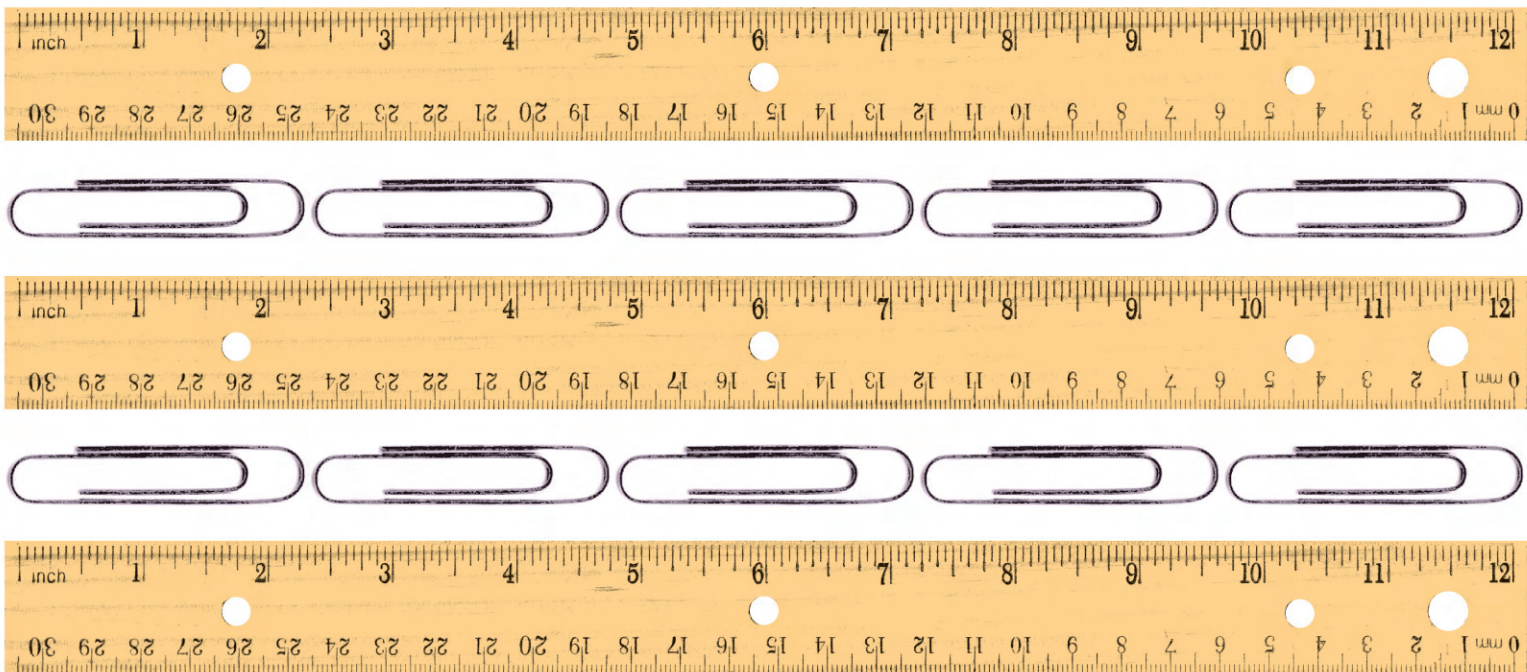


Sizing Up Measurement

ACTIVITIES FOR GRADES K-2 CLASSROOMS



VICKI BACHMAN



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Length

Introduction

Before our students get to school they have a lot of experience with linear measurement. Their ability to reach things and to be independent is directly connected to length. They are very aware of their personal height in comparison with others and they are constantly growing out of everything from clothes to shoes to beds. Informal observations and comparisons of measurements of length are part of our students' everyday lives.

Kindergarten, first-, and second-grade students need many varied experiences and explicit instruction to bridge their informal understandings to the mathematical ideas and vocabulary of linear measurement. It is our job to build on what children know and are able to do and eventually introduce to them standard units of measure such as centimeters, inches, and feet.

The fifteen length lessons increase in complexity as the chapter progresses. Early lessons focus on making direct comparisons, whereas later lessons include concepts such as perimeter, doubling, and halving, often using standard units of measurement.

Many lessons involve some choice of measurement tool so that students can compare and discuss a variety of results. All of the lessons involve making predictions, solving problems, and communicating with others.



Rod Towers

Overview

In this lesson children build and then determine the height of Cuisenaire rod towers. Students build a tower with a partner, decide the measurement tool to use, measure their tower, and then in a whole-class discussion make comparisons between the towers.

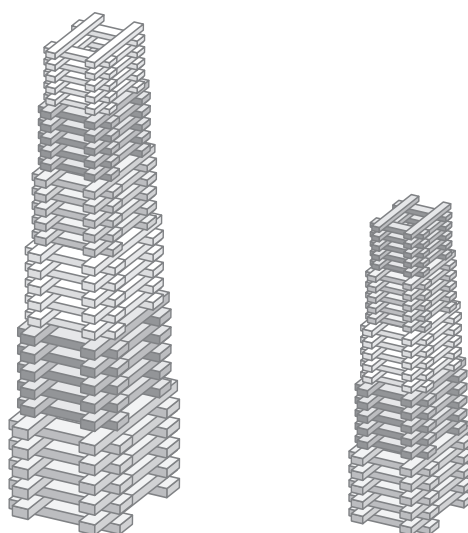
Materials

- ◆ Cuisenaire rods and/or blocks, 1 shoebox-size tub per pair of students
- ◆ measuring tools such as string or yarn cut into lengths of about 3 feet, measuring tapes, connecting cubes, yardsticks, meter sticks, and 1-inch cubes, enough so that partners have a choice of measuring tools

Vocabulary: cities, compare, Cuisenaire rods, height, long, longer, longest, measure, scarce, short, shorter, shortest, skyscraper, small, smaller, smallest, space, tall, taller, tallest, tower, vertical

Instructions

1. Prior to this lesson, provide a session for the children to explore the Cuisenaire rods or blocks. Once children are comfortably acquainted with the materials, ask them to describe what they notice. Discuss the variations among the materials and focus on similarities and differences to develop mathematical vocabulary.
2. Begin *Rod Towers* by explaining that tall buildings in cities are called *skyscrapers*. Ask the children why that name might have become popular. Explain that tall buildings are found mostly in cities because people build upward when land is scarce. Ask the children to tell about tall buildings that they have seen. Ask them to describe some of the things that might be involved in constructing a tall building.
3. Explain to the students that they are going to work with a partner to build a tower and then measure its height. Show the children how to position the Cuisenaire rods: beginning with the two longest rods and placing them parallel to one another, then stacking the next two in the opposite direction, and continuing upward, eventually decreasing by size as they go. Discuss the kind of cooperation it will take to work together to build a tower. Have several children share ideas about fair teamwork. When the expectations have been established, describe the procedures for distributing available materials.



4. Organize the class into partners. Let the children know how much work time they will have by using a timer or by establishing a stopping point on a clock in the room. Explain that when it is time to stop building, you will give a signal, and each

Compared with My Yarn	
Shorter	Longer

Figure 1–1 Compared with My Yarn Recording Sheet

- ❖ yarn cut to 4 different lengths ranging from 5 inches to a foot, 1 per student (make an equal number of pieces for each yarn length)
- ❖ 3-by-5-inch index cards, 10 to 20
- ❖ optional: *Compared with My Yarn* recording sheets, 1 per student (see Figure 1–1; see also Blackline Masters)
- ❖ optional: a collection of objects to be measured

Vocabulary: beginning, compare, end, height, length, line, longer, longest, measure, order, same, shorter, shortest

Instructions

1. Before class, prepare some word cards for the lesson. Write the words *compare*, *measure*, and *length*, one on each of three index cards. If you don't have a math word wall, you might consider creating one.
2. Read a book that involves an attribute of length or height (see "Materials" list). Discuss the mathematical focus of the story.

3. Show the children one piece of the cut yarn and ask the class to describe its length. Highlight the vocabulary that is used in their descriptions by writing each word on a blank index card. For instance, a child might say, “Your string is a little bit longer than my pencil.” Focus on the word *longer* and show or create a new word card. Continue this process with other descriptive words as they are used. If words like *inches* and *centimeters* don’t come up, you can decide whether or not you wish to introduce them.
4. Show the children the four different yarn lengths and let them know that in a few minutes you will give each of them a piece. Tell the students they will compare their pieces of yarn so that they will be able position themselves into one long line in order from the smallest yarn length to the largest.
5. Explain to the children that they will line up so that the children who have the longest pieces of yarn are at one end and those with the shortest are at the other end. Ask where the people who don’t have the longest or the shortest yarn will go. Ask, “What will happen to the yarn as we look at our line?” In order to make sure that children understand the directions, ask several students to repeat them for the class before you pass out the yarn.
6. As you pass out the yarn, hold the pieces together toward the top as if you were drawing straws or holding a bouquet and let students select a piece without looking at the length. This will ensure random distribution. Try to arrange it so that there are about the same number of children with each yarn length.
7. Help the children compare their pieces of yarn with a partner. Then help the class get into an ordered line. Setting a time limit adds to the excitement. You might say, “When I get to zero counting backward from fifty, let’s see if everyone can find his or her spot in the line!”
8. When the class line has been formed, most children will be next to someone with a piece of yarn that is the same length as their own. This could be a convenient way for children to cluster in small groups or partners for the upcoming yarn-length hunt. Have students hold their yarn pieces out in front of them so that the progression of length is easy to see.
9. Have students gather together and sit down while you explain the next phase of the lesson and introduce the recording sheet, if appropriate. Hold up a piece of yarn and ask the children to look around the room to help you find some things that are longer than the yarn that you are holding and some things that are shorter. Take your yarn over to the objects and compare the lengths or heights. Call attention to the end points of your yarn. Carefully position an end point to compare measurements and then show a counterexample by placing the end of

the yarn haphazardly. Discuss the results. If students will be using recording sheets, read it to them a couple of times, and then model the procedures for completion.

