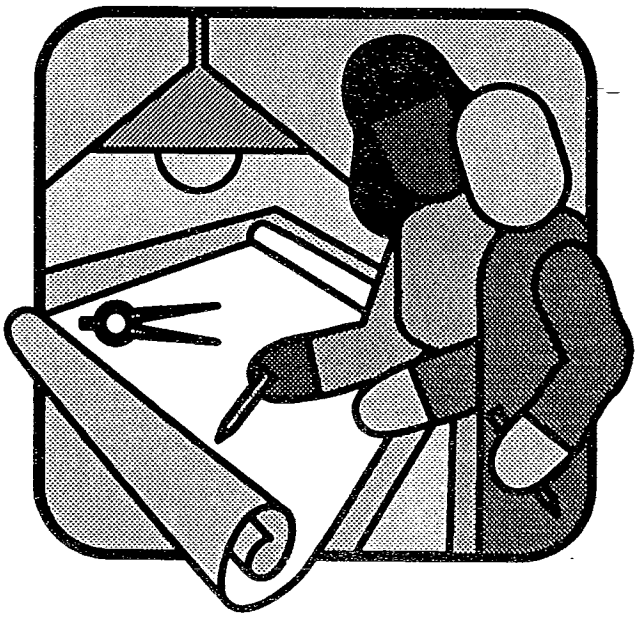
ORGANIZING

AND ANALYZING

ORGANIZACION



ESO ES LO IMPORTANTE

BACKGROUND INFORMATION

The following background piece was adapted from Gerald Kulm's *Math Power* and *Challenge of the Unknown: Community Leader's Resource Guide*, and from Stenmark, Thompson, and Cossey's *Family Math.*

Why is mathematics important?

"It is important that children develop the mathematical skills and concepts they need for algebra and other high school courses. But unless they learn to enjoy mathematical thinking and see the usefulness of math, many children are unlikely to reach their potential. Children often think of math as being only about numbers. They see it as abstract and difficult with no useful applications. But in real life, math involves:

- *Estimating*—finding an answer that is 'close enough.' Most real problems don't have just one exact answer.
- *Finding information*—looking at a situation and figuring out what to do and what strategy to use is more important than 'crunching numbers.'
- *Planning*—knowing what to do first and what steps to follow is the way real math problems are solved.
- *Visualizing*—being able to picture a situation or problem and represent it in a drawing or diagram" (Kulm, p. 1).

Don't children learn these skills at school?

"All too often, the mathematics that children learn in school is mostly rules and memorization. There is no question that really learning and understanding anything, including mathematics, involves hard work and effort. But hard work can also bring the enjoyment of discovery and the satisfaction of solving a problem" (Kulm, p. 2).

Kulm goes on to say that learning mathematics can be enjoyable when it involves:

- *Cooperation*—working together to solve a problem, not competing to see who can finish first;
- *Enjoyment*—experiencing success in solving a problem or learning a new idea;
- *Hands-on activity*—measuring, drawing, and building things;
- *Seeing patterns*—exploring the design, size, and shape of objects and ideas; and
- *Problem solving*—using common sense, trial and error, and reasoning to find answers to questions.

What are "problem-solving skills"?

"By *problem-solving skills*, we mean ways in which people learn how to think about a problem using such strategies as looking for patterns, drawing a picture, working backwards, working with a partner, or eliminating possibilities. Having a supply of strategies allows a choice of ways to start looking at a problem, relieving the frustration of not knowing how or where to begin. The more strategies you have, the more confident you become, the more willing you are to tackle new problems, and the better problem solver you become" (Stenmark, et al., p. xi–xii).

What do you mean by "hands-on" materials?

"By *hands-on materials*, we mean concrete objects—like blocks, beans, pennies, toothpicks—that are used to help children understand what numbers and space mean, and to help all of us solve problems. Traditionally, these materials are used mostly in the early elementary years and paper-and-pencil mathematics becomes the rule after second or third grade. This is unfortunate, since much of mathematics can best be explained and understood using the *tools of manipulative materials and models*; and, in fact, many research and applied mathematicians do just that" (Stenmark, et al., p. xii).

Specifically, what kinds of strategies should I use in doing math activities with the children?

- Emphasize cooperation and group effort. Let children do their individual work, but encourage them to share ideas and help each other.
- Focus on relationships, why things work, and ideas. Let children explain what they do. Encourage them to question and find out why things happen, not to accept an answer without understanding how they got it.
- Take your time. It is best to spend enough time so that everyone understands and enjoys an activity. Rushing along to cover more material can be frustrating to both you and the children. Try not to push too far, too fast. It is better to stop while everyone is enjoying themselves, saving some anticipation for continuing the next time.
- Avoid long, complicated paper-and-pencil calculations. Have a calculator handy. In most cases, the actual calculation is not as important as how and why to combine the numbers. If the children understand that, they can push the right buttons on the calculator.
- Avoid speed contests. Activities should be designed to emphasize reflective thought and problem solving.
- Use "Square One TV" segments to increase children's focus on problem-solving strategies. Encourage upper elementary and middle school children to watch the program at home, as well; research shows it can have positive effects on problem-solving skills.

"Some of the best teachers provide very little direct information to children. Instead, they ask questions and help children to discover for themselves. Try to practice asking questions that require more than just a "yes" or "no" answer. When you ask a question, *wait for an answer*, don't answer it yourself right away. Here are the kinds of questions you should try to ask:

- How did you figure that out?
- Why does it work that way?
- How do you know?
- Is there another way to do it?
- What do you like about doing this?" (Kulm, *Math Power*, p. xviii).

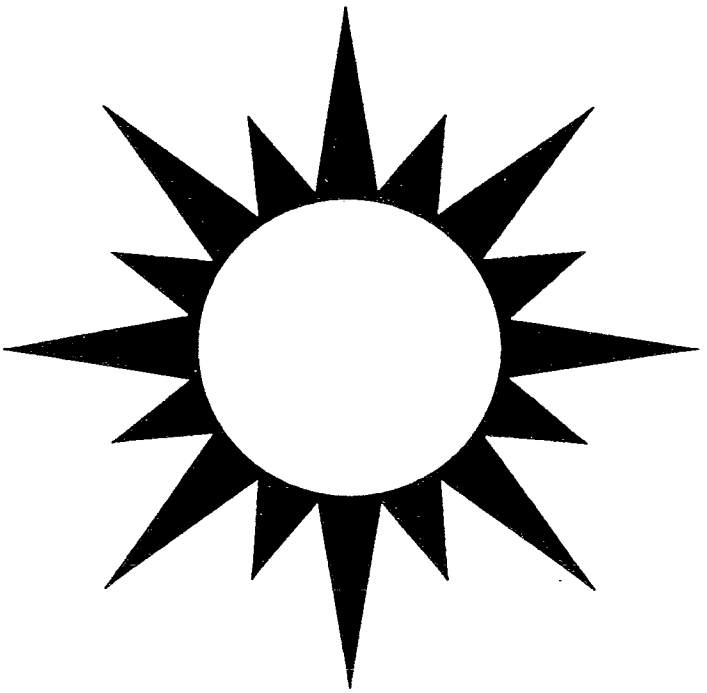
By teaching mathematics as a tool to use in exploring problems and finding solutions, children acquire skills that can serve them throughout their lives.

REFERENCES:

Kulm, G. 1989. *Challenge of the unknown: Community leader's resource guide.* Washington, DC: American Association for the Advancement of Science (AAAS).

Kulm, G. 1990. *Math power.* Washington, DC: American Association for the Advancement of Science (AAAS).

Stenmark, J. K., V. Thompson, and R. Cossey. 1986. *Family math.* Berkeley, CA: Lawrence Hall of Science.



ORGANIZING: WHAT'S IT ALL ABOUT?

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To gain experience collecting, organizing, and interpreting information.

ESTIMATED TIME:

Setting up:	Time to gather materials
Doing activity:	Introduction, about 10 minutes. Activity, about 15–20 minutes, depending on age. Discussion, 10 minutes
Cleaning up:	About 5 minutes

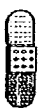
APPROPRIATE AGE GROUPS:

_____K–3 __X__4–6 __X__7–8

DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- ✧ number spinner
- ✧ dominos
- ✧ activity sheets
- ✧ sheet of graph paper



SAFETY CONSIDERATIONS:

None

ENRICHMENT FOR BILINGUAL STUDENTS:

- As archaeologists collect stones and pottery (artifacts) to tell them about past cultures and people, students can collect trash containers from numerous classes. What does the trash tell them about that class? Have students identify and list items under each classroom (classroom #1, etc.) to organize the information. What kind of questions would we expect to answer by looking at each classroom?
- Looking at specific Mayan ruins, what kind of statements could be made about the people and culture (see *Hispanic Culture: Past and Future*).

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- Activity is adaptable for students with hearing impairments.
- Pair students with visual disabilities with nondisabled students. To adapt spinners, glue dried split peas or beans on the edges of the spinners to indicate numbers.

BEFORE YOU BEGIN:

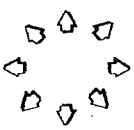
- Lay out dominos for students to distribute.
- Separate out number spinners for distribution (make sure spinners spin freely).
- Set out graph paper.
- Copy activity sheets.
- Make sure work areas are clear .

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- What similarities and differences did you observe between the dominos and spinners in this activity?
- What did you find when you examined the graph comparing dominos and spinners?

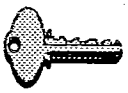
CLEAN UP:

- Collect all dominos (make sure colors are kept separate).
- Have students put spinners back in their plastic cases before they are collected.
- Collect extra graph paper.



WHERE CAN I GO FROM HERE?

Math Power, *Family Math*, and *A Collection of Math Lessons* are all good sources for ideas or activities to continue with spinners (see Book List).



WHY IT'S IMPORTANT:

Children need experience in collecting, organizing, and interpreting information in order to understand outcomes and test predictions or hypotheses. These are important ideas in math and science and in our daily lives.

HOW IT WORKS:

Tables and graphs are ways to organize information and make the information easier to comprehend. In this activity, the spinner or domino sum indicated a number that each child noted in the table after each spin or turn for six trials. Using this information, each child was able to find out more about his/her spinners and dominos by comparing their numbers with those of his/her partner and finding the numbers that appeared more often. Placing (plotting) this information on a bar graph served to highlight further the similarities and differences between using spinners and using dominos.

NOTES

REFERENCES:

Burns, M., and B. Tank. 1988. *A collection of math lessons.* New Rochelle, NY: The Math Solution Publications.

Kulm, G. 1990. *Math power.* Washington, DC: American Association for the Advancement of Science (AAAS).

Stenmark, J. K., V. Thompson, and R. Cossey 1986. *Family math.* Berkeley, CA: Lawrence Hall of Science.

ORGANIZING: WHAT'S IT ALL ABOUT?

ACTIVITY SHEET

1. Spin the spinner six times and have your partner record the results for each spin (trial) on the table below. Trade. Have your partner spin and you record his/her results below.

SPINNERS
Trials

Your name	#1	#2	#3	#4	#5	#6

What number appears most often? What is the highest number in the table?

2. Turn the dominos over so that the blank sides face up. Shuffle by moving the dominos around. Have your partner pick a domino. Record the sum of the domino numbers in your table below. Then return the domino number side down and shuffle again. Each person should do this six times.

DOMINOS
Trials

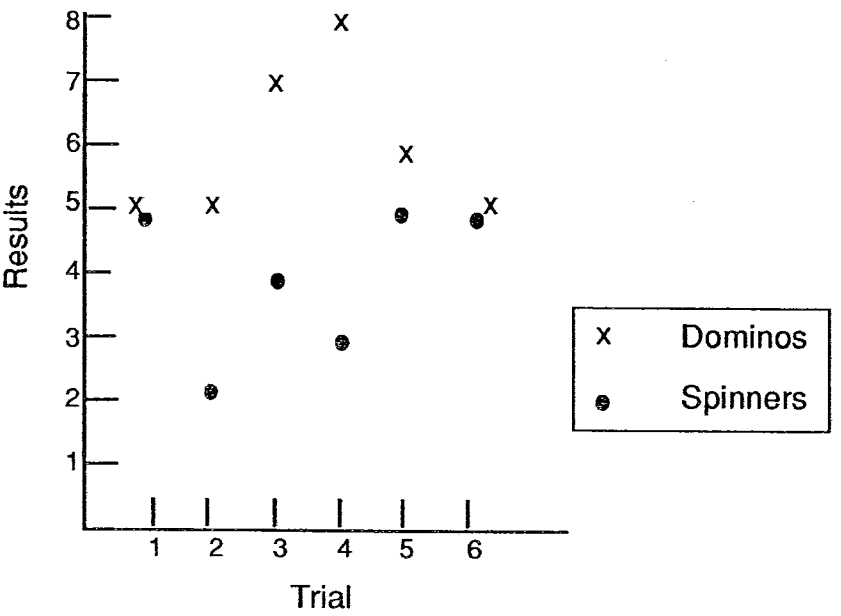
Your name	#1	#2	#3	#4	#5	#6

What sum appears most often? What is the highest sum in this table?

Challenge

3. Study the table shown below. What are the differences and similarities between the spinners and the dominos in this table?

Trials	Spinners	Dominos
#1	5	5
#2	2	5
#3	4	7
#4	3	8
#5	5	6
#6	5	5
Total	24	36
Average	4	6



4. What is the highest total you could get for six spins on the spinner? What is the highest total you could get for selecting six dominos? Which do you expect to have a higher average score?

5. Construct your own graph using the information you and your partner collected. How does your graph compare with the graph above.

ORGANIZACION: ESO ES LO IMPORTANTE

HOJA DE ACTIVIDADES

1. Haga girar la ruleta seis veces y deje que su compañero escriba los resultados en la tabla que se encuentra más abajo. Cambie de turno con su compañero. Deje que su compañero haga girar la ruleta y usted escriba los resultados.

LA RULETA
Pruebas

Nombre	#1	#2	#3	#4	#5	#6

¿Cuál es el número que aparece más frecuentemente? ¿Cuál es el número más alto en la tabla?

2. Voltee los dominós de manera que el lado en blanco quede hacia arriba. Mezcle los dominós y haga que su compañero escoja uno. Escriba en la tabla de abajo la suma que dan los números del dominó. Luego, ponga el dominó junto con los otros y mezclelos nuevamente. Repita esto seis veces y cambie de turno.

