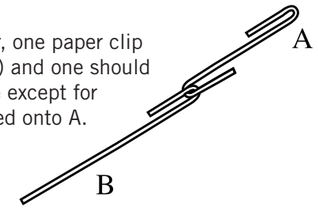
Center of Attention

Find the towns that are the centers of gravity for a variety of U.S. state maps. The center of gravity in any object is described as the point which acts as though the total mass of the object were at that point. An object will balance at its center of gravity point, or spin about it. The center of gravity is always below the point of suspension in an object, which is demonstrated in this activity.

Procedure:

- To make the center of gravity locator, one paper clip should be bent into an "s" shape (A) and one should be straightened as much as possible except for a hook at top (B). B should be hooked onto A. (See diagram).



- Students will suspend the map in the air by putting the hook (A) through one of the holes. The locator (B) will swing freely against the map.
- After letting the locator come to rest, students should gently press the locator into place on the card with their thumb. Use a pencil to trace the position of the locator.
- Do this again with the second hole in the map. An "X" shape should mark the approximate center of gravity on the map. When they unhook the locator, they should be able to balance the map on their finger at that "X."

Let students look at the map of the US to approximately locate the town that is located at the center of gravity of each state. Have them mark it with a star near the town name. Is the center of gravity necessarily in the geometrical middle of the state? States that are uniform in shape, like Colorado, might have a center of gravity in the middle, but states with unusual shapes like Massachusetts may not have a center of gravity in the exact middle.

Materials
(per student or team)

- paper clips fashioned into center of gravity locators (one per pair of students)
- pencils
- cut-out blank maps of some U.S. states that have had a hole punched in two corners of the map (card stock works best)
- detailed map of the U.S.

Resources

Exploratorium Magazine, Vol. 19, No. 3, Fall 1995

Fractals, The Patterns of Chaos, by John Briggs, 1992

Family Math, by Jean Kerr Stenmark, Virginia Thompson and Ruth Cossey

Family Math Sampler, EZUALS Program, Lawrence Hall of Science

Exploratorium Science Snacks, www.exploratorium.org

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SCIENCE On WHEELS

Mathfinder

Dear Teacher,

Thank you for having the *Mathfinder van* visit your school. We hope you enjoyed investigating mathematics with your students during Pacific Science Center's Science On Wheels experience. This flier is intended to help continue the enthusiasm generated by our visit and extend your students' learning.

The following activities have been selected because they encourage problem solving skills, which are important components in math. Please feel free to adapt them to suit your needs. The insert is written for your students, with activities you may choose to do as a class or copy for home use.

Thank you for having the *Mathfinder* van visit your classroom, and remember, have fun!

~Science On Wheels Teachers

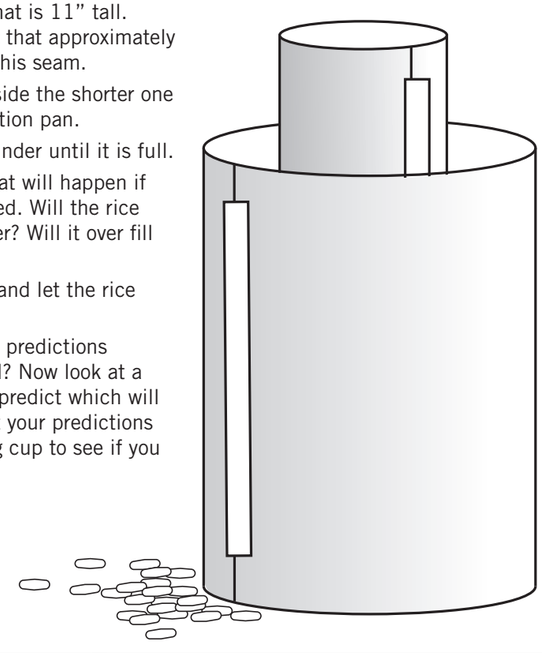
Cylindrical Volume

Can two cylinders of different heights have the same volume?

Can two cylinders of different heights have the same volume?

Procedure:

- Roll each of the sheets into cylinders, one that is 8.5" tall and the other that is 11" tall. Roll each piece of paper so that approximately 1 cm is overlapping. Tape this seam.
- Place the taller cylinder inside the shorter one and put them on the collection pan.
- Pour rice into the inner cylinder until it is full.
- Make predictions about what will happen if the inner cylinder is removed. Will the rice exactly fill the outer cylinder? Will it over fill or under fill it?
- Pull out the taller cylinder and let the rice spill into the shorter one.
- What happened? Were your predictions correct? Were you surprised? Now look at a variety of glasses. Can you predict which will hold the most volume? Test your predictions with water and a measuring cup to see if you are right.



Materials
(per student or team)

- two 8.5" x 11" sheets of paper or plastic transparency
- tape
- enough rice, beans or sand to fill the cylinders
- a pan to collect the filler material
- several glasses of varying sizes
- water
- a measuring cup

Three Bean Salads

Try these puzzlers to see if you can figure out the number of beans in each salad. Students will practice using ratios and proportions. The problems can be solved using very simple algebra or by simply guessing and checking.

Procedure:

- All three types of beans should go in each salad.
- Use the dried beans to help solve the problems and to make guesses.

Salad 1
This salad contains:
2 lima beans
Twice as many red beans as lima beans
Red beans
10 beans in all

Salad 2
This salad contains:
4 red beans
Half as many black-eyed peas as lima beans
10 beans in all

Salad 3
Lima beans make up half of this salad
The salad has exactly 2 red beans
The number of lima beans is double the number of red beans

Salad 4
This salad contains:
The same number of red beans as lima beans
3 more black-eyed peas than red beans
A total of 18 beans

- Can you come up with your own bean salad puzzlers?