10. Tell the children that with their piece of yarn they are ready to participate in the length hunt, which means they will measure things in the classroom as you just did. Remind students to record their results on their recording sheets (if appropriate). You can decide if this will be a free exploration in the room or will be limited to a collection of objects in designated locations from which children can make their selections. (Children may decide to cluster together, but essentially this is an individual task.)
11. Begin the length hunt. As children find items to measure, talk with them about their results using comparative language. Observe how the children measure and the items that they select for making comparisons. These examples can be used for the processing discussion.
12. Set a time limit for the length hunt. Cue the class when there is a minute remaining and then again with thirty seconds left. Getting close to finishing time will very likely cause a flurry of activity and ensure that children complete the task and are ready to process their results.
13. When everyone is ready, call the children together. Ask each student to find a classmate who used a different-length piece of yarn. Ask partners to read and describe their recorded results. Show the class some of the items that were measured. Discuss the fact that an object, such as a chalkboard eraser, can be longer than one piece of yarn and at the same time shorter than another. As you illustrate this with the appropriate pieces of yarn, call attention to the end points of the yarn and the end points of the comparison object. Again, use mathematical vocabulary such as *longer*, *shorter*, and *equal to* as you compare the yarn and objects. Give children opportunities to practice this language as well by encouraging them to describe their comparisons.

Extension

- ◆ Use graph paper, rulers, or connecting cubes to establish conventional measurements of the yarn.



Ordering Bears and Things

Overview

This lesson uses the familiar bear characters from the favorite story *Goldilocks and the Three Bears*, but instead of just three bears, children work with twelve bears, each a different size, along with a corresponding set of bowls, chairs, and beds. (See Figure 1–2.)

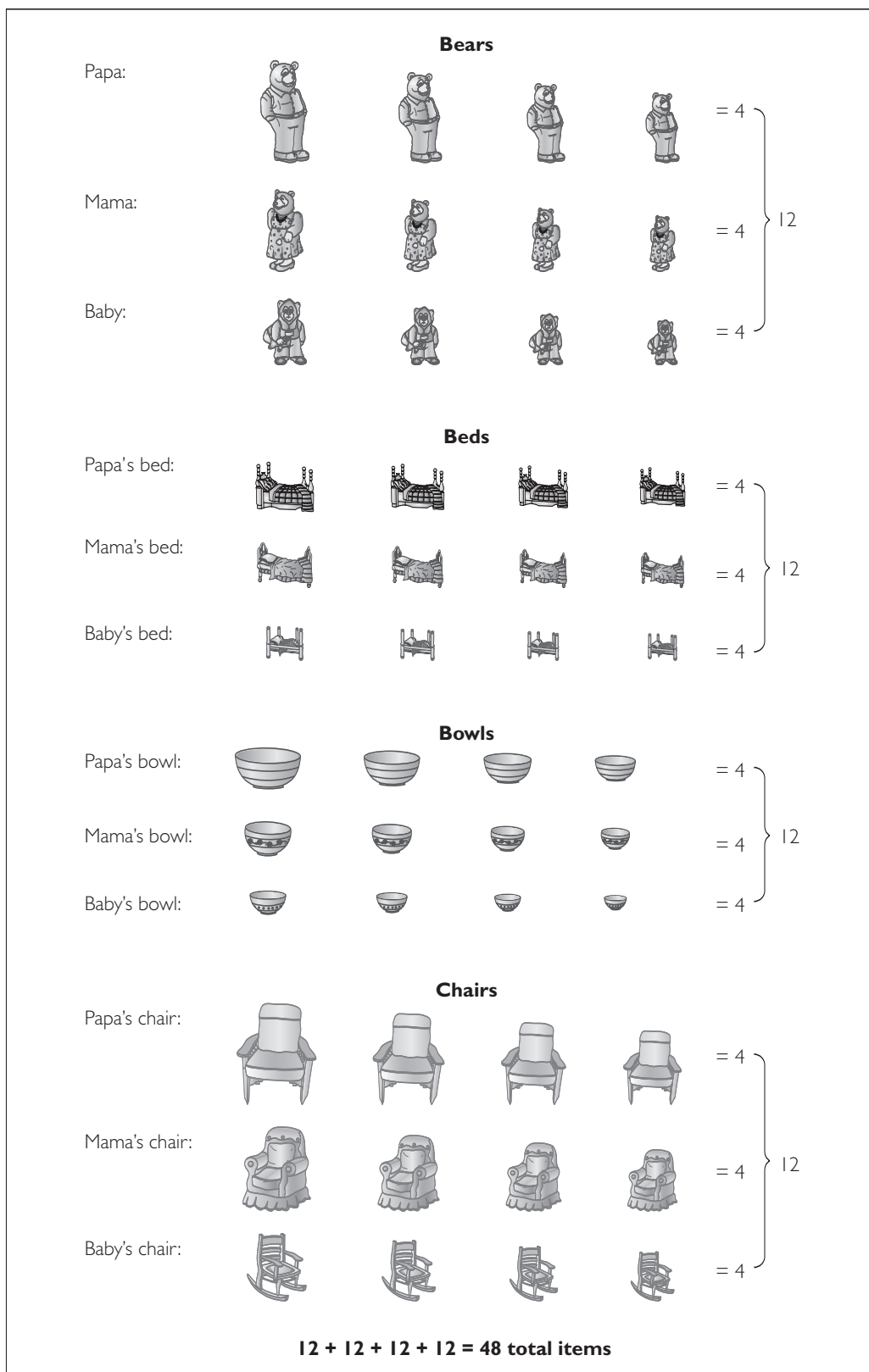


Figure 1-2 Ordering Bears and Things Lesson

As they place these items in order and create a one-to-one correspondence among them, children develop comparative and ordinal language and increase their understanding of number.

Materials

- ◆ *Goldilocks and the Three Bears*
- ◆ seriated sets of 3 bears, 3 bowls, 3 chairs, and 3 beds, 1 per pair of students, 4 sizes of each (see Blackline Masters)
- ◆ zip-top bags, 1 per pair of students
- ◆ 3-by-5-inch index cards, 10 to 20

Vocabulary: big, bigger, biggest, compare, eighth, eleventh, fifth, first, fourth, height, large, larger, largest, length, long, longer, longest, measure, ninth, order, second, seventh, short, shorter, shortest, sixth, small, smaller, smallest, tall, taller, tallest, tenth, third, twelfth

Instructions

1. Before class, prepare the sorting materials. Each set of materials should have a total of forty-eight pictures—twelve bears, twelve bowls, twelve chairs, and twelve beds, each of different sizes. To create a set, make a copy of each Blackline Master at four different sizes (using the copier's Reduce and Enlarge functions) on cardstock. Cut out the pictures and place them in a zip-top bag. Make enough sets so that children can work in pairs. (**Note:** For kindergartners, you may want to use just one item, such as the bears.)
2. Read *Goldilocks and the Three Bears* as an introduction to the lesson. Discuss similarities and differences between the characters, the bowls, the chairs, and the beds. Emphasize observations about the relative heights of the three bears. Reinforce comparative language, such as *bigger*, *smaller*, and so on. Create word cards, one word to an index card, to highlight the vocabulary you discuss.
3. Show the children a zip-top bag that contains a set of bears and accessories. Hold up the largest Mama Bear and the smallest Mama Bear and explain that you want to position all of the Mama Bears in order by height.
4. As you order the series of Mama Bears, think aloud about the placement of each piece. This gives the children an opportunity to observe the process of ordering and a context for using comparative language.
5. When you have ordered the Mama Bear pictures by height, play the *Missing Piece* game with a class volunteer. Explain that you are going to remove one of the bears and that the volunteer will have to guess where it belongs. Tell the class that you

will push the remaining bears back together so that the space where the missing bear belongs doesn't show. Ask for a volunteer. Tell your volunteer to look away while you remove a bear, and then push the remaining bears together to remove the space. Next, give the child the missing bear. While the child is looking for the correct spot to place the bear, verbalize what needs to be done. For instance, you might say: "We're looking for the spot where this bear is not too big and not too small. Is the bear in your hand bigger than this one? Is it smaller? Where does it belong so it fits just right?"

6. When the children understand the task of ordering the bears, introduce the accessories that go with the characters. Discuss the idea of placing the bowls, the chairs, and the beds in order. Model the use of comparative language as you show the materials. For example, "Here is my biggest Papa Bear and here is the biggest bowl" and "Here is the fourth chair and it goes by the fourth bed."
7. Pass out the sets of seriated pictures to partners. Designate places in the room where materials can be spread out so that children can sort and order the items. Explain that partners are to help one another order the sets and then play the *Missing Piece* game.
8. As you walk around the room and talk with children, discuss which pieces seem to be the easiest to place and which are the most difficult. Take the opportunity to do some assessing and play the *Missing Piece* game with individual students. It is natural for children to compare each bear one by one. When a student places missing pieces quickly, it is likely that this child is able to consider two criteria at once: (1) the missing piece in relation to all others that are smaller and (2) the piece in relation to all others that are larger. This shows that the child understands that a given number has its own distinct place in the order of numbers, being simultaneously smaller than some and larger than others.
9. After the materials have been put away, ask the children to consider some other things, besides the bears, that can be ordered by height. For instance, families can be ordered by height and groups of students can be ordered by height. Ask the children which would be easier to arrange in order by height—a family or a classroom full of children. Discuss the strategies that children used when ordering the bears, such as comparing two of them directly or selecting the largest or smallest and working from that extreme.

