GRADE 3 MATHEMATICS

Shape and Space

Grade 3: Shape and Space (Measurement) (3.SS.1, 3.SS.2)

Enduring Understandings:

Elapsed time is the measure of the duration of an event.

Units within a system relate to each other (e.g., seconds, minutes, hours, day, week, month, year).

We can use measurement to sequence events.

Essential Questions:

What activities take a minute, an hour, a day, a week, a month, or a year to complete?

How are seconds, minutes, and hours related?

How are days and months related?

Specific Learning Outcome(s):	Achievement Indicators:
3.SS.1 Relate the passage of time to common activities using non-standard and standard units (minutes, hours, days, weeks, months, years). [CN, ME, R]	➛ Select and use a non-standard unit of measure, such as television shows or pendulum swings, to measure the passage of time, and explain the choice. ➛ Identify activities that can or cannot be accomplished in minutes, hours, days, months, and years. ➛ Provide personal referents for minutes and hours.
3.SS.2 Relate the number of seconds to a minute, the number of minutes to an hour, and the number of days to a month in a problem-solving context. [C, CN, PS, R, V]	➛ Determine the number of days in any month using a calendar. ➛ Solve a problem involving the number of minutes in an hour or the number of days in a given month. ➛ Create a calendar that includes days of the week, dates, and personal events.

Prior Knowledge

Students may have had experience relating the number of days to a week and the number of months to a year. They may have had no formal experience with the passage of time related to minutes, hours, or seconds.

Background Information

Time is abstract and it cannot be seen, so it is a challenge to fully understand. Students need many experiences relating the passage of time to events in their life. They need to understand that the duration of an event/activity is determined by its start and end times and that there are standard units that we can use to describe the duration. Students should develop personal referents (length of a class or television show) to understand duration. This understanding is developed by having students do the following:

- Compare two events to determine which is longer or shorter.
- Measure the duration of events using non-standard units such as pendulums, sand timers, et cetera.
- Use standard units to measure the duration of events to ensure the measuring is uniform.

Mathematical Language

minutes
hours
days
weeks
months
years
seconds
calendar
passage of time

Learning Experiences

BLM
3.SS.1.1

Assessing Prior Knowledge: Interview

1. Use the cards included on BLM 3.SS.1.1. Have students order the months of the year.
2. Have students order the days of the week.
3. Ask the following:
   - How many months are there in one year?
   - How many days in one week?
   - How many days in two weeks?

January	February	March
April	May	June
July	August	September
October	November	December

Sunday	Monday	Tuesday
Wednesday	Thursday	Friday
Saturday		

Look for:

The student

- ❒ orders the months of the year
- ❒ orders the days of the week
- ❒ knows the number of months in a year
- ❒ knows the number of days in a week

- **Select and use a non-standard unit of measure, such as television shows or pendulum swings, to measure the passage of time, and explain the choice.**

Suggestions for Instruction

- Use non-standard units to measure the passage of time before introducing standard units. For example, have students make a pendulum using a weight suspended from a string. Students can count the number of swings it takes to complete tasks (count to 50, jump 10 times, walk to the classroom door, etc.). **Note:** Increasing or decreasing the length of the string will change the duration of time. This would be an interesting inquiry for students.
- Provide cards with pictures of familiar activities, some of which take a long time and some of which take a short time. Divide students into groups. In groups, have them sort the cards into short- and long-time activities, and discuss how they know. Share their reasons for their sorts with the class.

BLM 3.SS.1.2

- **Longer or Shorter?** Have students work with a partner. Students select a duration card (BLM 3.SS.1.2). Each partner chooses one of the activities on the card. Both students start at the same time in order to determine which activity takes the longest to complete.

Longer or Shorter? counting backwards from 20 to 1 or counting to 100 by 10s	**Longer or Shorter?** singing *Row, Row, Row Your Boat* or counting by 5s to 50
Longer or Shorter? counting to 20 or clapping your hands 10 times	**Longer or Shorter?** walking to the classroom door or stamping your foot 10 times
Longer or Shorter? printing your first and last name or saying the alphabet	**Longer or Shorter?** jumping 20 times or standing up and sitting down 10 times
Longer or Shorter? bouncing a ball 10 times or touching your toes 8 times	**Longer or Shorter?** saying your telephone number or tying your shoelace

- **Identify activities that can or cannot be accomplished in minutes, hours, days, months, and years.**

Suggestions for Instruction

- Reading a book such as *A Second Is a Hiccup: A Child's Book of Time* by Hazel Hutchins, illustrated by Kady MacDonald Denton, will provide real-life examples of the passage of time.
- **How long will it take?** Brainstorm a list of events/activities. Organize the list of events/activities into two groups: things that take a short time to complete (e.g., combing your hair, eating dinner, counting to 20) and things that take a long time to complete (e.g., reading a chapter book, building a house, growing a garden).

  Have students select an appropriate unit of measurement to describe the time it would take to complete each event/activity.

- **Provide personal referents for minutes and hours.**

Suggestions for Instruction

- **How long is a minute?** Have students put their heads down. Ask them to raise their head when they think a minute is up. Ask questions such as the following:
  - What did you notice?
  - How did you decide when to put your head up?
  - If you had to do this activity again how would you decide now? What would you change?
- **Egg/Sand Timer Activity:** Set the egg timer for one minute or use a one-minute sand timer. Have students find out the following:
  - How many cubes can you join together in a minute? in two minutes?
  - How many times can you print your first name in a minute? in two minutes?
  - How far can you count in a minute? in two minutes?
  - How many times can you hop in a minute? in two minutes?

- **Second Hand:** Draw students' attention to the second hand on an analog clock. Use the egg or sand timer to show that one revolution (from the 12 to the 12) of the second hand is equal to one minute on the timer(s).
- **Just a Minute:** Provide pairs with a stopwatch or a clock with a second hand. One student acts as the timer, and the other as the estimator.

  Student Instructions:

  a. Timer: Say "Go!"
     Estimator: Without looking at the time, signal when you think a minute has passed.
     Timer: Tell the Estimator whether the estimate was over or under a minute.
  b. Try it three times, and see if the estimates improve. Record your results.
  c. Switch roles.

- **How long does it take?** Work with a partner, list all the activities you can think of that take
  - about 5 minutes to do
  - about 10 minutes to do
  - about 30 minutes to do
  - more than 30 minutes to do

  Be prepared to share your list with the class. How are the lists the same? How are they different?
- **What can you do in an hour?** Have students relate daily events/activities to one hour. Set a timer or an alarm clock and have students connect the hour to classroom activities (e.g., math class, lunch, TV shows, playing video games).
- **A Day in the Life Of:** Have students keep a record of the activities they do over the course of a day. For each activity have them estimate the number of minutes or hours it takes to complete.

  Examples:

Activity	Time
Brushing teeth	2 minutes
Getting dressed	10 minutes
Eating breakfast	20 minutes

Assessing Understanding: Journal Entry

Would you use minutes or hours to measure

- the length of the school day?
- the length of recess?

Explain your choices.

- **Solve a problem involving the number of minutes in an hour.**

Suggestions for Instruction

- **How long does it take?** Ask students what they notice about the face of an analog clock (with a second hand). Look for numbers 1 to 12, 3 hands, tick marks between the numbers, et cetera. Point out that the every time the second hand moves to one of the small tick marks a second has passed. Have students determine the number of seconds in a minute by counting as the second hand makes one revolution.
- **Minutes in an hour?** Review the observations made about the face of the analog clock. Introduce the long hand as the minute hand. Have students watch to see what happens to the minute hand as the second hand completes one revolution (It moves one tick mark.). Ask students how many tick marks there are altogether (60). Point out that when the minute hand completes one revolution an hour has passed. Have students use this information to determine the number of minutes in an hour.

Assessing Understanding: Problems with Time

- Mike's video is 90 minutes long. Is that more or less than an hour? Explain how you know.
- Pat's mother said that she could play at her friend's for either 2 hours or for 150 minutes. Which one should she choose if she wants to play for as long as she can? Explain your choice.