DOMINOS
Pruebas

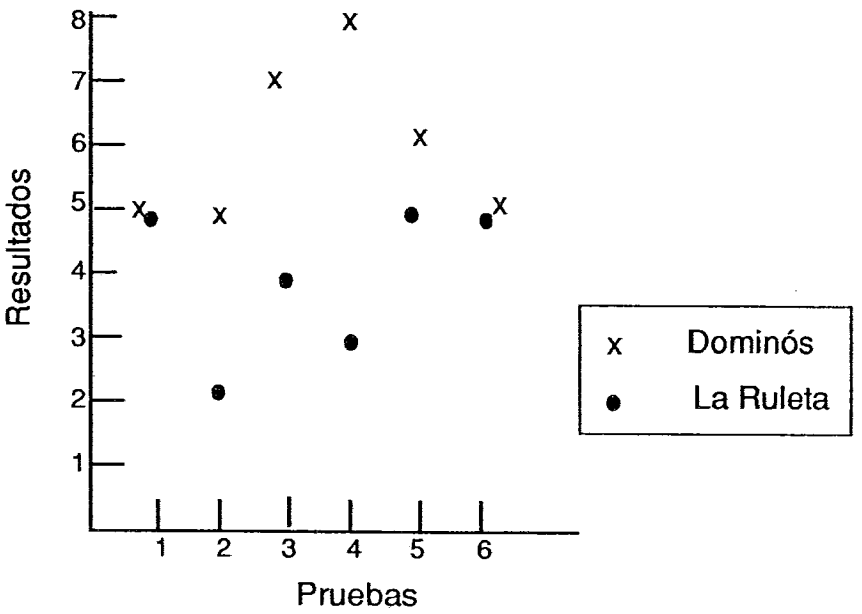
Nombre	#1	#2	#3	#4	#5	#6

¿Qué suma aparece más frecuentemente en la tabla de dominós?¿Cuál es la suma más alta de la tabla?

Reto

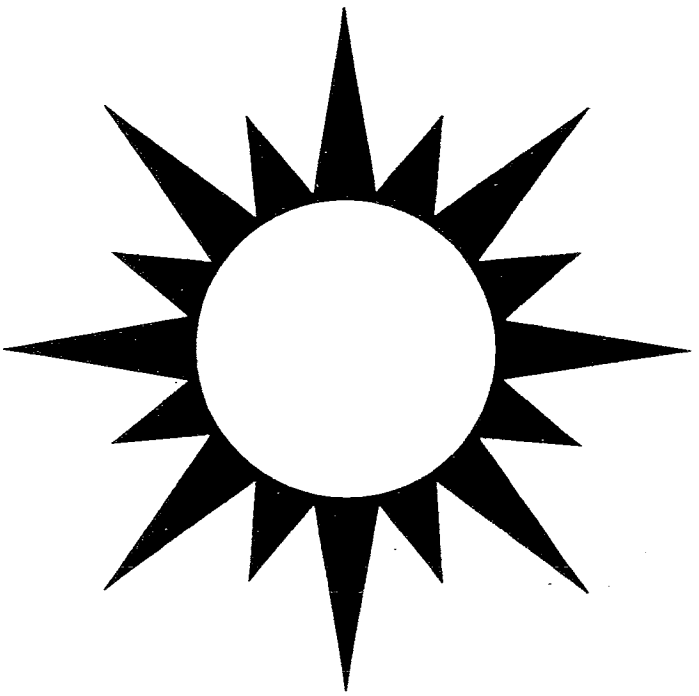
3. Estudie la tabla que se muestra a continuación. ¿Cuáles son las diferencias y las similitudes entre las ruletas y los dominós que se muestran en la table?

Pruebas	La Ruleta	Dominós
#1	5	5
#2	2	5
#3	4	7
#4	3	8
#5	5	6
#6	5	5
Total	24	36
Promedio	4	6



4. ¿Cuál es el mayor total que usted podría obtener si gira la ruleta seis veces? ¿Cuál es el mayor total que podría obtener si selecciona seis dominós? ¿Cuál de los dos tendrá el mayor promedio?

5. Haga su propio gráfico utilizando la información que usted y su compañero han recogido. ¿Cómo se compara su gráfica con la gráfica en el ejercicio #3?



SPINNERS

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To gain experience collecting, organizing, and interpreting information by performing experiments with spinners.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 10–15 minutes with younger children (less for older). Activity, about 20 minutes, depending on age. Discussion, 10 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

_____K–3 __X__4–6 __X__7–8

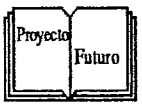
DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- ✧ 1 color spinner
- ✧ 1 recording sheet
- ✧ 2 activity sheets

SAFETY CONSIDERATIONS:

None



ENRICHMENT FOR BILINGUAL STUDENTS:

- Children can do the activity with each color representing a specific Mayan or Inca ruin. For example, blue represents El Charcoal in Chichen Itza, red represents Building J in Monte Alban, and yellow represents Pyramid of the Sun in Teotihuacan.
- Students can choose countries/capitals to match colors, for example, Mexico, Puerto Rico, and Cuba.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- Activity is adaptable for students with hearing impairments.
- Pair students with visual impairments with a partner and use adapted spinner (see *Organizing: What's It All About?* for a description of how to adapt a spinner).

BEFORE YOU BEGIN:

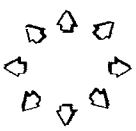
- Set color spinners out and check that spinners spin freely (if spinner packets have not been opened).
- Copy recording sheet and activity sheet.
- Make sure work areas are clear.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- Describe your spinner.
- What do you think saying that a spinner is "fair" or "unfair" means?
- How could you change your spinner to ensure that your spinner is unfair?

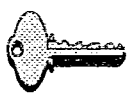
CLEAN UP:

Have students put spinners in their plastic cases and return them.



WHERE CAN I GO FROM HERE?

For middle school children, refer to *Math Power* edited by Gerald Kulm. For younger children, refer to *A Collection of Math Lessons* by Marilyn Burns and Bonnie Tank. (See the Book List.)



WHY IT'S IMPORTANT:

In all aspects of life, it is important to know how to organize and interpret information. Providing experiences in school and out of school, children will develop skills to solve problems in math and in their daily lives.

HOW IT WORKS:

As the spinner is divided, so is the opportunity of getting that number or color. Consequently, if the spinner is divided into fourths, you should have a 25 percent chance of getting a particular color or number each time you spin—that is, if the spinner is *fair* (accurate).

NOTES

REFERENCES:

Burns, M., and B. Tank. 1988. *A collection of math lessons.* New Rochelle, NY: The Math Solution Publications.

Kulm, G. 1990. *Math power.* Washington, DC: American Association for the Advancement of Science (AAAS).

Stenmark, J. K., V. Thompson, and R. Cossey. 1986. *Family math.* Berkeley, CA: Lawrence Hall of Science.

SPINNERS

ACTIVITY SHEET

1. Spin the spinner six times while your partner records the results on the answer sheet. Then change roles: Let your partner spin and you record the results on the answer sheet.

2. Compare the results of your spins.

   a. How are they different or the same?

   b. What color or number appears most often?

   c. Least often?

   d. Not at all?

3. Try it again. What happened this time?

4. Discuss with your partner what would happen if you tried it again. Why?

5. Try it. What happened?

Challenge

6. Organize the information you and your partner collected by constructing a graph of each color or number versus the number of times it came up on the spinner.

Spinners Recording Sheet
*Record Your *
Spin

Example:

Name	Red	Yellow	Green	Blue
Maria	II	I	II	I
John	I			𝍸

Name	Red	Yellow	Green	Blue

Name	Red	Yellow	Green	Blue

Name	Red	Yellow	Green	Blue

IGUALES POSIBILIDADES

HOJA DE ACTIVIDADES

1. Haga girar la ruleta seis veces mientras su compañero escribe los resultados en la hoja de respuestas. Ahora, cambie, su compañero hace girar la ruleta y usted escribe los resultados en la hoja de respuestas.

2. Compare los resultados.

   a. ¿Son iguales o diferentes?

   b. ¿Qué color aparece más frecuentemente?

   c. ¿Menos frecuentemente?

   d. ¿Qué color no aparece nunca?

3. Haga la prueba nuevamente. ¿Qué pasó esta vez?

4. Discuta los resultados con su compañero. ¿Qué pasaría si repite la actividad? ¿Por qué?

5. Haga la prueba. ¿Qué pasó?

6. Haga una gráfica con los resultados en la hoja de respuestas escribiendo los colores en una columna y el número de veces que aparecieron estos colores en la otra.

IGUALES POSIBILIDADES

Hoja de Respuestas

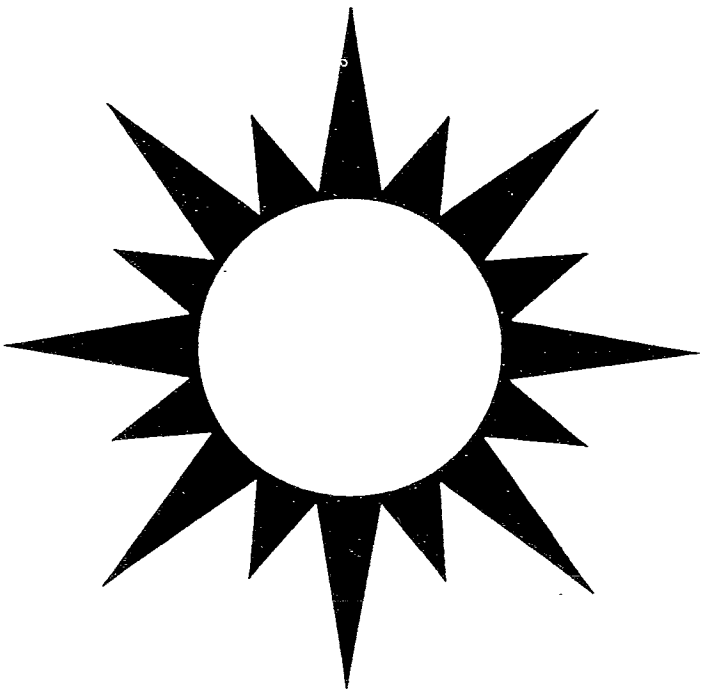
REGISTRE SUS VUELTAS

Ejemplo Nombre	Rojo	Amarillo	Verde	Azul
María	II	I	II	I
Juan	I			𝍸

Nombre	Rojo	Amarillo	Verde	Azul

Nombre	Rojo	Amarillo	Verde	Azul

Nombre	Rojo	Amarillo	Verde	Azul



SORTING AND CLASSIFYING

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To develop the ability to observe similarities and differences; to practice organizing information into a graph; to practice language skills relating abstract ideas to the real world.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 5 minutes and 10 minutes for younger children (start activity as a class separating beans). Activity, about 15–20 minutes, depending on age. Discussion, 10 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

__X__ K–3 __X__ 4–6 _____ 7–8

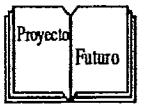
DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- 2 tangram sets (different colors) (See *Supplies and Suppliers*)
- 11 dominos
- 25 dried beans (lima, black, and kidney) for older children
- 2 activity sheets

SAFETY CONSIDERATIONS:

Remind children not to eat dried beans.



ENRICHMENT FOR BILINGUAL STUDENTS:

- Have students do the activity using dried pinto or black beans, dominos, or other familiar small objects. Graph the results of the class.
- Although the word *tangram* will be as unfamiliar to a bilingual child as a nonbilingual child, the ESL child may think he/she is the one not familiar with the word. It is important to emphasize that is not the case.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- Activity is adaptable for students with hearing impairments.
- Pair students with visual disabilities with nondisabled students. Student should explore objects to sort and classify. Additional time needs to be allowed for familiarization and sorting process in each activity.

BEFORE YOU BEGIN:

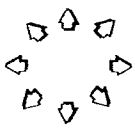
- Set out all packages of beans.
- Set out dominos and tangrams sets.
- Have activity sheets copied.
- Make sure work areas are clear.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- What did you do in each activity to sort the tangram pieces?
- How did you demonstrate how the tangrams and dominos were classified?

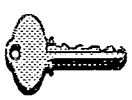
CLEAN UP:

- Collect all tangram pieces and seal them in their packages (make sure sets are complete and colors are the same in each package).
- Collect all dominos (be sure same color dominos stay together).
- Place beans back in packages.



WHERE CAN I GO FROM HERE?

Family Math (see references) and *A Collection of Math Lessons* by Marilyn Burns and Bonnie Tank (see Book List).



WHY IT'S IMPORTANT:

Sorting and classifying are important concepts in mathematics and in everyday problem solving. Many mathematics and science activities depend on having the ability to recognize similarities and differences. This ability assists us in recognizing patterns, an important key in advanced mathematics and science and equally important in our daily lives.

HOW IT WORKS:

Tangram pieces can be divided by shape, size, number of sides, or colors, while the dominos can be divided by even or odd sums; odd, even, or both numbers showing; color; and/or sum being divisible by a particular number. The challenge presents an exercise in examining similarities and differences using beans that can be sorted by color, size, and/or shape.

NOTES

REFERENCES:

Burns, M., and B. Tank. 1988. *A collection of math lessons.* New Rochelle, NY: The Math Solution Publications.

Shimek, W. 1969. *Patterns: What are they?* Minneapolis, MN: Lerner Publications Company.

Stenmark, J. K., V. Thompson, and R. Cossey. 1986. *Family math.* Berkeley, CA: Lawrence Hall of Science.

SORTING AND CLASSIFYING

ACTIVITY SHEET

1. Working with your partner, sort the tangram pieces into two or more groups. For example, one way to separate is by the number of sides each piece has. Describe what you did.

2. Pick one of the ways you sorted. Draw how you sorted the pieces without using words.

3. Repeat #1 and #2 with dominos.

4. Name two things you sort at home and how they are sorted. For example, socks are sorted by color.

Challenge

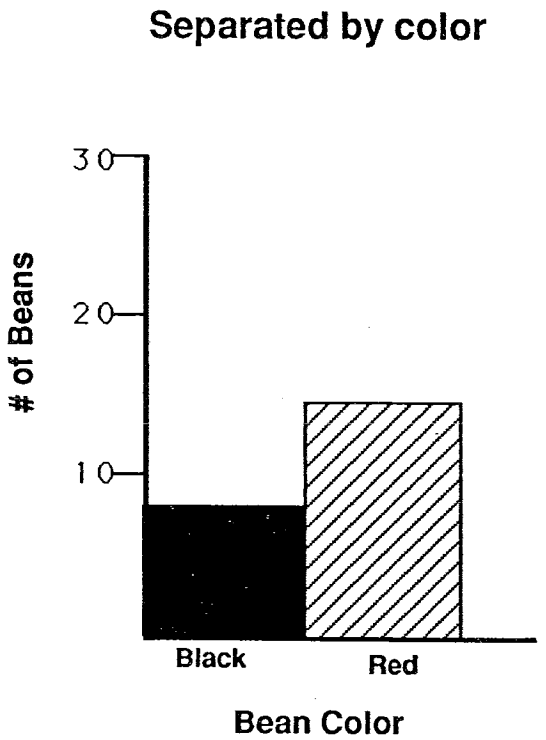
5. Do #1 with beans and tally your sorting.

   Example:

Type of Bean	# of Beans
Black	𝍸 III

6. Separate beans a different way and create a bar graph to show your work.

   Example:



7. Why do you think sorting is important?

COMO SELECCIONAR Y CLASIFICAR

HOJA DE ACTIVIDADES

1. Con su compañero, separe (clasifique) las piezas del tangrama de dos o más maneras diferentes. Por ejemplo, una manera de clasificar es por el número de lados que tiene cada pieza. Describa lo que hizo.

2. Escoja una de las maneras en que separó las piezas. Dibuje la manera como separó las piezas del tangrama.

3. Repita el ejercicio #1 y el #2 utilizando los dominós.

4. Nombre dos cosas que clasifica en su casa y cómo lo hace. Por ejemplo: los calcetínes se separan de acuerdo al color.

Reto

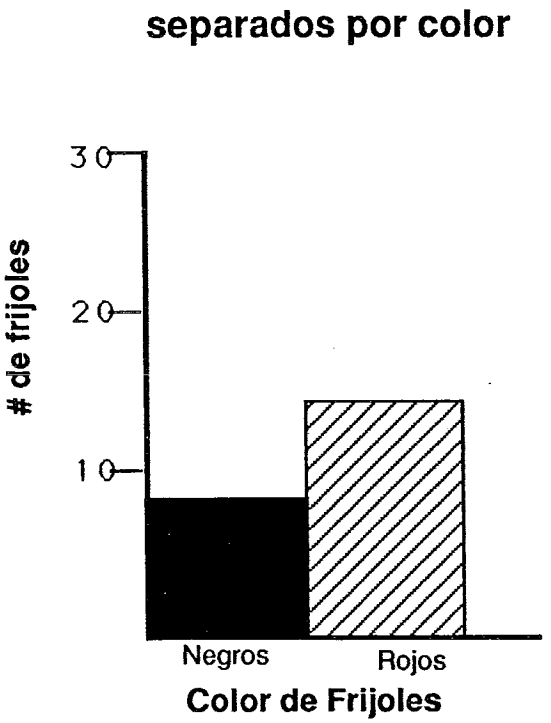
5. Haga el ejercicio #1 utilizando frijoles y lleve cuentas de lo que separó.

   Por ejemplo:

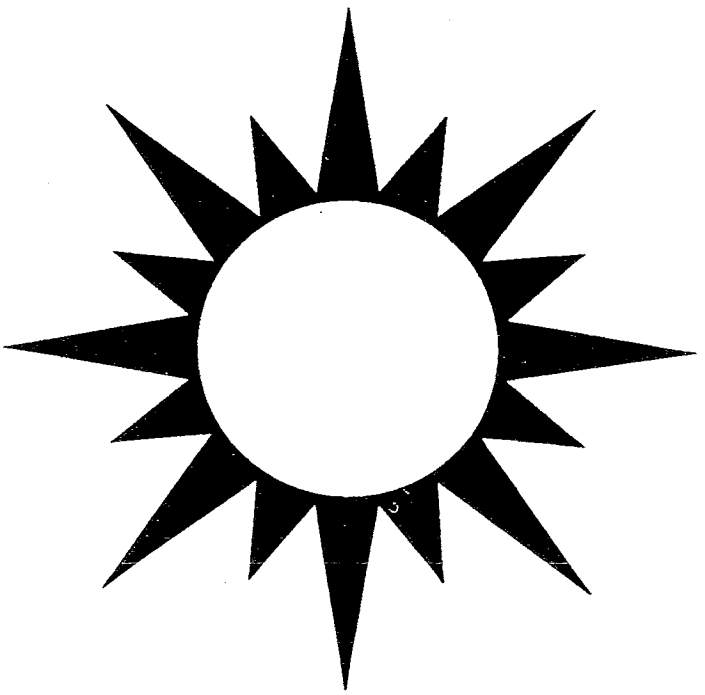
tipo de frijol	**# de frijoles**
negro	𝍸 III

6. Separe los frijoles de manera diferente y haga un gráfico con barras o columnas para mostrar su trabajo.

   Por ejemplo:



7. ¿Por qué es importante saber separar (clasificar)?



SYMMETRY

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To develop ideas about symmetry, images, and visualization.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, exploring line symmetry, about 10 minutes with younger children (less for older). Activity, about 15–20 minutes, depending on age. Discussion, 10 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

_X_ K–3 _X_ 4–6 _____ 7–8

DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- 2 mirrors
- 2 tangram sets (different colors)
- 2 activity sheets

SAFETY CONSIDERATIONS:

None

ENRICHMENT FOR BILINGUAL STUDENTS:

- Discuss differences they found between English and Spanish words: for example, *mom* vs. *ama* or *deed* vs. *bobo*.
- Have students explore symmetry in the Mayan, Inca, and/or Aztec ruins (see *Hispanic Culture: Past and Future* for reference books). Students could use mirrors to check for symmetry of each ruin they identified as symmetrical.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is adaptable for students with hearing impairments.
- ✧ Pair students with visual impairments with nondisabled students. Student should be given time to explore objects and then asked to divide the letters, words, or tangram pieces in half. To replace the portion of this activity that uses mirrors, students can trace each tangram piece on a sheet of paper. The nondisabled students could cut out the traced shaped and then allow the student with visual impairment to feel the shape and divide it in half by folding the paper. Ask the students to feel the new shape and describe how it is different.

BEFORE YOU BEGIN:

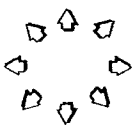
- ✧ Set out mirrors and tangram sets in color piles.
- ✧ Copy activity sheets.
- ✧ Draw letters on blackboard divided horizontally and vertically.
- ✧ Draw a parallelogram on the blackboard or poster board.
- ✧ Make sure work areas are clear.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- ✧ What do you do in these activities that is similar to cutting an apple in half?
- ✧ What do the objects you divided in half have in common?

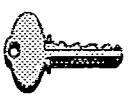
CLEAN UP:

- ✧ Collect all tangrams and seal them in their packages (make sure colors are the same in each package).
- ✧ Collect all mirrors.



WHERE CAN I GO FROM HERE?

Other books with symmetry activities: *Family Math* and *A Collection of Math Lessons* (see Book List).



WHY IT'S IMPORTANT:

In our vocabulary and in nature we find symmetry. Understanding the concept of (line) symmetry enables the child to prepare for advanced mathematic concepts as well as to understand better the world around us. For the bilingual child, this activity also helps to incorporate words into his/her vocabulary whether in English or Spanish.

HOW IT WORKS:

A letter that is cut in half will have line symmetry if you can take one half of the letter, flip it over, and consequently produce the other half of the letter. The two ways to flip the cut or divided letters are over a horizontal line and over a vertical line.

NOTES

REFERENCES:

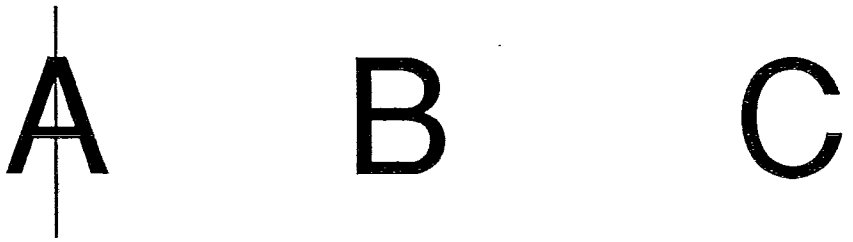
Arnold, C. 1984. *Measurements: Fun, facts, and activities.* New York: Franklin Watts, Inc.

Kulm, G. 1989. *Challenge of the unknown: Community leader's guide.* Washington, DC: American Association for the Advancement of Science (AAAS).

SYMMETRY

ACTIVITY SHEET

1. Draw a line to divide in half the letters below.
   Example:



   Use mirror to check if you divided the letter correctly. Place mirror on the line—you should see the whole letter again.

2. Print the rest of the alphabet in block form, as in #1, on the back of the activity sheet.

   A. Divide the letters into two parts that are exactly alike. (Draw the lines as you did in #1.)
   B. Use your mirror to check your answers.

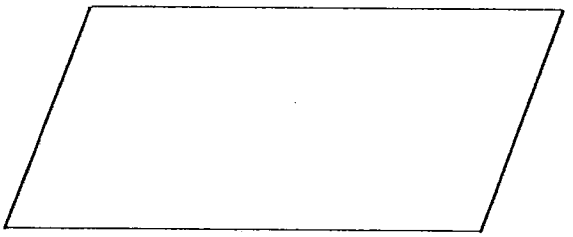
3. Which letters of the alphabet do not divide in half symmetrically?

4. Find words that can be divided in half by drawing a vertical (I) or horizontal (—) line.
   Examples in English and Spanish:

5. Take out tangram pieces. Without using your mirrors, can you tell whether all the shapes can be divided in half? Try using your mirrors to divide the shapes. What happened? Why?

Challenge

6. How could you change a parallelogram to divide it in half? Use your tangram parallelogram piece and any other tangram piece to check.

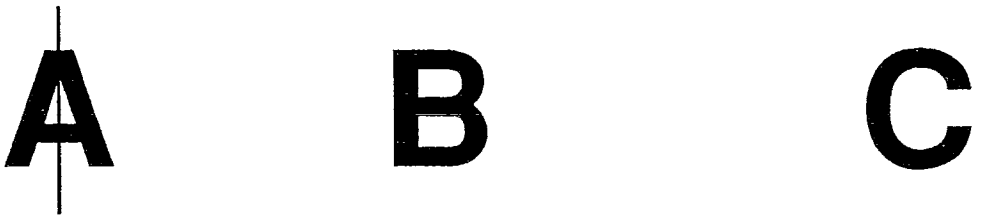


Parallelogram

SIMETRIA

HOJA DE ACTIVIDADES

1. Divida las letras en dos partes exactamente iguales.
   Ejemplo:



2. Escriba las letras del alfabeto en forma de bloque (como en el ejercicio #1). Use la parte de atrás de la hoja de actividades.
   A. Divida las letras como hizo en el ejercicio #1.
   B. Use el espejo para verificar. Coloque el espejo sobre la línea. Usted debe ver la letra completa.

3. ¿Cuántas letras del alfabeto hay que no se pueden dividir?

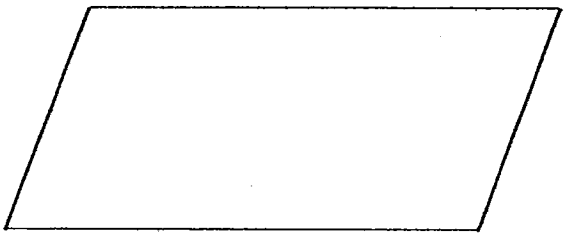
4. Busque palabras, en inglés y en español, que cuando se dividan por el medio con una línea vertical (l) o una línea horizontal (—) como resultado tengan dos mitades exactamente iguales.

   Ejemplo:

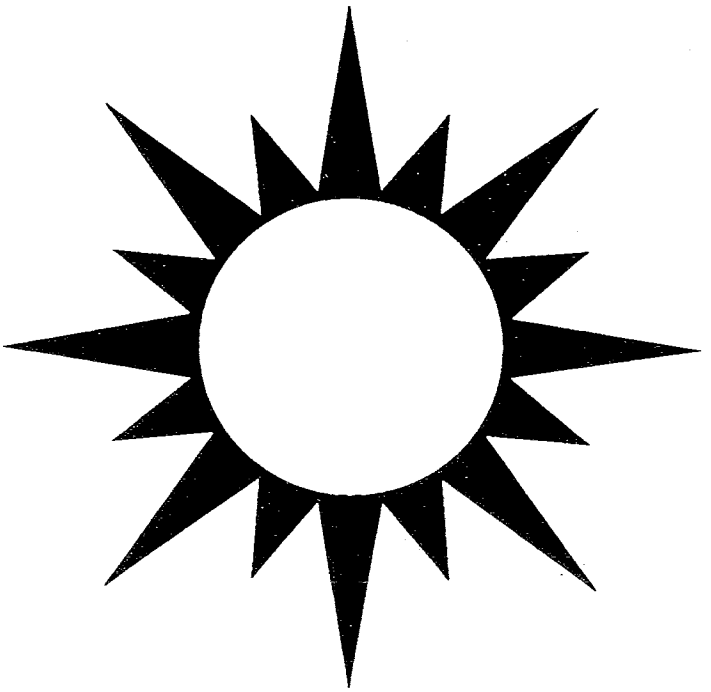
5. Trabaje con los pedazos del tangrama, sin usar el espejo. ¿Se pueden dividir todos los pedazos del tangrama? Use el espejo para dividir los pedazos del tangrama. ¿Qué pasó? ¿Por qué?

Reto

6. ¿Cómo puede cambiar el paralelogramo para poder dividirlo en dos partes exactamente iguales? Use otras figuras del Tangrama.



Paralelogramo



THE PLANE, THE PLANE!

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To develop an understanding of the four quadrants of the Cartesian graph; to become familiar with graphing points on the Cartesian plane.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 10 minutes. Each activity, about 15–20 minutes, depending on age. Discussion, 10 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

_____K–3 _____4–6 __X__7–8

DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- 2 Cartesian plane graphs (depending on the activity)
  - first-quadrant graph paper
  - four-quadrants graph paper
- 2 activity sheets

SAFETY CONSIDERATIONS:

None

ENRICHMENT FOR BILINGUAL STUDENTS:

The AAAS publication *Stepping Into the Future: Hispanics in Science and Engineering* (1992) includes a series of biographies, including some written by students. Use the names and biographies of Hispanic science and engineering role models to do the following activities:

a. Have students spell out the name of a role model by matching coordinates and letters of the names. Challenge other students to discover the name of the role model using those coordinates.
b. Have students match coordinates with states or countries where the role model was born and currently lives, and list the coordinates between those states or countries to demonstrate the distance.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is adaptable for students with hearing impairments.
- ✧ For students with visual impairments, students can locate points using a geoboard and rubber bands. Lay out bands to highlight the plane. The student can mark points with small rubber bands, pieces of tape, or even marshmallows! Have the student get a feel of the plane and then have him/her locate the intersection given as stated in the activity sheet.