Extension

- ◆ Have the children look at rulers and make predictions about the height of a bear in centimeters and/or inches. Then have them measure and record the height of the various bears using the rulers.



Name Trains

Overview

In this lesson, each child uses Snap Cubes and letter stickers to create a name train. Students compare the lengths of their name trains and determine how much longer some trains are than others.

Materials

- ❖ 1-inch Snap Cubes, enough for each letter of each student's first name
- ❖ dot stickers, enough for each letter of each student's first name
- ❖ chart of directions for activity (see Instruction 3)
- ❖ rulers, at least 1 per pair of students
- ❖ optional: *Name Trains* recording sheets, 1 per student (see Figure 1–3; see also Blackline Masters)

Vocabulary: combine, compare, equal, first, inch, last, length, longer, longest, ruler, same, shorter, shortest, total

Instructions

1. Create a context for the lesson by selecting the name of a familiar character, for instance, Franklin, if your students have heard some of the Franklin the turtle

Partner 1							
Partner 2							

The name _____ is **shorter**.

The name _____ is **longer**.

The name _____ is _____ cube(s) longer than _____.

Or

Both _____ and _____ are the **same length**.

Figure 1–3 Name Trains Recording Sheet

stories. Write the name in large print so that all of the children can see it. Have the children help you count the number of letters in the name and then connect that number of cubes, in this case, eight. Print the letters on eight small round stickers and place the letters on the cubes. Explain that you have built a name train for Franklin.

2. Ask the children to think about whether their first names will be longer, shorter, or the same length as Franklin's. Take an informal show of hands for each of the three possibilities. Have children record what they think in math notebooks or on a piece of paper that they can refer to later in the lesson.
3. Review and post the following directions:
 - a. With cubes, make a name train that shows your name.
 - b. Write the letters of your name on dot stickers and put them on the cubes.
 - c. Compare your name train with your partner's. Decide whose name is shorter or longer or if they are the same length.
 - d. Complete the recording sheet.

Note: Omit Step 4 if not appropriate. Demonstrate how to record if appropriate.
4. Pair up the students and distribute the cubes and stickers.
5. After the students have completed the activity, ask the children to think back to their original comparisons with Franklin's name. Have several partners share the specific results of their conversations or recording sheets. Then ask questions like the following:
 - Does anyone have a name that is the same length as Franklin's? How long is it?
 - Who has the longest name? Is it longer than Franklin's? How many inches long is it?
 - Who has the shortest name in the class? What is the length of that name train?
 - Did any partners have the same-length names? Raise your hands if you and your partner had the same-length names. How long are your names? What do you think is the most common name length in the class?
6. Have students confirm that the cubes they are using are 1 inch long by taking a cube and measuring a side with a ruler. Discuss the starting point to make sure that children are reading the rulers accurately.

Extensions

- ◆ Have students combine and compare the lengths of their first and last names.
- ◆ Have the class estimate and determine the combined length of everyone's first name. Help the students place all of the name trains together into one long line.



Match This Line

Overview

This partner activity involves one child drawing a straight line while the other attempts to replicate it. Both partners then measure their lines to see if they are indeed the same length.

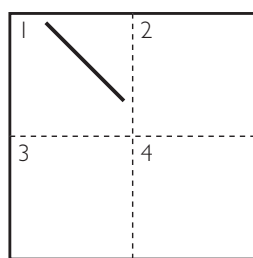
Materials

- ◆ a selection of measuring tools such as Cuisenaire rods, cubes, string, rulers, and tape measures, enough so that several pairs of students can choose the same tool

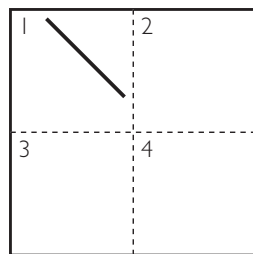
Vocabulary: above, below, diagonal, down, horizontal, length, line, long, longer, longest, match, short, shorter, shortest, sideways, slanted, straight, up, vertical

Instructions

1. Begin the lesson by asking the children to define *straight line*. With a marker and a piece of paper, or an overhead transparency, draw a straight line that will measure about 5 centimeters long when displayed on an overhead projector. Ask the children to try to draw a line that is the same length as yours on a piece of scratch paper.
2. Use one of the measurement materials to determine the length of your original line. If your students are discussing standard units of measurement, you may wish to discuss significant vocabulary such as *inch* and *centimeter*.
3. Distribute measuring tools to the children, allowing them to choose what they want to work with. Students can use the same tool that you used or other tools that make sense to them. Ask children who are using the same tool that you did to measure their lines and compare the lengths with yours. Ask a few children to show their straight lines and share their methods of measuring.
4. Give each child a piece of paper and show the class how to fold the paper in half twice, once horizontally and once vertically, to create four separate sections. Ask the children to number the sections 1, 2, 3, and 4. Explain that students will be working with partners to play a game of *Match This Line* using the different sections of the paper.
 - a. One partner draws a straight line, either vertically, horizontally, or diagonally, in Section 1 of his or her paper.
 - b. The other partner tries to draw a straight line that is the same length and orientation in Section 1 of his or her paper.
 - c. Both partners measure and compare their lines. (Demonstrate how to offset the two papers so that they are not directly aligned.)



Paper 1



Paper 2

- d. The second partner draws a line in Section 2 of his or her paper, and the game continues until the children have used all four sections.
5. Observe the children as they work and encourage the use of mathematical language. Reinforce and/or provide vocabulary as children compare the lengths of their line segments. For instance, a child might say, “My line is just a little bit longer.” You could respond with “It looks like it’s a bit less than a centimeter longer.”
6. If there is time, children can turn their papers over and use the sections on the back to repeat the activity.
7. In a class discussion, ask children which type of line they drew more often—horizontal, vertical, or diagonal. Demonstrate the meaning of these words as you talk. Have the children look at their papers to see if there was a particular type of line segment that was more challenging to reproduce than any other.
8. Ask several partners to share their methods of measurement and why they chose them. Find out how many children used cubes, Cuisenaire rods, string, tape measures, and rulers. Ask about the reasoning behind those choices. For example, a child might say, “We used cubes and we liked them because they were easy to line up and count,” or “We used a tape measure and we liked it because there are numbers already on it, but it was hard to tell what all those little lines were for.”
9. Ask children which measurement tool they have the greatest confidence in and why. Which seemed to be the most accurate? Why? Which tool would they choose to do this activity the next time? Why?

Extensions

- ◆ Allow children to use curved lines; they can measure and compare using yarn or string.
- ◆ Have children create small figures or symbols, like letters, for comparisons.



Around the Shape

Overview

Students use a variety of nonstandard units of measure such as toothpicks, cubes, Cuisenaire rods (one size at a time), and paper clips to measure the distance around geometric shapes. After making predictions, children measure and record the distance around their shapes. They then compare their results to determine which of the shapes has the greatest perimeter, or distance around.

Materials

- ◆ *Around the Shape* recording sheets of the following polygons: square, rectangle, triangle, and trapezoid, at least 1 per student (see Blackline Masters)



- ◆ measurement units such as toothpicks, cubes, paper clips, and Cuisenaire rods (grouped by color), enough so that several students can select the same material

Vocabulary: all, around, between, distance, gaps, half, length, long, longer, longest, next to, part, perimeter, short, shorter, shortest, side, spaces, width

Instructions

1. Introduce the activity by playing a guessing game about polygons that is similar to I spy and highlights some vocabulary that will be used during the activity. For instance, you might start with “I’m thinking of a shape that has four sides and each of those sides is exactly the same length” or “I’m thinking of a shape that can have different-length sides, but there are always three sides.” Continue the game until you have introduced each shape that the children will use in the activity. After each set of clues, reveal and name the shape that you are describing.
2. Explain to the children that they will be measuring around every side of a shape. Show the students the possible measurement units that they will choose from. Select a shape and one of the measurement units, like toothpicks, and ask students to make predictions about how many toothpicks will be needed to measure the distance of one side of the shape. After hearing the predictions, model measuring with the toothpicks, and compare the answer with their predictions. Next, ask,

“How many toothpicks will be needed to measure the distance around the whole shape?” Once again, after hearing the predictions, measure. Place toothpicks along the remaining sides of the shape. Together with the class, count the toothpicks to determine the perimeter, or distance around the shape. Discuss what to do if the measurement of a side does not work out evenly. For instance, suppose two toothpicks and about half of a third one fit along the side of a shape. Show the class that the length of the side can be recorded as $2\frac{1}{2}$. Explain that it is important to place the measurement objects end-to-end and not leave gaps between them.

3. Distribute a recording sheet (a copy of each shape) to each child. Direct each child to pick a shape and a measurement unit and then measure the sides of the shape and record. Individual students who have time may measure more than one shape using several different measurement units.
4. At the end of the lesson, partner each student with a classmate who measured the same shape so that they can compare their results. After students have had an opportunity to share their recorded information, have them talk about their experiences with the whole group by asking questions like these:
 - Who measured ——— (name a particular shape)?
 - Did you get exactly the same results as your partner? (Ask for some examples.)
 - Did any partners get different results? Why do you think this happened?
 - Does it make a difference if you and your partner used different materials? Why?
 - Does it matter how you place the measuring units? Can there be spaces between them? Can they overlap?
 - Did anyone get answers that weren’t exact? What did you do?
 - Which shape had the longest distance around? Why do you think so? Is there a way that we could check to make sure?
5. Post several recording sheets as examples in the room.

