

# Fraction Speed Bumps

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Fraction Challenges that Enhance and Review Basic Skills



### **About the author**

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**Revised 1/2010**

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Phone: (800) 359-0961 • [www.teachinteract.com](http://www.teachinteract.com)

ISBN# 978-1-56004-386-7

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## Standards

The nationwide movement for high standards has not only determined what students should learn, but also mandated that students demonstrate what they know. *Fraction Speed Bumps* is a standards-based program addressing National Math Standards and provides many opportunities for performance assessments. Students apply their math skills and creativity to solve a variety of fraction challenges. The cooperation, peer teaching, and group decision-making address Applied Learning Standards.

### **National Standards for School Mathematics (NCTM)**

Grades 5–8

#### ***Standard 1—Problem Solving***

- Use problem-solving approaches to investigate and understand mathematical content
- Develop and apply a variety of strategies to solve problems, with emphasis on multistep and non-routine problems
- Verify and interpret results with respect to the original problem situation
- Generalize solutions and strategies to new problem situations
- Acquire confidence in using mathematics meaningfully

#### ***Standard 2—Communication***

- Reflect on and clarify their thinking about mathematical ideas
- Discuss mathematical ideas and make conjectures and convincing arguments

#### ***Standard 3—Reasoning***

- Validate their thinking

#### ***Standard 5—Number Relationships***

- Develop number sense for whole numbers, fractions, and decimals
- Investigate relationships between fractions and decimals

#### ***Standard 6—Number Systems and Number Theory***

- Extend their understanding of whole number operations to fractions and decimals
- Understand how the basic number operations are related

### ***Standard 7—Computation and Estimation***

- Compute with whole numbers, fractions and decimals
- Develop, analyze, and explain procedures for computation and techniques for estimation
- Use estimation to check the reasonableness of results

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## **Student Guide**



## Purpose

Many students work fraction problems without any real fraction understanding. *Fraction Speed Bumps* offers a different approach to reviewing and manipulating fractions. Students, working in teams of three, experiment with fractions, share their findings, and use logical reasoning. They compete against both the fraction challenges and other teams. A wide variety of activities gives the teacher total control over the length of time spent each day, the number of days the unit will last, and finally, which team building competitions to choose. The Teacher Guide provides daily instructions and procedures. The Student Guide provides information that reviews and reinforces many fraction concepts. You may supplement the challenges provided as dictated by the needs of your students. You may also substitute your own choice of fraction problems for some or all of the competitions.

Every activity in *Fraction Speed Bumps* encourages students to use higher level thinking skills. Knowledge, application, analysis, evaluation, and synthesis are all experienced as the students work through the challenges in this unit. By working through *Fraction Speed Bumps*, students will understand and experience the following:

### **Knowledge**

1. Understand relationships involving fractions
2. Solve progressively more difficult problems
3. Devise creative solutions to fraction challenges
4. Understand more clearly how the functions of multiplication and division relate to fractions
5. Use addition, subtraction, multiplication, and division to solve problems
6. Gain a more complete understanding of fraction practices
7. Use metric measurements

### **Skills**

1. Tackle a problem creatively
2. Demonstrate risk-taking related to fractions and design, based on knowledge, estimation, math concepts, and visualization
3. Design competition models
4. Build on previous learning experiences to solve new fraction challenges

### ***Attitudes***

1. Confidence to use his/her own approach to create a solution
2. Appreciate the value of collaborative working relationships
3. Delight in seeing how others have solved a problem
4. Increase knowledge and confidence as they share insights and methods with others
5. Strive for a goal
6. Work cooperatively with other students to develop competition strategies
7. Enjoy increased confidence by developing different approaches to solving fractions

## Overview

*Fraction Speed Bumps* is a math unit that allows students to review fraction theory and enhances understanding of fraction relationships through exploration and competition. This competitive series of math challenges enables teams of three to earn points each day. Each event involves planning, logical thinking, cooperation, and a little luck. During the unit, teams amass points and use those points to purchase materials for building speed bumps. During the culmination, all remaining points are used in a design challenge competition. There are many ways for a team to meet with success.

The team competition allows individuals to attempt a different kind of fraction challenge, rather than just working on regular fraction problems. Teams generate answers based on a different challenge each day. These challenges help them see patterns and cement understanding. Students engage in competition that is both challenging and non-threatening. As the competition progresses, students use strategies based on their evaluation of their previous challenge experiences.

