Patterns & Functions

Success Through Conceptual Layering

Here is a way to teach number sense, fractions, geometry, and algebra using Conceptual Layering: the proven approach that ensures success for all students. Let Bill show you this simple procedure that enables students to master standards involving geometric visualization, graphing, t-tables, proportions, mathematical reasoning, and algebraic problem solving. Leave with a clear purpose and method.

By Bill Lombard

Teacher, Author, Consultant, Webmaster

bill@tttpress.com

Download this 15–page handout at

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Click on **Download Conference Materials** on left hand side

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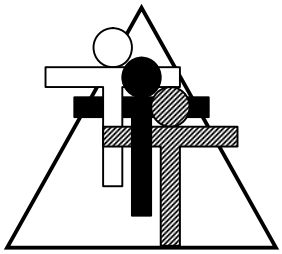

Teacher to Teacher Press

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Brad Fulton and Bill Lombard
Teacher to Teacher Press

"Building Mathematical Skill on a Foundation of Understanding"

Brad Fulton

- **Consultants**
- **Educators**
- **Authors**
- **Seminar leaders**
- **Teacher trainers**
- **Conference speakers**

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Known throughout the country for motivating and engaging teachers and students, Brad and Bill have authored over ten books that provide easy-to-teach yet mathematically-rich activities for busy teachers. In addition, they have co-authored six teacher training manuals full of activities and ideas that help teachers who believe mathematics must be both meaningful and powerful.

Seminar leaders and trainers of mathematics teachers

- California Math Council and NCTM presenters
- Lead trainers for summer teacher training institutes
- Trainers/consultants for district, county, regional, and national workshops

Authors and co-authors of mathematics curriculum

- *Simply Great Math Activities* series: five books covering all major strands
- *Math Discoveries* series: bringing math alive for students in middle schools
- Teacher training seminar materials handbooks for elementary, middle, and secondary school

Available for workshops, keynote addresses, and conference sessions.

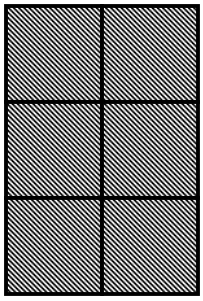
All workshops provide participants with complete and ready-to-use activities. These activities require minimal preparation, use materials commonly found in classrooms, and give clear and specific directions and format. Participants will also receive journal prompts, homework suggestions, and ideas for extensions and assessment.

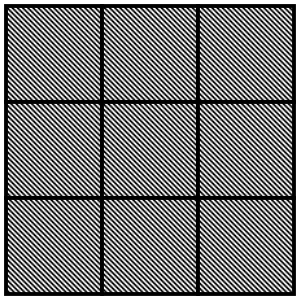
Brad and Bill's math activities are the best I've seen in 30 years of teaching!
Wayne Dequer, 7th grade math teacher

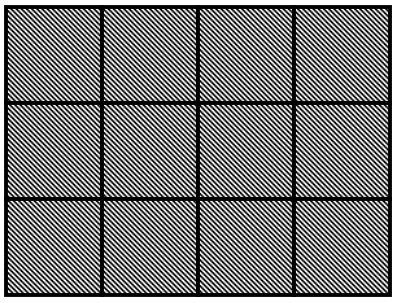
"The high-energy, easy-to-follow handouts were clear. The instructors were great!"
DeLinda Van Dyke, middle school teacher

References available upon request

Function 3

1 

2 

3 

Function 5

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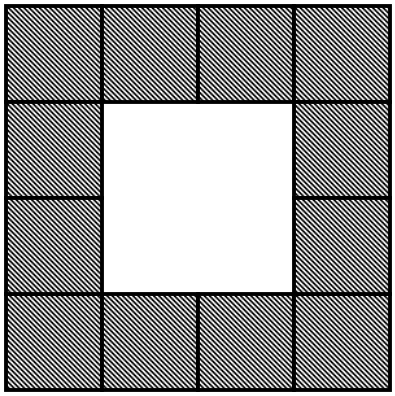

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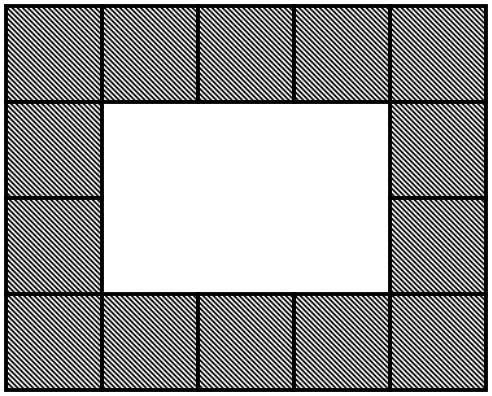

