

It Takes Ten

Math Grows Up (Measurement)

Objective

Students will estimate and measure weight to the nearest gram, length to the nearest centimeter, volume to the nearest milliliter and determine the area of a region.

Overview of the Lesson

Students review the importance and use of standard units of measure. The basic units of metric measure are reinforced in a song titled, "It Takes Ten". Students are immersed in activity based learning as they move from station to station estimating and measuring length, volume, weight, and area. At each station students first estimate, measure, and then compute the difference between the two. They estimate and measure marbles to the nearest gram and squeeze water-saturated sponges to practice measuring in milliliters. Students practice linear measurement estimation skills by throwing cotton balls and rolling toy cars. Students determine if they are a square or a rectangle by measuring and comparing arm span and height. Finally, each student determines the area of his/her foot by counting and computing the area by constructing a rectangle to approximate the area.

Materials

Teacher:

- A large shoe
- Direction Cards for each station
- Information Cards for each station

Per Each Station:**Marble Grab**

- Container with about 50 marbles
- Metric scale or balance

Sponge Squeeze

- Sponge
- Bucket of colored water
- 500 ml beaker or measuring cup

Car Race

- 4 Toy cars
- Meter stick

Cotton Ball Throw

- 2 Tape measures
- 4 Cotton Balls

Footprint

- Marker
- Graph paper
- Ruler
- Activity Sheet: Centimeter Square Graph Paper

Are You a Square or a Rectangle?

- Meterstick

Each Student:

- Activity Sheet: Measurement Stations
- Activity Sheet: Cooperative Group Rubric

Procedure

Begin the lesson with a discussion of the importance and usefulness of measurement. Elicit real world uses of measurement. Show the class a large shoe

(preferably greater than a size 12) and ask them to estimate the length and width of the shoe in centimeters. Members of sports teams are usually willing to cooperate in providing a shoe. Also ask the students to estimate the weight of the shoe in grams and the area of the shoe. Remind students of the formula for finding the area of a rectangle. (length times width). Pass the shoe around the class so that every student has an opportunity to examine it. They may bring in their estimates the next class period and compare their estimations with the actual measurements.

Discuss the importance of using a standard unit of measurement. Choose a student and compare the student's shoe with the large shoe. Tell the class that you wish to make a bed and you want to make it ten feet long using the chosen student's foot as a measure of one foot. Present the idea that the owner of the large shoes says that he will make the bed. What would happen if he used his foot as the unit of measure? Would the bed be the same size? You may wish to outline the "beds" on the floor using tape or yarn.

Review the metric system with the students by singing a song to help students remember the relationship and prefixes of metric measurements.

Divide the class into groups of four to work at stations to further explore concepts of measurement and to practice measurement skills. At each station, students are required to make an estimate before they make an actual measurement. They must then find the difference between the estimate and actual measurement using subtraction. All data is recorded on the Activity Sheet: Measurement Stations. There will be a direction card and an information card for each station. The information card will give benchmarks to help the students get a better estimate. The students will also be given directions on the order in which they are to go to the stations. Below is a brief description of each station. When students completed the stations, have them complete the Activity Sheet: Cooperative Group Rubric, to self-evaluate their work.

ACTIVITY STATIONS:

Marble Grab

Students estimate the number of marbles they can grab in a single handful. They will estimate and determine the weight to the nearest gram. The benchmark on the information card is that 5 marbles weigh about 26 grams (about 5 grams per marble).

Sponge Squeeze

Students saturate a sponge with colored water in a bucket and squeeze as much water as they can out of the sponge into a beaker. They are to estimate and then measure the water to the nearest milliliter. The information card has a print of the teacher's hand and the caption that this hand squeezed 300 milliliters.

Car Race

Students estimate and determine how far they can roll a toy car. The benchmark on the information card reminds the students that there are 100 centimeters in one meter. A one meter distance is marked off on the floor.

Cotton Ball Throw

Students stand behind a line and throw a cotton ball as far as they can. They estimate and measure the distance of their throw. The information card instructs students to notice the meter stick on the floor which they can use as a benchmark.