Extension

- ◆ In addition to the children’s suggestions for determining which shape has the longest perimeter, consider the following. Use string to measure around the shapes. Straighten each string, keeping track of which shape’s perimeter it represents, and compare the strings to see which is the longest.



Dots

Overview

In this activity, children have an opportunity to develop geometric and measurement skills. After drawing and connecting four dots with a straightedge to create a quadrilateral, children measure and compare the lengths of its sides.

Materials

- ◆ large drawings of quadrilaterals, such as a parallelogram, a rectangle, a trapezoid, an irregular quadrilateral, and a rhombus, about 5
- ◆ paper circles, 5 inches in diameter, 4
- ◆ a ball or skein of yarn
- ◆ rulers or straightedges, 1 per student
- ◆ centimeter or 1-inch cubes or tiles, about 15 per student
- ◆ optional: blank overhead transparency

Vocabulary: above, below, beside, closest, compare, corner, distance, dot, farthest, inside, left, length, long, longer, longest, measure, minimum, next to, rectangle, right, same, shape, short, shorter, shortest, side, space, straight line, top

Instructions

1. Explain to the class that you want to position the paper circles on the board so that they are not in a straight line and that at least three fingers can fit between any two of them. When you have all four paper circles arranged and taped in place, ask the children to consider which two are the closest together and which are the farthest apart. Encourage descriptive language such as *above*, *below*, and *next to*. Cut the yarn to create line segments from one paper circle to another. Compare the distance between the circles by comparing the lengths of the cut yarn. Tape the yarn segments to the paper circles to form a quadrilateral. Label the longest line *L* and the shortest line *S*.
2. Explain to the children that this activity will involve drawing four dots and connecting them to make a shape like you did with the circles and the yarn. Tell them that their shape does not need to look like one of the rectangles in the *Around the Shape* lesson (page 14), but it does need to have four corners (the dots) and four sides. (Show examples of some quadrilaterals such as a trapezoid and a rhombus.)
3. Model the procedure that the children will use. On the overhead projector or board, draw four dots that are not in a row and when connected will form an irregular quadrilateral. Place a ruler on two of the dots and draw a line to connect them. Repeat this process until all four dots are connected and a closed figure, or four-sided-shape, has been created.
4. Next, demonstrate how to find the length of each side of your shape. Use centimeter cubes or tiles. Think out loud as you carefully place the cubes next to one another, leaving no gaps between them. Explain that you are creating a line, or a path, with your cubes from one dot to another. Discuss ideas to help the children record parts of cubes such as $\frac{1}{2}$. For example: “I have some extra space left over here; what could I do? If it’s just a little bit, don’t worry about it. If it’s about half, show it

as one-half, or if there is another amount like three-fourths that makes sense, use that. Label sides with the number of cubes that were needed to go from one dot to another.”

5. Pass out the cubes or tiles, some blank $8\frac{1}{2}$ -by-11-inch paper, and the rulers or straightedges. Remind the children that they are to
 - draw four dots, not in a line, and at least three fingers apart;
 - connect them to form a four-sided shape;
 - measure each side of the shape using cubes or tiles; and
 - write the number of units used next to the side being measured. (See Figure 1–4.)
6. As you walk around and observe the children, help those who are having trouble drawing straight lines. Make a note of children who seem to be unconcerned about spaces between the cubes as they position the materials from dot to dot. Assist students as they record information about the length of each line.
7. As children complete the task, discuss their measurements. After the lesson, lead a whole-class discussion, asking questions like “Were any two of your lines the same length? How long was your longest line? How long was your shortest line? What was the difference between the two? How many more tiles or cubes did you use in your longest line than in your shortest?”

Extensions

- ◆ Have each child incorporate his or her four-sided shape into a picture or scene.
- ◆ Change the number of dots or the size of the paper.

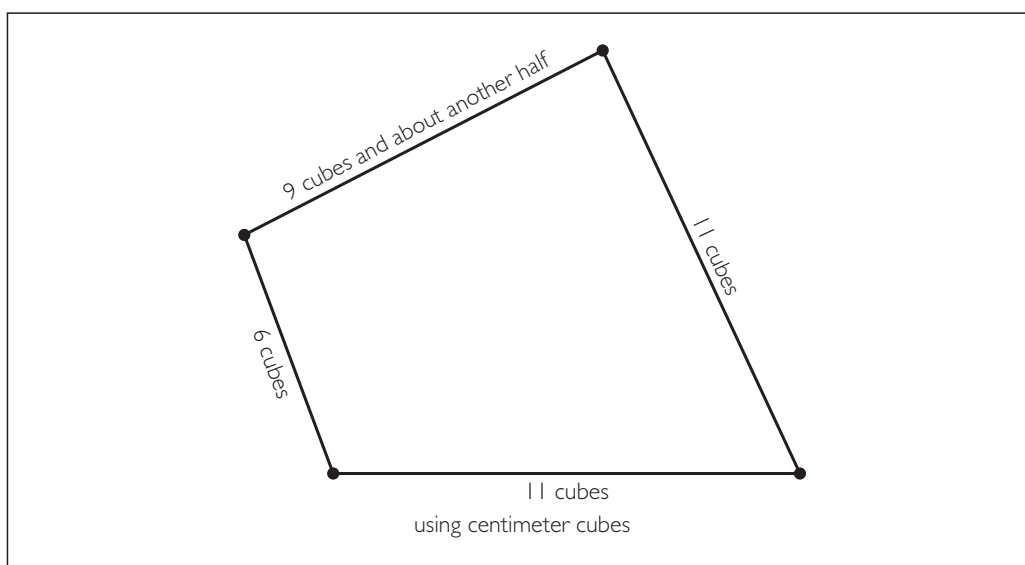


Figure 1–4 *An example of an irregular quadrilateral created during the Dots activity.*

- ◆ Have students use centimeter- or inch-grid paper and place the dots where the lines intersect.
- ◆ Have children experiment, using string or yarn, with measuring curved versus straight lines.



Growing Things

Overview

In this lesson, students learn about the process of planting seeds. The class keeps track of the length of time it takes for seeds to germinate and then of the weekly growth of the seedlings.

Materials

- ◆ children's literature books such as *From Seed to Plant*, by Gail Gibbons (1991), *Sunflower*, by Miela Ford (1995), and *The Tiny Seed*, by Eric Carle (1990)
- ◆ sunflower or bean seeds, avocado pits, and amaryllis bulbs, a variety, at least 16
- ◆ small plastic cups for seed samples, 8
- ◆ large transparent bag of potting soil
- ◆ pots with saucers, 6 inches in diameter, 6 or 7
- ◆ centimeter cubes and/or centimeter paper strips, 1 per student
- ◆ *Growing Things* recording sheet, 1 per student (see Blackline Masters)
- ◆ class calendar

Vocabulary: amaryllis, avocado, bulb, centimeter, germinate, growth, height, inch, length of time, measure, pit, predict, seed, sunflower, tall

Instructions

1. Before the lesson begins, number four of the pots 1 through 4 and arrange the planting materials so that students will be able to watch as you plant the seeds. Prepare and plant two or three extra pots in case of unforeseen events such as spills or lack of germination. Place some samples of the seeds in the eight plastic cups.
2. Begin the lesson by reading a story listed in the "Materials" section. Ask the children to describe what they understand about the relationship between seeds and plants. Pass around the small cups with the seed samples so that the children can examine and compare them. Tell the children the name of the plant that will grow from each seed and identify whether each seed is considered a seed, a bulb, or a pit.
3. Describe the planting process as you position the seeds in the four numbered containers. Place a saucer under each container and water each pot. Explain to the

children that you will place the seed pots in a sunny location and water them regularly.

- 4. Ask the class to consider questions such as these: “Do you think that a bigger seed will take longer to germinate or turn into a plant than a smaller seed? Do you think that more sunlight will make a difference? Do you think that talking to a plant will help? What do you think helps a plant grow from a seed?” Have students make predictions about when plants will germinate. When the various plants do begin to emerge, mark the pot numbers on the classroom calendar.
- 5. Show the children the recording sheet and explain that everyone in the class will work with a small group to keep track of one of the four plants (see Figure 1–5). Tell them that each week the children who are assigned to a particular seed pot will draw and measure any changes in that particular plant. Divide your class into four groups and assign each group to a certain plant.
- 6. Each week, provide a time for students to check their plants and update their recordings. Introduce the centimeter cubes and/or centimeter paper strips. Have a whole-class discussion about how to use these tools to get the most accurate information about the height of the plants without damaging them. Have children use the recording sheets to draw visuals and record growth.

Name:	I am observing seed number:	
Week 1	Week 2	Week 3
Week 4	Week 5	Week 6

Figure 1–5 Growing Things Recording Sheet

7. At the end of six weeks, have each group create a large display of its plant's growth from Week 1 to Week 6. Have groups share these displays with the class, and then post them in the classroom.

Extension

- ◆ Have students plant their own seeds to take home along with recording sheets and centimeter strips.



Measure the Classroom

Overview

After reading *The Line Up Book*, by Marisabina Russo, the class makes predictions about how many items could be lined up across the classroom. Children work in pairs to measure the width of the room using nonstandard units and report on their findings to the class. When the results are shared, issues involving unit size and quantity of measurement objects surface.

Materials

- ◆ *The Line Up Book*, by Marisabina Russo (1992)
- ◆ a variety of nonstandard measurement objects such as books, pencils, paper clips, clothespins, cubes, plastic links, Cuisenaire rods, and blocks, enough of each to span the width of your classroom
- ◆ optional: pad of chart paper

Vocabulary: across, fewer, in between, length, line, long, longer, longest, more, next to, object, predictions, same amount, short, shorter, shortest, space between, straight, width

Instructions

1. Show the class *The Line Up Book*, read the title, and ask the children if the title gives them a clue about what the book might be about. After reading the story, ask some questions like the following:
 - As the little boy lined things up on his way to the kitchen, what things did he use?
 - What did he use the most of?
 - What was the biggest object (or thing) that he used?
 - How many objects do you think he had in his line?

- What could the little boy do if he wanted to actually measure his room instead of just making a line to the kitchen?
 - Would it matter how he placed the objects or not? Why?
2. To create a list of objects in the classroom that might be used to measure the distance across the room, ask, “What are some things that we could use to measure our room here at school?” Write the children’s suggestions on the board or chart paper.
 3. Use a desk or another convenient surface to take some quick measurements and give the children a chance to make predictions and see results. For instance, you might place crayons across the desk, counting as you go. Next, use a different-size object, like cubes. Since small objects will require more counting, discuss ways that might help you keep track of larger numbers, such as inserting a different-colored cube each time you reach ten. This is also an opportunity to make a point of the significance of the careful placement of the objects, end-to-end without gaps.
 4. Have the children make some predictions about how many pencils would be needed to make a line from one side of the room to the other. Jot down on chart paper or the board some of their guesses. Do the same for a few of the remaining suggested objects. Ask, “Would it take more cubes or more books to go from one side of the room to the other? Why? More cubes or more pencils? More pencils or more paper clips?”
 5. Show children the materials that you’ve collected to measure the width of the classroom and invite the children to work with a partner to create a line of objects from one side of the room to the other. Remind the students that they can’t mix and match the items; they must use the same item for the entire distance. Have each child draw a picture of his or her measurement process and record the number of objects that it took to span the room.
 6. During the next class period, select some students to explain what they used to measure the room and how many objects were needed. Ask if there are two groups who used the same type of object to create a line across the room. Compare the counts. If the two reports are not exactly the same, discuss possible reasons for the differences. Record the results from all partners on the board or chart paper; for example: Jenny and Emily used pencils; it took 50.
 7. Ask the children to think about possible explanations for the different numbers that were reported. Refer to the counts that you’ve recorded to point out that the size of the measurement unit influences the count.
 8. End the lesson by having the children help you arrange the various nonstandard units that were used to measure the room in order by length.

Extensions

- ◆ Have children predict and investigate the classroom's length as opposed to its width.
- ◆ Collaborate with the physical education teacher to have the children use some materials from the physical education program to measure the gym.
- ◆ Ask children to measure the length of their bedroom or the length of a route to their kitchen.



Round and Round

Overview

After putting a collection of jar and bottle lids in order by size, students measure the circumference of the lids with string and compare the lengths of the strings.

Materials

- ◆ round lids from jars and bottles of varied sizes, 1 per student plus 2 or 3 extras
- ◆ paper sack large enough to hold all the lids
- ◆ string, about 12 inches long, 1 piece per student
- ◆ thick piece of yarn, about 12 inches long
- ◆ two-sided tape or masking tape

Vocabulary: alike, around, beginning, big, bigger, biggest, circle, circumference, compare, conjectures, counting words, distance, identical, length, less, long, longer, longest, more, most, order, similar, size, small, smaller, smallest

Instructions

1. Before class, put all the lids into the paper sack. To begin the lesson, jiggle the sack. As you shake the bag, explain to the children that the things inside the bag are alike in some ways, but not identical. Invite the children to speculate about what might be inside the bag. After discussing some possibilities, have each child reach inside and take a lid. If you have time, have each student write or tape his or her name on the lid.
2. Ask pairs of students who are seated near each other to describe two ways that their lids are the same and two ways that they are different. Then, as a whole class, discuss size attributes and highlight mathematical vocabulary such as *same size*, *smaller*, *larger*, and *compared with*.
3. Have the students speculate about who might have the very smallest lid. Have that child place the lid so that everyone can see it. Then ask, "Who has the next largest lid?" or "Who has a lid just a little bigger than this one?" Have that child

place his or her lid next to the first lid. Get consensus from the class that the lid is slightly larger before going on. Again ask, “Now who has the next largest?” and continue the process until all the lids have been placed in a row and ordered by size. If two lids appear to be the same size, have the class agree upon how they should be positioned; for example, they could be stacked or one could be placed above or below another.

4. After the lids have been placed in one long ordered row, pose this question: “How can we determine if one lid is smaller than another without picking them up and comparing them directly?” Discuss the children’s ideas about making indirect comparisons. Next, explain that they will be using yarn as a measuring tool to compare two lids.
5. Show the children your thick piece of yarn. Tell the class that you intend to wrap the yarn around a bottle lid so that you can measure the distance around it. Explain that the distance around a circle has a special math name called *circumference*.
6. Use one of the extra lids from the lid collection. Ask the students to predict how long the string will need to be in order to go around the lid exactly once. Make a cutting motion with your fingers to indicate some possible points that match their predictions.
7. Wrap the yarn around the lid and have a partner assist you as you cut the yarn at the point where it meets the beginning of the yarn after going all the way around the lid exactly once. Discuss the importance of being as accurate as possible when cutting the string. Explain that partners need to work together to hold and cut the string carefully.
8. Have children retrieve their lids from the row of lids. Pass out the measuring strings and scissors. Encourage partners to assist one another as they place and cut the string to measure the circumference of their lids.
9. When this task has been completed, the class will have a set of circumference strings to match the class set of lids. Have the children get back together as a large group. Ask the students if they think that the largest circle has the longest string and the smallest circle has the shortest string. Have children explain their reasoning. Once again mention that the distance around a circle is called a circumference. Ask the child holding the string with the longest circumference to hold it up and then to hold the lid up as well.
10. Next, have the children organize themselves in one long line spanning the classroom from longest string to shortest string. Ask them to bring their lids along with them as well.

11. Once the class is in line, ask them to hold up their circumference strings for comparison. With their other hands, have them hold out their lids.
12. Ask children to explain what they notice. Make a list of their remarks and have the children leave the lids and strings arranged in order so that you can create a display to remind them of their work.
13. Using two-sided tape or masking tape, select a variety of sizes and display each selected lid along with its circumference string. Indicate that the larger the lid, the longer the string.

Extensions

- ◆ Have children add to the lid collection, and make this measurement activity a learning center.
- ◆ Have students determine the length of the circumference strings in centimeters and/or inches.
- ◆ Have children look for circles in the room, for example, the trash can or the base of the class globe. They can measure the circumference and translate it into standard units of measurement.



Inch by Inch

Overview

Leo Lionni's book *Inch by Inch* provides an entertaining introduction to a familiar standard measurement unit. In the story, an inchworm proves that he can measure anything from a robin's tail, to a flamingo's neck, to a heron's legs, to the entire length of a hummingbird. This lesson helps children to understand length, width, and distance as they measure pictures of birds.

Materials

- ◆ *Inch by Inch*, by Leo Lionni (1995)
- ◆ 1-inch tiles or cubes, 20 per student
- ◆ pictures of birds, 2 per student (see Figure 1–6; see also Blackline Masters)

Vocabulary: all, between, distance, dot, end point, fraction, from . . . to . . . , height, length, long, longer, longest, measure, part, short, shorter, shortest

Instructions

1. Read the story *Inch by Inch* to the class. Discuss the inchworm's predicament and the clever way that he solved his problem.

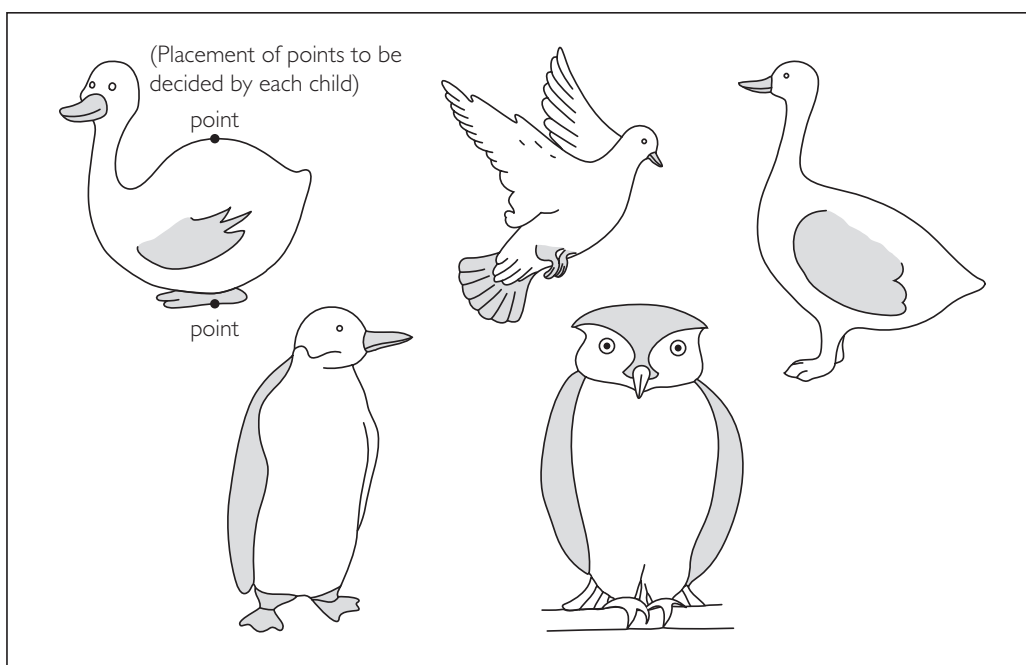


Figure 1–6 Examples of bird drawings used in the Inch by Inch activity.

2. Ask the children if they have seen worms outside, and discuss their lengths. Using one side of an inch square tile as a guide, draw a line segment to show how long an inchworm would actually be. Explain that each side of the tile is an inch long.
3. Talk about some of the things that the inchworm measured in the story. Show the children one of the bird pictures that will be used in the activity and talk about what measurements, such as length and width, could be taken using 1-inch tiles. Discuss some of the challenges that would be involved in measuring the bird, such as where to begin and end, what to use to measure the distance, and how to record what you've measured.
4. Choose a dimension such as height to measure with the tiles. Model creating two points to show where the height begins and where it ends. Draw a line between the two points, and then explain that this is where you intend to place the tiles. Place the tiles carefully so that they are touching, leaving no spaces between them. Have the children help you count as you position the tiles along the line. Discuss what would happen if spaces were left between the tiles.
5. Ask the children what they might do if the 1-inch tiles do not fit perfectly along the line. Discuss estimating to the nearest tile. Demonstrate writing a number that will indicate part of an inch, such as $\frac{1}{2}$.

6. Show the children the various bird pictures to be measured. Have students select one or two pictures to measure. After selecting their pictures, students can work on this activity independently or with a partner.
7. Review the procedures:
 - Decide upon the direction that you wish to measure your bird.
 - Make two points on the bird to show the end points of the distance to be measured.
 - Draw a line from one end point to the other.
 - Position the tiles between the two dots and along the line, leaving no space between them.
 - Count the tiles.
 - Record the results on your picture.
8. Circulate while the children work and take note of how accurately the children are managing the tiles. Encourage them to talk to you about their work by asking questions about how they decided to position their dots. Listen for vocabulary such as *length*, *width*, and *height*. Observe how students place tiles on their lines and how they deal with remainders.
9. When the children have finished working, discuss their results and the challenges that they encountered. Have a few volunteers share their recordings. Discuss whether or not the tiles fit in between the end points exactly. Ask if anyone had a picture that used the same number of tiles from point to point as another student. Compare the pictures and discuss whether or not the measured distances appear to be the same length.
10. Post the pictures in the room so that the children have a chance to look carefully at the variety of measurements that were taken.

Extensions

- ◆ Have children reuse the same pictures but measure in a different direction. It helps to mark the end points with a different color than the first set of points.
- ◆ Have students use centimeters instead of inches to measure the birds.



Partner Pictures

Overview

In this lesson, partners use two identical sets of stickers to create matching scenes or “twin” pictures. Partners attempt to position their stickers in exactly the same places on their papers and then use measurement tools to help them determine if they have done so.

Materials

- ◆ sets of five matching stickers, 2 per pair of students
- ◆ tools for measuring, such as paper centimeter strips, paper inch strips, or cube sticks, at least 1 per student (see Blackline Masters)
- ◆ crayons or colored pencils, enough for the class to share

Vocabulary: above, below, beside, between, bottom, centimeters, closer, different, distance, farther, left, matching, measure, near, next to, right, same, side, top

Instructions

1. Prior to the lesson, prepare two twin pictures using stickers. Position and place five stickers in the same locations on two pieces of paper and then determine a setting or scene for the pictures and decorate each the same way.
2. Begin the lesson by drawing two matching rectangles on the board. Invite a volunteer to come up and place an X somewhere in one of the rectangles. Tell the class that you want to position an X in the other rectangle in the same spot. Ask children to talk to each other for a minute or two about how to find the correct spot in the empty rectangle. Use some of their ideas to position the second X. For example, a student may suggest checking to see how far the first X is from the top of the rectangle and matching that distance in the second rectangle. Another student might suggest checking to see how far the X is from the left side of the rectangle. Use these types of suggestions to introduce the measurement tools. For example, demonstrate the use of cube sticks or paper strips to position the X on the second rectangle.
3. Ask your student volunteer to help position a second symbol in the rectangles, such as an O. This time, the X can also be used to help determine the spot for the O. Discuss various ways to check the accuracy of the position: from the top, the bottom, the sides, and the X.
4. Explain to the class that with a partner everyone will create twin pictures using paper rectangles (blank $8\frac{1}{2}$ -by-11-inch paper), and stickers. Show the children the pictures you made earlier and the sets of matching stickers. Remind the class of the examples using Xs and Os and then ask students to restate some of the measurement strategies. Record their ideas, such as measure from the top, measure from the sides, and measure from other points. Make sure that everyone has access to measurement tools.
5. Pair up the children, pass out two sets of stickers and two sheets of paper to each pair, and set them to work. First, Partner A places five stickers on his piece of paper. Then Partner B tries to place her set of stickers in the same positions on her

paper, with Partner A's help. Give children ample time to finish this part of the activity.

6. After the children have successfully placed their stickers, have them use crayons or colored pencils to create scenes. Students may choose to create different pictures or settings for their stickers. That could generate some interesting discussion about the perception of distance.
7. During a whole-class discussion, ask students if the placement of some stickers made it easier to match another person's picture. Ask: "If stickers were close to the outside edges, was it easier to match their positions than if they were closer to the center? Was it more difficult if they were closer to the center? Was it easier if you had stickers clustered together or far apart from each other? Were you able to accurately make twin pictures? Are the measurements fairly close?"
8. Put the pictures and the measurement tools on display. (See Figures 1–7 and 1–8.)

Extensions

- ◆ Increase the level of complexity of this task by introducing more features that students need to match. For example, have students create matching maps with features like rivers, roadways, and mountains.

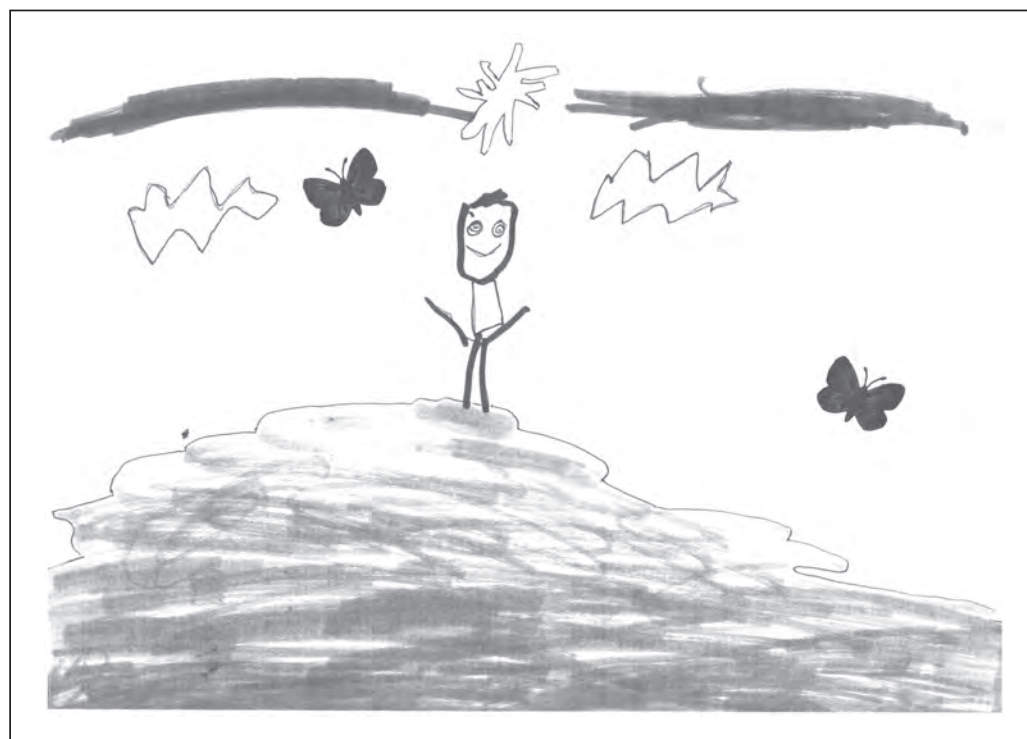


Figure 1–7 Tony placed his stickers first in the Partner Pictures activity.