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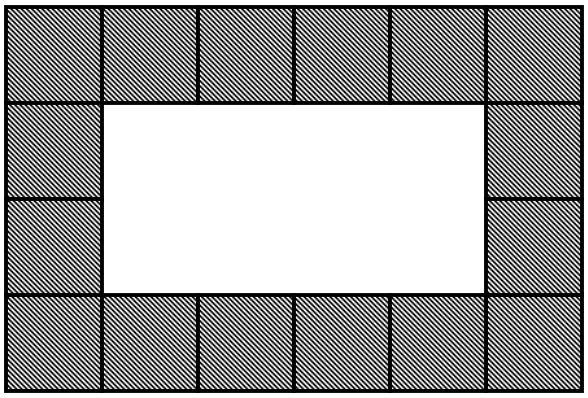

Function 14

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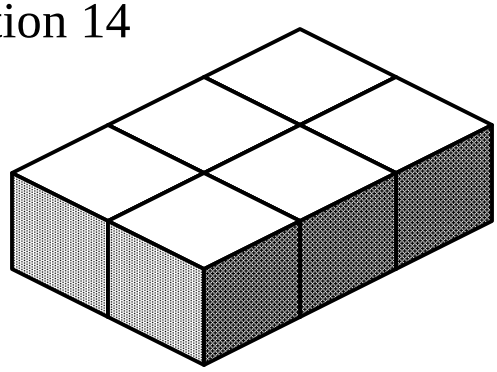

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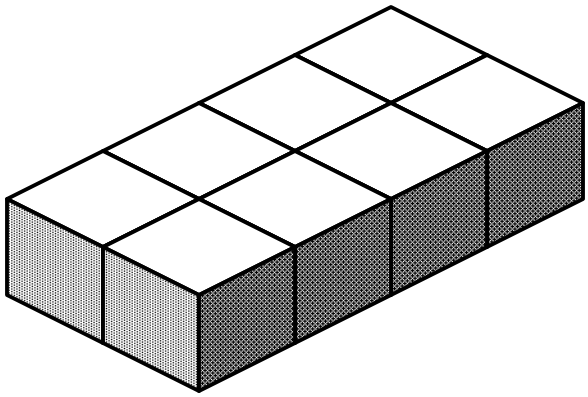

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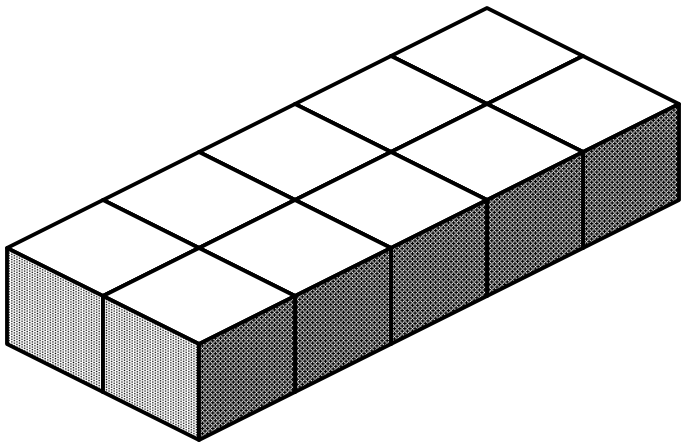

Function 15

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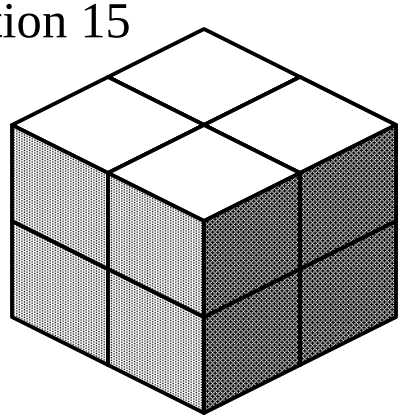

