriate tools to measure objects to the nearest unit: measuring length in meters and half inches; measuring liquid volume in fluid ounces pints, and liters; and measuring mass in grams. (3-5.2)

2-5.7 Use analog and digital clocks to tell and record time to the nearest quarter hour and to the nearest five-minute interval.

- Kindergarten students used analog and digital clocks to tell time to the hour. (K-5.6) First grade students used analog and digital clocks to tell and record time to the hour and half-hour. (1-5.8)
- In second grade, students use analog clocks to tell and record time to the nearest quarter hour and to the nearest five minute interval. (2-5.7)

- Third grade students will use analog and digital clocks to tell time to the nearest minute. (3-5.5)

2-5.8 Match a.m. and p.m. to familiar situations.

- This standard is not addressed at the Kindergarten or first grade level.
- Second grade students will match a.m. and p.m. to familiar situations. They also use analog and digital clocks to tell and record time to the nearest quarter hour and to the nearest five-minute interval (2-5.7)
- In third grade, students use analog and digital clocks to tell time to the nearest minute (3-5.6).

- **Key Concepts/Key Terms**

*These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

- *digits
- *Place value
- *Value
- *Units/ones
- *Tens/rods
- *Hundreds/flats
- *Thousands/cube
- *Standard form
- *Expanded form
- *Compose/decompose
- *Equivalent forms
- *Measure
- *Unit
- *Ruler
- *Centimeter
- *Feet
- *Yard
- *Liquid volume
- *Cup
- *Quart
- *Gallon
- *Weigh
- *Weight
- *Ounces
- *Pounds
- *Temperature
- *Thermometer
- *Fahrenheit
- *Celsius
- *Degrees
- *Length
- *Analog
- *Digital
- *Time
- *Clock
- *Hour
- *Half-hour
- *Quarter hour
- *Minute
- *Interval
- *A.M./ a.m.
- *P.M./ p.m.

Teacher Notes: Mathematics learning builds over the course of time. This is especially true with concepts such as number sense; equivalencies; weight, linear, and liquid measurement; time; money, just to name a few. As a result some topics are best acquired through repeated exposure in small on-going intervals of time. Therefore, while an introductory lesson has been provided for the concepts addressed in Module 1-1, First Nine Weeks, it is important to point out that students will need on-going formal and informal experiences throughout the year to ensure the automaticity and flexibility that is demonstrated with mathematical understanding.

Second grade students should continue to use concrete and pictorial materials to build understanding on the concepts addressed in Module 1-1, First Nine Weeks, for these year long indicators. Please refer to this Module and provide learning experiences that builds on prior learning to meet the indicators. Use the *Additional Instructional Strategies/Differentiation Variations* to gradually increase the capacity and allow student understanding to develop through repeated exposure.

MODULE

3-2

Geometry- Shapes

This module addresses the following indicators:

2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)

This Module contains 1 introductory lesson. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

  2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)
  - In kindergarten, students identified two-dimensional shapes: square, circle, triangle, and rectangle as well as the three-dimensional shapes cube, sphere, and cylinder (K-4.1). In addition, students represent two-dimensional shapes (K-4.2).
  - In first grade, students analyzed two-dimensional shapes square, circle, triangle and rectangle (1-4.2). Students classified these two-dimensional shapes as polygons or nonpolygons (1-4.3) and identified three-dimensional shapes prisms, pyramids, and cones (1-4.1).
  - In second grade, students analyze the three-dimensional shapes: spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shape of the faces, edges, corners, and bases of each (2-4.1).
  - In fourth grade, students represent the two dimensional shapes trapezoids, rhombuses and parallelograms and the three dimensional shapes cubes, rectangular prisms, and cylinders (4-4.4).

- **Key Concepts/Key Terms**

  *These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

  *Three-dimensional
  *Shape
  *Sphere
  *Cube
  *Cylinder
  *Prism
  *Pyramid
  *Square pyramid
  *Triangular pyramid
  *Cone
  *Face
  *Edge
  *Corner
  *Base
  *Horizontal
  *Vertical
  *Geometry
  *Horizontal

*Vertical
Vertex

Vertices

II. Teaching the Lesson

1. Teaching Lesson 3-2 A Faces, Edges, Corners and Bases (3 Dimensions)

2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)

For this indicator, it is **essential** for students to:

- Focus more on the properties of figures rather than on simple identification.
- Apply ideas to entire classes of figures, for example, all rectangles, rather than on individual models.
- Analyze classes of figures to determine new properties.
- Recognize the three-dimensional shapes: spheres, cubes, cylinders, prisms, pyramids, and cones including a square pyramid and a triangular pyramid.
- Recognize and define: faces, edges, vertices/corners, and bases.
- Recognize the two-dimensional shapes that make up the three-dimensional shapes.
- Recognize how the number of faces, edges, and corners of the various shapes relate to each other.
- Use proper mathematical vocabulary when referring to the vertices (corners) and horizontal/vertical when referring to position.

For this indicator, it is **not essential** for students to:

- None noted

a. Indicators with Taxonomy

2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)

Cognitive Process Dimension: Analyze
Knowledge Dimension:Conceptual Knowledge

b. Introductory Lesson

Lesson adapted from Navigating through Geometry in Prekindergarten-Grade 2: NCTM Navigations Series: Name that Block p. 19 and Pugalee. Developing Mathematical and Scientific Literacy: Effective Content Reading Practices, pgs. 74-75

Materials:
Geoblocks or other 3 dimensional objects such as blocks, cans, boxes, cones, tissue boxes, and straws

Lesson:
Teacher Note: Use proper mathematical vocabulary when referring to the vertices (corners) and horizontal/vertical when referring to position. Analysis should be limited to the number and shape of the faces, edges, corners, and bases of spheres, cubes, cylinders, prisms, pyramids, and cones. In other words, what are the two-dimensional parts that make up the three-dimensional shape and how does the number of faces, edges and corners of the various shapes relate to each other.

Students' spatial sense is enhanced by studying the faces, edges, and vertices of three-dimensional objects; describing what the faces look like; and naming the faces. Students should be given lots of various opportunities to explore geoblocks and real world shapes. They should see and hold different sizes of cubes, rectangular prisms and pyramids, and cylinders. Exploration with nets, both creating shapes from nets and taking shapes apart to make nets, will help students better understand shapes.

