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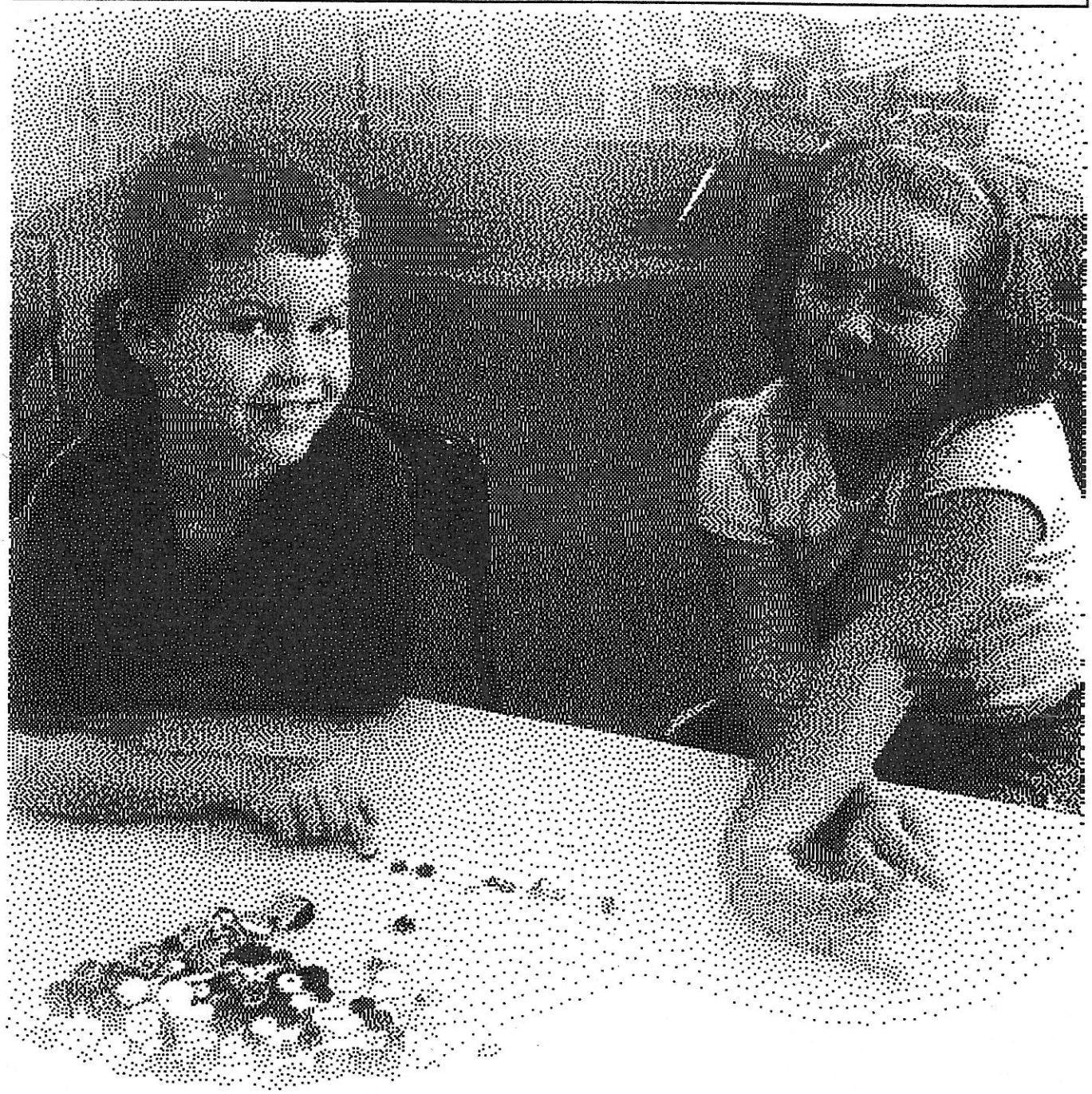

Billy's Button

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"Information for the Present, Knowledge for the Future"

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In This Issue

Also:

2004 NCTM Meeting, Frank Sottile Memorial Scholarship, and lots of other stuff.

Using Data and Linguine to Discover the Triangle Inequality

By Heather Godine,
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To form a triangle, the sum of the lengths of any two sides must always be greater than the length of the remaining side. As a geometry teacher, I struggled with the idea of how to make that concept meaningful to students. Typically, I would read over the inequality statement, ask the students if it made sense, and those paying attention would nod politely. However, the concept held little meaning for them beyond a few contrived examples. Below is a description of a lesson that I have used for the Triangle Inequality.

To begin the lesson, I use this scenario: "Triangles Unlimited manufactures triangles to meet your every need. Provide Triangles Unlimited with three lengths of your choice, and they will manufacture your own custom triangle using only the finest of materials." I tell the students that there was a glitch in manufacturing, and one of the employees at Triangles Unlimited felt that the company's claim might not be feasible. The employee was concerned that there might be certain groups of three lengths that would not form triangles. However, the employee was not certain how to determine which groups of three lengths would not form triangles.