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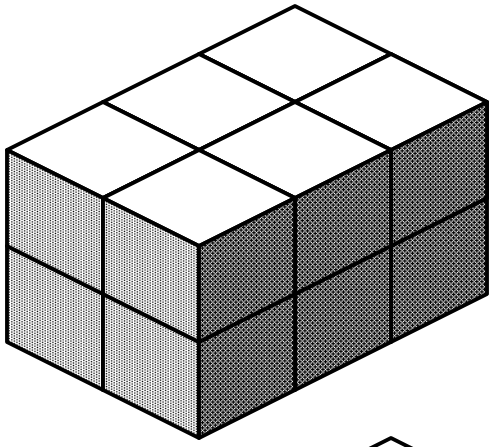

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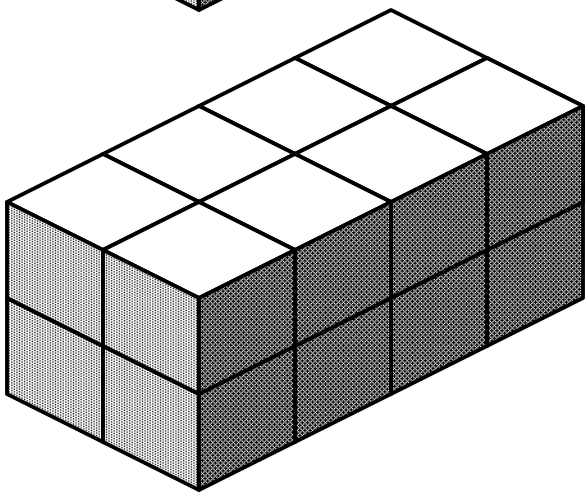
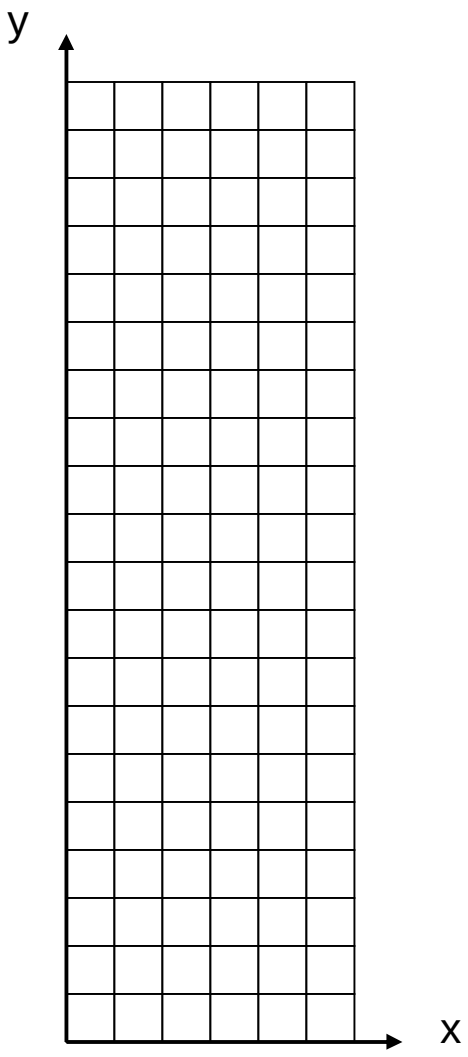


graph and t-table master

x	y
0	
1	
2	
3	
4	
5	



ACTIVITY 8

Patterns in Geometry

Materials:

- ☒ graph paper
- ☐ toothpicks, square tiles, multi-link cubes

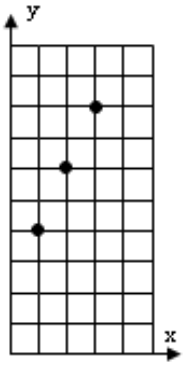
Overview: Students will measure perimeter, area, surface area and volume as they analyze functions. Graphing and t-tables will be used to make predictions

Vocabulary: perimeter, area, surface area, volume, function, slope, intercept

PROCEDURE

Skills:

- Measuring perimeter, area, surface area, and volume
- Using t-tables and graphs
- Finding formulas
- Evaluating expressions



1 Display a transparency of Function 1. With younger learners, you may wish to have toothpicks and square tiles available. You can also provide a copy of the functions to each student or group of students. The students will also need a piece of graph paper. Place a transparency of the graph and t-table master on top of your transparency.

2 The students should make a t-table and graph like yours on their graph paper. Ask them to find the perimeter of the first three terms of the function and record it on their graph paper (4, 6, and 8 units respectively). They should also graph these first three terms on their graph. As shown in the margin.