The competition assumes that students have worked previously with fractions. Brief fraction review lessons should be included at the beginning of a class period, followed by the team competition. Challenge fraction pages may be assigned as class work or homework, if needed.

There are different suggestions throughout the unit to help you modify the challenge to match the skill level of each class.

The Student Guide is a guide for reviewing and thinking about fractions. Examples are included to enhance and reinforce prior fraction knowledge.

The speed bump events and the culmination are “design challenges” which are hands-on activities. Building materials (paper strips) are purchased with the points earned earlier during the daily fraction competitions. These creative competitive designs are used during classroom team competitions, with the Slow Marble Race as the culminating activity.

### **Differentiation**

This unit offers opportunities for all students through:

1. Visual/spatial: drawing and designing competition model
2. Bodily/kinesthetic: hands-on creations/projects (models)
3. Interpersonal: interacting and planning with others
4. Intrapersonal: setting own goals, independent study, introspection, and use of creative materials

5. Linguistic: using words effectively in evaluations of strategies
6. Logical/mathematical: reasoning, calculating, thinking conceptually and abstractly, and seeing and exploring patterns and number relationships

### **Special Needs Students**

Like all Interact units, *Fraction Speed Bumps* provides differentiated instruction through its various learning opportunities. Students learn and experience the knowledge, skills, and attitudes through all domains of language (reading, writing, speaking, and listening) and math (counting, tallying, computing, etc.). Adjust the level of difficulty to best fit the needs of your students.

Allow students to use calculators. Assist special needs students in the activities to utilize their strengths and to succeed. Work together with the Resource Specialist teacher, Gifted and Talented teacher, or other specialist to coordinate instruction.

## About the Unit

*Fraction Speed Bumps* is a departure from traditional fraction problems. Each activity can be part of the long-term team competition or may stand alone as a challenging review lesson. Teams of three use the values provided each day to meet a variety of challenges. There are opportunities for teams to use logical thinking and strategic planning during each competition. The Student Guide includes basic review information for all students. Teams generate specific answers and compete against each other, but all teams earn points for each challenge.

The daily speed bump fraction challenge encourages every team member to work for the best solution. These challenges offer you flexibility. The competition can stop at any problem, or be split over two days. Discussion questions help students reflect on the main concept for the day. You may use the questions for individual written reflections or class discussion. The fraction challenges are varied and offer complicating twists to maintain interest and encourage competition.

This review unit helps students feel more confident and think about fractions differently while seeing the fraction/decimal relationship in a new way.

### ***Fraction speed bump challenges***

Fraction speed bump challenges are pages that review basic fraction processes and create a competitive atmosphere. The teacher may modify the pages to meet the needs of each class. Teams should take time to develop strategies for attacking each page.

### ***Fraction speed bumps: Marble rolling***

The actual speed bump marble-rolling activities allow teams to use skill to earn additional points. Some only require the rolling of marbles, while others include team discussion, cooperation, and the construction of a speed bump sheet. Select the types of speed bump activities that will work with your class and your schedule.

### ***Slow Marble Race***

The Slow Marble Race is the culmination of the unit. The teams use points they have earned to purchase thick paper for building their racetrack. This activity allows for design creativity and thinking “outside the box.” A team with a great idea may win even though it has less track length than other teams. Ideas gained from earlier speed bump marble-rolling competitions may be the key to slowing the marble on its descent from three inches. The unit allows you to choose the competition(s) that best fit(s) your teaching schedule for fractions.

***Friendly competition***

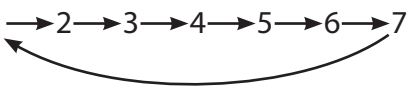
The competition in *Fraction Speed Bumps* is supposed to be friendly and foster camaraderie. As teammates discover the easiest way to solve a challenge, they should be encouraged to share their insights with each other. They are competing not only against the speed bump challenges, but against another teams' strategy.

1. Depending on the team makeup, the point totals may become lopsided. You can make the competition a good experience for all teams by choosing the best option for running a competitive culmination (see page 61).
2. You can use Extension and Homework activities to give some teams the chance to gain extra points, which makes the final event more competitive. Everyone likes to compete against worthy rivals.
3. Students learn that helping teammates and sharing the workload make the team stronger
4. By the final event, most teams will agree that their point total was a combination of math understanding, physical skill, and in some cases...luck

***Identifying opponents***

Each day teams need to sit in groups of three and be near their opponents so that the symbols and values written on a team sheet may be checked for accuracy.