BEFORE YOU BEGIN:

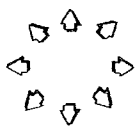
- ✧ Set out copies of the Cartesian plane graph that you'll be working with. Have extra copies ready.
- ✧ Copy activity sheets.
- ✧ Make sure work areas are clear.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- ✧ What are important things to remember in locating points on the plane?
- ✧ What do you suppose the ordered pair (0,0) is called? (The *origin*). Why?

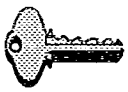
CLEAN UP:

Collect extra graph paper and return to packet.



WHERE CAN I GO FROM HERE?

Challenge of the Unknown: Community Leader's Guide and NCTM's *The Arithmetic Teacher*. (See Book List.)



WHY IT'S IMPORTANT:

Cartesian graphs are used in nearly every area of work today. For example:

- ✧ The doctor graphs a child's height versus weight to check his/her growth rate.
- ✧ A research pharmacist graphs the amount of antibiotic in an animal's blood over time to check how often a dose of medicine should be given.
- ✧ Newspapers print graphs of interest rates versus mortgage down-payment size.
- ✧ Weather forecasters graph average temperatures versus months of the year.

An understanding of how to plot and interpret graphs is essential for all children today.

HOW IT WORKS:

Moving first horizontally and then vertically, each ordered pair can be located on the grid (better known as the *Cartesian plane*). The student will realize that the ordered pairs in #2 of the first activity are following a pattern wherein the first member of the ordered pair goes up by one but the second follows a different pattern.

REFERENCES:

Foster, L. 1989. *Checkboard Press mathematics encyclopedia.* New York: Checkboard Press.

Kulm, G. 1990. *Math power.* Washington, DC: American Association for the Advancement of Science (AAAS).

Luce, M. 1969. *Points, lines and planes.* Minneapolis, MN: Lerner Publications Company.

Stenmark, J. K., V. Thompson, and R. Cossey. 1986. *Family math.* Berkeley, CA: Lawrence Hall of Science.

NOTES

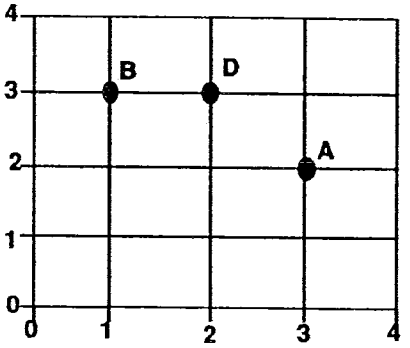
THE PLANE, THE PLANE I

ACTIVITY SHEET

You will need:

- graph paper
- pencil

First Quadrant



1. Follow the steps below with your partner to locate the ordered pairs on the grid provided.

   a. What letter appears at (3,2)?
   This indicates to go across the graph paper three lines and up two lines.

   b. What letter appears at (2,3)?
   Go across two lines and up three lines. Is this letter different from the one you found at (3,2)?

   c. What are the coordinates for the letter **B**?

   d. Make a mark on the coordinates (2,0).

2. Using one of the graph papers, locate the following ordered pairs:

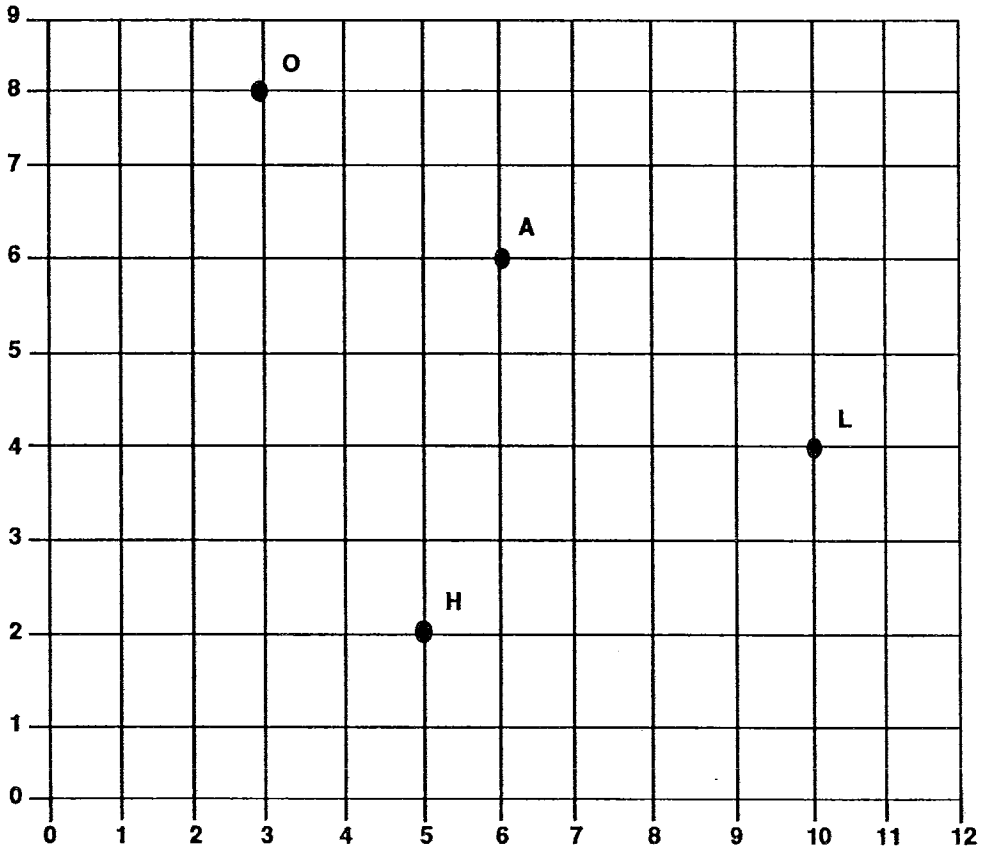
   (2,2): label it C (3,3): label it D
   (4,5): label it E (5,6): label it F

   If you would continue this pattern, what would be the number for the next ordered pair? And the one after that?

Challenge

3. Transfer the example below onto your graph paper with the ordered pairs (5,2), (3,8), (10,4), (6,6) and the letters accompanying those points.

First Quadrant



Using these letters, what do the points spell? (Clue: write the letters in the order given above.)

4. Select a word. Pick points for each letter on a sheet of graph paper and write out the Cartesian code for your word. Exchange your code and graph with your partner. See if you can solve your partner's puzzle while he/she solves yours.

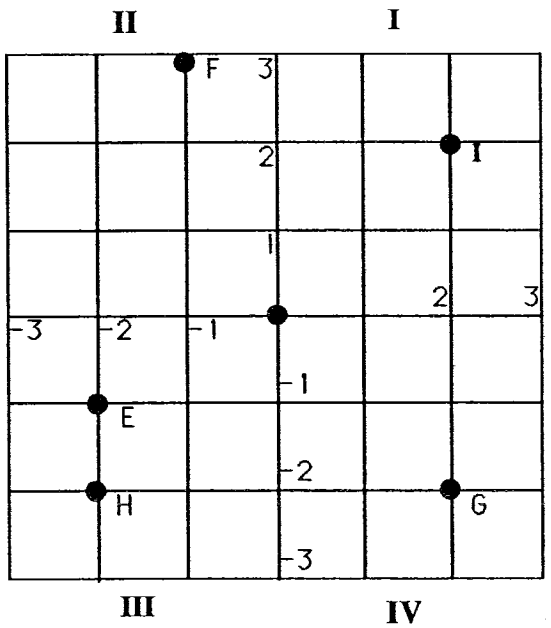
THE PLANE, THE PLANE II

ACTIVITY SHEET

In the previous activity, *The Plane, The Plane I,* you graphed points in what is called the **first quadrant** (or quarter) of the **Cartesian plane** (a common type of grid for graphing numbers). In this activity you'll work with all four of the Cartesian plane quadrants (see below).

You will need:

- ✧ graph paper
- ✧ pencil



1. With your partner, follow the steps below using the graph shown on the left.
   a. Locate the coordinate (ordered pair) (0,0). Put the letter **O** next to it.
   b. What are the coordinates of **F**? We move one left and three up to find **F**.
   c. Where is **G**? Go two right and two down to find **G**.
   d. What is the ordered pair at **E**?
   e. What are the coordinates of **H** and **I**? What is the difference between these coordinates and the coordinate for **G**?
   f. Mark an **X** on (0,-2).

2. Use the graph paper provided by your teacher, to locate points:

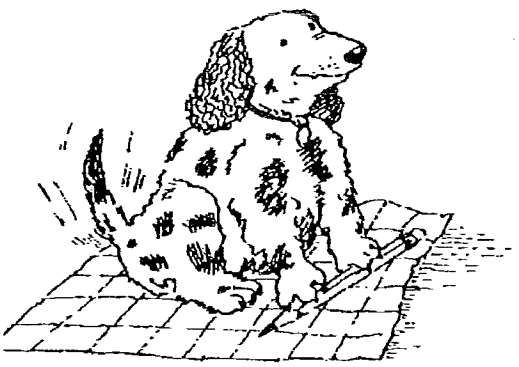
(1,1): label it Q	(-1,1): label it T
(2,2): label it R	(-1,-1): label it U
(-2,2): label it S	(-2,-2): label it V

What would be the next ordered pair in the first quadrant? Why do you think so?

3. What is the most important point to remember in locating coordinates?

Challenge

4. Select a word. Pick points for each letter of your word throughout the four quadrants and write out the "Cartesian code" for your word. Exchange with your partner to decode his/her message.



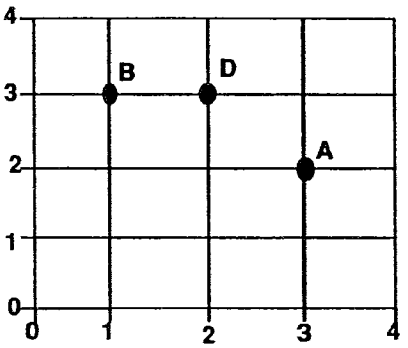
¿QUE PLANO? EL CARTESIANO I

HOJA DE ACTIVIDADES

Se necesita:

- ✧ papel de gráfico
- ✧ un lápiz

Primer Cuadrante



1. Use el dibujo que está a la derecha para responder la siguiente serie de preguntas y para encontrar los puntos:

   a. ¿Qué letra está en el (3,2)? Esto le indica que debe atravesar tres líneas y subir dos líneas.

   b. ¿Qué letra esta en el (2,3)? Cruce dos líneas y suba tres líneas.¿Es está letra diferente a la que encontró en (3,2)?

   c. ¿Cuáles son las coordenadas de la letra **B**?

   d. Ponga una marca en el (2,0).

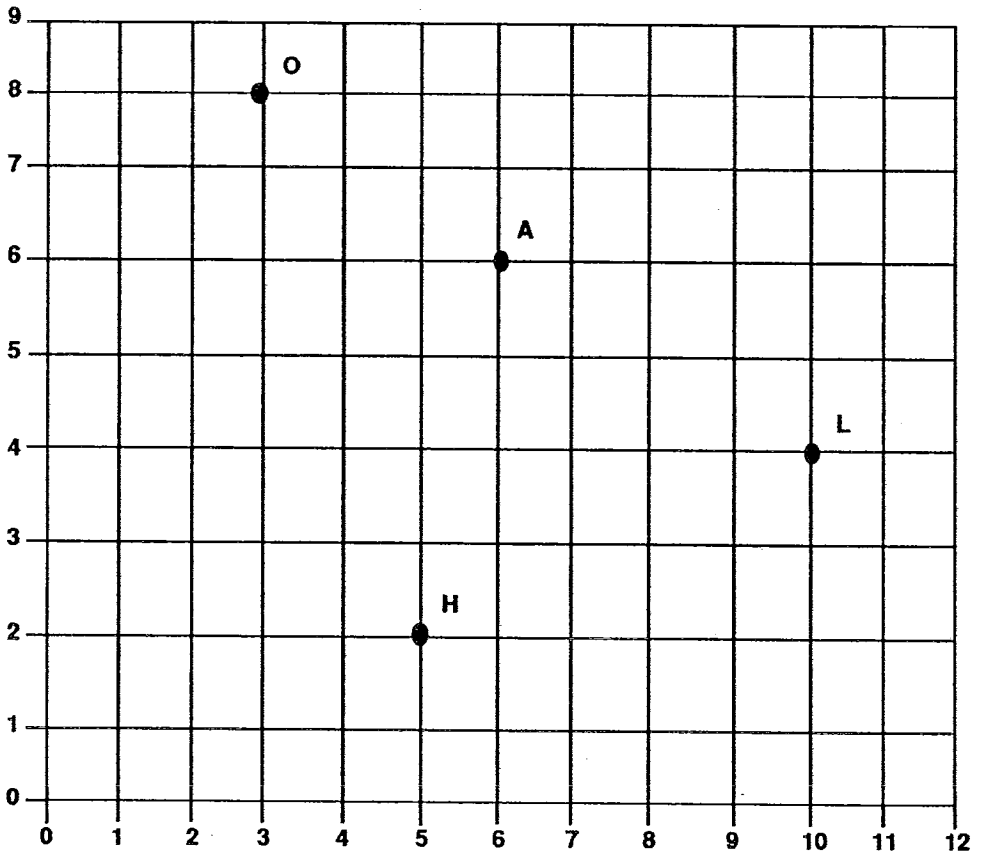
2. Utilice un pedazo grande de papel el gráfico para encontrar los siguentes pares ordenados:

   (2,2): marque este punto con la letra C
   (3,3): marque este punto con la letra D
   (4,5): marque este punto con la letra E
   (5,6): marque este punto con la letra F

   Si continuá, ¿Cuál será el próximo par ordenado? ¿Y después de ese par ordenado? ¿Por qué?

RETO

3. Usando su papel gráfico, marque los pares ordenados (5,2), (3,8), (10,4), (6,6) y las letras correspondientes tal como se ve en el ejemplo.



Si escribe las letras en el mismo orden que los pares ordenados, ¿qué palabra encuentra?

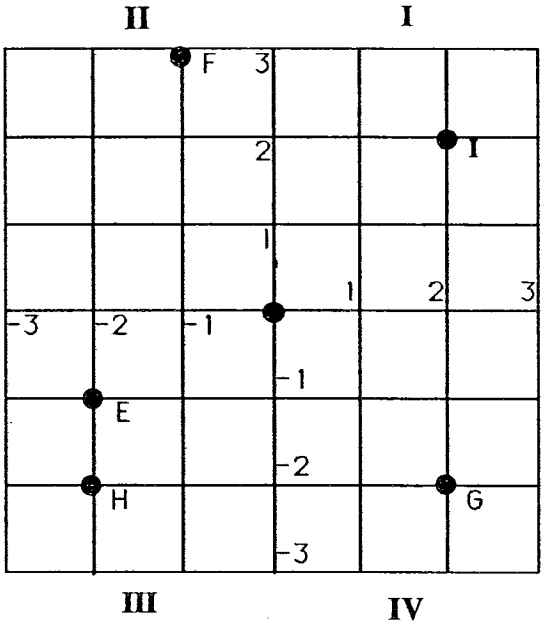
4. Invente sus propios problemas e intercámbielos con su compañero. Seleccione una palabra y ponga cada letra en diferentes puntos del plano. Luego, escriba su código para la palabra e intercambie planos con su compañero. Vea si puede adivinar la palabra que su compañero escogió

¿QUE PLANO? EL CARTESIANO II

HOJA DE ACTIVIDADES

En la actividad anterior *¿Qué Plano? El Cartesiano I,* usted localizó puntos en el **primer cuadrante** del **plano cartesiano** (un tipo de cuadrícula que se usa para representar números gráficamente). En esta actividad, usaremos los cuatro cuadrantes del plano cartesiano (vea la gráfica debajo).

Se necesita: ✧ Papel gráfico y un lápiz.



1. Use el gráfico que está a la izquierda para responder las siguientes preguntas:
   a. Escriba la letra "O" al lado de las coordenadas (0,0).
   b. ¿Cuáles son las coordenadas de **F**? Nos movemos 1 a la izquierda y 3 hacia arriba para llegar a **F**.
   c. ¿Dónde está **G**? Vaya 2 a la derecha y 2 hacia abajo.
   d. ¿Cual es el par ordenado que se encuentra en **E**.
   e. ¿Cuáles son las coordenadas de **H** y de **I**? ¿Cuál es la diferencia entre estas y las coordenadas de **G**?
   f. Escriba una X en (0,-2).

2. Utilice las hojas de papel gráfico de cuatro cuadrantes para encontrar las siguientes coordenadas:

   (1,1): marque este punto con la letra Q
   (2,2): marque este punto con la letra R
   (-2,2): marque este punto con la letra S
   (-1,1): marque este punto con la letra T
   (-1,-1): marque este punto con la letra U
   (-2,-2):: marque este punto con la letra V

   ¿Cuáles serán las próximas coordenadas (par ordenado) en el primer cuadrante?

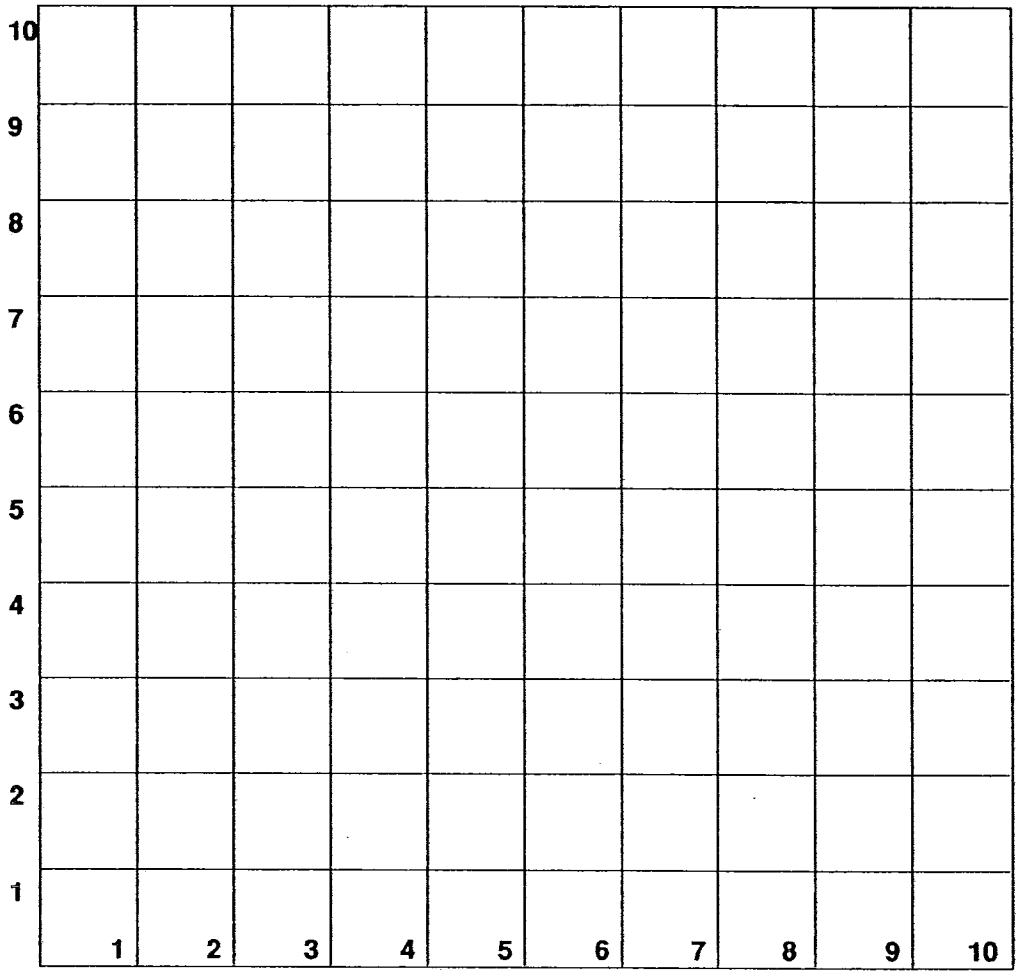
3. ¿Cuál es la cosa mas importante que tiene que tener en cuenta para encontrar las coordenadas (los pares ordenados)?

4. Seleccione una palabra y coloque cada letra en una coordenada (par ordenado) en los cuatro cuadrantes. Escriba "el código Cartesiano" para su palabra. Intercambie su código con el de su compañero y trate de descifrar el mensaje.

Cartesian Plane/El Plano Cartesiano

First Quadrant/Primer Cuadrante

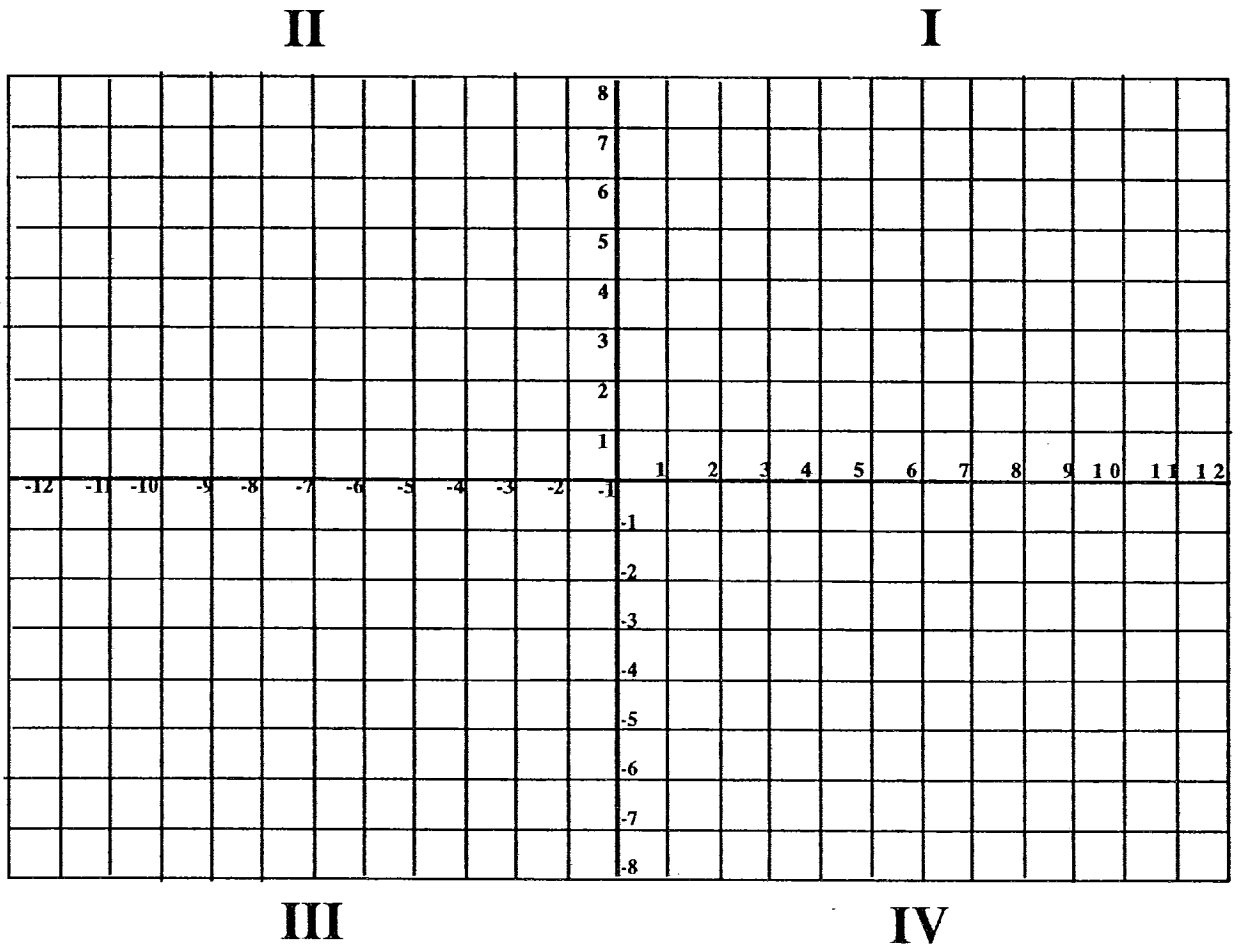
Graph Paper

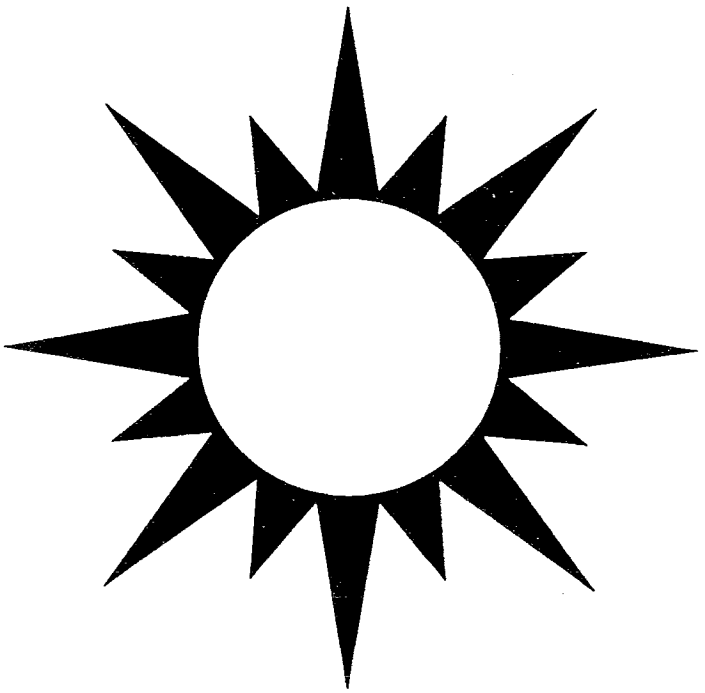


Cartesian Plane/El Plano Cartesiano

Four Quadrants/Los Cuatro Cuadrantes

Graph





ESTIMATION CONTEST

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT

To apply estimation as a strategy to solve a number problem; to practice using estimation.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 5 minutes. Activity, about 10–15 minutes. Discussion, 5 minutes
Cleaning up:	About 5–10 minutes

APPROPRIATE AGE GROUPS:

_____K–3 __X__4–6 _____7–8

DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- 1 piece of waxed paper
- 1 paper cup, 8 or 9 oz. (250 ml)
- toasted oat "Os" cereal (enough to fill the cup)
- 2 activity sheets
- 1 32-oz. (1,000-ml) container filled with toasted oat cereal. (Note: You need only one for the whole class.)

SAFETY CONSIDERATIONS:

Let children know whether they may or may not eat the cereal bits.

ENRICHMENT FOR BILINGUAL STUDENTS

See *Sorting and Classifying* "Enrichment for Bilingual Students."

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is easily adaptable for students with hearing impairments.
- ✧ Pair students with visual impairments with nondisabled partners. Tell the students the capacity of the large container and small cups. Allow students to open the large container and feel how full it is of cereal bits. Assist students in reading the volume markers on the sides of the container (if any) and to use the calculator.

BEFORE YOU BEGIN:

- ✧ Get out waxed paper; precut sheets for each group.
- ✧ Set out sealed container of cereal bits and cold cups. The first time you do this activity, you must count the number of cereal bits you put into the sealed container. Keep this number written in your book for future reference.
- ✧ Have activity sheets copied.
- ✧ Make sure work areas are clear.
- ✧ Set out boxes of cereal.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

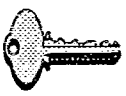
- ✧ What kind of information do you need to make an estimate?
- ✧ How could you make your estimate more accurate? (The cereal bits may pack into the small cup differently if you dump them out and start over. To increase the accuracy of your estimate, repeat the small cup count several times and take an average. Or, for a similar effect, pool the findings of several persons and take an average.)
- ✧ What's the difference between an estimate and a guess?

CLEAN UP:

- ✧ Throw away waxed paper and extra cereal.
- ✧ Put away sealed container of cereal.
- ✧ Collect all cups not used; throw away the used ones.
- ✧ Seal unused cereal.

WHERE CAN I GO FROM HERE?

See *Family Math, Challenge of the Unknown Community Leader's Resource Guide,* and/or *Challenge of the Unknown: Teaching Guide.* (See Book List.)



WHY IT'S IMPORTANT:

We use estimation each day to decide what time to get up; when to leave for work or school; how much food to buy or cook; how much water, juice, or milk to pour into our glass; how much shampoo to squeeze into our hand, and more. The list is endless.

WHY IT'S IMPORTANT: *continued*

Estimation is one of the most valuable concepts in mathematics and science. This measuring tool is used widely in numerous careers and in all areas of our everyday lives. Providing opportunities for the child to explore how estimating works in different situations will assist him/her to understand and easily use this important tool.

HOW IT WORKS:

You have a 32-oz. (or 1,000-ml) container filled with cereal and an 8-oz. (or 250-ml) cup. What is your estimate of the number of cereal bits in the large container? One way to solve this problem is by using the following logic:

$$\frac{\text{volume of container}}{\text{volume of cup}} = \text{number of full 8-oz. cups needed to fill large container}$$

Therefore

$$\frac{32 \text{ oz.}}{8 \text{ oz.}} = 4 = \text{number of 8-oz. cups needed to fill large container}$$

If I count 223 cereal bits in my cup, then my estimate would be:

$$\text{4 cups x 223 cereal bits in an 8-oz. cup} = \text{892 cereal bits in the 32 oz. container}$$

REFERENCES:

Matyas, M., J. B. Combs, and E. Ehrenfeld. 1991. *Girl Scouts, science and mathematics: Linkages for the future.* Washington, DC: American Association for the Advancement of Science (AAAS).

NOTES

ESTIMATION CONTEST

ACTIVITY SHEET

You will need:

- ✧ a cup (8 or 9 ounce)
- ✧ sufficient number of cereal bits (enough to fill your cup and still have some left over)
- ✧ a sheet of waxed paper

1. Given the following materials, how could you get an estimate of the number of the cereal bits in the large container that your teacher showed you? Try it.

2. What can you do to make your estimate more accurate?

3. We all make estimates every day. Each time you estimate, you have to have some information (as reference) before you can make a good estimate. What kind of information would you use in making the following estimates:

   a. You're going through a buffet line at a birthday party. How do you decide how much of each food to put on your plate?

   b. The bus will pick you up at 7:45 a.m. to take you to school. How do you decide what time to set your alarm so you can make it to the bus on time?

   c. Your family of four is expecting three relatives to visit for a special dinner. How do you estimate how much food to buy for the special dinner? How would the ages of the children in your family and your visitors affect your estimates?

   d. You're going on a field trip to a science museum in a nearby city. If you plan to take public transportation, buy your lunch, and buy a souvenir, how much money should you take with you? What if you are taking a car pool? Can you determine the distance and the car's approximate gas mileage to figure out how much money each person in the car should contribute for gas?

PRUEBA DE ESTIMACION

HOJA DE ACTIVIDADES

Se necesita:

- ✧ un vaso (puede ser de 8 ó 9 onzas)
- ✧ suficientes pedacitos de cereal (de manera que llen en el vaso y todavía sobren pedacitos)
- ✧ un pedazo de papel parafinado

1. Busque una manera de estimar cuantos pedacitos de cereal cheerios caben en el pote grande que la maestra le mostró.

2. ¿Qué puede hacer para obtener un estimado más preciso?

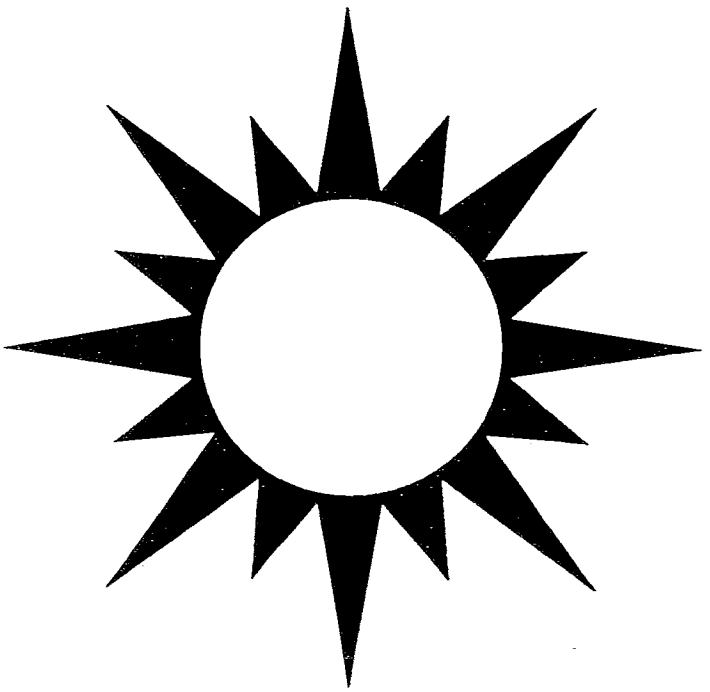
3. Todos los días tenemos que hacer estimaciones. En cada uno de los siguientes problemas, usted necesita cierta información para hacer una buena estimación. ¿Qué clase de información usaría para hacer las siguientes estimaciones?

   a. Se encuentra en fila para servirse la comida en una fiesta infantil. ¿Cómo hace para saber cuánta comida debe poner en su plato?

   b. El autobús lo recoje a las 7:45 de la mañana para llevarlo a la escuela. ¿Cómo hace para saber a qué hora debe poner el reloj de manera que pueda tomar el autobús a tiempo?

   c. Su familia que está formada de 4 personas espera la visita de tres familiares más. ¿Cómo puede hacer para saber cuánta comida debe comprar para la cena? ¿De qué manera la edad de los niños de la familia y la de los visitantes puede afectar su estimación?

   d. Va con la gente de su escuela a visitar el museo de ciencias en una ciudad cercana. ¿Cuánto dinero debe llevar para pagar el transporte público, su almuerzo y comprar un recuerdo? ¿Cuánto debe llevar si va en el automóvil de otra persona? ¿Puede calcular la distancia y el consumo de gasolina por milla del automóvil, para saber cuánto dinero debe contribuir cada persona para comprar la gasolina?



FOUR-TRIANGLE PROBLEM

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To explore spatial relationships and geometric concepts; to sort, classify, and graph shapes.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 5 minutes to explore tangram sets. Activity, about 15–20 minutes, depending on age. Discussion, 10 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

_X_ K–3 _X_ 4–6 _____ 7–8

DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

- ✧ 2 sets of tangrams of 2 different colors (7 pieces each) (See *Supplies and Suppliers*)
- ✧ 2 activity sheets

SAFETY CONSIDERATIONS:

None

ENRICHMENT FOR BILINGUAL STUDENTS:

- ✧ Although the word *tangram* will be as unfamiliar to a bilingual child as a nonbilingual child, the ESL child may think he or she is the one not familiar with the word. It is important to emphasize that is not the case. All children will find the word *tangram* different. The activity will seem like working on a puzzle.
- ✧ Discuss differences found between unfamiliar Spanish/English words used to describe shapes (cuadrado/square; paralelogramo/parellelogram). Have children compare shapes with shapes found in Mayan ruins (see *Hispanic Culture: Past and Future* for reference books). How do the shapes compare? Have them find shapes in their clothes (ponchos) and jewelry. How do the shapes compare?

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is adaptable for students with hearing impairments.
- ✧ Students with motor impairments or visual impairments may need to work with partners.

BEFORE YOU BEGIN:

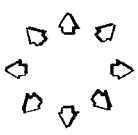
- ✧ Set out tangram packages, keeping colors separated.
- ✧ Have activity sheets copied.
- ✧ Make sure work areas are clear.
- ✧ Draw a parallelogram on the chalkboard.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- ✧ How many shapes did you get with two triangles?
- ✧ How many shapes did you get with four triangles? Draw one of your shapes on the chalkboard.
- ✧ What shape was formed most often?

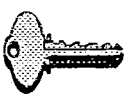
CLEAN UP:

- ✧ Collect all tangram pieces and seal them in their packages; make sure colors are the same in each package.
- ✧ Make sure each package contains two large triangles of the same color



WHERE CAN I GO FROM HERE?

For more activities, see *A Collection of Math Lessons* by Marilyn Burns and Bonnie Tank and *Math Power,* edited by Gerald Kulm (see Book List).



WHY IT'S IMPORTANT:

Children need opportunities to explore shapes in order to develop the spatial reasoning skills that are important in mathematics.

HOW IT WORKS:

Using only two tangram triangles (and following the "Rule") there are two shapes that can be made: a square and a larger triangle. However, with four triangles the number of shapes increases. A tally chart will demonstrate what shape occurs most. To provide another way of identifying and sorting the configurations, have students put up their drawings on the blackboard and explore the different color combinations within each shape. By creating a simple chart to tally the shapes (such as the one shown below), students can see the variety of shapes made, differentiate the shapes, and observe the most common shapes made.

Shape	*# of students*
☐ square	𝍸

NOTES

REFERENCES

Burns, M., and B. Tank. 1988. *A collection of math lessons.* New Rochelle, NY: The Math Solution Publications.

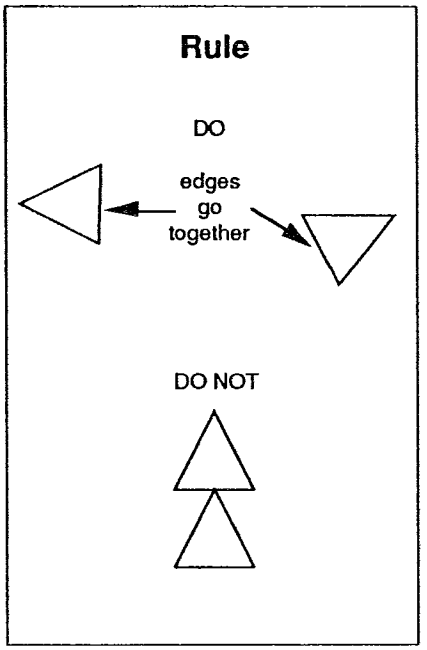
Froman, R. 1975. *Angles are easy as pie.* New York: Thomas Y. Crowell Company.

Kulm, G. 1990. *Math power.* Washington, DC: American Association for the Advancement of Science (AAAS).

FOUR-TRIANGLE PROBLEM

ACTIVITY SHEET

1. Separate the two large triangles from the tangram pieces and put the rest away in the package. Working by yourself, put the triangles together to form a square. Describe what you did and draw your square here, showing where the triangles are.



2. Working by yourself, see how many other different shapes you can find. Rule: You must put edges of the same length together. Draw your shapes. Compare with your partner.

3. Work with your partner. Make as many different shapes as you can using both of your triangles and your partner's triangles. Remember to follow the rule: Edges of the same length must be put together. Draw your shapes.

Challenge

4. How many different ways can you classify the tangram shapes you made? Describe. (Clue: Draw each shape on the back of the activity sheet. What makes each shape different? What makes each shape the same?)

5. List two things you now know about triangles.

   a.

   b.

6. List two things you know now about forming shapes.

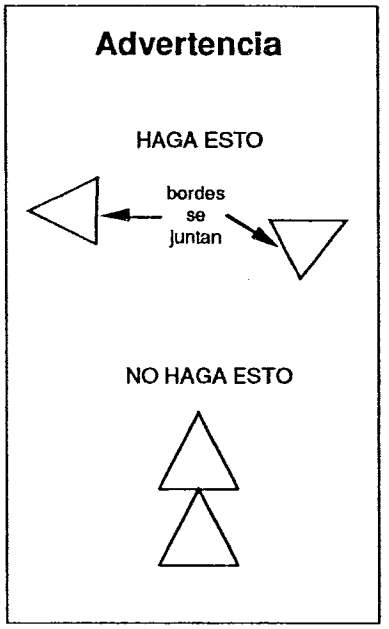
   a.

   b.

PROBLEMA DE CUATRO TRIANGULOS

HOJA DE ACTIVIDADES

1. Escoja los dos triángulos grandes del Tangrama y ponga el resto en la bolsa/saco plástico. Trabaje solo; junte los triángulos de manera que formen un cuadrado. Describa lo que hizo y dibuje la figura (indique los triángulos en la figura).



2. Trabaje solo; vea cuántas otras figuras diferentes puede encontrar. Advertencia: debe juntar los bordes que tengan el mismo largo. Dibuje las figuras. Compárelas con las de su compañero.

3. Trabaje con su compañero. Utilizando todos los triángulos haga diferentes figuras. Recuerde seguir la regla: debe juntar los bordes que tengan el mismo largo. Dibuje las figuras.

Reto

4. Cómo puede separar/clasificar las figuras que juntó? (Ayuda: dibuje cada forma en la parte de atrás de la hoja de actividades. ¿Qué hace que cada forma sea diferente? ¿Qué hace que cada forma sea igual?)

5. Mencione dos cosas que ha aprendido acerca de los triángulos.

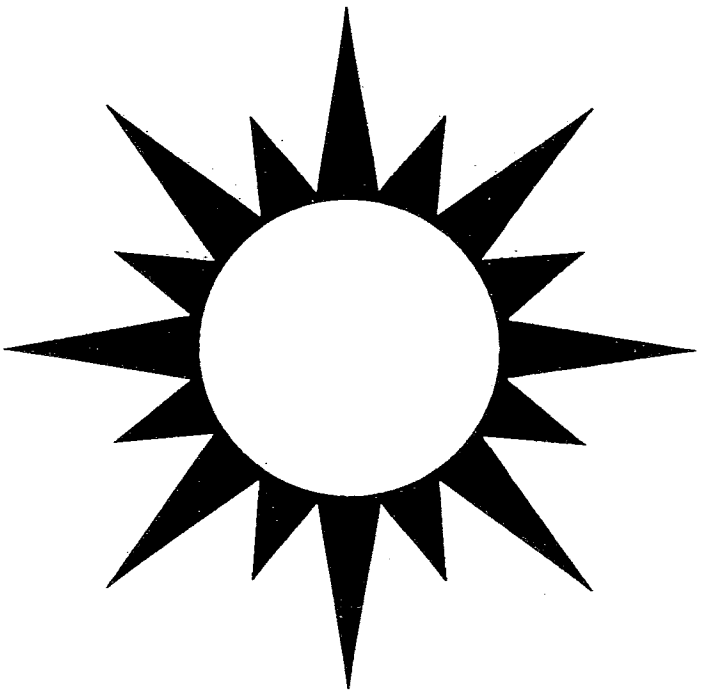
   a.

   b.

6. Diga dos cosas que haya aprendido sobre cómo hacer las figuras.

   a.

   b.



PATTERNS AND DESIGNS

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To explore ideas about patterns, geometric figures, surfaces, and angles.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 5 minutes to discuss patterns and designs in different subjects. Each activity, about 15–20 minutes, depending on age. Discussion, 10 minutes to chart the polyhedron results
Cleaning up:	About 5–10 minutes

APPROPRIATE AGE GROUPS:

X K–3 X 4–6 _____ 7–8

DO ACTIVITY IN GROUPS OF: 2

MATERIALS NEEDED (per group of 2 students):

Building a polyhedron

- ✧ 12 plastic coffee stirrers or toothpicks
- ✧ 10 gumdrops
- ✧ 2 activity sheets

Patterns and designs

- ✧ 1 piece of construction paper
- ✧ crayons
- ✧ 1 bottle of school glue
- ✧ 1 piece of cloth material with a pattern
- ✧ 1 scissors
- ✧ 2 patterned sheets of wrapping paper, especially those with geometric designs. (Also, see *Supplies and Suppliers* for sources of patterned papers.)
- ✧ old magazines

SAFETY CONSIDERATIONS:

Use scissors, candy, and coffee stirrers with proper precautions.

ENRICHMENT FOR BILINGUAL STUDENTS:

- ✧ Teachers should demonstrate configurations while verbally stressing names and areas referred to in the activity.
- ✧ Reinforce students' observations about the figures and utilize their observations as other figures are discussed.
- ✧ Refer to the geometric figures throughout the activity and have students share with the class what they built.
- ✧ Review patterns and discuss the polyhedrons built. Make sure that the word *polyhedron* is said in English and in Spanish during discussion.
- ✧ Have students compare their shapes with Mayan, Incan, and Aztec ruins (see *Hispanic Culture: Past and Future* for reference books). Are the shapes similar?
- ✧ Have students draw and compare their shapes with those found in their clothes, and with those found in Spanish architecture, tile, and decorations.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is adaptable for students with hearing impairments.
- ✧ For students with visual impairments, pair the students with nondisabled studentss. Also, you may want to use construction toys toys to build a sturdier model for students with visual disabilities to explore.

BEFORE YOU BEGIN:

For polyhedron activity:

- ✧ Write the following on the blackboard in preparation for closing of activity:

Name	Number of Edges	Number of Corners	Number of Sides

(Fill in student responses during discussion time.)

- ✧ Set out materials.
- ✧ Make sure work areas are clear.

For patterns and designs:

Set out materials.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

Polyhedron:

- ✧ How many edges does your shape have? Corners? Sides?
- ✧ Can anyone see a pattern? (Clue: edges + 2 = corners + sides)
- ✧ What is a polyhedron? (A three-dimensional figure or "solid" with at least four sides.)

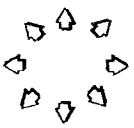
QUESTIONS TO ASK AS YOU DO THE ACTIVITY: *continued*

Patterns and Designs:

- What shapes were used most often in the pattern you found?
- Were there combinations of shapes that were used most often?

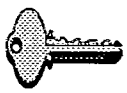
CLEAN UP:

- Collect all gumdrops and determine whether they need to be thrown away.
- Collect coffee stirrers and put in bags.
- Collect glue; make sure lids are shut tight.
- Store leftover paper and cloth materials.



WHERE CAN I GO FROM HERE?

Challenge of the Unknown: Community Leader's Guide and Teaching Guide. For younger children, *A Collection of Math Lessons*, Marilyn Burns and Bonnie Tank. (See Book List.)



WHY IT'S IMPORTANT:

Children need experiences working with patterns to understand how shapes interrelate and to understand the different ways geometric shapes can be manipulated to repeat and form patterns. Familiarization with shapes is important in advanced mathematics and in various careers such as architecture and clothes designing.

HOW IT WORKS:

Polyhedron:

A three-dimensional shape has height, width, and depth emphasized by the sticks and gumdrops used. As the student explores edges, corners, and sides, he/she will also be defining what the three dimensions are.

REFERENCES:

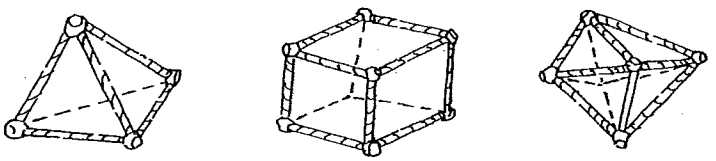
Kulm, G. 1989. *Challenge of the unknown: Community leader's guide.* Washington, DC: American Association for the Advancement of Science (AAAS).

NOTES

BUILDING A POLYHEDRON

ACTIVITY SHEET

1. Build one of these figures (polyhedrons).



- ✏ How many edges does it have (in other words, how many sticks did it take to build it)?
- ✏ How many corners does it have (that is, how many connections where three or more sticks meet)?
- ✏ How many sides does it have (how many triangles or squares can you find on the surface)?

2. Invent and build your own figure.

3. Draw your figure on the back of this page.

4. Using your figure(s) and your partner's, fill in the table below.

Your Name	Number of Edges	Number of Corners	Number of Sides

5. Can you find a relationship between the number of edges and the number of corners and sides?

Challenge

6. How would you describe what a polyhedron is?

PATTERNS AND DESIGNS

ACTIVITY SHEET

1. Study the cloth materials and pattern sheets you and your partner selected. Pick out shapes in the material. Do the shapes repeat to form a pattern? Draw the shapes and explain how the shapes come together.

2. Cut patterns (repeating shapes that form a design) from magazines and glue the shapes on a piece of paper.

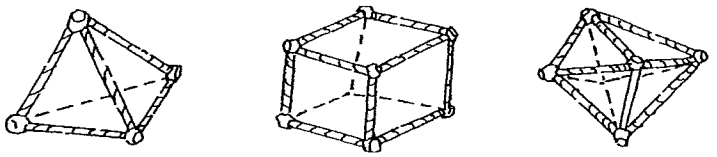
3. Where did you find patterns (that is, in wallpaper, curtains, elsewhere)? Describe.

4. Are there hidden or difficult-to-see patterns? Draw an example.

POLIEDRO

HOJA DE ACTIVIDADES

1. Construya una de estas figuras. Estas figuras son llamadas poliedros/polyhedron.



- ✏ ¿Cuántos bordes tiene (en otras palabras, cuántos palitos necesitó para construirlo)?
- ✏ ¿Cuántas esquinas tiene (es decir, cuántos puntos de conexión)?
- ✏ ¿Cuántos lados tiene (cuántos triángulos o cuadros puede encontrar en la superficie)?

2. Invente y construya su propia figura.

3. Dibuje su figura en la parte de atrás de la hoja de actividades.

4. Utilizando esta tabla, escriba su nombre y el número que corresponde en cada columna. Después, llene la tabla con la información de otros compañeros en su clase.

Su Nombre	Número de bordes	Número de de esquinas	Número de lados

5. Cuando la tabla esté completa, ¿puede ver alguna relación entre el número de bordes, el número de esquinas, y el número de lados?

Reto

6. ¿Cuál es la definición de poliedro? ¿Cómo describiría un poliedro?

PATRONES Y DISEÑOS

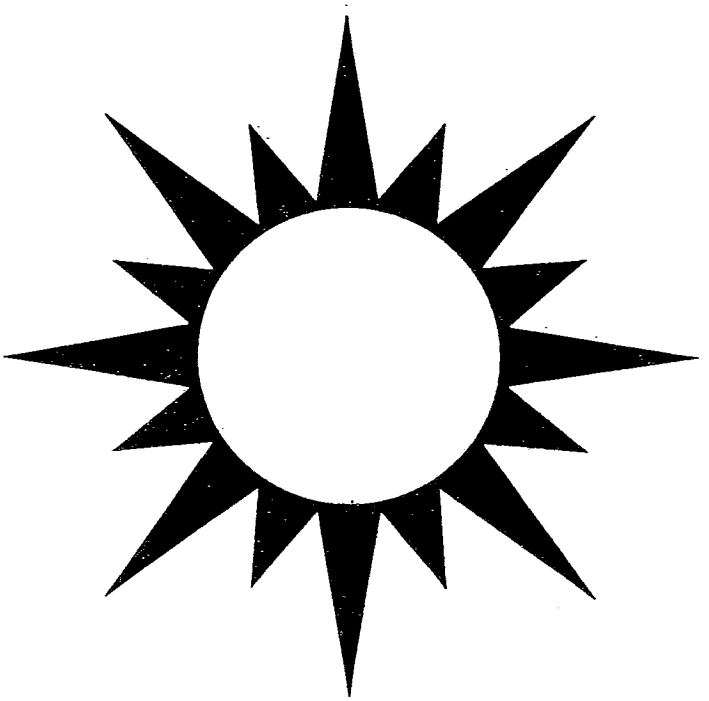
HOJA DE ACTIVIDADES

1. Estudie las telas y patrones que seleccionó. ¿Se repiten las figuras y forman un patrón? Dibuje las figuras y explique cómo se juntan.

2. Recorte patrones de figuras que se repitan de revistas y pégue las figuras con goma sobre un pedazo de papel.

3. ¿Dónde encontró patrones? (Por ejemplo, en el papel de la pared, en las cortinas o en otro diseño en la casa.)

4. De los patrones que encontró, ¿ Había algunos escondidos o difíciles de ver? Dibuje un ejemplo:



POPCORN MATH

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To define mode, median, and mean—an essential foundation for the understanding of statistics.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, read situation, about 10 minutes. Activity, about 20–25 minutes. Discussion, 10 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

_____K–3 _____4–6 __X__7–8

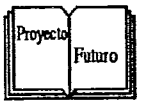
DO ACTIVITY IN GROUPS OF: 4

MATERIALS NEEDED (per group of 4 students):

- ✧ 2 number spinners
- ✧ 2 activity sheets
- ✧ 2 sheets of notebook paper

SAFETY CONSIDERATIONS:

None



ENRICHMENT FOR BILINGUAL STUDENTS:

- ✧ Have children investigate where corn orginated and to what countries it was introduced. Discuss the importance of corn in Hispanic culture. What foods have corn as a base? Discuss the countries that each of these foods are associated with and the relationship with how the corn crop spread.
- ✧ Discuss the nutritional aspects of corn. Have children make tamales.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is adaptable for students with hearing impairments.
- ✧ Pair students with visual and or motor impairments with nondisabled students. You may want to use dice (for students with motor impairments) or an adapted spinner (see *Organizing: What It's All About* for suggestions concerning students with visual disabilities).

BEFORE YOU BEGIN:

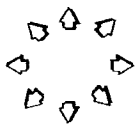
- ✧ Set out number spinners and check that spinners spin freely.
- ✧ Copy activity sheets.
- ✧ Make sure work areas are clear.
- ✧ Explain to class how to use spinners, that is, using spinners and recording the number of spins it takes to get all numbers (each number represents a card).

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- ✧ Are you surprised by the number of spins it took to get all six numbers? Why?
- ✧ What affected your results?

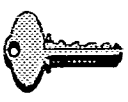
CLEAN UP:

Have students place number spinners back in the plastic bags before they are collected.



WHERE CAN I GO FROM HERE?

Math Power, A Collection of Math Lessons, and *Family Math* are all good resources for ideas and activities (see Book List).



WHY IT'S IMPORTANT:

Everyday life presents situations with vast amounts of information. Finding mode, median, and mean helps us to organize and understand information. In many science and mathematics careers, as in a number of other careers, an understanding of the basic concepts of statistics is essential.

HOW IT WORKS:

This activity helps to demonstrate how we can organize information to assist in making predictions. Noting the results with each spin in the table, the child is able to find the number that occurs most frequently (the mode), the number that is in the middle (median), and the number that is the average. Each of these is important in understanding what a group of numbers "looks" like. For example, the average age of a group of people attending a rock concert may be 17 years. But if a small group of senior citizens who like rock music attend, the average age may shoot upward, leaving one with the impression that the fans of this group are in their mid-twenties. In this case, it is important to look at the median and the mode, which are less affected by outlying values that is, those that are dramatically different. This type of information is very important to someone who is going to target publicity for a rock group.

NOTES

REFERENCES:

Burns, M., and B. Tank. 1988. *A collection of math lessons.* New Rochelle, NY: The Math Solution Publications.

Kulm, G. 1990. *Math power.* Washington, DC: American Association for the Advancement of Science (AAAS).

Osen, L. M. 1974. *Women in mathematics.* Cambridge, MA: MIT Press.

POPCORN MATH

ACTIVITY SHEET

The situation:

A popcorn company has found that sales improve when special treats and surprises are included in the boxes of popcorn. This particular company has recently put a picture card in each box of popcorn. The pictures are of famous women mathematicians: Hypatia, Emilie de Bretuil, Caroline Herschel, Sophie Germain, Mary Sommerville, and Emmy Noether. There are six mathematicians in the complete set. The same number of each type of card is used so when you buy a box, you have an equal chance of getting any one of the six different cards.

How many boxes do you think you would need to buy to get the complete set of six cards? (It is impossible to make the prediction because we don't know how many boxes were distributed in total. But we can simulate to get an estimate.)

You will need:

- ✧ 2 number spinners
- ✧ 2 sheets of notebook paper
- ✧ data sheet

1. As a group, discuss and predict how many boxes of popcorn you think you would have to buy to get all six cards. Write down your prediction below.

Name	Number of Boxes Predicted

2. Each person should tear off six small pieces of paper and write down the names of the six mathematicians, one on each slip of paper. Place the slips of paper by the spinners.

3. Divide your group in half: Two of you will spin and the other two will record your findings. On the data sheet, you will find the names of the six mathematicians. On your spinner, each mathematician is represented by a number:

1 = Hypatia	4 = Sophie Germain
2 = Emilie de Bretuil	5 = Mary Sommerville
3 = Caroline Herschel	6 = Emmy Noether

If you spin a 3, it means you got a box of popcorn with a Caroline Herschel card in it. Take the slip of paper with Herschel's name on it and put it in front of you. Since it only took you one spin to win this card, write a 1 in the space beside your name and in the column for Herschel.

You must keep spinning until you get all six numbers, that is, all six different cards. Record the number of spins it took to get each card on the chart on the following page.

After you have won all six cards, change places with your partner. He/she should spin until he/she has cards for all six mathematicians. Record the number of spins it took your partner to win each card.

4. After everyone in your group records the numbers of spins it took to win each picture card:

   a. Add up the total number of spins each member of the group did and enter that number in the column marked Sum. This is an estimate of how many boxes of popcorn you would have to buy to get all six cards.
   b. Total the Sum column. This will give you the overall number of spins by your group and is an estimate of how many boxes of popcorn your group would have to buy for everyone to get all six cards.

5. Write down the numbers you wrote on the chart along the edge of the paper in order from largest to smallest. You will have some numbers that are duplicates of each other, but write them all down.
   a. Find the number that occurs most often. This is the **mode.**
   b. Find the number that is halfway down the list, that is, there are the same number of entries above it as below it. This number is the **median.**
   c. To find the **mean** or **average,** divide the total number of spins (see #4B above) by the number of persons in your group.

6. Compare your group's prediction (#1) with your findings. How do they compare? Did you overestimate or underestimate the number of boxes you would have to buy?