3 The students should now be able to predict the perimeter of the fourth and the fifth term (10 and 12 units respectively). Ask them how they know this. They will see that the t-table and graph both increase by two units per term.

4 Ask them the perimeter of the tenth term. It is 22 units. Ask them how they arrived at their answer. Some will say they counted by two's from the fifth term. Others will say they added 10 to the fifth term since there are five more steps of two. Some students may think the perimeter would be 24 units since the tenth term should be twice as big as the fifth term. Ask them why this is not true. (Although you double the length of the shape in moving from term five to term ten, the height does not double. The two end units do not increase.)

5 Ask them to graph the fourth and fifth terms on their paper. You may wish to have them connect the dots with a line for clarity.

6 As they work on this pattern, you may ask them to find the perimeter of term 20, 50, 100, or 1000. In verbalizing how they

arrived at these answers, students will be on the threshold of stating the formula for the function.

7 Allow the students to work on the other patterns. You may wish to make this a whole class activity in which you display each of the functions in turn. Alternatively, you can have the other functions set up as stations which the students visit at their own pace in small groups.

You may also wish to have the students find the areas of the functions as they work making t-tables and graphs as before.

Functions 13 through 24 involve surface area and volume, but the process for their exploration is the same.

Journal Prompts:

Will the number of *square units* of a shape's area always be greater than the number of *units of length* of its perimeter? Will number of *cubic units* of volume always be greater than the number of *square units* of surface area on a three-dimensional shape? Can they ever be the same? Why or why not?

If the first term of a series had a perimeter of 8 units, the second term had a perimeter of 14 units, and the third term had a perimeter of 20 units, explain how you would find the perimeter of the 17th term.

Homework:

Students can work at home on any functions not finished in class. You may wish to provide the master of reduced patterns of the functions for them to take home.

Taking a Closer Look:

You may require students to find formulas for these functions and then evaluate the functions at levels such as step 100.

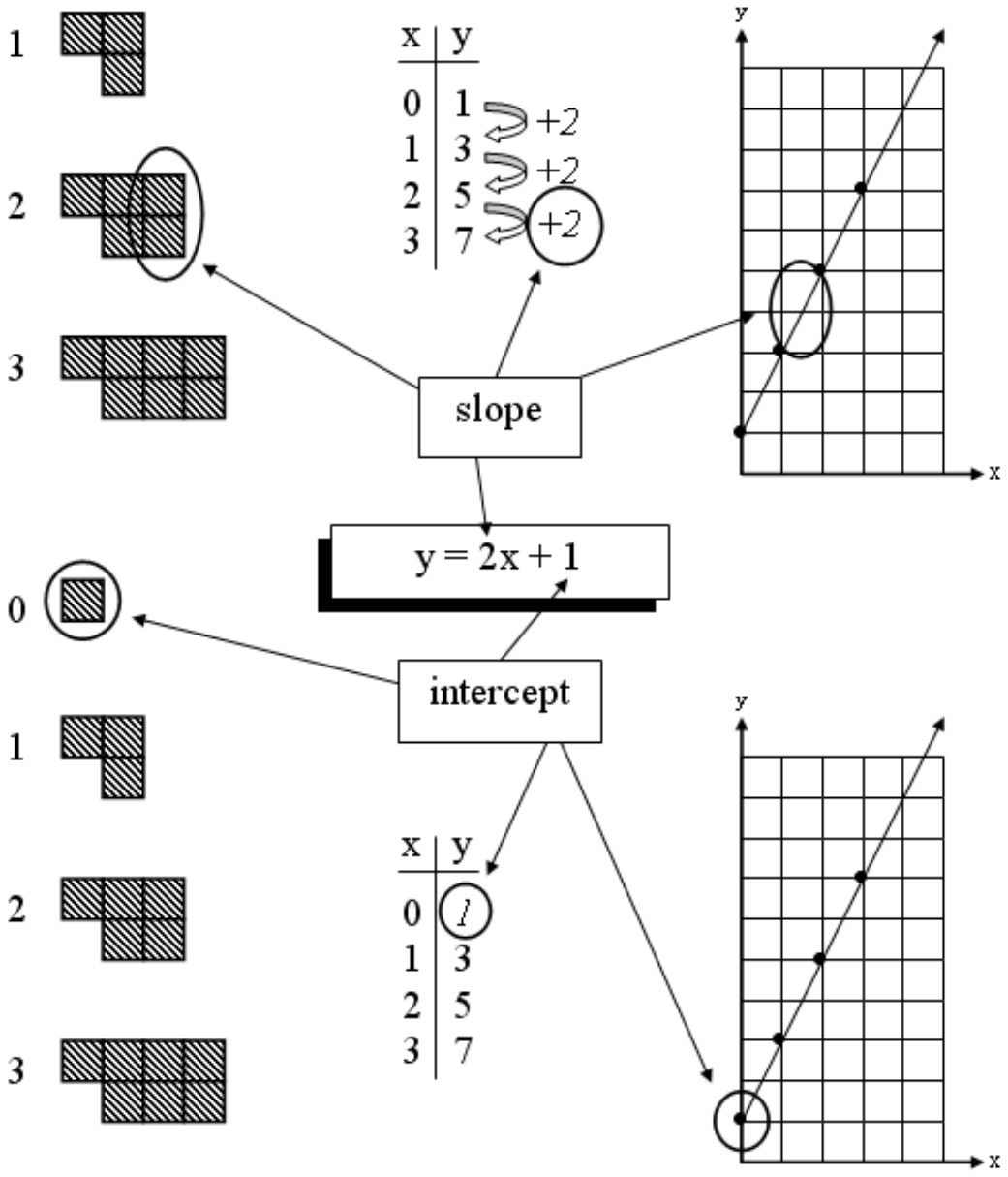
Functions 10, 11, 12, 23, and 24 are nonlinear functions and may prove more difficult for students.

Assessment:

Allowing students to work in small groups as they study these functions will allow them to correct many of their own errors. They will see discrepancies in their graphs and t-tables. Running the activity as a lab in which students move from station to station will also free you up to help struggling groups.

transparency master

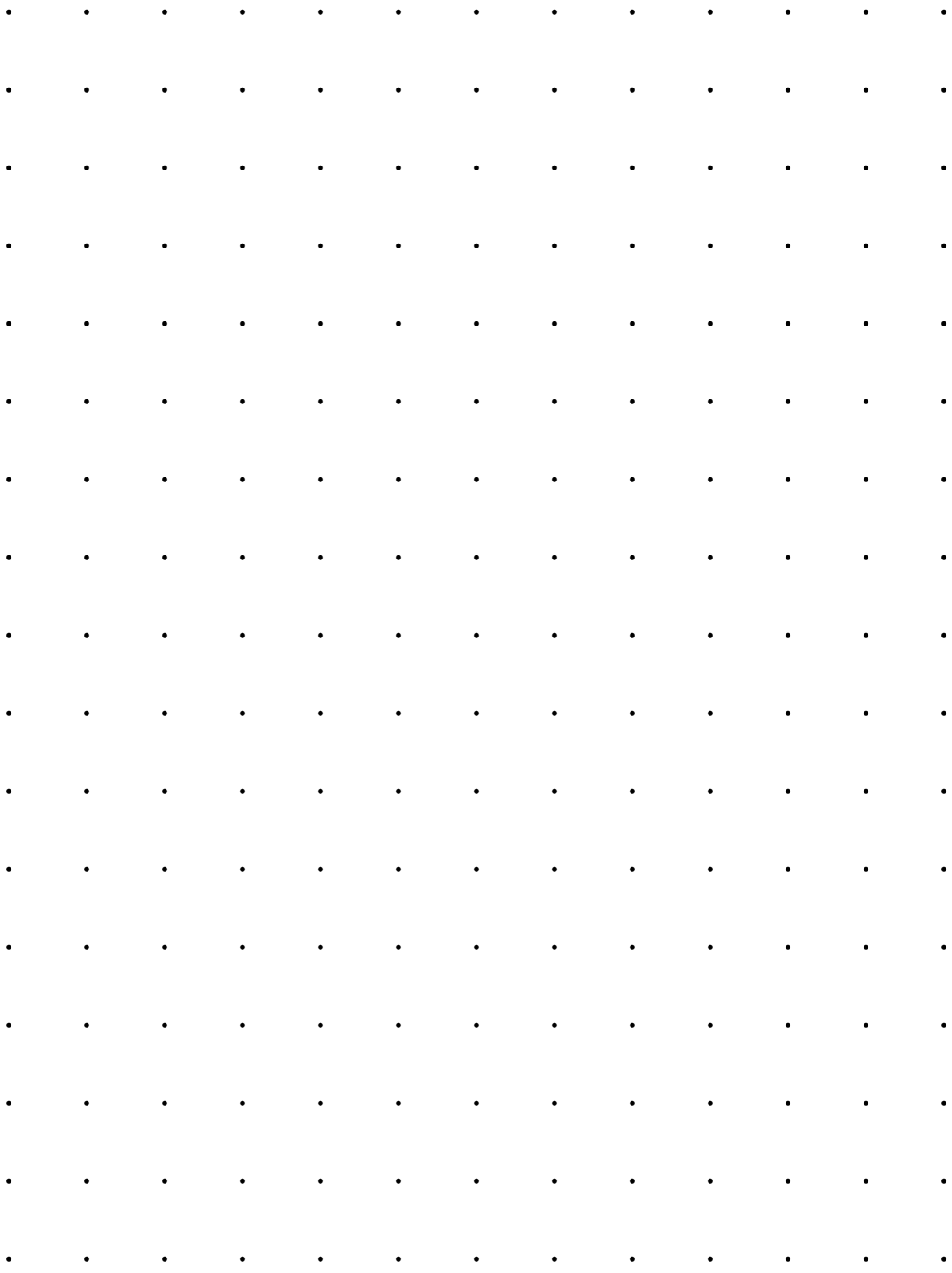
Note: A more detailed treatment of the algebra involved in this activity can be found in two other books by the same authors. The titles are *Simply Great Math Activities: Algebra Readiness* by Teacher to Teacher Press and *The Pattern and Function Connection* by Key Curriculum Press. Here is an abbreviated diagram of how the slope and intercept of a linear function can be derived from its picture, t-table, and graph.



