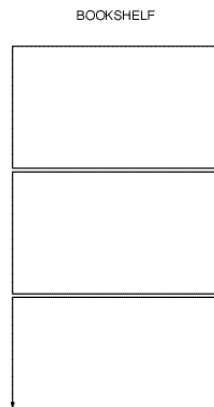


Students create their own fold-up math models, develop math problem-solving strategies, and “see” what math is all about. The ability to visualize while solving mathematical problems helps students gain confidence and builds superior thinking skills. Each activity is designed so that certain pieces of information are left out or hidden. By thinking, puzzling over the challenge, and asking questions, students find appropriate and varied solutions.

## BOOKSHELF CHALLENGE

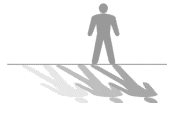
1. Have the students read all of the instructions and then engage the students in class discussion. The challenge, as written, is impossible because the length of the shelves is not included in the student information.
2. Begin by asking the students to ask any clarifying questions. Obviously, you want someone to identify that the challenge is missing some information. You may allow students to begin working on the challenge. Someone will eventually ask, “How long are the shelves?”  
*When students ask, each shelf is 8 cm long.*
3. Bookshelf construction information:
  - Students must measure and cut 3-cm strips and tape them together to create their continuous strip before they begin folding.
  - The bookcase is 12 cm high. The bottom is considered a shelf and the top of the 12-cm by 8-cm rectangle is the top shelf.
4. Students may want to diagram various ways to fold the strip before folding. Diagramming lessens the frustration students may experience when they use a random folding approach.
5. The 3-cm wide strip may be folded back along itself. Some parts of the bookshelf may be one thickness of paper and other places may be two layers thick. The less doubling up of the strip, the shorter the length of paper needed to complete the project. Each student seeks the shortest length for the model.
6. Last, cut each bookshelf where it is taped, measure the length of the each strip, and study the different folding patterns. One possible fold-up pattern:
7. **Bookshelf Extra Challenge**
  - Change the dimensions of the bookshelf, the number of shelves, and add one or more vertical dividers and have the class try again.



### BASIC CHALLENGE



45 minutes–  
1 hour



Individual  
activity

### MATH CONCEPTS

- Estimating
- Measuring



*Remember, this is only one possible solution to this challenge. Do not share this diagram with your students.*

## **BOOKSHELF CHALLENGE**

What is the shortest continuous piece of 3-cm wide paper that can be folded and taped to make a model bookshelf that is four shelves high?

**Math concepts**      Math visualizing, estimating, measuring

**Time allowed**      45 minutes to 1 hour

### **Materials**

Heavyweight paper (11" x 18") — *one sheet*

Ruler

Scissors

Tape

### **Use the following information:**

- The bookshelf has no back.
- Each shelf is 4 cm from the next.
- One shelf touches the floor.

### **Construction notes**

- Cut and fold the model from one long 3-cm wide piece of paper.
- Preplanning and experimentation are important components of this challenge.