Look for:

The student

- ❒ understands that there are 60 seconds in a minute
- ❒ understands that there are 60 minutes in an hour
- ❒ applies this information in a problem-solving situation

- **Determine the number of days in any month using a calendar.**
- **Solve a problem involving the number of days in a given month.**

Suggestions for Instruction

- **How many days?** Have students work in groups. Give each group a calendar. Ask them to explore the calendar to determine the number of days in each month. What did they notice?
- **Thirty days . . .** Introduce the rhyme: *Thirty days hath September, April, June, and November, and all the rest have thirty-one, except, February having 28. But Leap Year coming once in four, February then hath one day more.*
- **Hands Can Help:** Show students how they can use their hands to determine the number of days in each month. Have students make a fist. Touch the first knuckle and say January. Touch the space between the knuckles and say February. The next knuckle is March, et cetera. After saying July, go back to the first knuckle for August and continue. Months landing on a knuckle have 31 days and those landing in the spaces have 30 except for February.
- **February Is Special!** Talk to students about the fact that February has only 28 days except in a leap year when it adds one more day. Explain that this is because a year is made up of a little bit more 365 days, so every four years we add an extra day (leap year).
- **Calendar Problems:**
  - Mira is 2 years old. How many months is that?
  - Mr. and Mrs. Jones hired Zack to walk their dog for the month of October.
    - If Zack walks the dog twice a day, how many times will he walk the dog during the month?
  - Today is March 1.
    - Jillian's birthday is on May 2.
    - How many more days does Jillian have to wait until her birthday?
    - Explain how you know.

  Have students create their own calendar problems to share with the class.

- **Create a calendar that includes days of the week, dates, and personal events.**

Suggestions for Instruction

BLM 3.SS.1.3

- **My Year:** Provide students with a calendar template (BLM 3.SS.1.3) for each month. Have them fill in the month, days of the week, and dates. With the help of their family, have students put important events on their calendar (birthdays, holidays, anniversaries, special events, etc.). Students can use the calendar to record special school events as well.
  Note: This activity could be done using technology.
- **100-Day Investigation:** Many classrooms celebrate the 100th day of school. Have pairs of students use their calendars to determine when the 100th day of school will occur. They will need to figure out how many school days there are each month beginning in September, but this information does not need to be given to students before they attempt the problem. Provide scaffolding to groups when appropriate. (Teachers will have to decide ahead of time whether in-service/administrative days will count as school days for this problem.)

Assessing Understanding: Paper-and-Pencil Task or Interview

What unit of time would you use to measure the following?

- a ride to school by bike
- a picnic
- a journey to the moon
- a holiday
- a baby's age
- an adult's age
- recess
- a blink of an eye

Which month(s)

- is the shortest
- have 30 days
- have 31 days

Grade 3: Shape and Space (Measurement) (3.SS.3)

Enduring Understandings:

Objects have distinct attributes that can be measured with appropriate tools.

Standard units provide a common language for communicating measurement.

A measurement must contain a number and a unit.

Essential Questions:

Why do we need standard measurement units?

How are centimetres and metres related?

What referent can you use to estimate length in centimetres?

What referent can you use to estimate length in metres?

Specific Learning Outcome(s):	Achievement Indicators:
3.SS.3 Demonstrate an understanding of measuring length (cm, m) by ■ selecting and justifying referents for the units cm and m ■ modelling and describing the relationship between the units cm and m ■ estimating length using referents ■ measuring and recording length, width, and height [C, CN, ME, PS, R, V]	➔ Provide a personal referent for one centimetre and explain the choice. ➔ Provide a personal referent for one metre and explain the choice. ➔ Match a standard unit to a referent. ➔ Show that 100 centimetres is equivalent to 1 metre by using concrete materials. ➔ Estimate the length of an object using personal referents. ➔ Determine and record the length or width of a 2-D shape. ➔ Determine and record the length, width, or height of a 3-D object. ➔ Draw a line segment of a given length using a ruler. ➔ Sketch a line segment of a given length without using a ruler.

Prior Knowledge

Students may have had experience measuring length using non-standard units only.

Background Information

Students have had opportunities with measurement attributes using direct comparison and non-standard units. The use of non-standard units allows students to see the need for a standard unit. There should be ample discussion with the students to explore why standard units are necessary to ensure consistency when measuring. Centimetre and metre will be two standard units of measurement that will be introduced to students. It is important for students to have the time to discover personal referents for these standard units of measurement. Personal referents allow students to visualize measurement and make estimates more accurate.

Iteration means the act of repeating. In measurement, using a unit smaller than the object being measured and repeating it end-to-end is an example of iteration.

Referent is a point of reference used to compare in estimation (e.g., using the width of the baby finger as a referent for a centimetre).

Length is the distance from one end of an object to the other end, commonly measured in units of metres, centimetres, millimetres, and kilometres.

Height is the measurement from base to top.

Width is one dimension of a 2-D or 3-D figure.

Standard unit of measure is a unit commonly used to indicate the length, area, volume (capacity), mass, or temperature of an object; it is also used to indicate the passage of time.

Note: Students need to be taught how to use measuring tools (rulers, metre sticks). Some rulers leave a space before the zero and others use the end of the ruler as zero.

Students also need to learn the difference between the marks on the ruler (millimetres and centimetres). Using centimetre cubes and lining them up on the ruler will help students see which numbers represent centimetres. (Millimetres are introduced in Grade 5.)

Mathematical Language

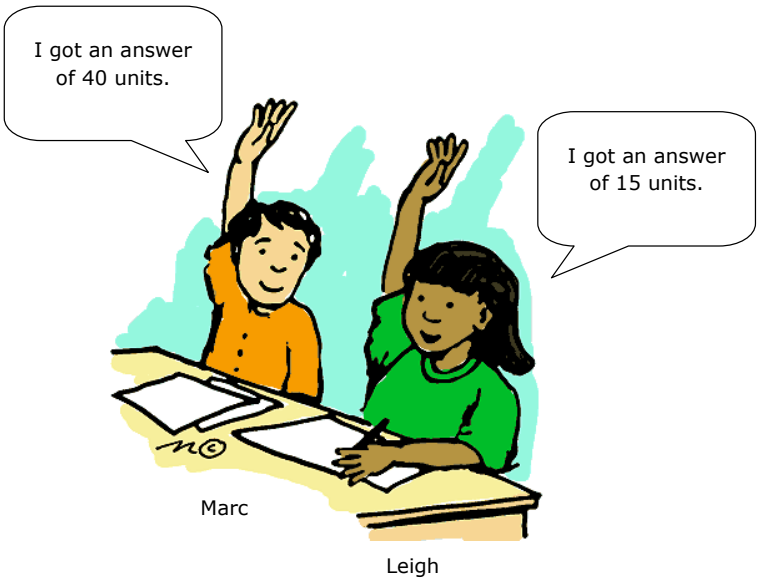
measure
measurement
standard unit
centimetre
metre
length
height
width
ruler
metre stick
referent
estimate
line

Learning Experiences

Assessing Prior Knowledge: Measurement Stations

1. Station 1: Provide several objects along with a non-standard unit, such as paper clips, craft sticks, cubes, et cetera. Students measure the length and/or height of the objects and record their findings.
2. Station 2: Draw two different curved or zigzagged lines on sheets of paper. Provide string and a non-standard unit. Students measure the length of the lines.
3. Station 3: Present a problem such as the following one. Have students write an explanation in their journals.

   Marc and Leigh measured the table.



Explain how this might have happened.

Observe students as they work.

Look for:

The student

- ❒ is able to use non-standard units to measure length and height
- ❒ measures from one end to the other without gaps or overlaps
- ❒ is able to record their measurements using a number and a unit
- ❒ is able to measure a curved or zigzagged line
- ❒ understands that the size of the unit determines the number of units needed (The larger the unit the fewer needed. The smaller the unit the more needed.)

- **Determine and record the length or width of a 2-D shape.**
- **Determine and record the length, width, or height of a 3-D object.**
- **Provide a personal referent for one centimetre and explain the choice.**
- **Match a standard unit to a referent.**
- **Estimate the length of an object using personal referents.**

Suggestions for Instruction

- **Creating the Need for a Standard Unit:** Read the book *How Big Is a Foot?* by Rolf Myller. This is the story about a young apprentice that is charged with making a bed for the queen. The king measures the distance around the queen using his foot as the unit. He sends those measurements to the apprentice who then uses his small feet as the unit to make the bed. Needless to say the bed is too small for the queen and the apprentice is sent to jail. While there, he comes to realize that the king's feet are bigger than his and that they need some sort of standard unit.

  Read the book but stop when the apprentice is thinking about the problem in jail.

  Have students write a letter to the apprentice explaining why the bed was too small for the queen.

  Discuss their explanations. Ask students how the marble copy of the king's foot helped the apprentice. Highlight the importance of the standard unit.

- **Centimetres:** Give students a centimetre cube (base-10 materials, centicubes, Cuisenaire rods). Explain that the length, width, and height of the cube are all equal to one centimetre. Have students use the cubes to measure various small objects recording the measurements with a number and centimetres as the unit.