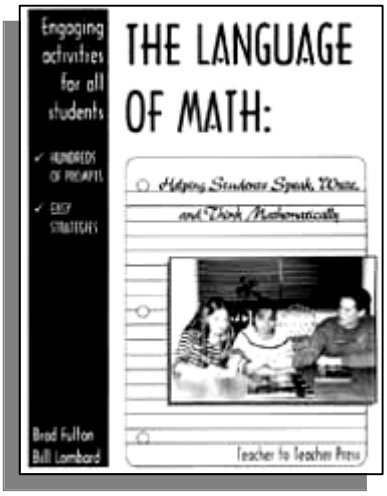
Simply Great Explorations in Geometry 50 Fulton and Lombard

$^{1}/_{2}$ inch grid paper

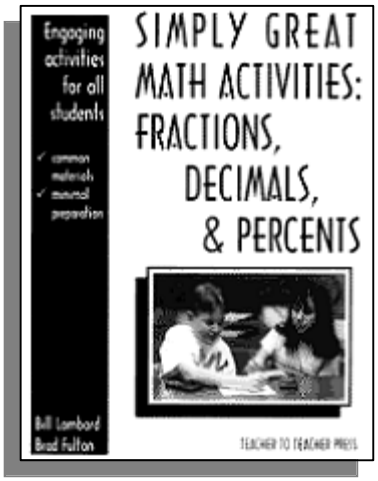
$^{1}/_{2}$ inch dot paper



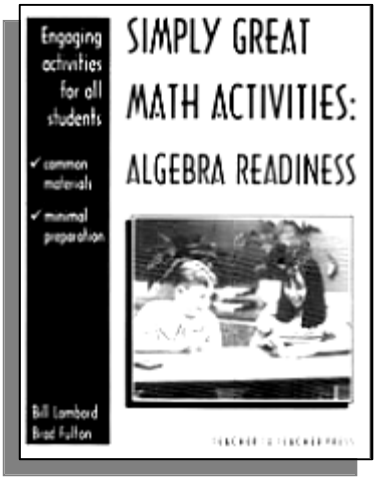
Books by Brad and Bill



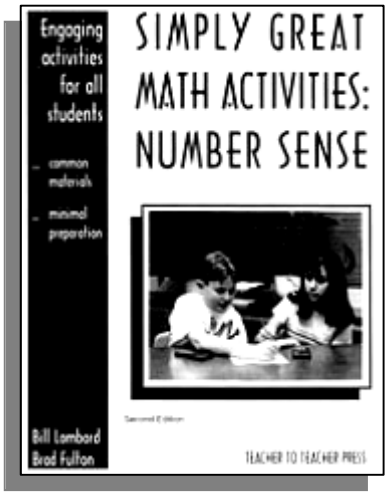
The Language of Math helps teachers create a classroom environment rich in mathematical thinking by showing them how to easily incorporate oral and written language into their math classes. Over 100 journal and discussion starters are included along with extensive instructions for making the most of your math time.