7. Compare your group's results with those of other groups. Were their findings similar to yours?

POPCORN MATH

DATA SHEET

Number of Spins You Needed to Win the Card							
Your names	**Hypatia (1)**	**Emilie de Bretuil (2)**	**Caroline Herschel (3)**	**Sophie Germain (4)**	**Mary Sommerville (5)**	**Emmy Noether (6)**	**SUM**

TOTAL _____

UTILIZANDO PALOMITAS DE MAIZ

HOJA DE ACTIVIDADES

Situación:

Una compañía que produce palomitas de maíz encontró que las ventas subían cuando se ponían premios y sorpresas especiales en las cajas de palomitas de maíz. La compañía distribuyó entre las cajas, fotografías de seis matemáticas famosas: Hypatia, Emilie de Bretuil, Caroline Herschel, Sophie Germain, Mary Sommerville y Emmy Noether, colocando una fotografía en cada caja. Si alguien compra una caja de palomitas de maíz tiene la misma posibilidad de sacar cualquiera de las seis fotografías. Si las cajas que se distribuyeron contienen el mismo número de fotografías de cada matemática, ¿cuántas cajas es necesario comprar para completar el juego de fotografías?

No se pueden hacer predicciones si no se sabe cuántas cajas se distribuyeron en total. Sin embargo, podemos inventar una situación para hacer una estimación:

Necesitará:

2 ruletas
2 hojas de papel
una hoja de datos

1. En su grupo, discuta y haga sus predicciones. ¿Cuántas cajas de palomitas de maíz tiene que comprar si quiere tener todas las seis fotografías? Escriba sus respuestas.

Nombre	Predicción

2. Cada persona debe preparar seis tiras de papel y escribir en cada una el nombre de una de las matemáticas famosas; una por cada tira de papel. Ponga las tiras de papel junto a la ruleta.

3. Divida su grupo en dos: dos estudiantes girarán la ruleta y dos escribirán los resultados. En la tabla (página 305) encontrará los nombres de las seis matemáticas famosas. Cada una de ellas será representada por un número en la ruleta así:

1 = Hypatia	4 = Sophie Germain
2 = Emilie de Bretuil	5 = Mary Sommerville
3 = Caroline Herschel	6 = Emmy Noether

Si cuando gira la ruleta saca el número "3", esto equivale a comprar una caja de palomitas de maíz con la fotografía de Caroline Herschel dentro. Usted deberá tomar la tira de papel con el nombre de Herschel escrito en ella y ponerlo delante suyo. Ya que solo tuvo que girar la ruleta una vez para sacar este nombre, escriba el número "1" en el espacio que se encuentra al lado de su nombre

y debajo del nombre de Herschel. Haga girar la ruleta mientras su compañero escribe los resultados, hasta que tenga los seis nombres. En la tabla, escriba el número de veces que tuvo que girar la ruleta para conseguir cada nombre.

Cuando haya conseguido sacar los seis nombres cambie de lugar con su compañero. El/ella debe girar la ruleta hasta que consiga los seis nombres. Escriba en la tabla el número de veces que le tomó a el/ella para sacar cada nombre.

4. Siga hasta que llene la hoja de respuestas. Cada uno de los miembros del grupo debe girar la ruleta hasta que saque todos los nombres. Luego:

   a. Sume el número de veces que cada estudiante tuvo que girar la ruleta para sacar los seis nombres; escriba el resultado en la columna "suma". Este resultado es un estimado del número de cajas de palomitas de maíz que tiene que comprar si quiere conseguir las seis fotografías.
   b. Calcule el total en la columna "suma". Este es el total del número de cajas de palomitas de maíz que su grupo debe comprar si cada uno quiere conseguir las seis fotografías.

5. Utilizando el gráfico de frecuencia, haga una lista de los resultados en orden incluyendo números que se repitan.

   a. Encuentre el que ocurre más frecuentemente. Esto es lo que llamamos **moda** (en inglés," mode")
   b. Encuentre el que resulta en el medio. Esto es lo que llamamos **mediana** (en inglés, "median")
   c. Sume todos los números y divídalos por el total de los números que tiene en su lista. Esto es lo que se llama **promedio o media** (en inglés, "average").

6. Compare los resultados obtenidos en el ejercicio #2 con sus estimaciónes en el ejercicio #1. ¿Qué encontró?

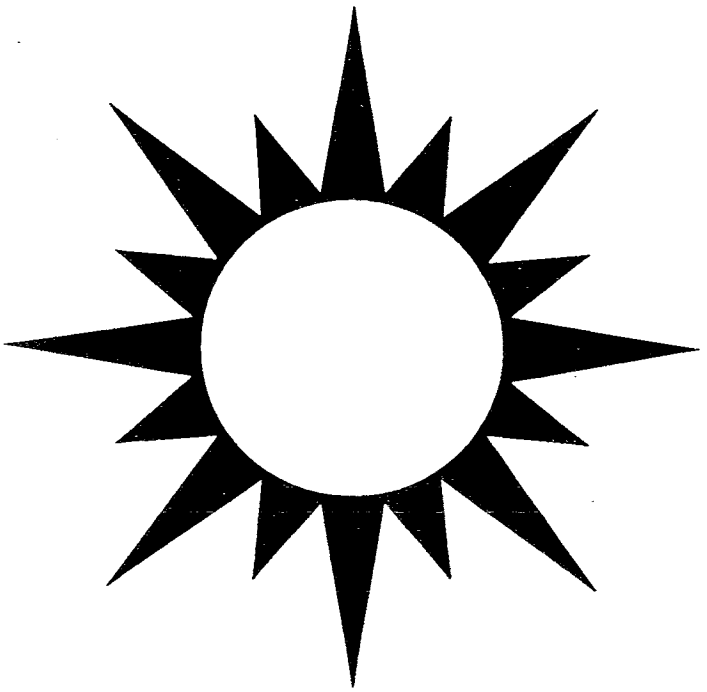
7. Compare los resultados con los de otros grupos. ¿Qué encontró?

UTILIZANDO PALOMITAS DE MAIZ

HOJA DE DATOS

Numero de Vueltas Para Conseguir las Fotografías							
Sus nombres	**Hypatia (1)**	**Emilie de Bretuil (2)**	**Caroline Herschel (3)**	**Sophie Germain (4)**	**Mary Sommerville (5)**	**Emmy Noether (6)**	**SUMA**

TOTAL _____



RATES AND PREDICTIONS

SUGGESTIONS FOR TEACHERS

WHAT'S THE POINT?

To explore ideas about rates, predictions, and graphing.

ESTIMATED TIME:

Setting up:	About 5 minutes
Doing activity:	Introduction, about 5–10 minutes. Activity, about 20–25 minutes, depending on age. Discussion, 5 minutes
Cleaning up:	About 5 minutes

APPROPRIATE AGE GROUPS:

_____K–3 __X__4–6 __X__7–8

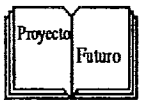
DO ACTIVITY IN GROUPS OF: 3

MATERIALS NEEDED (per group of 3 students):

- ✧ 1 measuring tape
- ✧ 2 activity sheets
- ✧ 1 graph paper
- ✧ 2 small pieces of masking tape

SAFETY CONSIDERATIONS:

Students will be moving around the room, consequently chairs and tables will need to be out of the way.



ENRICHMENT FOR BILINGUAL STUDENTS:

- ✧ See *Organizing: What's It All About?*, "Enrichment for Bilingual Students." Questions to explore with students: How did Mayans use the sun (rate of movements) to plan their cities and crops?
- ✧ Contact Hispanic organizations (see *Introduction*) and universities to locate Hispanic scientists and engineers. Invite scientists to visit your school and classroom to share how he/she makes predictions.

ADAPTATIONS FOR PARTICIPANTS WITH DISABILITIES:

- ✧ Activity is adaptable for students with hearing impairments.
- ✧ Team students with visual impairments with sighted student. Additional time should be allowed for the student to work on the measurement portion of activity.

BEFORE YOU BEGIN:

- ✧ Have tape measures laid out for students to distribute.
- ✧ Set out graph paper.
- ✧ Copy activity sheets.
- ✧ Write on the chalkboard the number of feet you want them to measure if they are going to stay in the classroom.
- ✧ Make sure work areas are clear.

QUESTIONS TO ASK AS YOU DO THE ACTIVITY:

- ✧ Do taller people cover more distance as they walk than shorter people?
- ✧ What did you observe about height and pace?

CLEAN UP:

- ✧ Collect tape measures and rubber band together
- ✧ Collect extra graph paper.

WHERE CAN I GO FROM HERE?

Challenge of the Unknown: Teaching Guide, Math Power, and *A Collection of Math Lessons* are all good sources for activities and ideas.

WHY IT'S IMPORTANT:

Science and mathematics revolve around organizing information to help us understand relationships among pieces of information.

HOW IT WORKS:

Gathering data about each person and entering this information in a simple table helps students compare and understand how each person differs or is similar. This activity helps demonstrate how height (hip height) and stride are related. The graph that each child creates with his/her information, in essence, summarizes the information each child gathered. Each child can then predict by studying the graph what other children's results will be, that is, how many steps they'll take in a 5-foot (1.5-meter) area or what their stride length is.

NOTES

REFERENCES:

Foster, L. 1989. *Checkboard press mathematics encyclopedia.* New York: Checkboard Press.

Kulm, G. 1989. *Challenge of the unknown: Community leader's resource guide.* Washington, DC: American Association for the Advancement of Science (AAAS).

Maddux, H. C. 1986. *Challenge of the unknown: Teaching Guide.* New York: W.W. Norton.

RATES AND PREDICTIONS

ACTIVITY SHEET

1. Find a clear area in your classroom. Using your tape measure, measure a 5-foot (60-inches or 150-cm) line on the floor. Mark the start and finish of your line with small pieces of masking tape. All groups: Take turns walking (slowly, casually) the measured area while other group members count the number of steps you take. Record the number of steps in the table below or on the chalkboard.

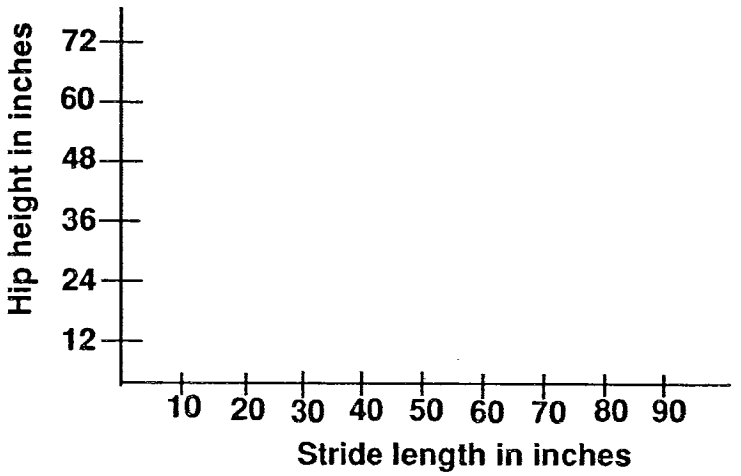
Name	# of steps	Pace length	Stride length	Hip height

2. Find the average length of your pace (the distance between your left and right feet) by dividing 5 feet by the number of steps you took to walk it. Record your answer on the table.

3. To find the length of your stride multiply the length of your pace by two. Record your stride length in the next column.

4. Each member of the group will need to measure hip height (hip height is up to the hip bone in the upper leg). Record it in the table.

5. Construct a graph like the one shown with each group member's stride length and hip height in inches or centimeters. Use graph paper.



6. What does the graph show? What is the relationship between stride length and hip height? How does the graph show this relationship?

Challenge

7. Predict how many steps each group member would take to walk 15 feet (4.5 meters)? 20 ft (6 meters)? What information are you using to make your predictions? Now measure a line of that length on the floor and test your predictions.

PREDECIR LA VELOCIDAD

HOJA DE ACTIVIDADES

1. Dentro de la clase, mida una distancia de 5 pies (60 pulgadas ó 150 centímetros). En su grupo, tomen turnos para que cada niño camine y cuente, el número de pasos que dá dentro de la distancia que midió. Escriba sus resultados en la tabla que aparece abajo o en el tablero.

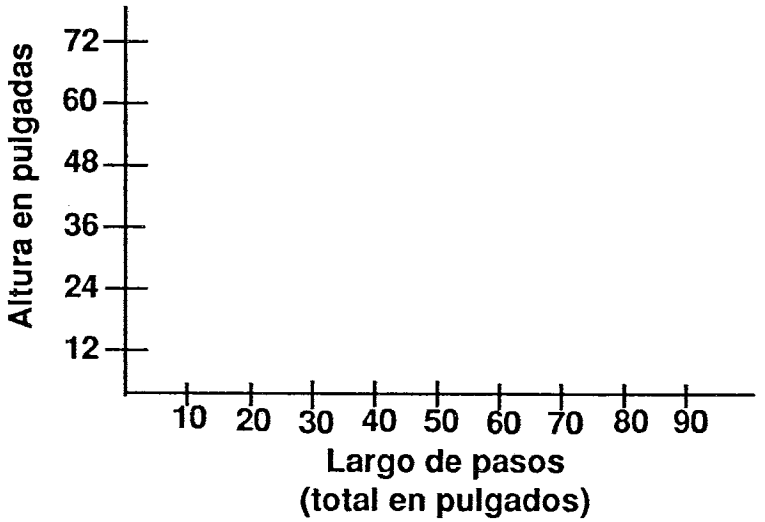
Nombre	# pasos	Largo del Paso	Largo de dos Pasos	Altura de Cadera

2. Divida el número de pasos entre 60 pulgadas (la distancia que midió), para saber el promedio del largo de un paso. Haga otra columna en la tabla del ejercicio #1 y titule la columna "Largo del Paso".

3. Para saber el largo total de una zancada/dos pasos, multiplique el largo del paso por 2. Ponga sus resultados al lado de la columna #2 y titule la nueva columna "largo de dos pasos."

4. Mida el alto de su cadera en pies y pulgadas (el alto de la cadera se mide desde el hueso de la cadera en la parte superior de la pierna). Escriba sus respuestas, en otra columna arriba y titúlela "altura de cadera."

5. Haga una gráfica de sus respuestas.



6. ¿Cómo se relaciona la altura de la cadera con el largo del paso total? ¿Qué relación hay entre la altura de la cadera y el largo de la zancada? ¿Cómo muestra ésto el gráfico?

Reto

7. ¿Cuántos pasos tomará cada miembro de su grupo en 15 pies? ¿En 20 pies? ¿Que información usará para estimar esta respuesta? Cuando termine su estimación dibuje una linea de 15 pies y una de 20 pies en el piso y verifique sus predicciones.