Part 1
For part 1, the teacher will introduce the cube and the cone. Students should work in pairs or in trios with their own set of blocks or objects. The teacher will introduce the disciplinary literacy strategy, Fact Summary, to help students organize facts about the shapes so that the information is helpful in approaching learning tasks. The teacher creates a copy of the Fact Summary Sheet below on chart paper. Students create a copy of the same sheet in their student mathematics notebook. The teacher models completing the Fact Summary Sheet with the information as the students create their individual sheets.

Fact Summary Sheet for Three-Dimensional Shapes						
Shape	# of Faces	Shape of each face	# of Edges	# of Corners (Vertex, Vertices)	#of Bases	Shape of Base(s)

As the teacher holds up a cube, the students find one like it from the shapes provided for their groups. Name the shape and have students record the term "cube" on their Fact Summary sheet. Have the students touch the faces, count the number of faces, and identify the shape of each of the faces. Students record the information on their Fact Summary Chart in their notebook.

Introduce the term, Edge, to the students. Have the students touch each edge and count the number of edges. Students record this information on the Fact Summary Sheet.

Discuss the name for the corners (vertex for one and vertices-plural). Have the students touch each vertex as they count them. Students are to record the number of vertices on the Fact Summary Sheet in their notebooks.

The teacher then holds up a "cone" and instructs the students to find the "cone" from their shapes. Continue the process above to complete the Fact Summary Sheet with information about the cone.

Part 2

Review the Fact Summary Sheet with the information recorded in part 1. Continue the same process used in part 1 to complete the Fact Summary Sheet for the cylinder and the pyramid.

Part 3

Review the Fact Summary Sheet with the information recorded in parts 1 and 2. Continue the same process used in part 1 to complete the Fact Summary Sheet for the sphere, the triangular prism, and the rectangular prism.

c. *Misconceptions/Common Errors*

Polygons have sides and vertices (or corners). We do not use the word sides with three-dimensional figures because it is unclear whether the word refers to faces or to edges.

All bases are faces, but not all faces are bases. There are 2 bases on a prism and 1 on a pyramid. The name of the prism or pyramid is the name of the shape of the base. All sides of a prism are rectangular and all sides of a pyramid are triangular. A cone is a 3-dimensional figure with one curved surface (usually circular), one curved edge, and one vertex. A cylinder is a 3-dimensional figure with two parallel and congruent circles as bases, one curved surface, two curved edges, and no vertices.

d. *Additional Instructional Strategies/Differentiation*

Variations for lesson above:

- Have one person pick a shape in their mind. The other students ask yes or no questions about the shape until they have figured out which shape it is.
- Put a shape in a clean sock. Have a student reach in the sock and feel the shape and describe it. Let the other students try to guess what it is.

Shape Sorts with 3-D Figures

Have students work in groups of four with a set of 3-D shapes. (Refer to the vocabulary list for the shapes that meet this indicator.)

- Activity One**:** Each child randomly selects a shape. In turn, the students tell one or two things they find interesting about their shape. There are no right or wrong responses.

- Activity Two: Children randomly select two shapes. The task is to find something that is alike about their two shapes and something that is different. Have students select their shapes before they know the task.

- Activity Three: The group selects one shape at random and places it in the center of the workspace. Their task is to find all other shapes that are like the target shape, but all according to the same rule. For example, if they say, "This one is like our shape because it has a curved side and a straight side," then all other shapes that they put in the collection must have these properties. Challenge them to do a second sort with the same target shape but using a different property.

- Activity Four: Do a "secret sort". You or one of the students creates a small collection of about five shapes that fit a secret rule. Leave others that belong in your group in the pile. The other students try to find additional pieces that belong to the set and/or guess the secret rule.

This activity was adapted from: Teaching Student-Centered Mathematics, Grades K-3, 2006 edition, pages 194-195, by John Van de Walle.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

- Geometric Solids and Their Properties (A lesson from Illuminations where students analyze characteristics and properties of three dimensional figures and name the faces of the common geometric solids. This is the first lesson in a series. There are other lessons that can be accessed from this page to continue further learning. Caution: Some of the shapes are not in 2nd grade standards.) http://illuminations.nctm.org/LessonDetail.aspx?id=L406
- I've Seen that Shape Before (Students work with 3-dimensional figures and their properties.) http://illuminations.nctm.org/LessonDetail.aspx?id=L237
- Solid Figure Factory (Match the name to the correct figure.) http://www.harcourtschool.com/activity/solid_figure_factory/
- Solid Figures and Plane Shapes (Match the 2D figure to a face on the 3D figure.) http://www.harcourtschool.com/activity/solid_figures_plane_shapes/
- Geometric Solids Activities http://www.reallygoodstuff.com/pdfs/145749.pdf
- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/
- Additional SMART Notebook interactive lessons and activities can be found by browsing the following site below. Teachers can browse by grade level, subject, or curriculum standard(s). http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm.

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. The lesson can also be assessed using a disciplinary literacy graphic organizer, The Frayer Model. The link to the site for instructions to create and use the Frayer Model is below.
http://wvde.state.wv.us/strategybank/FrayerModel.html
However, other formative assessment strategies should be used.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module. The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

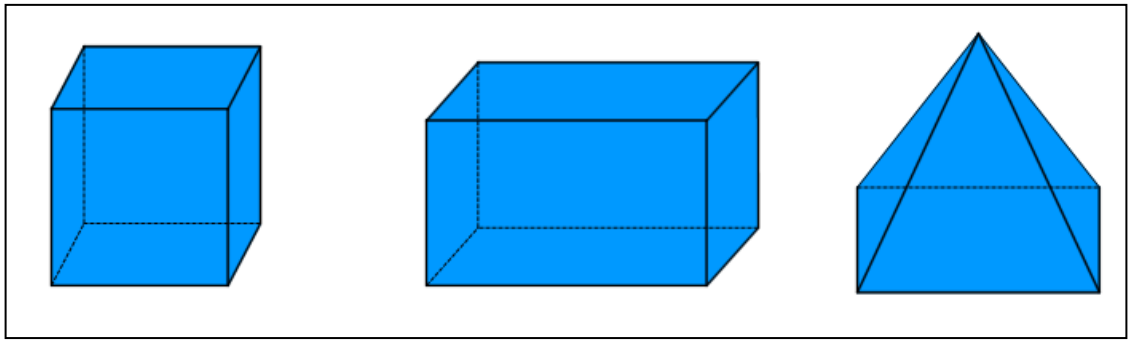
2-4.1: Analyze the three-dimensional shapes spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shapes of the faces, edges, corners, and bases of each. (B4)
The objective of this indicator is to analyze, which is in the "analyze conceptual knowledge" cell of the Revised Taxonomy table. Conceptual knowledge is not bound by specific examples; therefore, students analyze the three-dimensional shapes: spheres, cubes, cylinders, prisms, pyramids, and cones according to the number and shape of the faces, edges, corners, and bases of each. The learning progression to **analyze** requires students to recognize the three-dimensional shapes and identify the faces, edges, corners, and bases of each. Students explain and justify their mathematical thinking (2-1.3).