Materials
(per student or team)
- 3 different types of uncooked, dry beans *such as:*
  red beans
  lima beans
  black-eyed peas

One Bean, Two Bean, Red Bean, White Bean

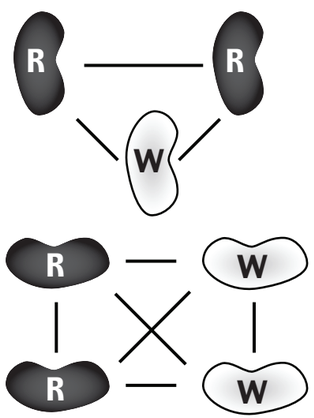
Procedure:

- In front of the class, put three beans into a brown paper bag. Show that there are two red beans and one white bean.
- Ask the students if you were to pull two beans out at once, what two colors are more likely to come out? Take predictions and reasons and then pull out two beans and show the class the results. Mark the results on the board, either RR, or RW. Chances are good that you pulled out a red bean and a white bean, but in any case put those two beans back in, try again and mark results, in this way demonstrating what the students will do.
- Give each pair of students a brown paper bag with the three beans. Instruct them to do as you did, pulling two beans out at the same time, marking their data on paper, putting the beans back, and then doing it again, perhaps 20 times or more. (More tries will yield better data.) Discuss results.
- This is truly non-intuitive for most of us. It seems that one would be much more likely to draw two red beans out of the bag because there are more of them. But the diagram to your right may help to explain why this is not so. The chance for red and white to be combined is twice as likely as red and red.
- How can we improve the odds and increase the likelihood that any combination is equally as likely to happen? Add one more white bean? Try it out and then have a look at the diagram to your right.

Challenge:

Is there any way to combine the bean ratios to increase the likelihood of pulling out any combination to 50/50? Try it either through a diagram or trial and error!

Materials
(per student or team)
- brown paper bags
- painted lima beans or markers of uniform shape in two colors
- pencils and paper



Walk Through a Piece of Paper

Procedure:

a) Fold the paper in half along its length.

b) Then fold the paper in half along its width.

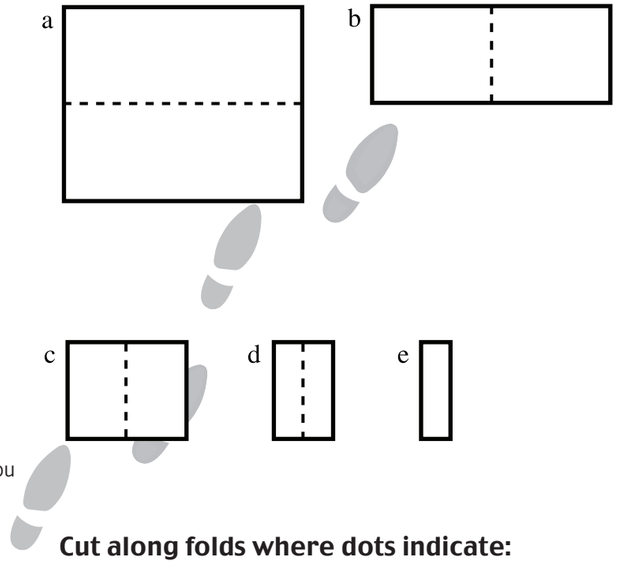
c-e) Fold the paper in half along its width twice more. Your paper will now be in 16 sections.

f) Open all width folds and flatten so that these folds are still visible. Start at one end and cut along that crease from the central fold to within half an inch of the opposite side.

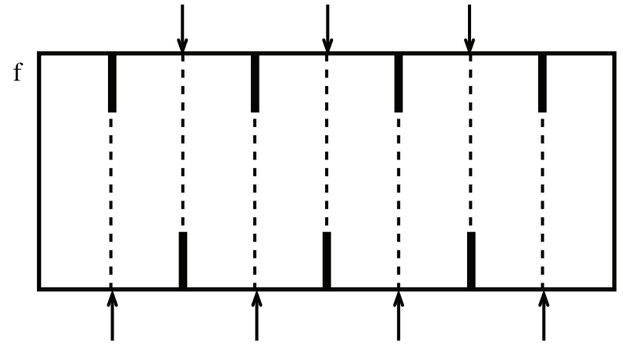
Repeat with the next crease, but cut from the unfolded side and stop within half an inch of the folded side.

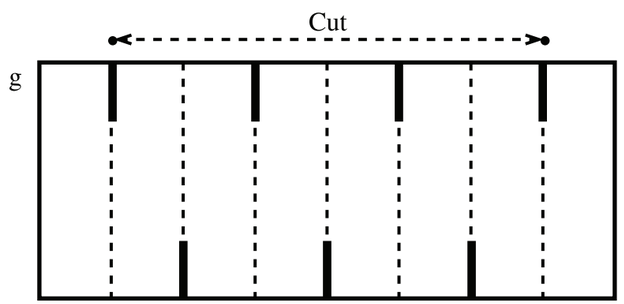
Continue cutting and alternating until all creases are cut.

g) Now cut through the central fold, except for the end pieces. Leave them intact. Open up your creation. Can you walk through it? Can you make another one with a smaller piece of paper? Or with fewer or more creases? What happens?



Cut along folds where dots indicate:





Materials
(per student or team)
- 8.5" x 11" sheet of paper (scrap paper is encouraged)
- scissors