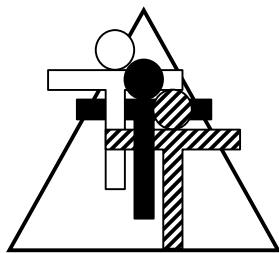


NUMBER LINE

DEVELOPING MATHEMATICAL THINKING IN FRACTIONS, DECIMALS, PERCENTS, AND ALGEBRA

By Brad Fulton and Bill Lombard



Teacher to Teacher Press

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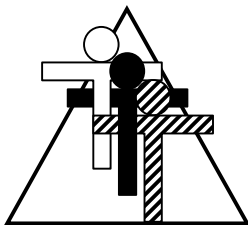
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This resource manual is dedicated to the students of Brad Fulton and Bill Lombard, who have been sources of inspiration to us as teachers. Without these students our lives would not be as rich and rewarding as they are.

For consultant services contact:

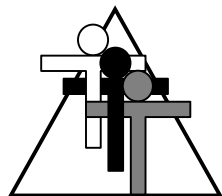
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“Building Mathematical Skill on a Foundation of Understanding”



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 35 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

Fraction Number Line

- ✓ Helps students understand the magnitude of fractions, decimals, and percents
- ✓ Demonstrates fractional, decimal, and percent equivalencies
- ✓ Develops fraction number sense
- ✓ Fosters mathematical communication in a fraction environment
- ✓ Can be used as a warm-up or whole class activity

Fraction Number Line

Materials:

- fraction cards
- tape
- string
- activity master

Overview: If you want to build number sense with fractions, if you want to help students see the connections between fractions, decimals, and percents, if you want to generate rich mathematical discussion then this quick and easy activity is for you. Use it as a planned activity, a warmup, or a quick filler.

Vocabulary: numerator, denominator, greater than, less than, reciprocal

PROCEDURE**Skills:**

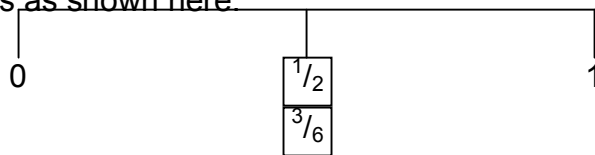
- Comparing fractions
- Ordering fractions
- Simplifying fractions
- Finding equivalent fractions
- Understanding reciprocals

- 1 You will need to draw a number line on the board. It should run the length of the entire board. It should only include the numbers zero and one as shown:



- 2 Give each student a card from the simplified fraction set. (You can copy these onto card stock to make them more durable.) Each student can come to the board and tape their fraction where it should go. You may wish to have them do this one at a time, in small groups, or as a whole class. Students should be able to explain their reasoning for the placement. Ask other students if they agree with a card's location and have them explain why.
- 3 For example, let's assume $\frac{1}{4}$ and $\frac{1}{3}$ have been placed on the number line. The next student has to place $\frac{1}{5}$ on the line. He or she might use common denominators to determine that $\frac{1}{5}$ is the smallest of the three. On the other hand, the student could reason that larger denominators mean a whole has been cut into smaller parts, so the one fifth is smaller than the one fourth or the one third. The student might use division to convert the three fractions to decimals or use percent equivalents to tell that the fifth was the smallest. Encouraging students to look at these fractions in multiple ways will foster the conceptual fraction sense students need.

- 4 Once students have completed this task, they are ready for the equivalent fraction cards. There are two ways to present this activity. The first is to pass out the cards from this set as before. The second is to mix these cards with the simplified set. This will allow students to see the equivalency of the fractions as shown here:

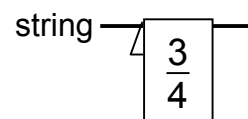
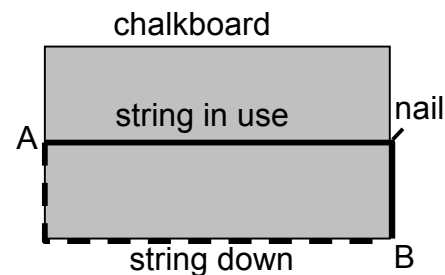


- 5 The third activity that can be done with the cards involves the decimal cards. Again these may be presented individually or mixed with the fraction cards to show equivalency. Both approaches are conceptually rich, and doing the activity one way does not preclude doing it the other.
- 6 Lastly, mix the percent cards with the decimal and fraction cards so students will become familiar with all three forms of fraction notation.
- 7 This activity is most powerful if presented over a period of days throughout the year. More learning and more retention will occur that way. If you would like to make it easier to use this activity on a regular basis, consider putting up a permanent number line. To do this, run a string from a nail or tack on one side of your chalkboard (A) to the other, over another nail, and down to the chalk tray (B) as shown. Fasten it there with a third nail. When you want to remove the number line, unhook it from the nail and run it under the chalk tray as shown by the dotted line. Each fraction card has a dashed line indicating where to fold it backward so it can be hung on such a string.
- 8 Two blank masters are included to make cards of your own. You can also use 3 x 5 index cards or sticky notes.

Good Tip!



You can play a variation of the card game, "War" by using the cards. Give pairs of students a set of cards and let them play against another pair. Each team lays a card face up and the team with the greater fraction wins both cards. In the event the cards are equal, an addition card is played.



Journal Prompts:



Put these three fractions in order from least to greatest. Explain your reasoning.

$\frac{3}{5}$ $\frac{7}{10}$ $\frac{6}{11}$

The fractions $\frac{1}{4}$ and $\frac{2}{5}$ have been placed on the number line. What fraction might go in between them? How do you know?

Homework:



You can use the enclosed activity master for homework, or assign a page from a text or workbook.

Taking a Closer Look:



Include mixed numbers and improper fractions. Or ask students to place the reciprocals of their cards on the number line.

Assessment:



This activity can be checked as the students are putting up their cards. you can also check them by converting all the cards to decimals. If you assign the homework master, use the following key to check it.

Answer Key:

Set 1:

$\frac{1}{4}$ $\frac{3}{8}$ $\frac{1}{2}$ $\frac{3}{4}$ $\frac{5}{6}$

Set 2:

$\frac{1}{4} = \frac{2}{8}$ $\frac{7}{12}$ $\frac{9}{15} = \frac{3}{5}$ $\frac{2}{3}$

Set 3:

$\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ $\frac{4}{5}$ $\frac{5}{6}$

Set 4:

$\frac{1}{5} = .2$ $\frac{1}{4}$ 30% $\frac{1}{3}$.35

Set 5:

.5% .05 $\frac{1}{10}$ $\frac{1}{4}$ 50% 100%

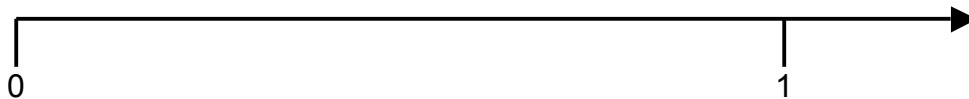
Activity master

Number Line Fractions

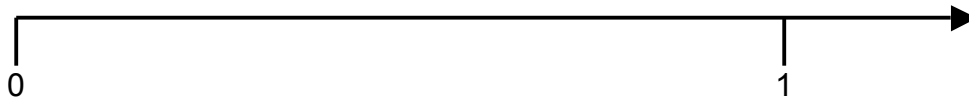
Name _____

Put the following fractions, decimals or percents on their number lines in the correct locations.

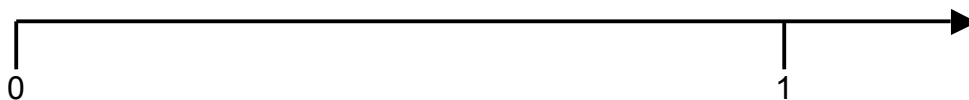
Set 1: $\frac{3}{8}$ $\frac{5}{6}$ $\frac{1}{4}$ $\frac{1}{2}$ $\frac{3}{4}$



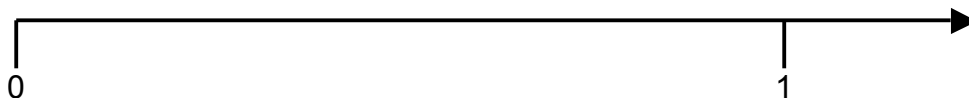
Set 2: $\frac{2}{8}$ $\frac{2}{3}$ $\frac{9}{15}$ $\frac{7}{12}$ $\frac{1}{4}$ $\frac{3}{5}$



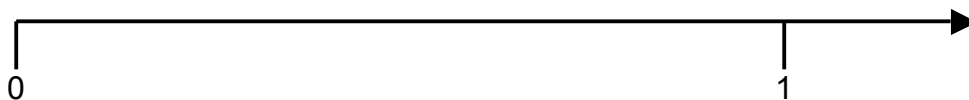
Set 3: $\frac{3}{4}$ $\frac{2}{3}$ $\frac{1}{2}$ $\frac{5}{6}$ $\frac{4}{5}$



Set 4: $\frac{1}{3}$ $\frac{1}{5}$ $.2$ $\frac{1}{4}$ 30% $.35$



Set 5: 100% $.05$ $\frac{1}{10}$ 50% $.5\%$ $\frac{1}{4}$



1 | 4

3 | 5

2 | 3

2 | 5

1 | 3

1 | 5

1 | 2

3 | 4

$1 \frac{1}{7}$ $1 \frac{1}{8}$ $5 \frac{1}{6}$ $6 \frac{1}{7}$ $1 \frac{1}{6}$ $4 \frac{1}{7}$ $4 \frac{1}{5}$ $3 \frac{1}{7}$

1 | 9

8 | 9

7 | 8

7 | 9

5 | 8

5 | 9

3 | 8

4 | 9

7
—
10

11
—
12

5
—
10

7
—
12

3
—
10

5
—
12

1
—
10

1
—
12

$$\frac{3}{6}$$

$$\frac{6}{8}$$

$$\frac{2}{6}$$

$$\frac{4}{8}$$

$$\frac{2}{4}$$

$$\frac{2}{8}$$

$$\frac{3}{3}$$

$$\frac{4}{6}$$

.1

.01

.2

.20

.25

.3

.33

.35

.4

.45

.5

.50

.05

.6

.65

.7

.75

.8

.08

.9

.90

.95

1.0

1.05

10%

1%

25%

50%

75%

$33\frac{1}{3}\%$

$66\frac{2}{3}\%$

11%

5%

9%

11%

72%

65%

70%

60%

80%

99%

.5%

12¹/₂%

39%

102%

150%

200%

1.1%

On a national test, only the most difficult items on division of decimals proved more difficult than ordering decimals.

Research Ideas for the Classroom Early Childhood Mathematics Douglas Owens, Ed.

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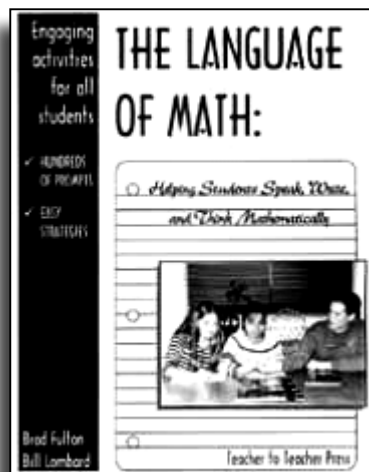
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- ◆ Downloadable handouts from our workshops
- ◆ Quotes for motivating students
- ◆ Links to other valuable resource websites
- ◆ Order forms for our materials
- ◆ A bibliography of great mathematical reading
- ◆ Calendars showing where and when you can hear
Brad and Bill present

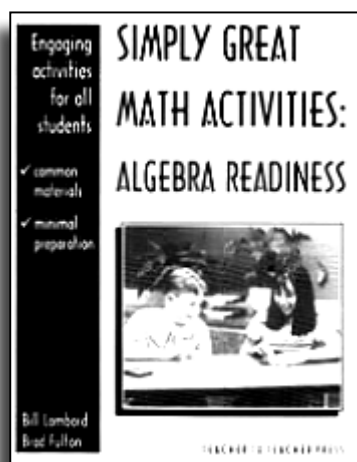
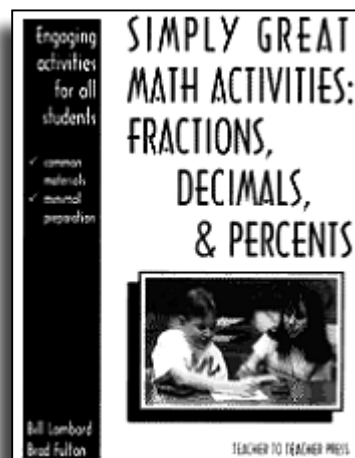
Happy surfing!

Books by Brad and Bill



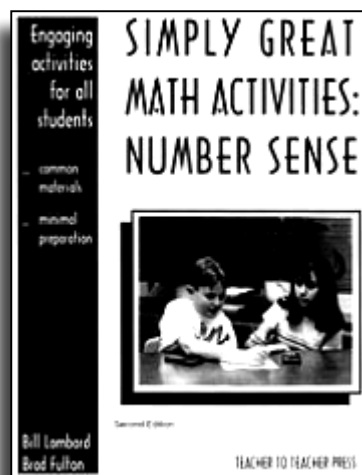
The Language of Math helps teachers create a classroom environment rich in mathematical thinking by showing them how to easily incorporate oral and written language into their math classes. Over 100 journal and discussion starters are included along with extensive instructions for making the most of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

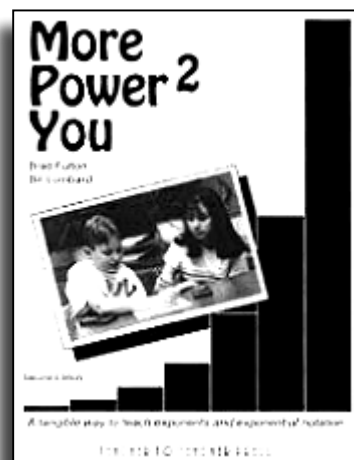
Students don't even think they are doing math sometimes because these activities are so fun and engaging, but they are developing rich and valuable number sense as they explore these eleven creative activities.



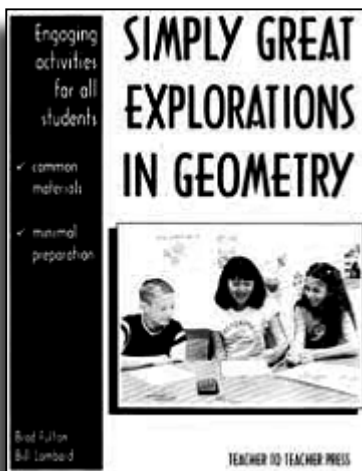


Our first book is still one of our most popular. Every teacher we talk to who has tried this approach to functions has been amazed at what their students have learned and accomplished. Over 150 pages of multiple representations of functions cover such concepts as slope, intercept, and function notation.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

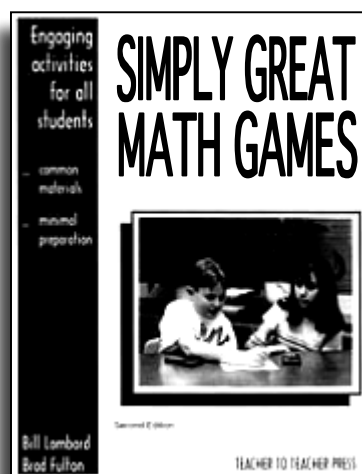
Exponents will finally make sense to your students after they participate in the unique activities found in this book. Both positive and negative exponents are demonstrated conceptually. Your students will even be able to explain *why* $n^0 = 1$.



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.



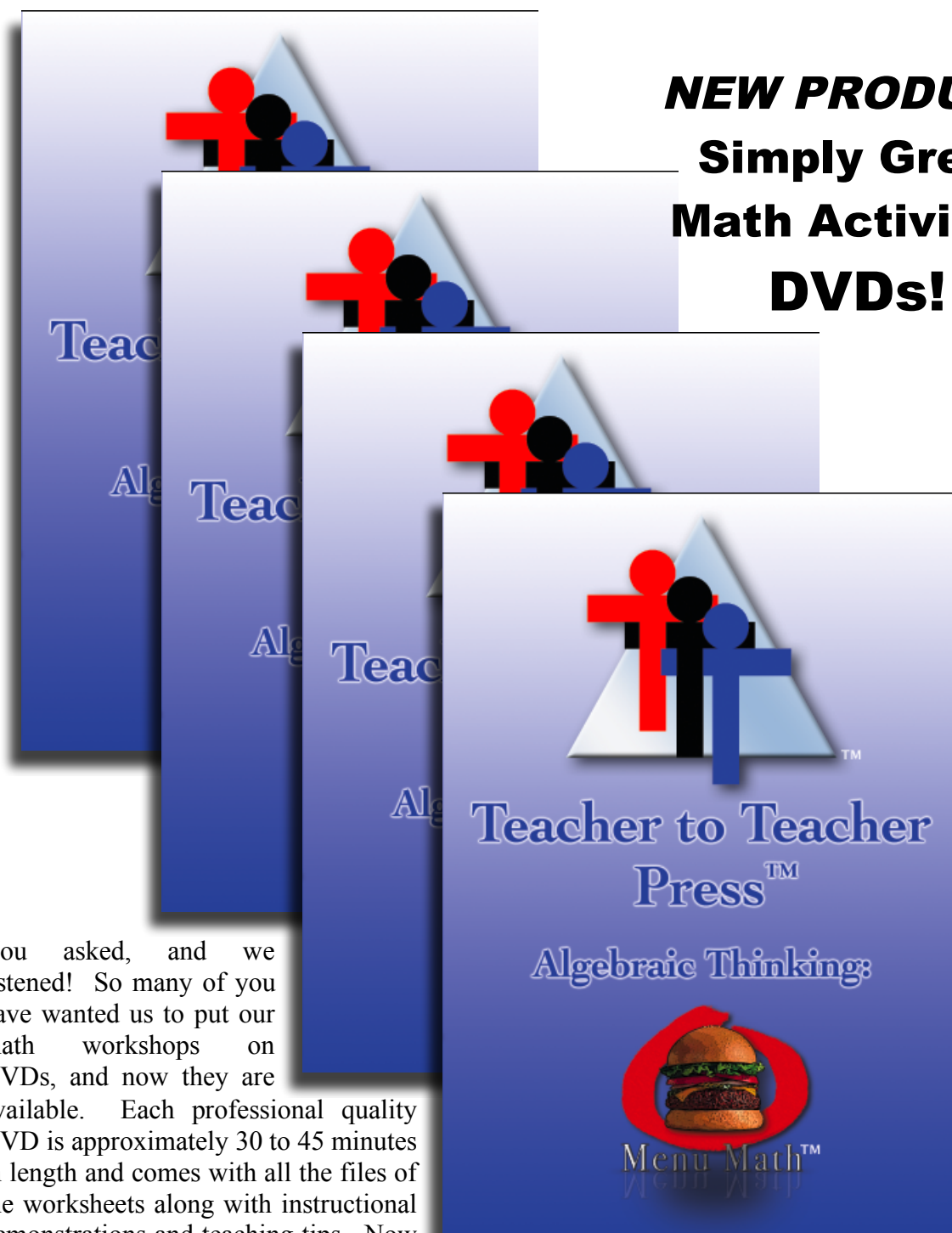
A dozen engaging and educational games await you and your students in this creative and highly adaptable book. You'll find games that reinforce basic operations with whole numbers, fractions, decimals, and integers as well as algebraic skills. Game masters will serve a spectrum of grade levels and skill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



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