At this point, I provide the students with the TRIANGLE INEQUALTY HANDOUT (figure 1), and at least three pieces of linguine. (I prefer using linguine to spaghetti because the linguine doesn't roll as easily.) I instruct the students to work on task #1, where they are to break a piece of linguine into three parts to form the sides of a triangle and to measure the lengths of each side. Students record the measures of the sides as small, medium, and large. It is possible for the sides to be equal; students still need to order the sides from smallest to largest. Inevitably at least one student will break the linguine so that it is impossible to form a triangle. I tell that student to put those pieces aside, mention how it is a good thing that I gave out extra pieces of linguine, and ask that student to try again.

When students have measured the lengths of three sides that form a triangle, I instruct them to write the measurements of the sides on the board. I use a chart similar to the FORMS A TRIANGLE chart in figure 2. It is possible that students will measure incorrectly, but the sheer number of students measuring is likely to compensate for the error. If I notice a significant error, I may ask a student to remeasure the sides. However, students often will catch their own mistakes if they notice that their measurements seem "out of place" with the other measurements on the board.

At this point, I instruct students to begin task #2, where they are to break a piece of linguine into three parts to form the sides of a non-triangle and to measure the lengths of each side. This task is redemption to those who were "ahead" on task #1. It is important to stress to students that it must be impossible to create a triangle even if the linguine were rearranged. Many students will attempt to create "non-triangles" with sides that can be closed to form triangles. When students finish measuring, they also record the measurements of the sides of the non-triangles in a chart on the board. I use a chart similar to the FORMS A NON-TRIANGLE chart in figure 2.

While students are completing tasks #1 and #2, I record the data for their small, medium, and large sides for the triangle and the non-triangle into six lists on the TI-83. I use the calculator to determine the mean of each list. I record those measures on the board in a chart similar to the one in task #3 of the TRIANGLE INEQUALITY HANDOUT (figure 1.)

After students have recorded the average measures of the sides of the triangles and the non-triangles, I instruct them to begin task #4, where they are required to form conjectures about the measures of sides of triangles and non-triangles. Students first work alone, then with a partner, and finally in groups of four. Each group is required to write a statement of conjecture on the board and explain that statement to the class.

After the groups have read their statements of conjecture, I use those statements to lead into the Triangle Inequality. Sometimes groups will write their statements of conjecture as an inequality, but most groups write the statements of conjectures in words. A typical statement might be "For a triangle, the measures of the sides are closer together. For a non-triangle, the measure of the large side is much larger than the other two sides."

As I lead the class into the final form of the Triangle Inequality, I ask them if it is possible for the sum of the small and medium sides to equal the large side. This sends the students back to work with the linguine. After some trial and error, students come to the conclusion that if the sum of the small and medium sides were equal to the large side, the triangle would be "flat", having no point. Using linguine on the overhead is a great way to illustrate that conclusion.

In its final form, the students write the Triangle Inequality as "small+medium>large." Students find that the use of the small, medium, and large terminology makes the statement more understandable. In addition, students are able to connect this statement back to the opening situation with the employee at Triangles Unlimited. The company's claim really is false, and

this is what the company must consider when making the triangles.

The linguine and the data bring the Triangle Inequality "alive" in the classroom. The linguine gives students a tangible experience that they can hook to the triangle inequality. The collection of class data gives all students a reason to measure accurately. The calculation of a class average streamlines the data to allow students to form conjectures. This lesson makes the Triangle Inequality more than just a series of contrived examples, allowing students to construct meaning while immersed in the concept.

FORM A TRIANGLE

small	medium	large

FORM A NON-TRIANGLE

small	medium	large

Task #1: Form a Triangle

Break a piece of linguine into three parts so that a triangle is formed. Measure each side of the triangle to the nearest tenth of a centimeter. Record the measures of each side of the triangle from smallest to largest. Write the measures in the space below and on the class chart.

small	medium	large

Task #2: Form a Non-Triangle

Break a piece of linguine into three parts so that a triangle cannot be formed, even if the parts were rearranged. Measure each side of the non-triangle to the nearest tenth of a centimeter. Record the measure of each side of the non-triangle from smallest to largest. Write the measures in the space below and on the class chart.

small	medium	large

Task #3: Find a Class Average

In the chart below, record the average measure of the small, medium and large sides for the triangle and the non-triangle.

	TRIANGLE	NON-TRIANGLE
small		
medium		
large		

Task #4: Make a Conjecture

Examine the patterns between the average small, medium and large sides fc triangle and the non-triangle. Record your observations below.

Task #5: Form a Conclusion

Examine the conjectures made by the class. In the space below, use an inequality to write the relationship between three sides of any triangle

The Triangle Inequality: