*Investigating*

# Fractions, Decimals, and Percents

## Contents for Grades 4–6

***Investigating Fractions, Decimals, and Percents*** (Grades 4–6) is organized around 5 units. Each unit comprises a two-week (10-day) sequence of investigations, games, routines, and minilessons.

## 2 The California Frog-Jumping Contest: Algebra

BY BILL JACOBAND CATHERINE TWOMEY FOSNOT

### DAY ONE: JUMPING

The frog-jumping context is used to generate the open number line model that will be used throughout the unit to explore and represent equivalence of algebraic expressions.

### DAY TWO: JUMPING BUDDIES

A minilesson examines representations of division problems as expressions represented on an open number line. A new investigation and subsequent math congress focus on using the open number line as a tool for considering the relationships among different common multiples.

### DAY THREE: THE BENCHES

An investigation and subsequent math congress encourage the transition from arithmetical strategies to algebraic strategies such as using equivalence and substitution.

### DAY FOUR: THE FENCE

A minilesson uses the double number line to examine proportional relationships. An investigation involving greater numbers encourages systematic exchange, and use of the equivalence and substitution strategies explored on Day Three.

### DAY FIVE: THE COMBINATION CHART AND EXCHANGE

A math congress introduces the combination chart as a tool for exploring exchange of equivalent amounts.

### DAY SIX: THE FROG-JUMPING CONTEST

An investigation explores variation, and using equivalence to solve for unknowns.

### DAY SEVEN: THE FROG-JUMPING CONTEST

A math congress explores the strategy of using equivalent amounts to simplify problems.

### DAY EIGHT: THE OLYMPICS

A minilesson further develops and supports students' understanding of variables. The subsequent series of investigations encourages the use of a variety of strategies, including the use of more formal algebraic notation using variables.

### DAY NINE: MORE OLMYPICS

Preparations for a math congress give students a chance to share and discuss their work from Day Eight. The congress itself enables students to reflect upon different ways of representing a problem.

### DAY TEN: MORE PROBLEMS AND ASSESSMENT

A minilesson supports students in thinking about algebraic expressions in relation to other expressions. A series of assessments highlights the various algebraic strategies students have constructed.

### REFLECTIONS ON THE UNIT

## 3 Best Buys, Ratios, and Rates: Addition and Subtraction of Fractions

BY BILL JACOB AND CATHERINE TWOMEY FOSNOT

- **DAY ONE: BEST BUY ON CAT FOOD**
  The context of cat food prices is introduced to support the development of several big ideas related to proportional reasoning, fractions, and equivalence.
- **DAY TWO: BEST BUY ON CAT FOOD**
  Small-group discussions, followed by a math congress, give students a chance to share and discuss their work from Day One. The congress also introduces the ratio table model.
- **DAY THREE: THE PRICE OF BIRDSEED**
  A minilesson highlights the usefulness of the money model when adding certain fractions. During the birdseed investigation, students are supported in developing proportional reasoning and in using a ratio table flexibly as a powerful tool.
- **DAY FOUR: THE PRICE OF BIRDSEED**
  A minilesson highlights the usefulness of the money model when subtracting certain fractions. The subsequent math congress builds on the work of Day Three, with an emphasis on proportional reasoning.
- **DAY FIVE: THE EMPORIUM'S GOURMET MIX**
  A minilesson highlights the usefulness of the clock model when adding certain fractions. The puppy food investigation encourages students to consider how fractions express relationships and to understand that the whole matters.
- **DAY SIX: THE EMPORIUM'S GOURMET MIX**
  Small-group discussions, followed by a math congress, give students a chance to share and discuss their work from Day Five. The congress also introduces the double number line as an important model for operations with fractions.
- **DAY SEVEN: THE GAS TANK**
  The gas tank investigation encourages the development of the double number line model with common wholes as a tool for addition and subtraction with fractions.
- **DAY EIGHT: THE GAS TANK**
  A minilesson on using common wholes when adding fractions highlights the double number line as an important way to represent equivalent fractions. A math congress gives students a chance to share and discuss their work from Day Seven
- **DAY NINE: THE PENNSYLVANIA TURNPIKE**
  A minilesson on using common wholes when subtracting fractions highlights the double number line as an important way to represent equivalent fractions. The turnpike investigation provides a context in which students begin to use the double number line model as a tool to think with.
- **DAY TEN: THE PENNSYLVANIA TURNPIKE**
  A minilesson highlights the benefit of simplifying first when adding certain fractions. A math congress gives students a chance to share and discuss their work from Day Nine.
- **REFLECTIONS ON THE UNIT**

## 4 The Mystery of the Meter: Decimals

BY BILL JACOB, JOHN MICHAEL SIEFRIED, AND CATHERINE TWOMEY FOSNOT

### DAY ONE: THE WEIRD DIALS

Investigation of the mystery meter context and the subsequent math congress support an early understanding of decimal representations.