There are several methods for identifying opponents:

1. Put team names in a hat and pull each out to determine opponents
2. Have the first place team (most points earned) compete against second place, third against fourth, etc.  $1 \leftrightarrow 2$   $3 \leftrightarrow 4$   $5 \leftrightarrow 6$   $7 \leftrightarrow 8$
3. You may have an odd number of teams. If so, give each team a number and have one check two, two check three, three check four and the last team will check the first.  $1 \rightarrow 2 \rightarrow 3 \rightarrow 4 \rightarrow 5 \rightarrow 6 \rightarrow 7$   


All teams should get to compete against all other teams during the unit.

## Daily Tasks

Some teacher and student tasks are repeated throughout the unit. Since teams will quickly become familiar with the structure of the competition, these tasks are not always included in every set of instructions.

### **Teacher tasks:**

1. Get out student folders
2. Arrange desks in threes
3. Place papers face down before starting
4. Write fraction examples on the board
5. Lead class review discussion as needed before the competition starts
6. Write number on team papers indicating order of finishing
7. Write answer on board to aid students when checking opponent's work
8. Determine, when a team finishes first, if they may work on homework, an Extension sheet, or cut out speed bumps, catching trays, or racetrack segments
9. Collect team folders each day
10. Decide if an extension, homework, or assessment sheet will be assigned for the day

### **Student tasks:**

1. Write team name on papers
2. Write answers neatly on team the speed bump challenge page
3. Make sure that Checkers check opponent's answers and score sheet
4. Understand that a mistake results in a two-point penalty
5. Remind Recorders to write points earned and spent on the score sheet during the competition and at the end of each challenge

**Daily Directions***Day 1***Daily Plan**

- Form and name teams
- Introduction, roles and responsibilities (page 2 of the Student Guide)
- Take the Pretest

**Materials**

- Team folders—*one per group*
- Cooperative work rubric—*one per team (or class chart)*
- Score sheet—*one per team*
- Student Guide—*class set*
- Pretest/Posttest—*class set*
- Pencils
- Markers

**Teacher Reference**

- Pretest/Posttest Key

**Preparation**

1. Assign students to heterogeneous teams and set up team folders. See setup directions on page 16.
2. Designate a work area and an area for each team to store all materials. Three desks side-by-side make for the best work area.

**Procedure**

1. Announce team assignments and allow teams a few minutes to select team names
2. Distribute team folders and direct students to write their team name on the outside of the folder. Under their team name, they should write their individual names.

*Small group*



- a. Teams need their folders every day
  - b. The Recorder is responsible for the folder during class time and keeps the materials organized
  - c. Team folders are turned in at the end of each class period
4. Distribute individual Student Guides and have each student write the team name and his/her own name at the top. Read the roles and responsibilities on page 2 of the Student Guide.
  5. Answer any questions and collect team folders
  6. Administer the Pretest and correct it before the class meets again

*Individual*

Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Pretest/Posttest

Skip the ones you do not know and work on the ones you think you know.

**For numbers 1 through 5, circle the answers you choose.**

1. Which two fractions are the largest?

$$\frac{9}{12} \quad \frac{7}{10} \quad \frac{2}{20} \quad \frac{3}{13} \quad \frac{5}{7} \quad \frac{4}{8} \quad \frac{4}{5} \quad \frac{4}{7}$$

2. Which two fractions when added will give the smallest answer?

$$\frac{2}{13} \quad \frac{1}{11} \quad \frac{4}{40}$$

3. Select two fractions that will give the largest answer when subtracted.

$$\frac{1}{7} \quad \frac{3}{8} \quad \frac{4}{5} \quad \frac{9}{10}$$

4. Which two of these can be multiplied to get an answer less than  $\frac{1}{2}$ ?

$$\frac{7}{8} \quad \frac{3}{5} \quad \frac{2}{3} \quad \frac{19}{20}$$

5. How many of these can you use as divisors to get answers less than  $\frac{1}{4}$ ?

$$\frac{1}{3} \text{ divided by...} \quad \frac{1}{2} \quad \frac{1}{4} \quad 2$$

6. Reduce these fractions and explain how you reduced them.

a.  $\frac{16}{32}$

b.  $\frac{40}{90}$

c.  $\frac{7}{21}$

7. Fill in the missing values.

$$\frac{\boxed{\phantom{000}}}{\boxed{5}} = \frac{\boxed{6}}{\boxed{\phantom{000}}} = \frac{\boxed{\phantom{000}}}{\boxed{20}} = \frac{\boxed{200}}{\boxed{500}}$$