Footprint

Students estimate and determine the area of their own feet. The information card shows the footprint of the school coach's foot marked in square centimeters. Students may count squares or use the formula for area (length times width = area). To use this formula, students draw a rectangle that approximates the area of a foot. They should consider how the parts outside the rectangle could "fit" inside the rectangle. Students should agree where they rectangle should be drawn. See student work sample, "Footprint: Student Work".

Are You a Square or a Rectangle?

Students estimate and measure their height and arm span to determine if they are a square or a rectangle. If the arm span is the same as the height, the student is a square. If the two measurements are different, then they are rectangles. The information card gives the height and arm span of the teacher and also states that the teacher is a square.

Mathematically Speaking...

Young learners need many experience with estimating measurement including linear, weight, volume, and area. To discourage wild guesses, the introduction of benchmarks is helpful. Students should be able to hold their hands a centimeter apart and a meter apart. This will help them in estimating linear distances. Students should also be able to pick up a paper clip and know it weighs about one gram. In the marble grab, students used their number sense to make a good estimate of the weight of the marbles. They knew that every five marbles weigh 26 grams and should reason that one marble would weigh a little more than 5 grams. Students can use their number sense to make a good estimate.

When teaching young children to measure in standard units, it is important to have them examine the ruler to determine the endpoint of the measurement scale. The

measurement scale on some rulers begins at the edge of the ruler while others have a definitive mark. Careful attention needs to be given to help young learners correctly position the ruler parallel to the line they are measuring.

Extensions & Connections

Students may compile the class data that they collected at the various stations. They could graph and analyze the data to determine the average distance they were able to roll a car or throw a cotton ball.

Have students collect data concerning whether people are squares or rectangles from a variety of age groups to determine if age affects the outcome. Would a kindergarten class have about the same number people squares or rectangles as a fifth grade class? Would adults and children have about the same proportions of squares and rectangles?

Students could measure the size of their hands and determine if there is any correlation between the size of the hand and the amount of water that they could squeeze at the Sponge Squeeze Station. A scatter plot could be made of the hand area and the milliliters that were squeezed with that hand. Further study could be made as to whether people who are left-handed squeezed more water than right-handed people.

Resources

Fifth-Grade Book: Addenda Series, Grades K-6. (1992) National Council of Teachers of Mathematics. Reston, Virginia. ISBN 0-87353-320-8; #452E1B.

How Big is a Foot. (1990) Written and illustrated by Rolf Myller. Dell Publishing. Division of Bantam Double Day. Dell Publishing Group, Inc. New York, New York. ISBN: 0440-404-95-9

Math and Science, A Solution: Activities to Investigate Mathematics and Science. (AIMS). (1987) Fresno, California.

Ideas for Online Discussion

(Some ideas may apply to more than one standard of the **NCTM Professional Standards for Teaching Mathematics**.)

Standard 1: Worthwhile Mathematical Tasks

- Does the use of learning stations assist student learning?
- What mathematical skills are being utilized at the learning stations? Are these skills appropriate for this grade level in your opinion?
- How do these activities draw on student background and experiences?
- What stations did students seem to puzzle over and think?

Standard 3: Students' Role in Discourse

- How do learning stations help students to enhance their communication skills?
- What appeal does the song "It Takes Ten" have for students? Do you feel singing helps students remember, or is it "rote"? What memory devices or gimmicks do you use with students?

Standard 5: Learning Environment

- The video teacher stated that allowing students to work at stations requires a great deal of management. What are some effective management techniques that you have used to allow students to work effectively at stations?
- In providing this type of learning station set-up, what accommodations must be made in the classroom? If a particular classroom cannot accommodate this level of noise and movement, what adjustments can be made?
- What elements of this lesson encourage risk-taking?




















































