1. Consider Group A and Group B below when answering the following questions:

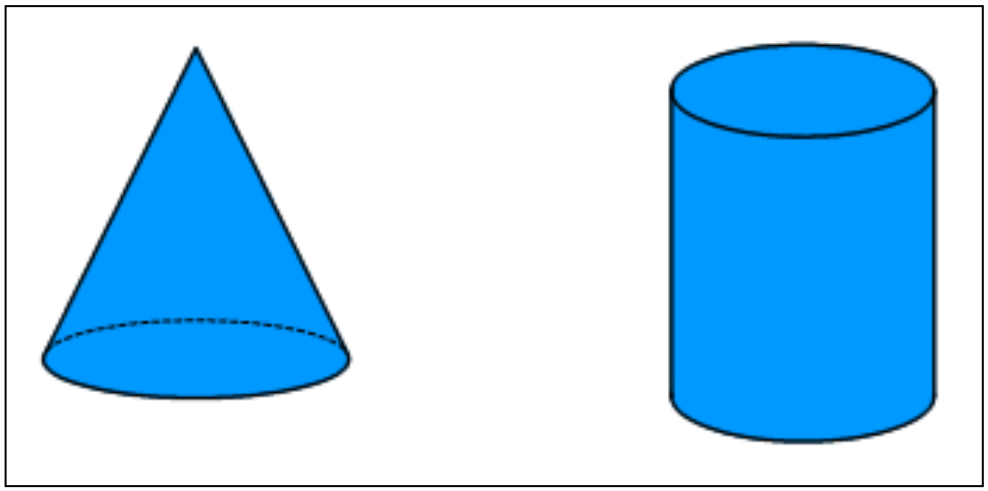
   a. Name at least two ways the figures in Group A are similar to those in Group B.

   b. Name at least two ways the figures in Group A are different from those in Group B.

Group A



Group B



MODULE

3-3

Putting together and taking apart shapes/ Lines of symmetry

This module addresses the following indicators:

2-4.2: Identify multiple lines of symmetry. (B1)
2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)

This module contains 2 lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

  2-4.2: Identify multiple lines of symmetry. (B1)
  - In kindergarten, symmetry is not addressed. In first grade, students examine the two-dimensional shapes: square, triangle, and rectangle to determine if they have a line of symmetry as well as houses, animals, etc. (1-4.4).
  - In second grade, students identify multiple lines of symmetry in one object including squares, rectangles, triangles, and circles (2-4.2).
  - In third grade, symmetry is not addressed. In fifth grade, students analyze shapes to determine line symmetry and/or rotational symmetry (5-4.6).

  2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)
  - In kindergarten, students identified (K-4.1) and represented (K-4.2) two dimensional shapes: squares, triangles, and rectangles, and circles (and). In first grade, students identified three-dimensional geometric shapes: prism, pyramid, and cone (1-4.1), analyzed two-dimensional shapes: circle, square, triangle, and rectangle (1-4.2), and classified two-dimensional shapes as polygons and non-polygons (1-4.3).
  - In second grade, students predict the results of combining and subdividing polygons and circles (2-4.3).
  - In third grade, the students analyze the results of combining and subdividing circles, triangles, quadrilaterals, pentagons, hexagons, and octagons (3-4.7).

- **Key Vocabulary/Concepts**

  *These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

*Line	*Horizontal	*Triangle
*Symmetry	*Diagonal	*Circle
*Multiple	*Vertices	*Polygon
*Identify	*Square	*Square
*Vertical	*Rectangle	*Triangle

*Rectangle	*Subdivide	*Symmetry
*Circle	*Predict	
*Combine	*Results	

II. Teaching the Lesson(s)

1. Teaching Lesson 3-3A Combine and Subdivide Polygons and Circles

2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)
For this indicator, it is **essential** for students to:

- Use the two-dimensional shapes with which they have worked to date (circle, square, triangle, and rectangle).
- Use spatial reasoning to visualize what shape might result by combining or subdividing.
- Use their understanding of symmetry to visualize what shape might result by combining or subdividing.

For this indicator, it is **not essential** for students to:

- Use polygons other than a circle, a square, a triangle, or a rectangle.

a. Indicators with Taxonomy

2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)
Cognitive Process Dimension: Understand
Knowledge Dimension:Conceptual Knowledge

b. Introductory Lesson

Lesson adapted from Navigating through Geometry in Prekindergarten-Grade 2: NCTM Navigations Series: Cutting Corners, pp 22-26 and Pugalee, Developing Mathematical and Scientific Literacy: Effective Content Reading Practices, pgs. 130-131

Materials:

- assorted pattern blocks or die cuts of squares, rectangles, and triangles
- paper/math notebooks & pencil per student

Lesson:
Teacher Notes: In 1st grade, students identified a single line of symmetry for the two dimensional shapes square, rectangle and

triangle. However, discussion was limited to identification of one line of symmetry and a circle was not included due to its infinite lines of symmetry. As a result, the teacher should draw on prior knowledge of these two-dimensional shapes. Discussion can now begin regarding multiple lines of symmetry in one object, including a circle.

In 2nd grade, students move to predicting the results of combining and subdividing polygons and circles. Students should use the two-dimensional shapes with which they have worked to date (circle, square, triangle, rectangle).