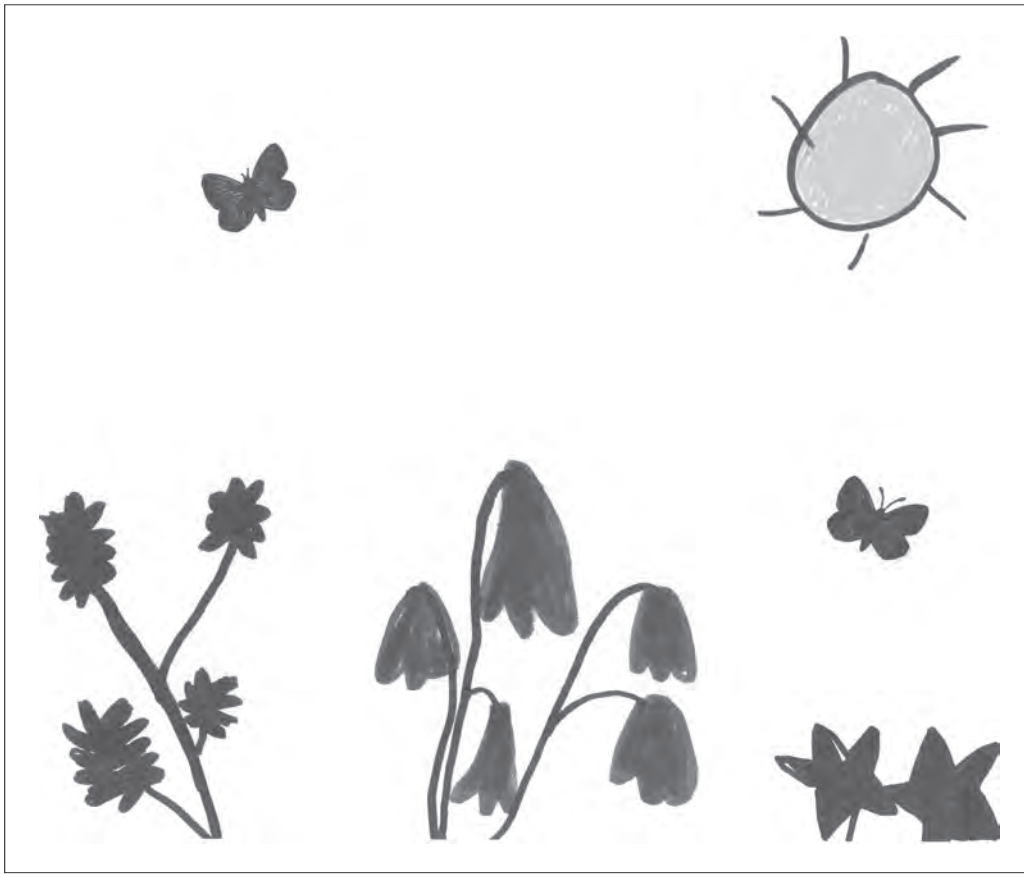


Figure 1–8 *Camille used cubes to measure from the outside edges to position her stickers. Then she drew her picture.*



Foot Race

Overview

Foot Race is a dice game designed to build children’s mental image of 1-inch units. It helps students develop the understanding that twelve consecutive inches equal one foot. Play requires students to roll a die and connect the corresponding number of 1-inch cubes until they get to 1 foot.

Materials

- ◆ rulers or inch strips (see Blackline Masters), 1 per student
- ◆ number dice, 1 per student
- ◆ 1-inch cubes, 12 per student
- ◆ demonstration objects such as a paper clip, an eraser, and a book
- ◆ 3-by-5-inch index cards, at least 5
- ◆ optional: *Foot Race* recording sheets, 1 per student (see Blackline Masters)

Vocabulary: combine, compare, connect, cube, dice, die, exactly, foot, inch, least, most, possible, repeat, roll

Instructions

1. Show the class a ruler and a 1-inch cube. Ask the students to share what they know and/or notice about these objects. Using the 3-by-5-inch index cards, create word cards, writing one word on each card: *ruler*, *inch*, and *foot*. As you read the words aloud, explain that inches and feet are units of measure that people can use to describe how long something is. Cubes and rulers are tools that help people count and keep track of inches and feet. Discuss real-life connections such as buying shoes or measuring a window to see how long a curtain rod should be.
2. Hold up some of the demonstration objects like a paper clip, a book, and an eraser. Ask the children to consider whether each object is closer in length to an inch or a foot. Check the predictions using a ruler and/or cubes.
3. Introduce *Foot Race* by explaining that the game requires players to keep track of inches by connecting 1-inch cubes until they reach a foot.
4. Demonstrate rolling a die, counting out the corresponding number of cubes, and connecting them. Repeat this process until you have built a tower that is a foot high. Explain that players do not need an exact roll of 12 to finish. The recording sheets will reinforce the understanding that 12 inches is the exact number of inches in a foot. (See Figure 1–9.)
5. Provide each student with twelve cubes, a number die, and a 1-foot strip or ruler, along with a pencil and a recording sheet, if appropriate for your students. Ask the children if they are likely to roll a total of exactly 12 to go out. Discuss the reasons for their predictions. As students roll their die, have them place cubes directly on top of the ruler so that they can see the relationship between inches and a foot.
6. Set a predetermined amount of time to play the game. Circulate while the children work, observing and discussing their progress. As you interact, you can assess students' counting accuracy and efficiency.
7. After the class plays the game for the designated amount of time, ask the children to put their materials away and prepare to discuss their results. Begin the processing by having the children first show you with their fingers about how long an inch is and then show with their hands the length of a foot. Determine whether anyone finished the game with exactly 12 inches and discuss what those students rolled. Next ask the people who went beyond 12 on their final roll to raise their hands. Discuss some reasons for these results.

Game 1 I rolled: _____ _____ _____ _____ _____ _____			_____ _____ _____ _____ _____ _____
I had exactly 12 when I went out. Yes or No			
Game 2 I rolled: _____ _____ _____ _____ _____ _____			_____ _____ _____ _____ _____ _____
I had exactly 12 when I went out. Yes or No			
Game 3 I rolled: _____ _____ _____ _____ _____ _____			_____ _____ _____ _____ _____ _____
I had exactly 12 when I went out. Yes or No			

Figure 1–9 Foot Race *Recording Sheet*

8. If there is time, give some examples of combinations from game results and ask the children if the numbers combine to make exactly one foot or more than one foot. For example: $5 + 5 + 5 = 12$? $4 + 6 + 2 = 12$? $4 + 5 + 6 = 12$? $6 + 6 = 12$?

Extensions

- ◆ Have students count up the number of games they have completed and make some guesses about how long that number of feet would look like. Ask if that length would fit in your room, the hallway, the playground, or the gym.
- ◆ Have the children use rulers end-to-end or tape measures to confirm the accuracy of the distances in feet that were reported during the class session of *Foot Race*.
- ◆ Ask the children to think about some of the combinations of numbers that could be rolled to go out on exactly 12. Write those equations on the board. For instance: $6 + 6 = 12$, $2 + 5 + 5 = 12$.
- ◆ Have students use two dice instead of one. See how many feet the class has accumulated after ten minutes.
- ◆ Have students use centimeter rulers instead of inch rulers during the lesson.



Sticker Pictures

Overview

In this lesson, children incorporate stickers into theme-related pictures that they have drawn. Once their stickers are positioned, they choose from a variety of measurement tools to determine the distance from one sticker to another. The children then compare the distances.

Materials

- ◆ stickers, preferably tactile foam, 3 per student
- ◆ crayons or markers, enough for the class to share
- ◆ selection of measuring tools such as 1-inch or 1-centimeter cubes, rulers, strips of paper, and string, enough for each pair of students
- ◆ 3-by-5-inch index cards, 3
- ◆ optional: chart paper

Vocabulary: above, below, beneath, between, bottom, closest, distance, farthest, left, length, longest, measure, middle, right, shortest, top, under

Instructions

1. Prior to the lesson, prepare word cards for *distance*, *length*, and *measure*. Put each word on an index card.
2. Begin the lesson by explaining to the class that each student will make a picture using three stickers and then measure the distance between the stickers. You may want to use stickers that go along with a particular topic. For example, if you are involved in a unit on butterflies, your stickers could relate to that theme.
3. Model the activity. Show the children the three stickers you have chosen. Draw a picture to provide a suitable background scene, for instance, flowers, clouds, and trees.
4. Place your three stickers on the drawing so that the distances are dissimilar. Ask the children to describe what they notice about the placement of the stickers. On chart paper or on the board, where everyone can see, record the mathematical vocabulary as the children use comparative terms such as *closer*, *farther*, *longer*, *shorter*, and so on. (See Figure 1–10.)
5. Display the word cards. Show and discuss the measurement tools that children will choose from. Select a measurement tool and measure the distances between your stickers, demonstrating how to count and compare.
6. Invite the children to select three stickers, make their own pictures on blank 8½-by-11-inch paper with crayons or markers, and use a measurement tool of their choice

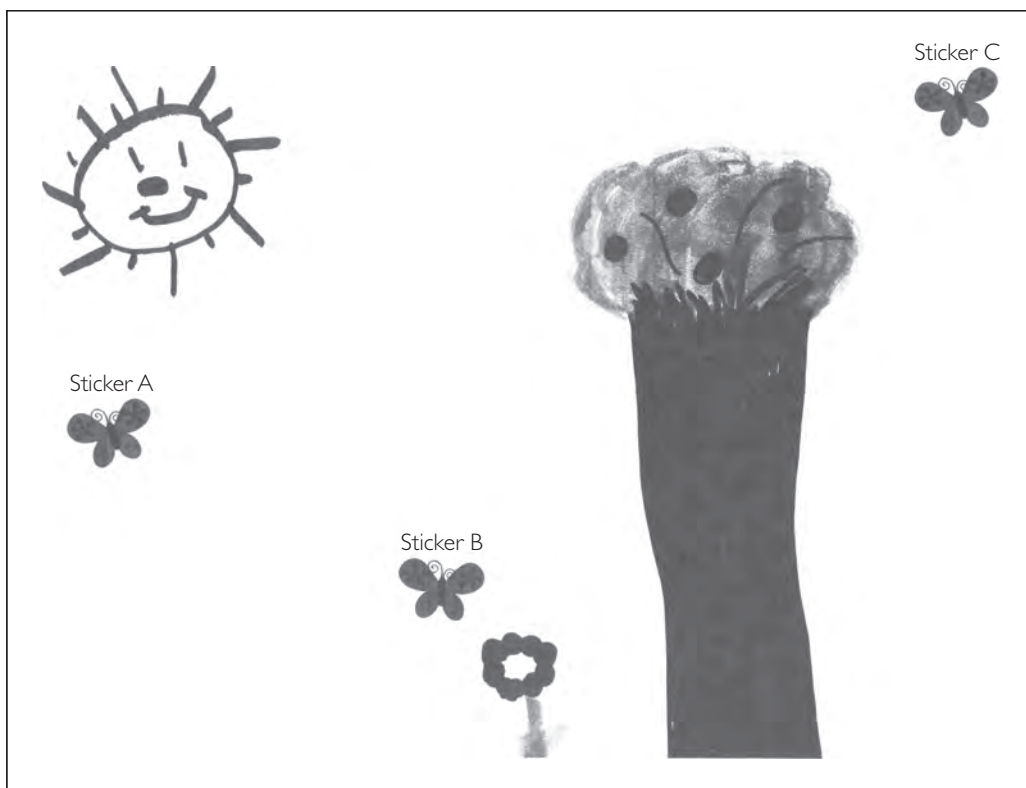


Figure 1–10 Samantha created a drawing, placed her stickers, and then measured the distances with cm cubes.