Standard 6: Analysis of Teaching and Learning

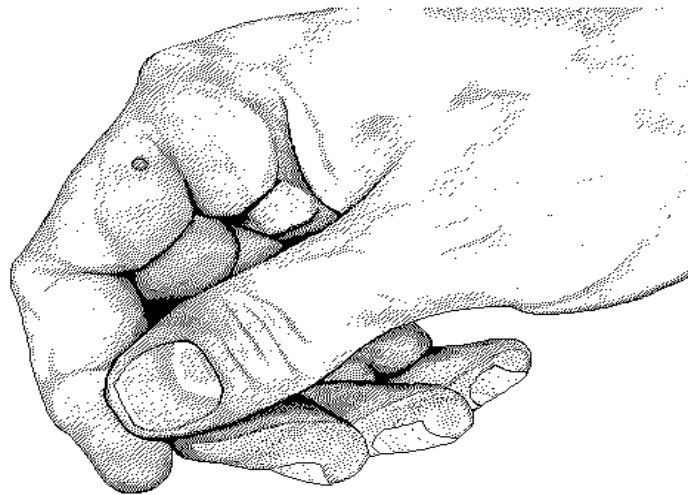
- The teacher in this video discussed the importance of utilizing many of the students' senses in learning. There are many schools that focus their program around the seven multiple intelligences (Howard Gardner's work). How do you utilize different senses in promoting understanding of mathematical concepts? How do you integrate art, music, and linguistic skills with math?
- How do you assess how students are learning when they are involved in a variety of different activities?

COOPERATIVE GROUP RUBRIC

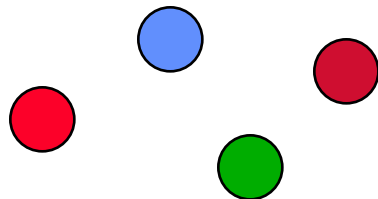
NAME _____

PEER _____

	SELF		PEER	
				
1. Good behavior				
Get along with group				
Talked quietly				
Stayed with the group				
Friendly to my group				
2. We followed directions.				
3. I did my job well.				
4. We included everyone in our work.				
5. I always waited my turn.				
6. I shared with each person.				
7. We all listened to ideas.				
8. I stayed on task.				
9. I said please and thank-you.				
10. I disagreed with ideas, NOT people.				
11. I called each partner by name.				
12. I said encouraging words.				
13. We checked for accuracy.				
14. I understood the assignment.				
15. We turned in one paper.				
16. We agreed with our report and signed it.				

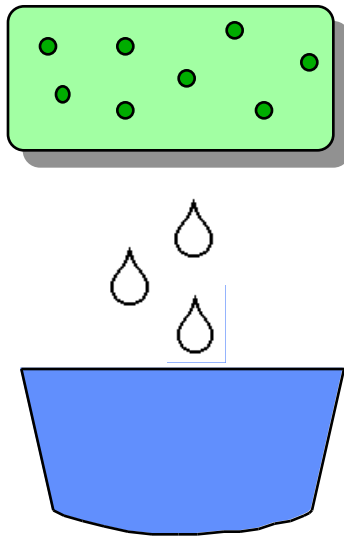


Marble Grab



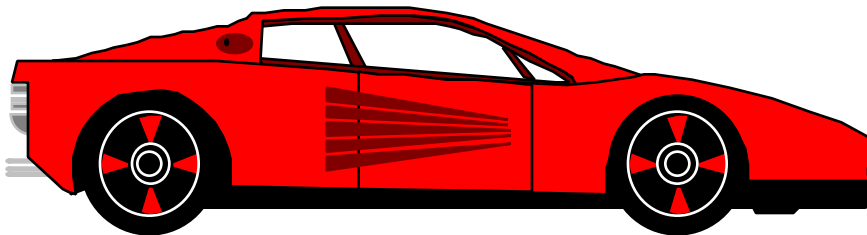
- 1. Estimate (in grams) the amount of marbles you can grab in your right hand. Record your answer.**
- 2. With right hand only, grab a fist of marbles from the container.**
- 3. Weigh the marbles on a balance or scale. Record your answer.**

SPONGE SQUEEZE



- 1. Have the sponge soaking in large bucket of water.**
- 2. Estimate the amount of water (in milliliters) that you think you can squeeze out of the sponge (one squeeze only). Record your results.**
- 3. Squeeze the sponge into a separate container. Measure the water “squeezed.” Record your results.**

Car Race



- 1. Estimate the distance (in centimeters) a toy sports car can roll. Record your results.**
- 2. Place the cars at the starting line. Push one car at a time. Measure the distance the car moved in a straight line, from the starting line. Record your results.**



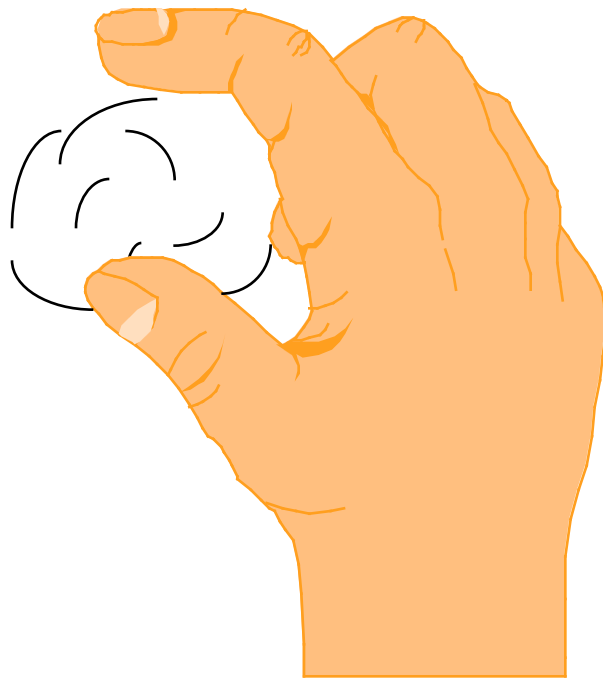
FOOTPRINT

- 1. Estimate the area of your shoe (in square centimeters). Record your results.**
- 2. Trace your shoe. Draw a rectangle that is approximately the size of your shoe. Find the area.**
- 3. Use transparent centimeter square graph paper to determine the area of your foot. Record your results.**
- 4. Cut out your footprint. Sign your name with the area and post it.**

Name _____

Measurement Stations

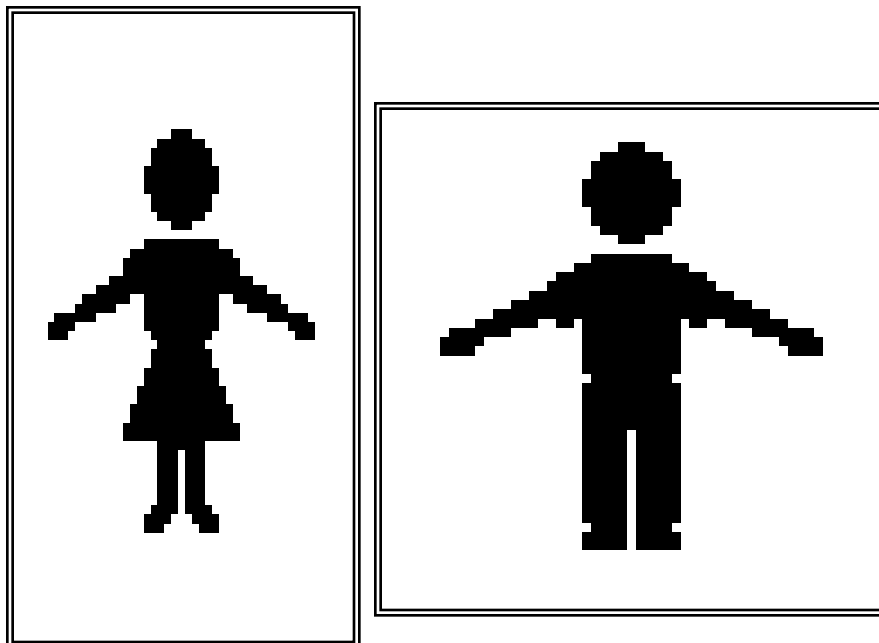
	Estimate	Actual	Difference	Ideas
1. MARBLE GRAB (in grams)				
2. SPONGE SQUEEZE (in milliliters)				
3. CAR RACE (in centimeters)				
4. FOOTPRINT AREA (in square centimeters)				
5. COTTON BALL THROW (in centimeters)				
6. SQUARE OR RECTANGLE (in centimeters)	Height	Arm Width	Height	Arm Width
Based on this information, I have determined that I am close to a (square, rectangle)				