What shapes might result by subdividing (cutting apart) a rectangle? How does placement of the line of symmetry affect the resultant shape? In other words, if the line of symmetry is drawn vertically in a rectangle then two squares may result. On the other hand, if the line of symmetry is drawn diagonally in a rectangle then two triangles will result. Students need numerous and varied experiences with concrete materials such as pattern blocks and computer models in order to develop and expand spatial reasoning.

Lesson: Each student will be given assorted pattern blocks or die cuts of squares, rectangles, and triangles. The emphasis should be on spatial reasoning – can a student visualize what shape might result by combining two or more of the pattern blocks or die cuts. The disciplinary literacy strategy of Think, Pair, Share will be used as formative assessment.

Think: Ask the students the following question:
How many ways can you form rectangles, triangles, and squares by combining more than one of the shapes you have been given?
Students record results by drawing a sketch of their combinations in their student mathematics notebooks.

Pair: Students pair with a peer to share their ideas and sketches. Students discuss their understanding of the concept. The idea is for students to synthesize their ideas, question information, and provide justification for thinking. Limit the time so that students focus on the task.

Share: Student pairs share with whole group.

c. *Misconceptions/Common Errors*

Young students have difficulty recognizing shapes that have been rotated or flipped. This activity helps them see shapes in different orientations.

d. *Additional Instructional Strategies/Differentiation*

Try this activity starting with different shapes like a large triangle or trapezoid.

Develop their understanding of this skill through numerous and varied experiences with concrete materials such as pattern blocks and computer models in order to develop and expand spatial reasoning.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

- Online Interactive Geobard (Use this to help show combining and subdividing polygons.) http://standards.nctm.org/document/eexamples/chap4/4.2/part2.htm
- Another Geoboard from National Library of virtual manipulatives http://nlvm.usu.edu/en/nav/frames_asid_277_g_1_t_3.html?open=activities&from=category_g_1_t_3.html
- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/
- Additional SMART Notebook interactive lessons and activities can be found by browsing the following site below. Teachers can browse by grade level, subject, or curriculum standard(s). http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm.

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. The Think, Pair, Share activity from the lesson will serve as formative assessment and should guide future instruction. However, other formative assessment strategies should be used.

2. Teaching Lesson *3-3B Lines of Symmetry*

2-4.2: Identify multiple lines of symmetry. (B1)

For this indicator, it is **essential** for students to:
- Understand symmetry.
- Use vocabulary such as vertical, horizontal, diagonal, and vertices when identifying a line of symmetry.

For this indicator, it is **not essential** for students to:
- Include a circle due to its infinite lines of symmetry

a. Indicators with Taxonomy

2-4.2: Identify multiple lines of symmetry. (B1)
Cognitive Process Dimension: Recall
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Lesson adapted from Navigating through Geometry in Prekindergarten-Grade 2: NCTM Navigations Series: Folding Shapes pp.59-61

Materials:
- Paper cutouts of large circles, squares, nonsquare rectangles, equilateral triangles, isosceles triangles, and regular pentagons and hexagons for each student. The circles should have 4" diameters, and the polygons should be of similar size.
- A box of crayons of different colors for each table of students
- Four to six rectangular mirrors, at least 4" by 6", or Miras (A Mira is a geometric device made from semiopaque colored plastic. This device allows students to see a reflection of the objects on one side of the Mira-just as a mirror does-and also see through the plastic so they can trace the image on the other side.

Lesson:

Place 4 students at each table with a box of crayons and a mirror or Mira. Give each child a paper square and ask them to fold it in half and then open it back up. Point to the fold and tell them that another name for this fold line is "line of symmetry". Each shape on either side of the line is the same size and shape (congruent). Have them use the mirrors or Miras to see the congruent shapes on either side of the line of symmetry. Discuss what the shapes are and what they make when put together. Have them color the line with a crayon. Let them share their lines of symmetry with each other.

Note that everybody's might not be the same, but that they are all correct. Now challenge them to find 3 more lines of symmetry with their square and color each one a different color.

Give the students the rectangle and triangle(s). Have them discuss what kind of shapes they are and what their names are. Then have them describe the shapes, identify their attributes, and how they are alike and different. Point out that regular polygons have congruent sides (all sides are the same length). Now, let them explore and discover the lines of symmetry for each shape. Have them trace the lines of symmetry with different color of crayons. When they finish, have them compare their lines of symmetry with the other people at their table. Have the students at each table create a table displaying what they discovered about the number of sides and the lines of symmetry. Have them put the name of the polygon in the table.

Ask: What are some hunches you might have about the number of lines of symmetry in regular polygons? Non-regular polygons?

c. *Misconceptions/Common Errors*

Students may try to draw a line of symmetry that divides a shape in half but does not make mirror images. Paper folding is the best way for students to see this.

d. *Additional Instructional Strategies/Differentiation*

Connections can be made to art when making snowflakes and hearts. Students can create pictures with a line of symmetry. Connections can be made in science with the human body, butterflies, and architecture.

Pattern Block Symmetry
Students need a plain sheet of paper with a straight line through the middle. Using about six to eight pattern blocks, students make a design completely on one side of the line that touches the line in some way. The task is to make the mirror image of their design on the other side of the line. When finished, they use a mirror to check their work. They place the mirror on the line and look into it from the side of the original design. With the mirror in place, they should see exactly the same image as they see when they lift the mirror. You can also challenge them to make designs with more than one line of symmetry.

This activity is taken from: Teaching Student-Centered Mathematics, Grades K-3, 2006 edition, page 211, by John Van de Walle.

Folding Shapes
This activity is taken from NCTM Navigating through Geometry in Prekindergarten-Grade 2, 2001 edition, page 59.

Symmetry and Alphabet Symmetry
This activity is taken from Hands-On Math for Grades 2-3, from Creative Teaching Press, 1995 edition, page 99.