to quantify the distances between their stickers. Have them record their measurements at the bottom of their pictures or between the stickers. (**Note:** Tactile foam stickers make it especially easy to judge the edge of each sticker as the children do their measuring.)

7. Post these questions in a place where all can see:

- What is the longest distance between two of your stickers?
- What is the shortest distance between two of your stickers?
- How do you know? What did you use to measure the distance?

If students are ready for more complexity, follow up with questions about the actual lengths, such as:

- How much longer is the distance between stickers (A and B) than (B and C)?
- Is there another way that you could check this measurement?

8. Have partners discuss these questions with each other. Walk around the room and listen to their conversations. When everyone is ready, ask a few children to share their results with the class. Choose examples that feature different measuring tools. Help focus students' attention on the placement of measurement materials. Demonstrate a situation where part of a cube, for example, is on the line and part is not. Discuss how this part could be counted.

Extensions

- ◆ Allow students to use more stickers and/or larger pieces of paper.
- ◆ Have children measure the stickers on someone else's paper to check that student's results. Do partners get the same results? If not, why not?
- ◆ Have children dictate their observations about the relative distances between their stickers, and type them below the pictures. Put them on display.
- ◆ Change the instructions so that children try to have all of the stickers the same distance apart.
- ◆ Have the class create a mural of stickers and then figure out the farthest distance between two stickers.



Double or Half

Overview

Children have long been fascinated by characters of extreme size. From Stuart Little to the giant in *Jack and the Beanstalk*, size is often a featured aspect of storytelling. In this lesson children explore the concepts of doubling and halving by comparing different-size pictures of an imaginary little boy named George.

Materials

- ◆ *George Shrinks*, by William Joyce (1985)
- ◆ set of five pictures of George that gradually increase in size, 1 per pair of students (see Blackline Masters)
- ◆ 3-by-5-inch index cards, 2
- ◆ measuring tools such as cubes, tiles, string, rulers, grid paper, and Cuisenaire rods, enough for each pair of students

Vocabulary: big, bigger, biggest, double, enormous, half, height, length, long, longer, longest, original, regular, shrinks, small, smaller, smallest, tall, taller, tallest, tiny, twice

Instructions

1. Before class, create two word cards. On one index card write *half*; on the other, write *double*.
2. Read *George Shrinks* to the class. Discuss what it would be like to be *impossibly little* or *enormous*. Encourage the children to identify heights by thinking about questions like “What if you were as big as a building? What if you were as tiny as a butterfly?”
3. Show the children the original picture of George (the 4-inch version with a G on his shirt). Then show them the other four pictures of George. Ask the children what they notice about these pictures. Acknowledge that they are different sizes

and explain that two of the pictures have a special relationship to the original picture. One of the pictures is actually *half* (show the word card) the height of the original George and another is *double* (show the word card) the height of the original George. (See Figure 1–11.)

4. Discuss the meanings of the words *double* and *half*. Demonstrate the definitions using tangible examples made with plastic links or paper clips, paper, and/or string.
5. Explain to the children that in today's math lesson they will work with a partner to decide *which* George is half the height and which one is double the height of the George with the G on his shirt. Show the children the tools that are available, such

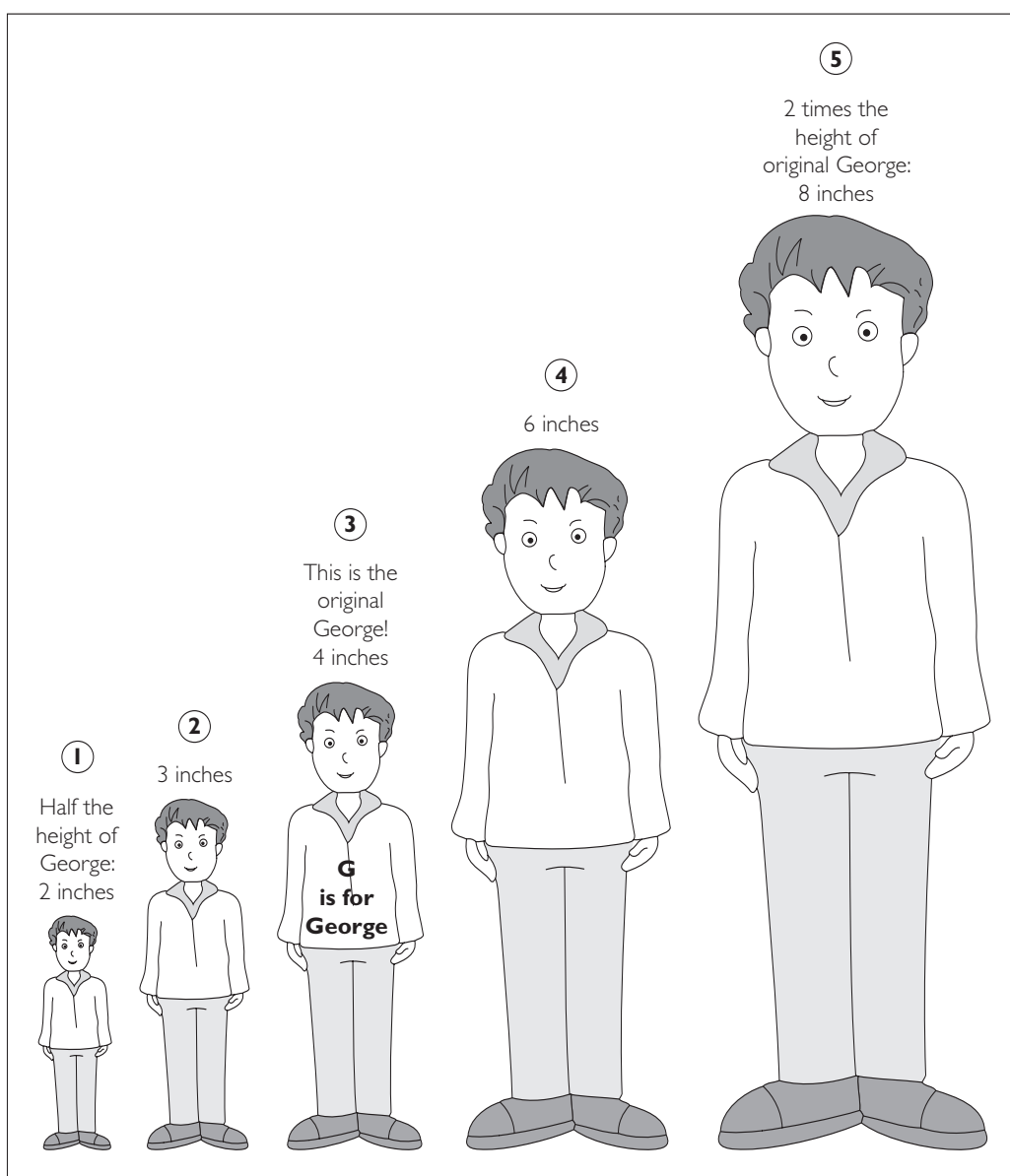


Figure 1–11 Set of five George characters for the Double or Half activity.

as Cuisenaire rods, grid paper, rulers, string, tiles, and cubes. Then provide time for children to talk in small groups about how to solve the problem. Ask volunteers from different groups to share their thinking with the whole class.

6. Provide each pair with a set of the five George characters and have them select the measuring tools of their choice. Students can cut the characters out during the lesson if that is a strategy that comes up. Set a time limit for solving the problem and check in periodically to give students a sense of how much time remains. For example, tell the students that they will have twenty minutes to complete their work.
7. When the time is up, call the class together and ask the children to discuss their efforts. Students may say things like, “We used cubes to measure and we found that the smallest George was two inches, the middle one was four inches, and the tallest one was eight inches,” or “We used string, and the littlest one looked much smaller than the biggest one.” Record the statements as students share. Help children articulate their ideas about halving and doubling by demonstrating them with the measuring tools. Reinforce the ideas of *doubling height*, *twice as big*, and *half* by writing the words and emphasizing their mathematical language.

Extensions

- ◆ Revisit the lesson and have children use a different measurement tool than they did during their initial exploration of the problem.
- ◆ Children can each create their own character using 1-inch grid paper. After they have drawn and measured the character, they can create another that is twice as tall or double in length. Ask the children if doubling the length is the same thing as doubling the height. How are length and height related?