Cotton Ball Throw

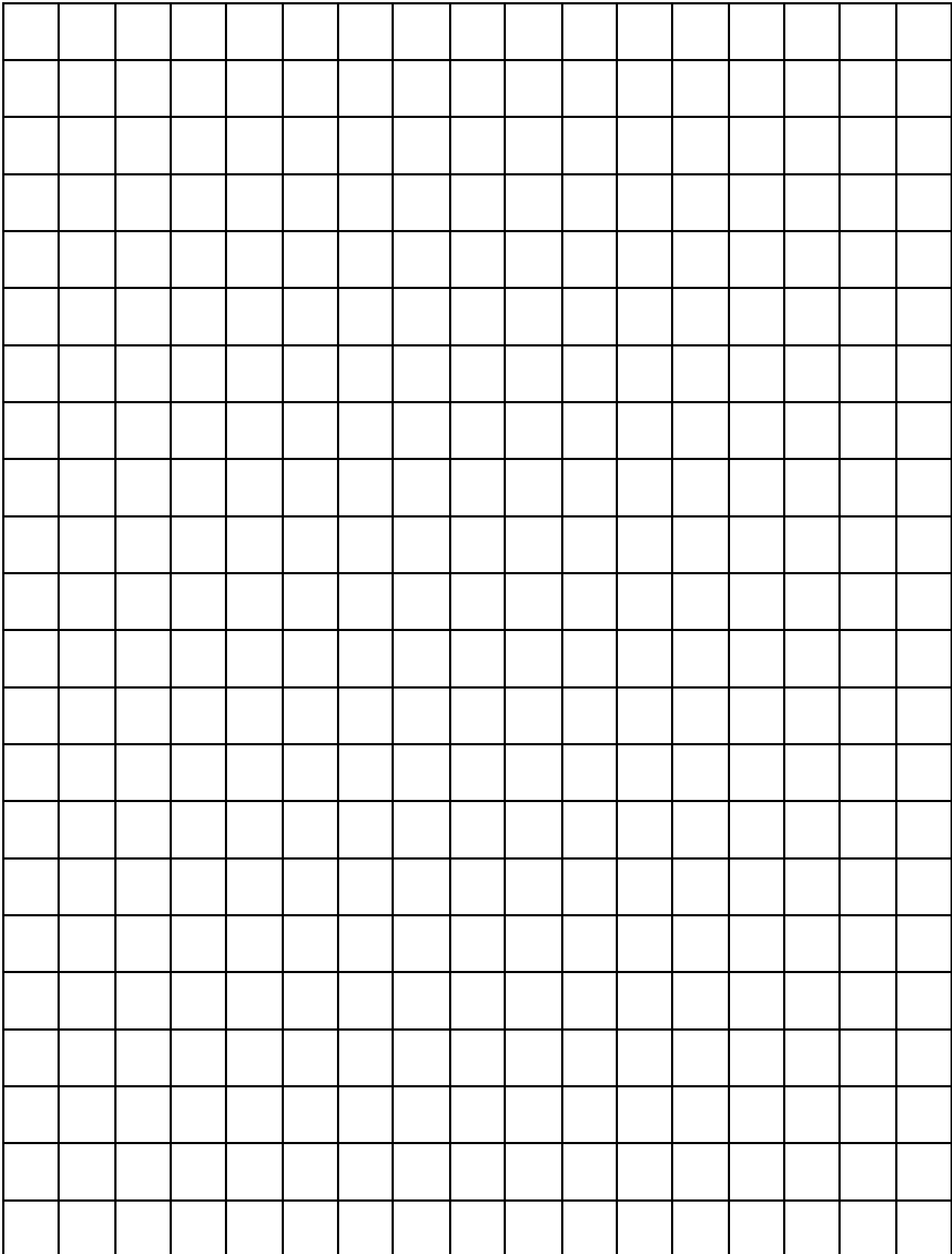
- 1. Estimate the distance in centimeters you think you can throw a cotton ball. Record your results.**
- 2. Place your feet on the “Starting Line.” Throw the cotton ball one time only. Measure the distance from the starting line to the cotton ball. Record your results.**

ARE YOU A SQUARE OR A RECTANGLE?



1. Estimate your height and arm span (in centimeters). Record your results.
2. Let your partner measure your height and arm span (in centimeters) and record the measure.
3. Determine if you are a square or a rectangle. Record your results.

CENTIMETER SQUARE GRAPH PAPER



FOOTPRINT: STUDENT WORK