Students can look for and identify lines of symmetry all around them in things like clothes, tongs, and forks.

e. Technology

- Line Symmetry Webquest (Many activities found here.) http://www.adrianbruce.com/Symmetry/index.html
- Complete a Pattern Symmetry Activity (Choose among three levels. Questions follow for discussion.) http://www.haelmedia.com/OnlineActivities_txh/mc_txh3_001.html
- Symmetry (Enter site as guest.) http://www.ixl.com/math/practice/grade-2-symmetry
- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/
- SMART Notebook interactive lessons and activities can be found by browsing the site below. Teachers can browse by grade level, subject, or curriculum standard(s). http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm.
- Video from Links Learning on Line Symmetry (The video discusses vertical and horizontal line symmetry, multiple lines of symmetry, real world symmetry, alphabet symmetry, includes practice and more.) http://www.linkslearning.org/Kids/1_Math/2_Illustrated_Lessons/4_Line_Symmetry/index.html

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. Teachers should observe students as they fold and then draw the multiple lines of symmetry on their paper. Students should be able to explain why their fold is a line of symmetry. Students should also identify multiple lines of symmetry

for each shape. However, other formative assessment strategies should be used.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module. The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

2-4.2: Identify multiple lines of symmetry. (B1)

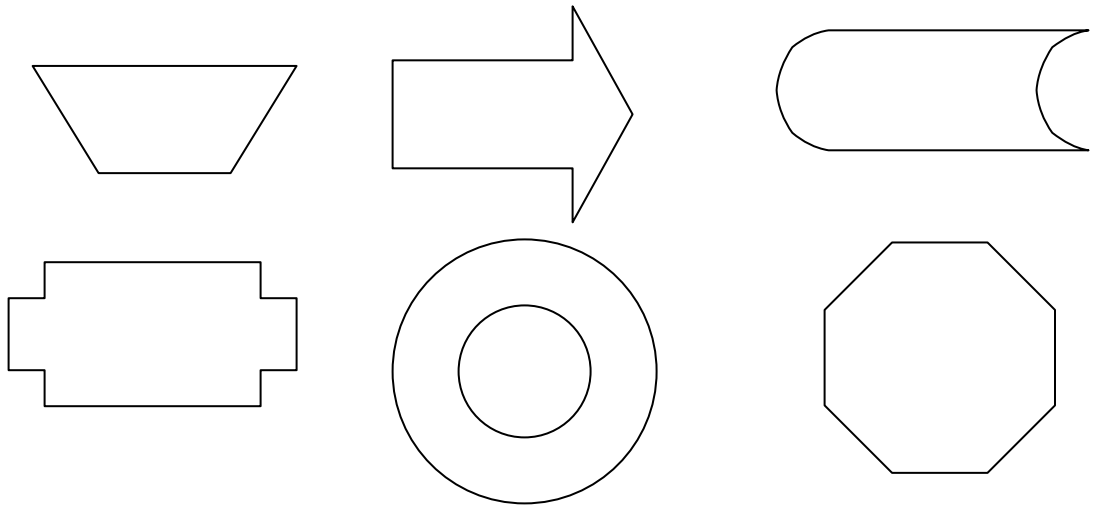
The objective of this indicator is to identify, which is in the "remember conceptual knowledge" cell of the Revised Taxonomy table. Conceptual knowledge is not bound by specific examples; therefore, students identify lines of symmetry using a variety of examples. The learning progression to **remember** requires students to recall the meaning of terms such as horizontal, vertical, diagonal, etc.. Students explore concrete experiences with squares, rectangles, triangles, and circles in finding lines of symmetry. They analyze patterns (2-1.4) and generate conjectures (2-1.2) about where the line of symmetry occurs. Students should explain and justify their mathematical thinking during and after these experiences (2-1.3).

2-4.3: Predict the results of combining and subdividing polygons and circles. (B2)

The objective of this indicator is to predict, which is in the "understand conceptual knowledge" cell of the Revised Taxonomy table. To predict is to draw a conclusion from presented information. The learning progression to **predict** requires students to recall and identify polygons and circles. Students explore how to combine and subdivide shapes using concrete and/or pictorial models. Students generate conjectures and exchange mathematical ideas about their results (2-1.2). Students generalize the connection between fractional parts when combining and subdividing polygons and circles (2-1.7). They use their understanding from these experiences to make predictions about other situations.

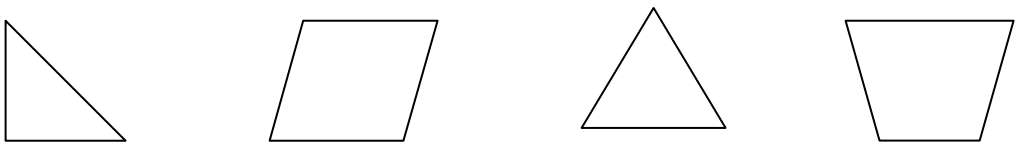
Assessment item 1 adapted from Prekindergarten – Grade 2 Mathematics Assessment Sampler, DeAnn Huinker. National Council of Teachers of Mathematics, 2006. pages 108-109.

1. Aunt Sally likes to bake unusual cookies for her nephews, Billy and Bob. To get a cookie, they have to tell her how to cut a cookie so that each get a fair share. Show Aunt Sally how to cut each cookie below into two pieces that are the exact same shape and size.



2. Draw a line to divide each figure. Name the 2 figures that were made when you drew the line.

3. Which 2 figures could be used to make a square? You may use 2 of the same shape or 2 different shapes.



MODULE

3-4

Measurement

This module addresses the following indicators:

2-5.4: Generate common measurement referents for feet, yards, and centimeters. (B6)
2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)
2-5.6: Predict whether the measurement will be greater or smaller when different units are used to measure the same object. (B2)

This module contains 3 lessons. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

- **Continuum of Knowledge**

  2-5.4: Generate common measurement referents for feet, yards, and centimeters. (B6)
  - In first grade, students generate common referents for whole inches. (1-5.5).
  - In second grade, students should develop their own personal bench-marks for feet, yards, and centimeters and progress to common benchmarks for the class (2-5.4).
  - In third grade, students should use their understanding of the relationship between meters/yards, kilometers/miles, liters/quarts, and kilograms/pounds to generate common referents (3-5.4).

  2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)
  - In first grade, students were allowed to determine and share their own personal benchmarks. (1-5.5) and use these benchmarks to estimate length to the nearest whole inch. (1-5.6)
  - Second graders use common measurement referents to make estimates in feet, yards, and centimeters. (2-5.5)
  - In third grade, students use common referents to make comparisons and estimates associated with meters compared to yards, kilometers to miles, liters to quarts, and kilograms to pounds. (3-5.4)

  2-5.6: Predict whether the measurement will be greater or small when different units are used to measure the same object. (B2)
  - In Kindergarten and first grade, this standard is not addressed.
  - In second grade, students predict whether the measurement will be greater or smaller when different units are used to measure the same object. (2-5.6)
  - This lays the foundation for conversions that will come at later grades (4-5.8).