- **Centimetre Walk:** Provide each student with a 1-cm cube or a 1-cm paper strip. Take students on a walk and have them measure and record items 1 cm long. Ask small groups to sort their findings and to display their results.
- **Measuring Me:** Have students work with a partner to measure various body parts using centimetres. Provide rulers and measuring tapes. Be sure that students know how to use the measuring tools.

  Examples:

Body Part	Measurement
arm	
leg	
finger	
nose	
hand	
foot	

- **Measurement Detective:** Have students go on a hunt in the classroom for objects that are of a specified length.

  Examples:

Length	Object
2 cm	
5 cm	
10 cm	
15 cm	
20 cm	
30 cm	

  Note: This activity could be done at home instead of the classroom.

- **Determining a Referent for a Centimetre:** Have students take out their pencils. Ask them how they could measure the pencil without using a ruler. Brainstorm some solutions. If students do not come up with a referent, ask them to look at their hands. Ask, "Is there some part of your hand that might be about one centimetre in length or width?" Have students measure to check.

  Once the referent has been determined have students use it to estimate the length or width of various objects and then measure to check their estimates.

BLM 3.SS.3.1

- **Wriggler Derby Game**

  Objective: to accumulate a large number of centimetres, or to attain a large number of reasonable estimates

  Number of players: 2

  Materials: bags containing an even number of mixed up wrigglers (e.g., ribbons, yarn, string, paper strips, pipe cleaners)
  rulers, tape measures, or metre sticks

  Directions:

  Note: Decide with the students the range for reasonable estimates (e.g., within 5 cm, 10 cm, and so on) based on the lengths of the wrigglers provided and students' experiences before beginning the game.

  In pairs, students take turns fishing out a wriggler, estimating the length, and then measuring the length. Record on the chart (BLM 3.SS.3.1). Continue taking turns until all the wrigglers have been fished out of the bag.

Wriggler Derby			
Wriggler	**Estimate**	**Measurement**	**Reasonableness**
Red yarn	30 cm	24 cm	yes
Yellow yarn	22 cm	26 cm	yes

- **Measuring Shapes/Objects**
  - Give students a 2-D shape. Ask them to measure the length and width of the shape.
  - Give students a 3-D object such as a cereal box, and have them measure the length, width, and height of the box.
- **I Spy:** Play a game of "I Spy" using measurement. For example, "I spy with my little eye something in the classroom that is 10 cm long."
- **Four (or more) Star Measurer:** Develop measurement criteria with students. Ask them to identify what makes a good measurer. Record their suggestions. Select the key elements for a "Four Star Measurer" chart.

  Examples:
  - I used a referent to estimate the length, width, or height.
  - I started measuring at one end of the object.
  - I started measuring at the zero mark on the ruler.
  - I recorded using both a number and a unit.

Assessing Understanding: Performance Tasks

1. Provide a collection of 2-D shapes and 3-D objects.

   Student Directions:

   - Pick one 2-D shape. Measure its length and width. Record your results.
   - Pick one 3-D object. Measure its length, width, and height. Record your results.

2. Provide a collection of different objects such as popsicle/craft sticks, straws, stir sticks, toothpicks, pipe cleaners, et cetera.

   Student Directions:

   - Pick two of the objects.
   - Estimate their length using your referent. Record.
   - Use a ruler to find the actual measurement. Record.

Self-Assessment: Have students use the "Four Star Measurer" criteria to self-assess.

Look for:

The student

- ❒ is able to measure the length, height, and width of a 3-D object accurately
- ❒ is able to measure the length and width of a 2-D shape accurately
- ❒ is able to use a referent to make a reasonable estimate

- **Show that 100 centimetres is equivalent to 1 metre by using concrete materials.**
- **Provide a personal referent for one metre and explain the choice.**

Suggestions for Instruction

- **Introducing the Metre:** Present this problem. The classroom flooring is going to be replaced (or carpeted). The flooring company wants to know the length and width of the room so they can order enough flooring. How can we measure it?

  Discuss possible solutions.

Have students measure the length of the room using a 30-cm ruler. Talk about any difficulties they might have had using a 30-cm ruler (small tool and unit, had to keep moving the ruler, had to keep track of the number of cm so they could add them up at the end, etc.).

Tell them that there is a larger unit that might be easier to use. Show students the metre stick. Ask them to estimate its length in centimetres. Place centicubes or base-10 materials along the top of the metre stick to show that it is equal to 100 cm.

Have them measure again using the metre stick.

Talk about why they might have found it easier to use (fewer iterations, count in metres rather than cm, faster, etc.). Students might have found it difficult to use the metre stick when there was less than a metre to measure. If so, discuss possible solutions.

- **Metre Search:** Have students find objects in the classroom that are about 1 metre, more than 1 metre, or less than 1 metre. Make a class list.
- **Referent for a Metre:** Let students experiment to find a personal referent for a metre. Provide an opportunity for sharing their referents and explaining their choices.
- **Measurement Game:** Students work in groups of 2 to 4.

  Note: Before playing the game, have the class decide the degree of accuracy needed (e.g., within 5 cm [either higher or lower than the actual measure]).

  Materials: 30-cm ruler, metre stick, tape measure for each group

  Directions:

  - Player 1 selects an object in the classroom and gives the dimension to be measured (length, width, height).
  - Each player writes down an estimate. (Encourage students to use their referent.)
  - Player 1 measures to check.
  - Those players that meet the degree of accuracy decided on previously score 1 point.
  - Player 2 takes a turn.
  - Play continues until one player has 10 points.
- **I Spy:** Extend the I Spy game to include measurements in metres.

Assessing Understanding: Performance Assessment

1. Give the student adding machine tape or string. Ask them to cut a piece that is about one metre long (without the use of a measuring tool). Ask them to explain how they decided where to cut. Have them measure to check the accuracy of their estimate.
2. Ask the student to measure an object in the classroom using metres. Observe.

Look for:

The student is able to

- ❒ use a referent to make a reasonable estimate of the size of a metre
- ❒ explain how they used their referent to estimate
- ❒ measure accurately in metres
- ❒ record measurements using a number and a unit

- **Draw a line segment of a given length using a ruler.**
- **Sketch a line segment of a given length without using a ruler.**

Suggestions for Instruction

- **Line Segment Drawing:** Have students measure the length of specified parts of their body and then use a ruler to draw a line segment to equal that length.

  Example:

Body Part	Length	Line Segment
Finger	6 cm	———
Nose		

- **Line Segment Estimation Game**

  Work in pairs.

  Materials: 10- or 20-sided die, rulers

  Directions:

  1. Player 1 rolls the die.
  2. Both players draw a line equal to the number shown in centimetres without using a ruler.
  3. Players then measure to check.
  4. If the line drawn is close to the number, the player scores a chip or a point.
  5. Player 2 rolls.
  6. The game continues until one player has 5 chips/points (or more).

Grade 3: Shape and Space (Measurement) (3.SS.4)

Enduring Understandings:

Objects have distinct attributes that can be measured with appropriate tools.

Specific tools measure specific attributes.

Essential Questions:

How are grams and kilograms related?

What referents can I use to estimate grams and kilograms?

What tools can I use to measure mass?

Will changing the shape of an object affect its mass?

Specific Learning Outcome(s):	Achievement Indicators:
3.SS.4 Demonstrate an understanding of measuring mass (g, kg) by ■ selecting and justifying referents for the units g and kg ■ modelling and describing the relationship between the units g and kg ■ estimating mass using referents ■ measuring and recording mass [C, CN, ME, PS, R, V]	➛ Provide a personal referent for one gram and explain the choice. ➛ Provide a personal referent for one kilogram and explain the choice. ➛ Match a standard unit to a referent. ➛ Explain the relationship between 1000 grams and 1 kilogram using a model. ➛ Estimate the mass of an object using personal referents. ➛ Determine and record the mass of a 3-D object. ➛ Measure, using a scale, and record the mass of everyday objects using the units g and kg. ➛ Provide examples of 3-D objects that have a mass of approximately 1 g, 100 g, and 1 kg. ➛ Determine the mass of two similar objects with different masses, and explain the results. ➛ Determine the mass of an object, change its shape, re-measure its mass, and explain the results.

Prior Knowledge

Students may have had experience

- determining which of two objects is heaviest/lightest by comparing
- selecting a non-standard unit for measuring the mass of an object and explaining why it was chosen
- estimating, measuring, and recording the mass (weight) of an object using non-standard units

Background Information

Students will be estimating and measuring mass using the gram and kilogram. Estimating mass can be a challenge because the object's size and shape are not directly related to its mass. Students need ample exploration with developing a sense of what a gram and kilogram feel like.