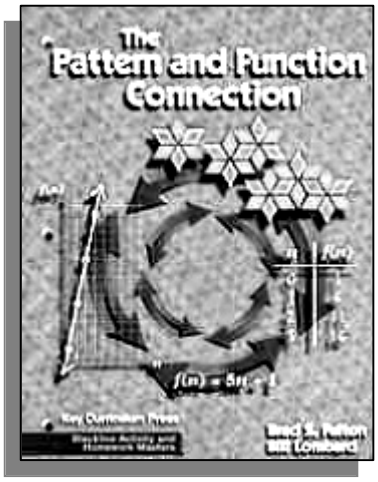
Here are a dozen unique and conceptual activities that will help your students add, subtract, multiply and divide fractions as well as connect them to decimal and percent representations. Both you and your students will love the novel and creative approach.



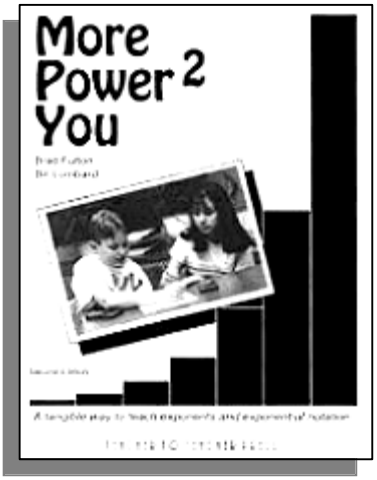
Teachers are raving about how effective these activities have been in their classrooms. Children as young as fourth grade and college students alike say that algebra is easy and makes sense because of this incredible approach.



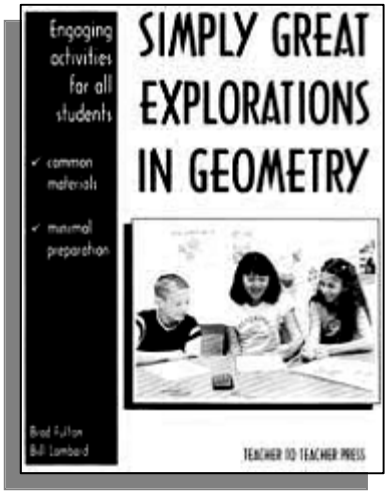
Students don't even think they are doing math sometimes because these activities are so fun and engaging, but they are developing rich and valuable number sense as they explore these eleven creative activities.



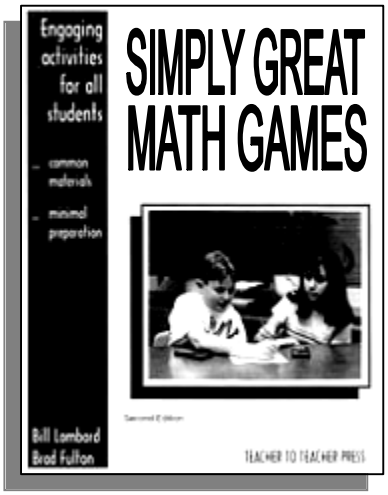
Our first book is still one of our most popular. Every teacher we talk to who has tried this approach to functions has been amazed at what their students have learned and accomplished. Over 150 pages of multiple representations of functions cover such concepts as slope, intercept, and function notation. Even elementary students have developed an understanding of functions with this book.



Exponents will finally make sense to your students after they participate in the unique activities found in this book. Both positive and negative exponents are demonstrated conceptually. Your students will even be able to explain *why* $n^0 = 1$.