- **Key Vocabulary/Concepts**

  *These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

  *Measure *Measurement *Feet

*Yard	*Estimate	*Greater
*Centimeters	*Referents	*Smaller
*Benchmark	*Predict	

II. Teaching the Lesson(s)

1. Teaching Lesson 3-4 A Measurement Referents (Feet, Yard, CM)

2-5.4: Generate common measurement referents for feet, yards, and centimeters. (B6)

For this indicator, it is **essential** for students to:

- Develop a familiarity with the standard units of a foot, yard, and centimeter
- Understand that each one of their common referent may be different

It is **not essential** for students to:

- use common referents to make estimates

a. Indicators with Taxonomy

2-5.4: Generate common measurement referents for feet, yards, and centimeters. (B6)

Cognitive Process Dimension: Create
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson

Materials:
Inch rulers
Centimeter rulers
Yard sticks
Paper dollar bills that are actual size

Lesson: Lesson adapted from Van de Walle activity 8.19

Teacher Notes: In second grade they should develop their own personal benchmarks for feet, yards and centimeters and progress to common benchmarks for the class. After generating the benchmarks, students should use them to make estimates in feet, yards, and centimeters. Second grade is the first time students are introduced to the metric system. Therefore, sufficient and varied experiences with metric rulers marked in whole centimeters will be necessary for conceptual understanding.

Personal Benchmark activity: Have students find personal references on their bodies for the following lengths: 1 foot and 1 yard. Heights to waist, shoulder, or head can be considered as well as lengths of arms and arm spans. After developing lists of benchmarks, have students use only their bodies to "measure" or estimate measures of various lengths and heights. After recording these estimates, they should measure each length with a ruler and check their accuracy.

c. *Misconceptions/Common Errors*

Students might think that a common referent is equivalent to the actual measurement.

d. *Additional Instructional Strategies/Differentiation*

Note: This initial lesson is for foot and yard. Centimeters should be handled in a similar manner at a separate time. Negative transfer can occur when two very similar concepts are taught at the same time. (Sousa, How the Brain Learns).

- Provide students with many opportunities to create and use personal benchmarks in class
- Create a class list of different personal benchmarks for a foot, yard, and centimeter that students can refer to when measuring
- How Big Is A Foot by Rolf Myller **.** This book tells a story about using someone's foot to measure the length of a bed and the problems that occur when measuring using a nonstandard unit.
- In a future lesson, repeat the process from the bullet above with centimeters.
- About One Unit activity (Van de Walle activity 8.17) For this activity, give students a model of a standard unit and have them search for things that measure about the same as that one unit. For example, to develop familiarity with the meter, give students a piece of rope 1 meter long. Have students make lists of things that are about 1 meter. Keep separate lists for things that are a little less (or more) or twice as long (or half as long). Encourage students to find familiar items in their daily lives. In the case of lengths, be sure to include circular items. Later, students can try to predict if a given object is more than, less than, or close to 1 meter.

e. *Technology*

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/

- Additional SMART Notebook interactive lessons and activities can be found by browsing the site below. Teachers can browse by grade level, subject, or curriculum standard(s). http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm.

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. Teacher observations of students personal benchmarks will indicate an understanding of the differences between a foot and a yard. Teacher should question students about why they chose the benchmark they did and whether they would measure in a foot or a yard if measuring for precision. However, other formative assessment strategies should be used.

2. Teaching Lesson 3-4 B Estimate Feet, Yards, and Centimeters

2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)

For this indicator, it is **essential** for students to:
- use common referents for feet, yards, and centimeters
- make distinctions between metric and customary units of feet, yards and centimeters

It is **not essential** for students to:
- make comparisons of units other than feet, yards and centimeters

a. Indicators with Taxonomy

2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)

Cognitive Process Dimension: Apply
Knowledge Dimension: Procedural Knowledge

b. *Introductory Lesson*

Materials:
Rulers
Yard sticks
Number stories

Lesson:

- Students will create a four-column chart in their mathematics notebooks. The four headings will be Item, Referent Measure, Prediction, Actual Measure. For this lesson, students will use only the Item and Referent Measure columns.
- Students use their personal referents to measure assorted items in feet and yards. Teachers should identify the items that students will measure. Students record their data in the Item and Referent Measure columns of the charts they created in the mathematics notebooks.
- In a future lesson, repeat the same process with centimeters.

c. *Misconceptions/Common Errors*
Students may confuse common referents for inches and centimeters.

d. *Additional Instructional Strategies/Differentiation*

- Second grade is the first time students are introduced to the metric system. Sufficient practice and varied experiences with metric rulers marked in whole centimeter units will be needed for conceptual understanding of centimeters.
- Students will need lots of varied practice and experience using common referents to make estimates using feet, yards, and centimeters. Estimation helps develop familiarity with the standard units.
- Emphasize the use of approximate language in measuring activities. For example,
  using words such as about, is a little more than, is a little less than can be useful with younger students because many measurements do not come out even. (Van de Walle 2007 p.378)
- Measurement estimation should be an ongoing activity. Having a daily measurement to estimate posted on a bulletin board or chart is one way to provide practice for students.

e. *Technology*
Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of

learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding

- Ladybug Lengths (Students measure objects using nonstandard units. Link these to standard units.) http://illuminations.nctm.org/LessonDetail.aspx?id=L123
- How Many Steps? (Students measure steps in nonstandard units and show their data in a bar graph. Link these to standard units.) http://illuminations.nctm.org/LessonDetail.aspx?id=L187
- Magnificent Measurement (This is a series of lessons on measuring using objects, pictures, and symbols. Link these to standard units. This unit incorporates length, area, volume, weight, and time. All of these may not be needed or could be used during a different module.) http://illuminations.nctm.org/LessonDetail.aspx?id=U66
- What Should I Measure Next? How About ME! (Students practice measurement by measuring themselves. Students use nonstandard units to measure their heights and arm spans. Link these to standard units.) http://illuminations.nctm.org/LessonDetail.aspx?id=U187
- Teddy Bear Measures (Measure the teddy bear with the ruler to see how many units tall he is…play as a whole class or individually.) http://www.apples4theteacher.com/measure.html
- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/
- Additional SMART Notebook interactive lessons and activities can be found by browsing the site below. Teachers can browse by grade level, subject, or curriculum standard(s). http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm.