Ensure all scales (pan balance, kitchen scales, beam scales) are accurate prior to having students use them.

Mass: A measure of how much matter there is in an object. In the international system (SI) of units, the units of mass include grams (g) and kilograms (kg).

In daily life, the terms **mass** and **weight** are virtually interchangeable, but in reality they are not the same thing. An object on the moon weighs less than it does on Earth, and in space is weightless. The mass of the object does not change, regardless of where it is. Mass is measured with a balance.

Weight: A measure comprising a combination of the mass of an object and the pull of gravity on that mass. Weight is measured with a scale.

Students should be introduced to the correct terminology.

Mathematical Language

mass
weight
scale
balance
gram
kilogram
compare
estimate
estimation
referent

Learning Experiences

Assessing Prior Knowledge: Performance Task

1. **Heavier or Lighter:** Have students compare (without a measuring tool) two objects to determine which is heavier/lighter.
2. **How Heavy?** Have students use non-standard units to estimate and then measure the mass of a given object.

Observe to determine if the student is able to

- ❒ determine the heaviest/lightest object using direct comparison
- ❒ use a non-standard unit to estimate the mass of an object
- ❒ use a non-standard unit to find the mass of an object

- **Provide a personal referent for one kilogram and explain the choice.**
- **Match a standard unit to a referent.**

Suggestions for Instruction

- **Introducing the Kilogram:** Introduce the kilogram and make a list of items students know are purchased by the kilogram. Collect advertisements and package labels showing kilogram amounts.

  Use the terms *kilo* and *kilogram* so students become familiar with both. Introduce the format *kg* for recording.

  Have students make a class collection of kilogram items (i.e., items with a mass of 1 kilogram). Ask them to label each item and its mass.

- **Making a Kilogram:** In small groups have students make their own kilogram mass. Use materials such as a zippered bag and pennies or cubes, a container and sand, a zippered bag and marbles, et cetera. Use the balance scale and the standard kg mass to check their work.

- **Kilogram Referent:** Using their kilogram mass or a standard kg unit, have students see if they can find something in the classroom that can serve as a referent for the kg. Share findings with the class.

- **How much does it weigh?** Have students use a balance scale to find the mass of a set of objects. Make sure that some of the objects weigh either more or less than a kg. Have a class discussion around any difficulties they had completing the task. What happened when the object didn't weigh exactly one or more kilograms? Is there a smaller unit we can use to measure mass? Introduce the gram. (A centimetre cube weighs one gram.)

- **Explain the relationship between 1000 grams and 1 kilogram using a model.**
- **Provide a personal referent for one gram and explain the choice.**
- **Estimate the mass of an object using personal referents.**
- **Provide examples of 3-D objects that have a mass of approximately 1 g, 100 g, and 1kg.**
- **Determine and record the mass of a 3-D object.**
- **Measure, using a scale, and record the mass of everyday objects using the units g and kg.**

Suggestions for Instruction

- **How are kilograms and grams related?** Have students test to find out how many centimetre cubes it takes to balance a kilogram mass (1000).

  The common unit for measuring mass is the kilogram; a gram is one-thousandth of a kilogram. Introduce the format *g* to record grams.

- **Referent for a Gram:** Have students explore (at school or at home) to determine a personal referent for a gram (a counter, paper clip, a small bean, a raisin, a jellybean, etc.). Share their findings with the class.

- **How much is 100 grams?** Ask students if they have ever been to a store that has a bulk food section. Have they ever bought anything from that section? Point out that bulk food prices usually tell you how much it costs to buy 100 grams. How much is 100 grams?

  Provide several different sets of objects (cubes, counters, craft sticks, pennies, or wrapped candies), zippered bags, a balance scale, and a 100-gram mass. Have students estimate (using their referent) how much of each object will make 100 grams. Put the objects in zippered bags. Measure to check.

  Ask why you can get more of one item than another if both bags weigh 100 grams (weight of each piece differs, the size of each piece differs, etc.).

- **Mass Ordering:** Have students bring in a collection of food boxes (cereal, crackers, pasta, etc.). Look at the boxes to find the mass. Order the boxes from lightest to heaviest. What boxes could be put together to make about a kilogram of food? 500 grams of food?

BLM 3.SS.4.1

- **Mystery Eggs (Containers):** Fill plastic eggs or small sealable containers with a variety of items (different masses) such as cotton balls, flour, salt, pennies, pasta, rice, beans, chocolate chips, foam chips, et cetera. Seal the eggs/containers with tape and label each with a number or letter.

  Have students use their referent to estimate the mass of each one. Record.

  Now, have students use a balance scale and standard mass units to find the actual weight of the eggs/containers. Record on BLM 3.SS.4.1.

  Students can calculate the difference between their estimate and the actual weight.

  Example:

Egg/Container	Estimate	Actual	Difference
A	200 g	220 g	20 g
B			

Assessing Understanding: Performance Task

1. **Estimating Mass:** Have students use their referents to estimate
   - the mass of an object in grams
   - the mass of an object in kilograms and grams
2. **Measuring Mass:** Have students measure the objects in question 1 to check their estimates.

Look for:

The student is able to

- ❒ use a referent to estimate the mass of an object in kilograms
- ❒ use a referent to estimate the mass of an object in grams
- ❒ measure accurately in kilograms
- ❒ measure accurately in grams
- ❒ measure accurately in kilograms and grams

- **Determine the mass of two similar objects with different masses, and explain the results.**
- **Determine the mass of an object, change its shape, re-measure its mass, and explain the results.**

Suggestions for Instruction

- **Similar Objects, Different Mass?** Read the book *The Dragon's Scales* by Sarah Albee, illustrated by John Manders. This story addresses misconceptions related to measuring mass: the more objects the greater the mass and the larger the object the greater the mass.

  Discuss the misconceptions with the students.

  Note: Provide experiences with objects that are small but have a greater mass than large objects. Use a variety of shapes and sizes of objects, such that mass cannot be determined by appearance.

- **Same Size, Different Mass?** Provide similar objects. For example,
  - lunch bags containing different materials (e.g., one with feathers or marshmallows and one with cubes or craft sticks)
  - a golf ball and a table tennis ball
  - a baseball and a tennis ball

  Have students find the mass of each.

  Ask them to explain why the mass differs if the objects are the same size (e.g., made of/contain different materials, solid or hollow, different purposes).

- **Parcel Comparison:** Have students compare 3 parcels that are exactly the same size, but with different masses (under 1 kg). Discuss everyday applications.

- **Will it change?** Give students a piece of play dough or plasticine. Have them roll it into a ball and then find its mass.

  Tell students that they are going to use all of the material in their ball to make something different. Do they think that the mass will change or will it stay the same? Record their thoughts.

  Reshape the material and weigh it again.

  What did they find out? Why did this happen? (The object will have the same mass unless additional material has been added or some has been taken away.)

Assessing Understanding: Paper-and-Pencil Task

Answer the following questions in your journal/notebook:

1. Is it possible for a small object to weigh more than a large one? Explain your thinking.
2. Two objects are the same size. Will they have the same mass? Explain your thinking.
3. Why does the mass of an object stay the same when you change its shape?

Grade 3: Shape and Space (Measurement) (3.SS.5)

Enduring Understanding:

Perimeter is a measure of length.

Essential Questions:

What is perimeter and how is it measured?

Where is perimeter used in the real world?

Specific Learning Outcome(s):	Achievement Indicators:
3.SS.5 Demonstrate an understanding of perimeter of regular and irregular shapes by ■ estimating perimeter using referents for centimetre or metre ■ measuring and recording perimeter (cm, m) ■ constructing different shapes for a given perimeter (cm, m) to demonstrate that many shapes are possible for a perimeter [C, ME, PS, R, V]	➛ Measure and record the perimeter of a regular shape, and explain the strategy used. ➛ Measure and record the perimeter of an irregular shape, and explain the strategy used. ➛ Construct a shape for a given perimeter (cm, m). ➛ Construct or draw more than one shape for the same perimeter. ➛ Estimate the perimeter of a shape (cm, m) using personal referents.

Prior Knowledge

Students may have had no prior experience with perimeter.

Background Information

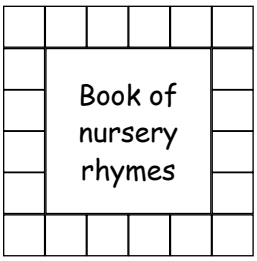
Students need to be immersed in investigations using a variety of concrete materials to help students develop strategies for finding the perimeter of an object. When students construct the meaning for perimeter they will begin to recognize the outside of any object as its perimeter. This idea will help students' later understanding of area. Estimating perimeter by using personal referents can help students verify if their measurements are reasonable.