### DAY TWO: MOVING THE HANDS ON THE DIALS

Continued investigation of the mystery meter and the subsequent math congress promote a deeper understanding of place value involving decimals.

### DAY THREE: READING THE METER

A new meter investigation has students try to read meters with obstructed dials to develop an understanding of part-whole relations between adjacent dials.

### DAY FOUR: ZIG'S RULE

A minilesson focuses on several big ideas related to equivalent operations involving multiplication and division. The investigation and math congress continue development of part-whole relations between digits in place value.

### DAY FIVE: WHAT IS A KILOWATT-HOUR

A new investigation and math congress develop the relationship between watts, kilowatts, and kilowatt-hours.

### DAY SIX: MORE LIGHT BULB MYSTERIES

The investigation encourages students to think multiplicatively and to use whole number computation strategies when working with decimals.

### DAY SEVEN: LIGHT BULB MYSTERIES AND THE METER READER GAME

A math congress gives students a chance to share and discuss their work from Day Six. The Meter Reader game helps consolidate students' understanding of the concepts developed throughout the unit.

### DAY EIGHT: THE BEDTIME MYSTERY

A new investigation helps deepen students'understanding of the place value involved in adding and subtracting decimals. The math congress highlights how computation strategies used for whole numbers also work for decimals.

### DAY NINE: THE MYSTERY DEEPENS

A more complex investigation further develops students' fluency in using decimal arithmetic and the math congress highlights the range of strategies students have developed.

### DAY TEN: THE REAL BEDTIME AND THE COST OF ENERGY FOR THE TELEVISION

A minilesson focuses on equivalent operations. The final investigations and math congress consolidate students' understanding of computation with decimals.

### REFLECTIONS ON THE UNIT

## 5 Exploring Parks and Playgrounds: Multiplication and Division of Fractions

BY LYNN D TARLOW AND CATHERINE TWOMEY FOSNOT

### DAY ONE: RUNNING FOR FUN

The context of running in a marathon supports the development of several big ideas and strategies related to multiplication of a fraction by a whole number. The context also encourages use of the double number line model.

### DAY TWO: RUNNING FOR FUN

Small-group discussions and a subsequent math congress give students a chance to share and discuss their work from Day One. A minilesson encourages decomposing and using partial products.

### DAY THREE: TRAINING FOR NEXT YEAR'S MARATHON

A minilesson encourages the use of landmark fractions and partial products. A new context focuses on multiplication and division with fractions and the relationship between these operations.

### DAY FOUR: THE MARATHON TRAINING RESULTS

A minilesson supports the use of doubling and halving. Small-group discussions and a subsequent math congress give students a chance to share and discuss their work from Day Three.

### DAY FIVE: HOW ARE MULTIPLICATION AND DIVISION OF FRACTIONS RELATED?

A minilesson supports the use of tripling and thirding. Small-group work deepens students' understanding of the relationship between multiplication and division with fractions.

### DAY SIX: EXPLORING PLAYGROUNDS AND BLACKTOP AREAS

The context of developing a playground extends students' work to multiplication of a fraction by another fraction. The context also encourages use of the array model.

### DAY SEVEN: COMPARING BLACKTOP AREAS

A math congress gives students a chance to share and discuss their work from Day Six.

### DAY EIGHT: COMPARING THE COST OF BLACKTOPPING

A minilesson offers more support in using the array model for multiplication of fractions. A new context focuses on multiplying with equivalent forms of fractions—percentages and decimals—and extends students' work with rational numbers.

### DAY NINE: COMPARING THE COST OF BLACKTOPPING

A minilesson encourages interchanging numerators (or denominators) to derive the product of two fractions. Small-group discussions and a subsequent math congress give students a chance to share and discuss their work from Day Eight.

### DAY TEN: A DAY FOR REFLECTING

Creation of a wall display gives students a chance to reflect on and celebrate their mathematical development.

### REFLECTIONS ON THE UNIT