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. Teacher observations and student notebook responses /oral explanations will inform for future instruction. However, other formative assessment strategies should be used.

3. Teaching Lesson 3-4 C
Size Versus Number of Units for a Given Measure

2-5.6 Predict whether the measurement will be greater or small when different units are used to measure the same object. (B2)

For this indicator, it is **essential** for students to:
- know inches are smaller units than feet and feet are smaller units than yards
- understand that larger units will create a smaller measure and smaller units will create a larger measure

It is **not essential** for students to:
- convert units of measurement

a. Indicators with Taxonomy

2-5.6 Predict whether the measurement will be greater or small when different units are used to measure the same object. (B2)
Cognitive Process Dimension: Understand
Knowledge Dimension: Conceptual Knowledge

b. Introductory Lesson
Materials:
Inch rulers
Centimeter rulers
Yard sticks
Objects of different lengths to measure

Suggested Literacy Connection: *How Big is a Foot?* Written and illustrated by Rolf Myller. This book is good to finish the lesson so the students can connect what they just did with the making of the queen's bed.

Lesson:
As this is an introductory lesson, only feet and yards are addressed. The teacher can add centimeters in a future lesson.

Teacher Note: A somewhat difficult concept for students is to predict whether the linear measurement will be greater or smaller when different units are used to measure the same object. For example, if Taylor measures her desk top in yards and Anna Lee measures the same desk top in feet, will the number of feet determined by Anna Lee be greater than or smaller than the number of yards determined by

Taylor? The emphasis here is on conceptual development of measurement – if a student understands the concepts of "feet" and "yards," they will be able to determine that when measuring in yard the determined number will be smaller than when measuring the same object in feet because the unit used for measuring is larger. This lays the foundation for conversions that will come at later grades.

Find the student with the smallest foot and the largest foot. Then say that we are going to measure the teacher's desk with each foot. Before they measure, ask the students to estimate how many "feet" the desk will be and write their estimates on sticky notes. Have them place the sticky notes on a number line to see what the range of guesses is. Have them each measure the desk. Discuss the different answers. Ask: Who had the biggest foot? How many of their feet did it take to measure the desk? Was that more or less than the person with the smaller foot? Why is that so? What would happen if we measured the teacher's desk with a paper clip? Would it be more or less than the feet? Why?

Review the different ways to measure using inches, feet and yards. Divide the group into pairs or trios. Assign each group a unit of measure to use to measure several objects. The objects can be some you brought in or things in the room like the length of the room, string, width of the door, etc. Discuss that the object will probably not be the exact unit of measure. Decide as a group how to handle this. Will it be 5 inches and a little more or is it closer to 5 or 6 inches? Have each group measure the objects with their unit of measurement. When everybody has finished measuring, have each group tell how many units of measure the object was without telling what specific unit they used and let the other groups guess which unit of measurement they used. Ask the groups to come up with a generalization about what happens when you measure with different lengths of measurement.

c. *Misconceptions/Common Errors*

Students have difficulty understanding that the smaller the unit the larger the measure and the larger the unit the smaller the measure.

d. *Additional Instructional Strategies/Differentiation*

- Students need numerous experiences predicting whether the linear measurement will be greater or smaller when different units are used to measure the same object. The emphasis is on conceptual development and understanding. Students need to test predictions by measuring objects using different units.
- The Changing Units activity (Van de Walle 2007 p. 380) is an activity that can provide practice where this skill is the focus. Have students measure a length with a specified unit. Then provide them with a different unit that is either twice as long or half as long as the original

unit. Have students predict the measure of the same length using the new unit. Students should write down their predictions and explain how these were made. Discuss predictions and then have them make the actual measurement. Cuisenaire rods are good to use for this activity.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding

- How Big Is A Foot? http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Mathematics/Measurement/MEA0212.html
- Inchworm Measurement http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Mathematics/Measurement/MEA0203.html
- Making Estimations in Measurement http://eduref.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Mathematics/Measurement/MEA0005.html
- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/
- Additional SMART Notebook interactive lessons and activities can be found by browsing the site below. Teachers can browse by grade level, subject, or curriculum standard(s). http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm.

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. Students should complete the four column chart from the previous lesson as formative assessment. However, other formative assessment strategies should be used.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module. The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

2-5.4: Generate common measurement referents for feet, yards, and centimeters. (B6)

The objective of this indicator is to generate which is in the "create conceptual" knowledge" of the Revised Taxonomy table. Conceptual knowledge is not bound by specific examples; therefore students should generate common measurement referents for feet, yards, and centimeters. The learning progression to **generate** requires students to differentiate between feet, yards, and centimeters. Students generate conjectures and exchange mathematical ideas to produce common measurement referent (2-1.2). Throughout this process, students should generalize connections among mathematics and the real world. (2-1.7)

2-5.5: Use common measurement referents to make estimates in feet, yards, and centimeters. (C3)

The objective of this indicator is to use which is in the "apply procedural knowledge" cell of the Revised Taxonomy table. Procedural knowledge is bound by specific examples. Therefore, students should use common measurement referents to make estimates in feet, yard, and centimeters. The learning progression to **use** requires students to generate common measurement referents for feet, yards, and centimeters. Students will apply these common referents to make estimates in feet, yard, and centimeters. Students should explain and justify their reasoning when making these estimates (2-1.3) and use a variety of forms of mathematical communication to share their estimates (2-1.6) .

2-5.6: Predict whether the measurement will be greater or small when different units are used to measure the same object. (B2)

The objective of this indicator is to predict which is in the "understand conceptual knowledge" cell of the Revised Taxonomy table. Conceptual knowledge is not bound by specific examples. Students predict whether measurements will be greater or smaller when different units are used to measure the same object. The learning progression to **predict** requires students to recall the size of a centimeter, inch, and foot and compare these units. Students generalize math concepts such as the smaller the unit used to measure, the larger the measure and the larger the unit the smaller the

measure (2-1.5). Students should explain and justify their predictions. (2-1.3)

1. Think about the length of each of these objects.
Are they about the size of one foot, one yard, or one centimeter?
Classify them by their size in the chart below.
Note: *There are some items in the list that do not match any of the measurements*.