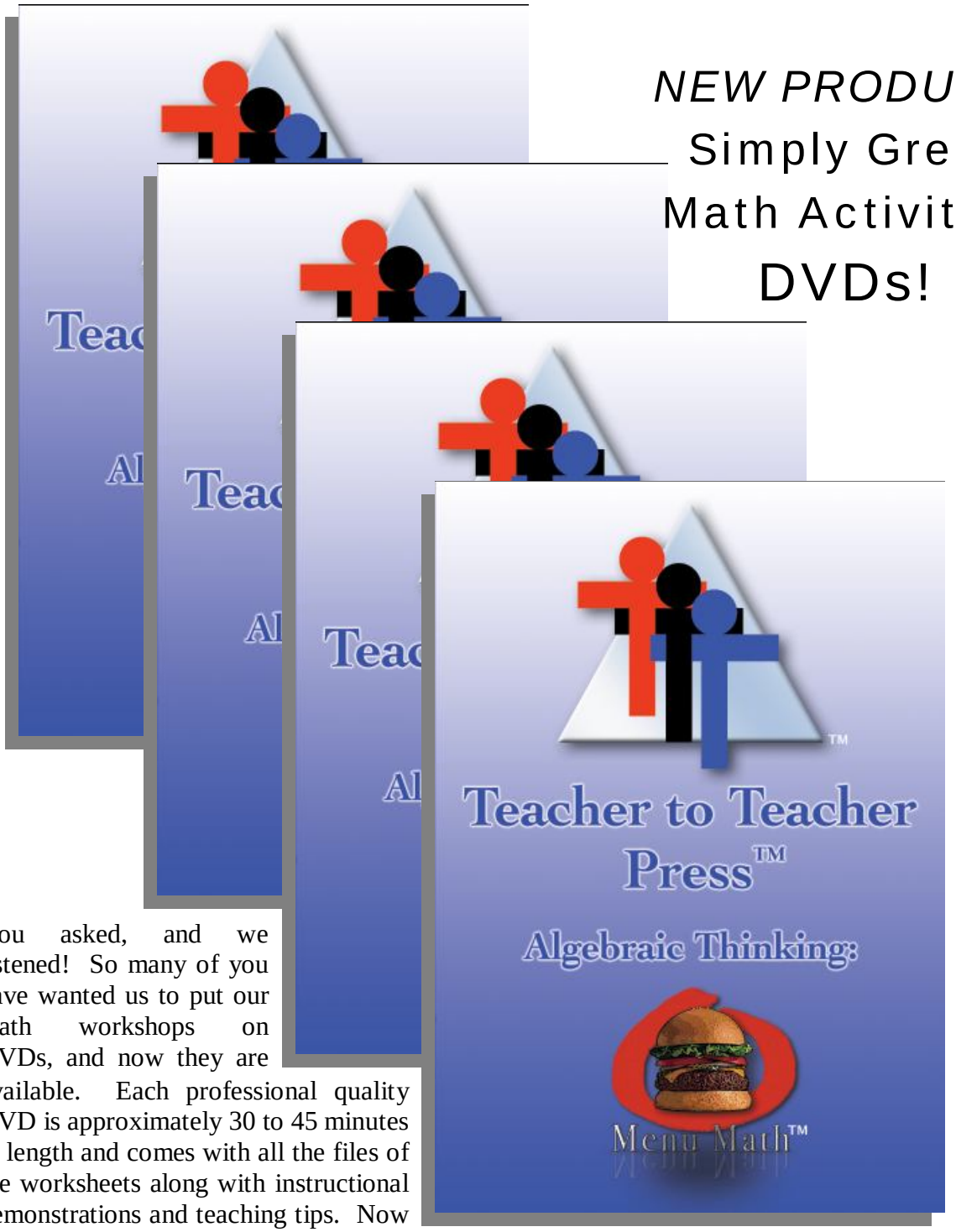


Over one dozen geometry activities will excite your students as they discover the connections between geometry and fractions, decimals, percents, and even algebra. Area formulas, angle measurement, polygon attributes, vocabulary, and construction are covered.



A dozen engaging and educational games await you and your students in this creative and highly adaptable book. You'll find games that reinforce basic operations with whole numbers, fractions, decimals, and integers as well as algebraic skills. Game masters will serve a spectrum of grade levels and skill levels. Your students will beg for more!

Download *free* sample chapters at our website:
www.tttpress.com



NEW PRODUCT!

Simply Great Math Activities DVDs!

You asked, and we listened! So many of you have wanted us to put our math workshops on DVDs, and now they are available. Each professional quality DVD is approximately 30 to 45 minutes in length and comes with all the files of the worksheets along with instructional demonstrations and teaching tips. Now you can "attend" your own Bill and Brad workshop anytime you want. We offer DVD versions of some of our most popular activities. Check our website to see the latest titles.

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