Perimeter is the distance around a closed figure.

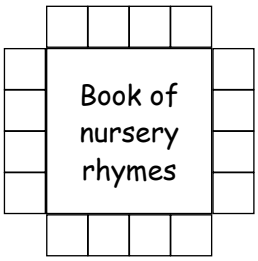
Note: There is no expectation that students are taught a formula for finding perimeter.

When measuring the perimeter using blocks or tiles, show students the correct method, as illustrated below:

Incorrect method:



Correct method:



Mathematical Language

perimeter
regular
irregular
construct
estimate
circumference
distance around

Learning Experiences

Assessing Prior Knowledge

Due to the fact that students have not had previous experience with perimeter, it is important to assess their prior knowledge.

Read a book such as *Racing Around* by Stuart J. Murphy, illustrated by Mike Reed.

This book tells the story of a young Mike's participation in a 15-kilometre race that takes place on "Perimeter Path." Before the race Mike rides around the athletic field and the zoo. His brother uses his odometer to figure out the perimeter for each location. The illustrations clearly demonstrate the meaning of perimeter.

- **Measure and record the perimeter of a regular shape, and explain the strategy used.**
- **Measure and record the perimeter of an irregular shape, and explain the strategy used.**

Suggestions for Instruction

BLM 3.SS.5.1

- **Finding Perimeter:** Provide students with a selection of items. Have them do the following:

  a. Select an object (e.g., book) from the group. Using cubes, estimate and record the distance around (or the perimeter of) the object. Now measure and record the distance around (or perimeter).

  b. Select a second object that has a greater perimeter than the first one measured. Estimate, measure, and record its perimeter.

  c. Repeat step (b) with a third object, and then order these 3 objects based on their perimeters, from least to greatest or greatest to least.

Object	Unit Used for Measuring	Estimate	Actual
Object A			
Object B			
Object C			

- **Irregular Shapes and Perimeter:** Show students some irregular shapes. Ask how they might find the perimeter. (Use a ruler and measure each side then add the dimensions together.) Measure and record their findings.

- **"Really" Irregular:** Ask students how they think they would be able to find the perimeter of an outline of their hand or foot. Will any of the measurement tools we have been using to measure so far work? Why?

  Let students investigate to see if they can find the perimeter.

  Discuss their findings/difficulties.

  If it does not come up in the discussion, suggest using a piece of string first and then measuring with a standard measuring tool.

  Have students find the perimeter of their hand and foot.

BLM 3.SS.5.2

- **Conflicting Cylinders:** Provide a set of differently sized cylinders. Label each with a number or letter.

  Have students select a cylinder and then estimate whether the circumference (perimeter of a circle) of a cylinder is less than, equal to, or greater than its height.

  Measure to check. Record their findings.

  Example:

Cylinder	Circumference is *less than, equal to,* or *greater than* the height.	Circumference (Perimeter)	Height	Correct?
1	less than	15 cm	12 cm	no
2				

- **Larger Perimeters:** Have students measure the perimeter of the classroom using metres. If possible, have them measure the perimeter of the gymnasium or other larger space.

- **Construct a shape for a given perimeter (cm, m).**
- **Construct or draw more than one shape for the same perimeter.**

Suggestions for Instruction

- **Same Perimeter, Different Shape:** Give students this problem:

  The perimeter of a shape is 12 cm. What might the shape look like? Find more than one possibility. Use tiles to make the shape. Record your shapes on centimetre-grid paper.

  Note: Use only horizontal or vertical lines. On centimetre-grid paper, the units formed by diagonal lines are not equal to the units formed by horizontal and vertical lines.

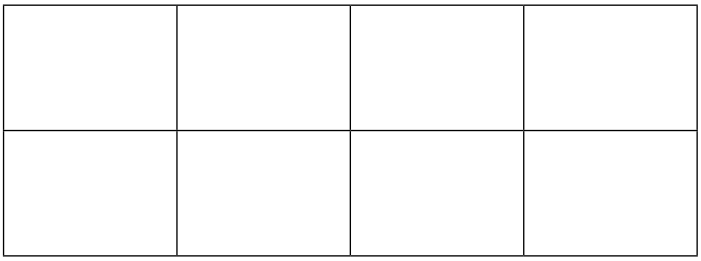
  (To prove this to students use two identical squares of paper. Fold one square on the diagonal. Match the diagonal to one of the sides of the second square. Students will notice that the diagonal is longer than the side.)

- **Tiles Problem:** Give students 8 tiles. Ask them to make a rectangle and find the perimeter.

  Now, have them use the 8 tiles to make other shapes.

  Record the shapes on centimetre-grid paper and record the perimeter of each.

How many different shapes can you make?

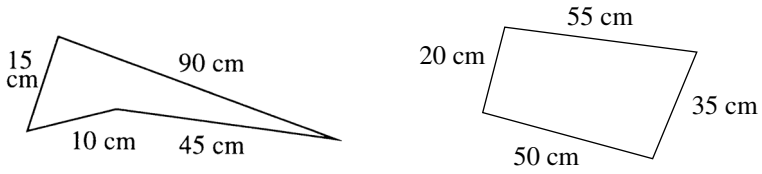


- **Rope/Cord Investigation:** Give students a rope or strong cord 160 cm in length. Tie the rope together at the ends. Ask students, in groups of 4, to make as many different shapes as possible with the rope. Measure the sides of each shape and record the perimeter in a table.

  Discuss the results.

  Note: Tying a knot decreases the actual length, so you may want to provide extra length to allow for the knots.

  Examples:



Shape (approximately 160 cm in length)	Perimeter

- **Estimate the perimeter of a shape (cm, m) using personal referents.**

Suggestions for Instruction

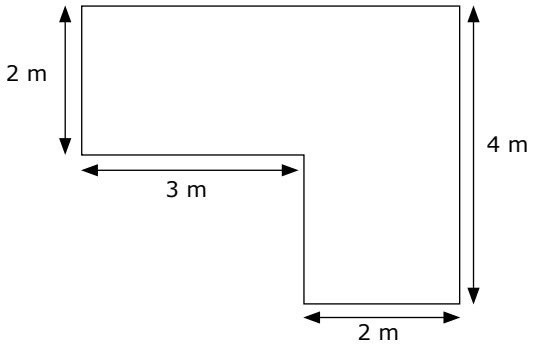
- **Perimeter Search:** Have students select objects in the classroom, estimate their perimeter using their referents, and then measure to check.
- **Seating Problem:** Use the book *Spaghetti and Meatballs for All: A Mathematical Story* by Marilyn Burns, illustrated by Debbie Tilley, to explore perimeter in a problem-solving situation. In this book, the family plans a family dinner for 32 people. Throughout the story, they change the configuration of the tables as more guests arrive in order to have everyone sit together. Students can use tiles and chips to help solve the seating problems.

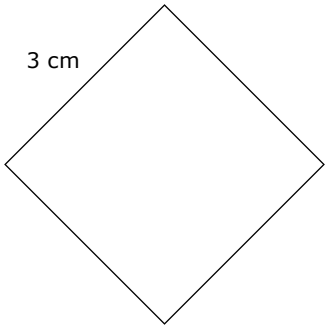
BLM
3.SS.5.3

Assessing Understanding: Paper-and-Pencil Task

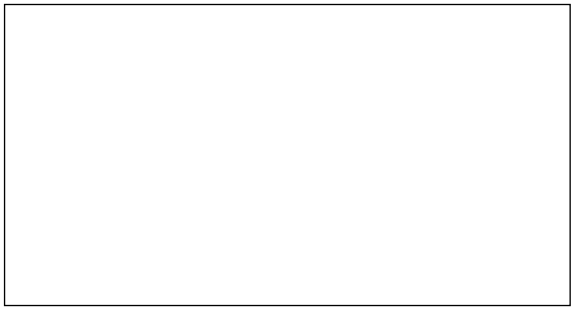
Perimeter

1. Mrs. Smith wants to make a rectangular garden with a perimeter of 24 metres. What might her garden look like? Give 3 possibilities. Record your shapes on centimetre-grid paper.
2. Find the perimeter of the following shapes:





3. Measure to find the perimeter.



Measurement Activity Day: Have students participate in a variety of measurement tasks.

Examples:

1. **Heavy Order to Fill:** (Provide 6 different items of varied weights.) Arrange the items from heaviest to lightest. Check by weighing or comparing by hand.
2. **Standing Long Step:** From the starting line take one giant step. Estimate the distance to the nearest centimetre from the starting line. Measure to check.
3. **Time on Your Hands:** Estimate how many times you can do certain activities (e.g., jump, hop on one foot, touch your toes) in 15 seconds, 30 seconds, and 1 minute.
4. **Around and About:** Estimate the distance around (perimeter) given objects and then measure to check.
5. **Suck It In:** Hold a 10-cm square of paper at the end of a straw by sucking in. Walk until the paper drops. Estimate and then measure the distance in metres.
6. **Backward Jump:** Stand with your feet together and take one jump backward. Estimate and then measure the distance.
7. **Paper Plate Toss:** Toss a paper plate like a discus. Estimate the distance in metres. Measure to check.
8. **Big Foot:** (Give students an extra large outline of a foot.) Estimate and then measure the perimeter.

Observe students as they work through the activities.

Student Self-Assessment:

I can

- ❒ estimate centimetres and metres using my referents
- ❒ measure centimetres and metres accurately
- ❒ estimate the passage of time using referents
- ❒ estimate perimeter using referents
- ❒ measure perimeter accurately

My goal is _____.

Grade 3: Shape and Space (3-D Objects and 2-D Shapes) (3.SS.6, 3.SS.7)

Enduring Understandings:

Geometric shapes and objects can be classified by attributes.

Objects can be described and compared using geometric attributes.

A 3-D object can be analyzed in terms of its 2-D parts.

Essential Questions:

How can 3-D shapes be described?

How can 2-D shapes be compared and sorted?

Specific Learning Outcome(s):	Achievement Indicators:
3.SS.6 Describe 3-D objects according to the shape of the faces, and the number of edges and vertices. [C, CN, PS, R, V]	➔ Identify the faces, edges, and vertices of a 3-D objects, including cubes, spheres, cones, cylinders, pyramids, and prisms. ➔ Identify the shape of the faces of a 3-D object. ➔ Determine the number of faces, edges, and vertices of a 3-D object. ➔ Construct a skeleton of a 3-D object, and describe how the skeleton relates to the 3-D object. ➔ Sort a set of 3-D objects according to the number of faces, edges, or vertices.
3.SS.7 Sort regular and irregular polygons, including ■ triangles ■ quadrilaterals ■ pentagons ■ hexagons ■ octagons according to the number of sides. [C, CN, R, V]	➔ Classify a set of regular and irregular polygons according to the number of sides. ➔ Identify regular and irregular polygons having different dimensions. ➔ Identify regular and irregular polygons having different orientations.

Prior Knowledge

Students may have had experience

- sorting 3-D objects and 2-D shapes using two attributes
- describing, comparing, and constructing 3-D objects and 2-D shapes
- identifying 2-D shapes and 3-D objects in the environment

Background Information

Pierre van Hiele and Dina van Hiele-Geldof (cited in Van de Walle, Karp, Lovin, and Bay-Williams 346–351), mathematics teachers from the Netherlands in the 1950s, researched the development of geometry thinking. Through their research they identified five sequential levels of geometric thought. Two of the levels are listed below. Most Grade 3 students will be at Level 0 or 1.

There are four characteristics of these levels of thought:

- The levels of geometric reasoning/understanding are sequential. Students must pass through all prior levels to arrive at any specific level.
- These levels are not age-dependent.
- Geometric instructional experiences have the greatest influence on advancement through the levels.
- Instruction or language at a higher level than the level of the student may inhibit learning.

Level 0 (sometimes labelled as Level 1): **Visual**

At this level students can name and recognize shapes by their appearance, but cannot specifically identify properties of shapes. Students may think that a rotated square is a "diamond" and not a "square" because it looks different from their visual image of square. Most students in Kindergarten to Grade 3 will be at Level 0 (visualization).

Suggestions for instruction at this level include

- sorting, identifying, and describing shapes
- working with physical models
- seeing different sizes and orientations of the same shape in order to distinguish the characteristics of the shape and to identify features that are not relevant
- building, drawing, making, putting together, and taking apart 2-D shapes and 3-D objects

Level 1: Analysis (Some students may be at this stage.)

At this level students begin to be able to identify the properties of shapes. They use appropriate geometric vocabulary related to properties. They are able to move beyond less important features such as size or orientation in order to sort and classify shapes. They start to describe the relationship between shapes and their properties.

Suggestions for instruction at this level include

- focusing on properties (defining, measuring, observing, or changing) by using concrete or virtual models
- problem solving involving shapes
- classifying shapes based on their properties

Terminology

3-D Objects:

Vertex, Vertices: Can be used in the following ways:

- The common endpoint of two sides of a polygon.
- The common endpoint of two rays that form an angle.
- The common point where three or more edges of a 3-D solid meet.

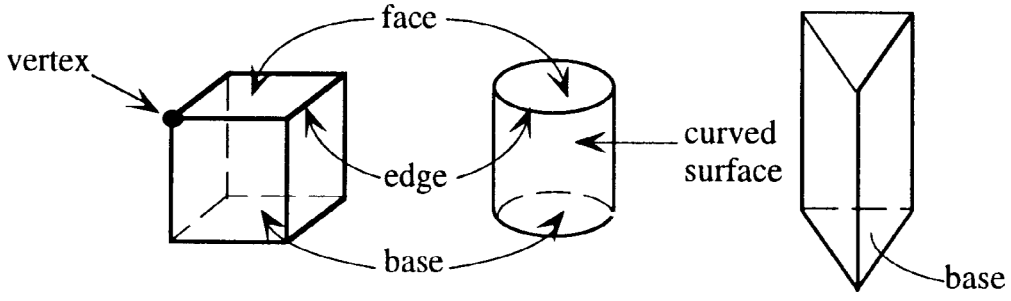
Note: A cone has an **apex,** but it is often referred to as a vertex.

Edge: The line segment where 2 plane faces of a solid figure meet.

Face: A flat surface of a solid.

Surface: Cones and spheres have curved surfaces (i.e., a cone has 1 face and 1 curved surface).

Base: A particular side or face of a geometric figure.



Prism: A 3-D figure (solid) that has two congruent and parallel faces that are polygons (the bases); the remaining faces are parallelograms.

Pyramid: A polyhedron whose base is a polygon and whose lateral faces are triangles that share a common vertex.

2-D Shapes:

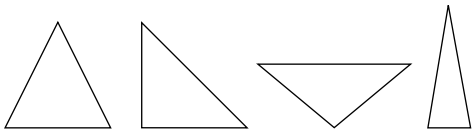
Polygon: A closed plane figure formed by three or more line segments.

Regular polygon: A polygon in which all sides and all angles are congruent.

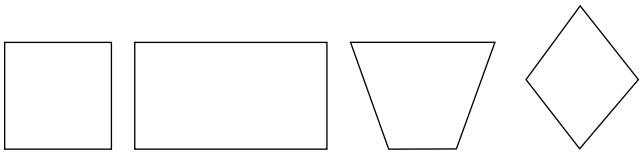
Irregular polygon: A polygon whose sides and angles are not all congruent.

Polygon Names: Note: Regular polygons are shown first.

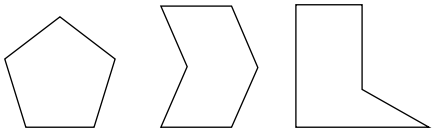
3 sides—triangle



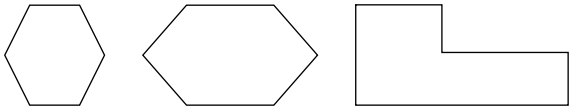
4 sides—quadrilateral



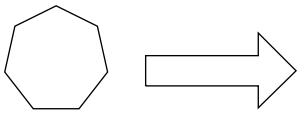
5 sides—pentagon



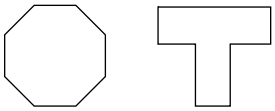
6 sides—hexagon



7 sides—heptagon



8 sides—octagon



Mathematical Language

cube
sphere
cone
cylinder
prism
pyramid
face
edge
vertex
vertices
curved surface
skeleton
polygon
regular polygon
irregular polygon
triangle
quadrilateral
pentagon
hexagon
heptagon
octagon
three-dimensional
two-dimensional
attribute
property
sides
shape
object

Learning Experiences

Assessing Prior Knowledge

Give students a small group of regular and irregular 3-D objects.

1. Have them sort them according to two attributes and then state their sorting rule.
2. Sort a set of objects into two groups. Have students identify the sorting rule.

Give students a small group of regular and irregular 2-D shapes.

1. Have them sort them according to two attributes and then state their sorting rule.
2. Sort a set of objects into two groups. Have students identify the sorting rule.

Observation Checklist:

The students are able to

- ❒ sort a collection of 3-D objects according to two attributes
- ❒ sort a collection of 2-D shapes according to two attributes
- ❒ state the sorting rule ❒ 3-D ❒ 2-D
- ❒ identify the sorting rule of a pre-sorted set ❒ 3-D ❒ 2-D

- **Identify the faces, edges, and vertices of a 3-D object, including cubes, spheres, cones, cylinders, pyramids, and prisms.**
- **Identify the shape of the faces of a 3-D object.**
- **Determine the number of faces, edges, and vertices of a 3-D object.**
- **Construct a skeleton of a 3-D object, and describe how the skeleton relates to the 3-D object.**
- **Sort a set of 3-D objects according to the number of faces, edges, or vertices.**

Suggestions for Instruction

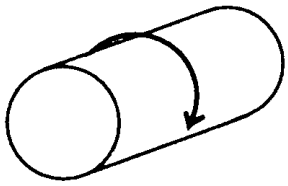
- **Prisms and Pyramids:** Present a pre-sorted set of prisms and pyramids (prisms in one group, pyramids in the other). Ask students why they think the objects are grouped in this way. Students should notice that
  - the triangular faces of pyramids meet at one vertex
  - the pyramid sits on one face (base)
  - the prisms have rectangular faces and 2 faces that are of a different shape (except in the case of a rectangular prism).
- **Exploration:** Allow students time to build and explore with 3-D objects (models, box collections, etc.). Direct discussions to enable students to determine attributes of 3-D objects. Model the terminology:

rolls	doesn't roll
flat faces	curved surfaces
vertices	no vertices
slides	doesn't slide
stacks	doesn't stack

  type of edges (straight or curved)

  Record 3-D–object attributes on a reference chart. Provide illustrations and words to indicate attributes.

  Example:



curved surface

- **How do they get their names?** Use a set of prisms (especially prisms with bases that are not rectangular) and pyramids. Beside each object place a tag with its name on it. Have students explore the objects to see if they can figure out how the object got its name. Discuss their findings. Guide students to see that pyramids get their names by the shape they sit on (base) and prisms get their names by the shape of the two congruent, non-rectangular faces (base) (except in the case of a rectangular prism or a cube).

  Work with the students to arrive at a definition for both terms.

- **Vocabulary:** Using a prism and a pyramid, focus students' attention on the faces, edges, and vertices. Together as a class write a definition for each term.

- **Cones, Spheres, and Cylinders:** Read the book *Sir Cumference and the Sword in the Cone* by Cindy Neuschwander, illustrated by Wayne Geehan, to introduce students to cubes, cones, cylinders, and pyramids.

  Have students describe cones, spheres, and cylinders in terms of faces, edges, and vertices. Introduce the term "curved surface."

BLM 3.SS.6.1

- **Class Chart:** Have students work in pairs or small groups. Give each group a different 3-D object. Have them use their object to fill in the following information (BLM 3.SS.6.1):

Name of Object	Number of Flat Faces	Number of Curved Surfaces	Number of Edges	Number of Vertices	Shape of the Base

  Have groups present their findings to the class. Record the information on a class chart.

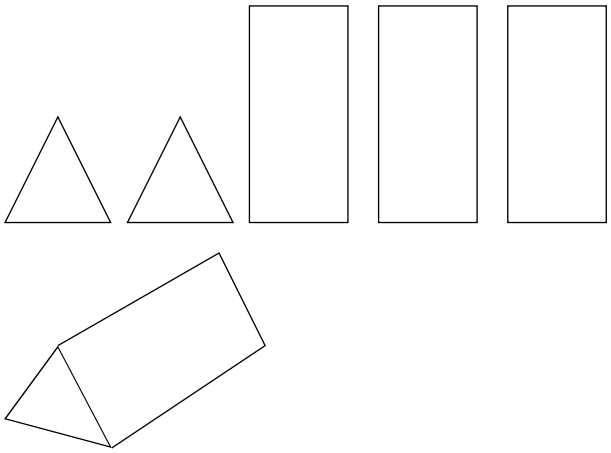
Assessing Understanding: Journal/Notebook Entry

Explain how prisms and pyramids are similar. Explain how they are different.

Suggestions for Instruction

- **Guess the Object:** Trace the faces of a variety of 3-D objects. Show students the faces and have them guess the object they came from.

  Example:

  triangular prism

  Have students create their own "Guess the Object" to share with the class.

  Note: This can be done with real-world materials such as food boxes, toothpaste boxes, chocolate boxes (e.g., Toblerone boxes). Students then have to identify the actual box the faces represent along with its geometric name.

- **Feely Can Puzzles:** Place a 3-D object in the can. Pass the can from one student to another. Each student reaches in, feels the object, and then gives one of its attributes. When it is felt that all possible attributes are exhausted, students can identify the object.

- **Riddle Me 3-D:** Have students write riddles for 3-D objects.

  Example:

  I am a 3-D object.
  I have 5 faces.
  I have 9 edges.
  I have 6 vertices.
  My base is triangular.
  What am I?

  Create a class riddle book for 3-D objects.

- **Skeletons:** Have students construct skeletons for 3-D objects.

  Use

  - straight straws and twist ties

    Insert twist tie into the ends of the straw.

- toothpicks and mini marshmallows/modelling clay

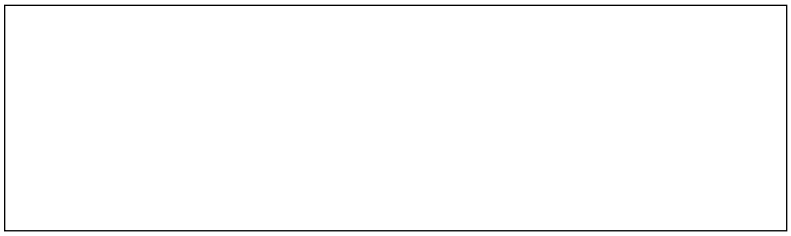
The straws/toothpicks are the edges and the twist ties/marshmallows are the vertices.

Have students describe their skeleton in relation to the object.

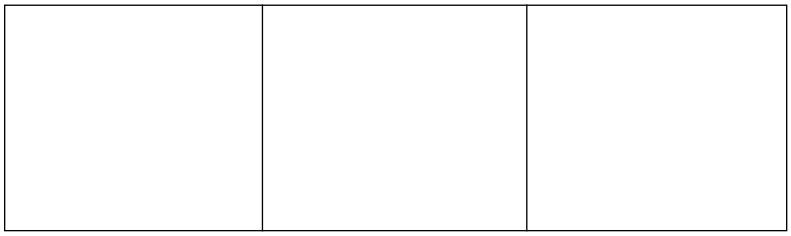
Extension:

1. Cut the straws into different lengths. Lengths can be given a monetary value and students can calculate the value of their completed skeleton.
2. Each student/pair makes a skeleton for a particular food stuff box. When finished, set up the skeletons in one location and the boxes in another. Have students match the skeleton to the correct box.

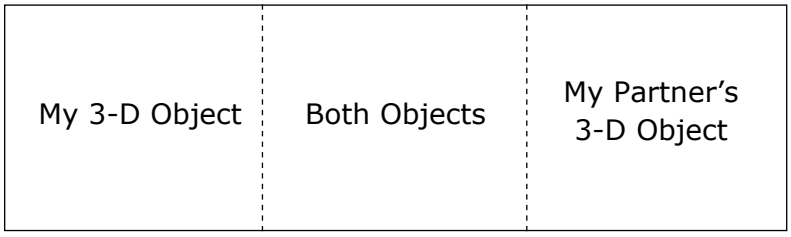
- **Object Comparison:** Fold a letter size paper the hot dog way.



Divide the front half in thirds and cut each line up to the fold.



Use this like a Venn diagram.



Each partner takes a different 3-D object.

Students compare and contrast their objects. In the "My 3-D Object" section (under the flap) the student describes attributes that are unique to their object. In the "My Partner's 3-D Object" section the student lists attributes that are unique to the partner's object. In the middle section attributes that are common to both are listed.

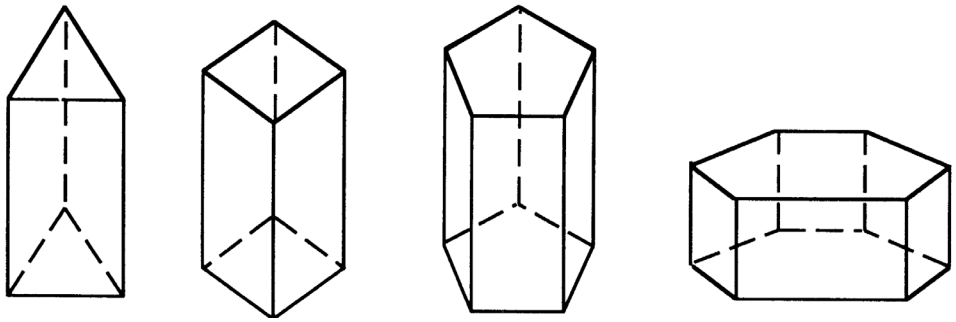
- **Object Sorting:** Use a Venn diagram. Have students sort the objects using their own sorting rules. Make a class list of the sorting rules used.

  Examples:

  - 6 faces, 12 edges
  - more than 6 vertices, more than 9 edges

Assessing Understanding

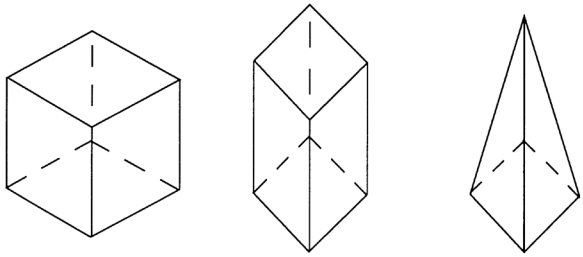
1. You have 12 straws and 8 marshmallows/twist ties. What skeleton of a 3-D object can you make using all of these straws and marshmallows?
2. Record the number of faces, vertices, and edges for each of these prisms.



3. The base of a solid is square. What is the name of the solid? Are there any other solids it might be? Use drawing and writing to explain your thinking.

   Sample rubric: Note: "Square prism" is an acceptable term.

   Possibilities:



cube

rectangular prism/square prism

square pyramid

Low response: includes 2 names with attempted drawings and explanations

Medium response: includes 3 names with reasonable drawings and explanations

High response: includes 3 names with accurate drawings and complete explanations

- **Classify a set of regular and irregular polygons according to the number of sides.**
- **Identify regular and irregular polygons having different dimensions.**
- **Identify regular and irregular polygons having different orientations.**

Suggestions for Instruction

- **Geoboard Sort:** Give each student a geoboard and one elastic. Have them make a shape that has 3 or more straight sides. Do a class sort of the shapes based on the number of sides.

- **Name the Shape:** Read the book such as *The Greedy Triangle* by Marilyn Burns, illustrated by Gordon Silveria. This is the story of a bored triangle that keeps going to the local shapeshifter to add another side/angle to his shape. Shape vocabulary from triangles to decagons is introduced. Real-world examples for the shapes are also given.

  Have students use a geoboard to act out the story as it is being read.

  Note: The book *Twizzlers Shapes and Patterns* by Jerry Pallotta, illustrated by Rob Bolster, also introduces the vocabulary for shapes up to ten sides.

- **2-D Sort:** Provide students with a collection of paper shapes of various sizes. Ask students to sort the collection into two groups and to name the groups. Have students regroup the collection and sort it in other ways.

  With each sort, have students describe the attribute(s) common to the group (e.g., sides and vertices). Note: If students have not done a "circle, not circle" sort, it is important to direct their attention to this.

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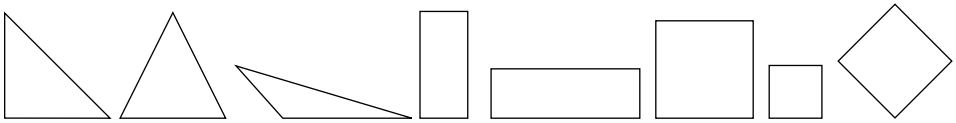
  Follow-Up: Have the class develop a chart, organizing the attribute information of each 2-D shape.

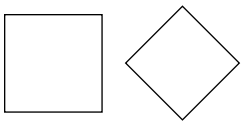
Shape	Number of Sides	Number of Vertices
triangle	3	3
quadrilateral	4	4
pentagon	5	5

- **Regular or Irregular Polygons:** Read a book such as *If You Were a Polygon* by Marcie Aboff, illustrated by Sarah Dillard. This book introduces students to regular and irregular polygons. Discuss the difference between the two types of polygons. Have the class come up with a definition for both types.

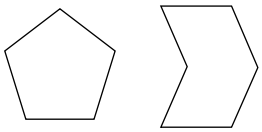
- **Geoboard Shapes:** Ask students to make different sizes of 1 shape or different types of the same shape on their geoboard. Have them record their shapes on dot paper.



Assessing Understanding: Paper-and- Pencil Task

1. 

   How are the shapes the same? How are they different?

2. 

   How are the shapes the same? How are they different?

Look for:

The student

- ❒ identifies all shapes as polygons
- ❒ identifies specific shapes as quadrilaterals or pentagons
- ❒ identifies specific shapes as regular and irregular polygons
- ❒ gives specific names to square and rectangle

Suggestions for Instruction

- **Geoboard Challenges:** Have students work in pairs or small groups to solve the following challenges:
  - How many different pentagons can you make on your geoboard? Record your pentagons on dot paper.
  - How many different quadrilaterals can you make on your geoboard? Record your quadrilaterals on dot paper.
- **Feel a Shape:** Provide opportunities for students to identify 2-D objects by touch only. For example, place attribute blocks in a "feely can," or pair students and have one student place a 2-D object in the hands of another student (with hands behind back).

- **Vocabulary Game:** Have students work in pairs. The first student draws a vocabulary card. They try to get their partner to identify the word by giving them clues (without saying the word). Students can keep track of the number of clues needed or a time limit can be set.

  Vocabulary cards might include the following:

polygon	triangle	square
rectangle	quadrilateral	pentagon
hexagon	heptagon	octagon
side	vertex	regular polygon
irregular polygon	corner	2-D

- **Five Questions (similar to Twenty Questions):** Ask students to pose a maximum of five questions that require Yes/No answers in order to guess the name of a 2-D shape. Sample questions: Does it have less than 5 sides? Does it have square corners? Are its sides equal in length?

- **The Important Thing About _____:** Use the book *The Important Book* by Margaret Wise Brown, illustrated by Leonard Weisgard. The author uses a basic format for writing about the important aspects of everything from a spoon, an apple, and the wind to a shoe.

  The following is a modified format.

  The important thing about _____ is that [*the most important attribute*].

  It _____.

  It _____.

  It/A _____,

  and it _____.

  But the important thing about _____ is that [*repeat from the first line*].

  Have students write their own page for a class book about 2-D (and 3-D) shapes (objects) using this format. (Students should be able to modify the format to make it work for their shape/object.)

Example:

The important thing about a square is that it has four equal sides.
It is a special rectangle.
It has four vertices.
It is a quadrilateral,
and it is also a polygon.
But the most important thing about a square is that it has four equal sides.

- **Fun with Tangrams:** Introduce the tangram puzzle to students. Have them identify the shapes of the seven tans (triangles, a parallelogram, and a trapezoid). Have students try to put the puzzle back into a square.

  Read a book such as *Grandfather Tang's Story* by Ann Tompert, illustrated by Robert Andrew Parker, or *The Tangram Magician* by Lisa Campbell Ernst and Lee Ernst. Have students reproduce the animals/objects from the book(s).

  Problem Solving: Have students explore to determine whether regular polygons can be made with a different number of tangram pieces. Make a large class chart and have students post their solutions. This could be a long term project.

  Example:

Number of Pieces	Triangle	Square	Rectangle	Pentagon	Hexagon
1					
2					
3					
4					
5					
6					
7					

  Note: Some of these are not possible.

Assessing Understanding: Journal/Notebook Entry

1. How are 2-D shapes and 3-D objects related?
   (3-D objects are made up of 2-D shapes. 3-D objects get their names from their 2-D shaped bases.)
2. Draw 5 different pentagons.

Putting the Pieces Together: Performance Task

Present the following scenario:

The local art gallery wants to put up a geometry display, and they have asked our class to help. You are going to work in pairs. Each pair will need to

- pick either a 2-D shape or a 3-D object
- make a skeleton model of your shape/object and label its parts
- create a picture/collage using your shape or object (The picture could be done using the shape/object only and changing size and orientation. The collage could be real-world examples of the shape/object [digital pictures, pictures cut from magazines/newspapers, etc.])
- do research to see if you can find some artist(s) that has/have used your shape/object in their art work (painting, sculpture, quilting, crafts, construction, etc.)
- if possible, bring some real-world examples for the display
- present your work to the class and to any visitors

Have students set up their displays.

Have them present their work to the class. If possible, have them extend invitations to other classes or school personal. Parents might also be invited.

Assessment:

Develop assessment criteria with the class. Students can use the criteria to do a self-assessment (group). It can also be used by the teacher as a summative piece.