Width of your little finger
An adult male's shoe
A spoon
Piece of notebook paper
Width of a doorway
Height of a table
Distance from your elbow to fist
Length of a car

About One Centimeter	**About One Foot**	**About One Yard**

2. Determine if the following are possible or impossible.
a. Austin said his bed was about 7 yards long.
b. A flower is 1 foot tall. Is it possible for a classroom to be 3 feet high?
c. A car is 2 yards long?
d. A park bench is 30 centimeters wide.

3. Four children measured the width of a carpet with the length of each of their shoes. The chart shows how many footsteps it took to measure the width of the carpet.

Name	**Number of Footsteps**
Stephen	15
Erlane	13
Ana	16
Carlos	12

Which student had the smallest shoe length? Explain your thinking.

4. A group of students were measuring their desktops with different objects. Sara said her desktop was 10 crayons wide. Kristi measured her desk with paperclips. About how many paperclips do you think she will need to measure her desk? Explain your thinking.

MODULE

3-5

Recalling Measurement Facts

This module addresses the following indicators:

2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)

This Module contains 1 introductory lesson. These lessons are **INTRODUCTORY ONLY**. Lessons in S3 begin to build the conceptual foundation students need. **ADDITIONAL LESSONS will be required** to fully develop the concepts.

I. Planning the Module

The first bullet under the Continuum of Knowledge represents students' prior knowledge and/or skills related to this standard. It is recommended that students are pre-assessed on this prior knowledge.

Continuum of Knowledge

2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)

- In kindergarten, students learned to recall the equivalencies 7 days = 1 week and 12 months = 1 year (K-5.8).
- Second grade students recall the equivalencies 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour, and 24 hours = 1 day (2-5.9).
- In third grade, students will learn to recall the equivalency 60 seconds = 1 minute (3- 5.7).

Key Vocabulary/Concepts

*These are vocabulary terms that are reasonable for students to know and be able to use. Terms without the * are additional terms for teacher awareness, knowledge and use in conversation with students.

*Foot	*Feet	*Inches	*Minute	*Hour
*Day	*Yard	*Equivalent		

II. Teaching the Lesson(s)

1. Teaching Lesson 3-5 A Basic Length, Time Equivalents

2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)
For this indicator, it is **essential** for students to:

- know the equivalencies 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour

For this indicator, it is **not essential** for students to:

- know the equivalency 60 seconds = 1 minute
- convert units of measurement

a. Indicators with Taxonomy

2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)

Cognitive Process Dimension: Remember
Knowledge Dimension: Factual Knowledge

b. Introductory Lesson

Lesson Part A:

Students should be given lots of opportunities to recall and use these measurements throughout the year. Having the students make their own measuring devices will help them understand and remember the equivalencies. Color tiles are 1 inch long. Have students line 12 of them together and then cut a strip of construction paper as long as the 12 color tiles. Then they can mark off the 12 spaces to make their own ruler. Have them make 3 feet this way, put them together to make a yard stick.

Lesson Part B:

Since the students have been exposed to telling time all year, this would be the time to count the minutes on the clock to show that there are 60 minutes in an hour. Individual student clocks will give the students the opportunity to count out the minutes themselves and discover that there are 60 minutes in an hour. When they have a good grasp on the concept of am and pm, discuss with them how there are 12 hours in the am and 12 hours in the pm and when you put them together, you have a day.

Have them list different activities that the class does during the day and how long they last. Ex: lunch 30 minutes, recess 25 minutes, silent reading, 15 minutes. etc. Ask them: What activities can they do in an hour or close to an hour?

c. *Misconceptions/Common Errors*

No typical student misconceptions noted at this time.

d. *Additional Instructional Strategies/Differentiation*

Students need to recall the listed equivalencies, therefore student experiences should be numerous and varied enough so that they understand the equivalencies.

For example, students can take a 12 inch ruler and place on a yardstick to discover that 3 feet = 1 yard.

e. Technology

Virtual manipulatives should NOT take the place of concrete manipulation of objects/materials. Once conceptual understanding has been reached, you may move to pictorial representations and then virtual manipulatives. Concrete manipulatives should be the focus of learning to build conceptual understanding. Real life situations/representations are critical for conceptual understanding.

- SMART Board Interactive Whiteboard Lessons and Resources http://www.scholastic.com/interactivewhiteboards/
- SMART Notebook interactive lessons and activities can be found by browsing the following site: http://education.smarttech.com/ste/en-US/Ed+Resource/Lesson+activities/Notebook+Activities/Correlated+Search+us.htm. Teachers can browse by grade level, subject, or curriculum standard(s).

f. Assessing the Lesson

Formative assessment is embedded within the lesson through questions and observation. The teacher should observe and use student responses from the lesson to guide instruction. However, other formative assessment strategies should be used.

III. Assessing the Module

At the end of this module summative assessment is necessary to determine student understanding of the connections among and between the indicators addressed in this module. The following examples of possible assessment strategies may be modified as necessary to meet student/teacher needs. These examples are not derived from nor associated with any standardized testing.

2-5.9: Recall equivalencies associated with length and time: 12 inches = 1 foot, 3 feet = 1 yard, 60 minutes = 1 hour; and 24 hours = 1 day. (A1)

The objective of this indicator is to recall which is in the "remember factual" knowledge cell of the Revised Taxonomy table. Although the focus of the indicator is to recall, the learning progression should integrate concept building activities that support retention of these facts. The learning progression to **recall** equivalencies requires students to explore these equivalencies using concrete and/or pictorials models. As students generalize connections among these models and mathematics (2-1.7), they

generate conjectures (2-1.2) about the relationships between these measures. They explain and justify their answers (2-1.3) to their classmates and teacher. Students may use a variety of forms of communication to recall these equivalencies such as using words, pictures, and/or numbers. (2-1.6)

1. The following statements are false. Correct the statements so they will be true.

- There are 36 hours in one day.
- There are 10 inches in one foot.
- One day has 60 minutes.
- One yard has 100 inches.
- 12 inches are in one yard.