



Grade 3 Concept Maps

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Concept Map for *Mathematical Thinking at Grade 3*

Students are introduced to some of the content, processes, and materials they will be using to solve problems in mathematics as they explore the three areas of the *Investigations* curriculum: **number** (patterns, addition combinations, odds and evens, doubling and halving); **data** (collecting, organizing, representing, and describing information about themselves); and **space** (symmetrical designs with pattern blocks)

INVESTIGATION 1: *What's a Hundred?* – Students count and group quantities to make 100; become familiar with number patterns on the 100 chart; explore materials used throughout the curriculum as problem-solving tools; communicate their mathematical thinking through written and spoken language

Session 1: How Much Is 100?

Students explore interlocking cubes; count and group to 100; use words, pictures, and numbers to record their thinking

Sessions 2, 3: Working with 100

Students explore the 100 chart, looking for and using number patterns; count by 10's on the chart; build with 100 cubes

INVESTIGATION 2: *Doubles and Halves* – Students construct symmetrical patterns and use them as a foundation for learning addition combinations ($1 + 1$ to $10 + 10$); develop and use addition strategies; explore which numbers can be divided into halves

Session 1: Pattern Blocks

Students explore pattern blocks and construct a design with mirror symmetry; develop strategies for adding two numbers; find numerical patterns

Session 2: Strategies for Addition

Students continue to develop strategies for addition; use known addition combinations to help learn unfamiliar ones

Sessions 3, 4: Finding Doubles and Halves

Students continue work on addition strategies and explore which numbers can be divided evenly into two equal parts

Sessions 5, 6, 7: Doubling with Money

Students learn to recognize the values of coins; find the values of various coin collections; combine coin collections

INVESTIGATION 3: *Data and Handfuls* – Students sort and classify information; collect, record, and represent data; describe data represented in tallies or graphs; use grouping to count; develop strategies for combining and comparing quantities

Sessions 1, 2: Collecting and Representing Data

Students observe, classify, count, and record data about themselves; use pictures, tallies, and graphs to organize and display data

Sessions 3, 4: Handfuls of Cubes and Other Objects

Students continue to focus on using grouping to count and on developing strategies for combining and comparing amounts

INVESTIGATION 4: *Exploring Odds and Evens* – Students explore the characteristics of odd and even numbers; examine how odd and even numbers behave when they are combined; use evidence gathered from examples to make conjectures about the ways numbers behave; become familiar with the calculator as a mathematical tool

Session 1: Adding Odds and Evens

Students experiment with combining odd and even numbers and develop conjectures about how odd and even numbers behave

Session 2: Odds and Evens on the Calculator

Students become comfortable with the calculator as a mathematical tool; recognize the decimal point; explore different ways to write and understand the meaning of 0.5

Session 3: What We've Learned About Odds and Evens

Students use evidence to develop general statements; organize their writing about mathematics to communicate their ideas clearly; support their statements with arguments and examples

Concept Map for *Things That Come in Groups* (Page 1 of 2)

To develop experience with some of the uses of multiplication and division, students work with things that come in groups, with patterns in the multiplication tables using the 100 chart, and with rectangular arrays. Students also invent and solve problems as they become familiar with the multiplication tables up to the 12's

INVESTIGATION 1: *Things That Come in Groups* – Students find things that come in groups; use multiplication notation to mean groups of things; write and illustrate multiplication sentences

<p>Session 1: Many Things Come in Groups Students find things that come in groups of certain sizes; recognize multiplication situations; pose and solve multiplication problems</p>	<p>Session 2: How Many in Several Groups? Students illustrate multiplication situations; describe multiplication situations using words and numbers</p>	<p>Session 3: Writing and Solving Riddles Students write and solve math riddles; write questions based on math statements</p>	<p>Session 4: Each Orange Had 8 Slices (Excursion) Students multiply to solve story problems; keep track of partial answers in two- and three-step problems; check problems by skip counting</p>
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INVESTIGATION 2: *Skip Counting and 100 Charts* – Students recognize that skip counting represents multiples of the same number and has a connection to multiplication; look for patterns in multiples of 2 through 12 on the 100 chart; understand that the patterns numbers make can help us multiply those numbers

<p>Session 1: Highlighting Multiples in 100 Charts Students skip count by 2's and 3's; find patterns in the 2's and 3's charts</p>	<p>Session 2: Using the Calculator to Skip Count Students identify and use patterns to highlight multiples on the 100 chart; make connections between skip counting and multiplication</p>	<p>Sessions 3, 4: More Practice with Multiples Students recognize multiples of the same number; write about patterns in the 100 chart</p>	<p>Sessions 5, 6: Discussing Number Patterns Students continue to describe patterns and recognize multiples</p>
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INVESTIGATION 3: *Arrays and Skip Counting* – Students recognize that finding the area of a rectangle is one situation in which multiplication can be used; use arrays to skip count; use arrays with skip counting to multiply and divide; find factor pairs; make connections between number and shape in an array

<p>Sessions 1, 2: Arranging Chairs Students make rectangles for quantities of 12 and other numbers; find factors of 12 and other numbers</p>	<p>Sessions 3, 4: Array Games Students practice multiplying and dividing with arrays; connect an array's numbers with the array's shape; learn the multiplication tables</p>	<p>Session 5: The Shapes of Arrays Students further connect number and shape in arrays; find all the factors of 36</p>
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INVESTIGATION 4: *The Language of Multiplication and Division* – Students understand the relationships between multiplication and division; determine whether word problems can be solved using division and/or multiplication; use multiplication and division notation to write number sentences

<p>Sessions 1, 2: Multiply or Divide? Students understand and solve multiplication and division story problems; use correct notation to write number sentences</p>	<p>Sessions 3, 4: Writing and Solving Story Problems Students continue to write and solve word problems; are becoming more familiar with the relationships between multiplication and division</p>
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Concept Map for *Things That Come in Groups* (Page 2 of 2)

INVESTIGATION 5: *Problems with Larger Numbers* – Students multiply and divide in real-life situations; use patterns to solve problems; organize and present data in tables and line plots; sort out complex problems that require both multiplication and addition

Session 1: Calculating Savings

Students multiply by 7 and 30; use patterns to solve multiplication problems

Session 2: Many, Many Legs

Students continue to solve multiplication problems; combine solutions to two or more problems

Session 3: Data Tables and Line Plots

Students make data tables and line plots; write story problems; solve multiplication problems that involve more than one step

Session 4: A Riddle with 22 Legs

Students make a table for keeping track of possibilities; practice multiplying and dividing

Concept Map for *Flips, Turns, and Area*

Students explore shape and area in this unit through the use of *tetrominoes* (arrangements of four squares with full sides touching); investigate patterns, congruence, ideas about area, and the three geometric motions: slides, flips (reflections), and turns (rotations)

INVESTIGATION 1: *Motions with Tetrominoes* – Students measure area by covering a flat space with square units; systematically find all possible geometric arrangements of a given number of squares; find patterns for covering a space; compare areas of rectangles having different dimensions; describe physical motions in precise ways as a series of slides, flips, and turns; explore congruence

Session 1: Tetrominoes

Using tetrominoes, students investigate congruence; describe how to move shapes to demonstrate congruence; find a pattern to cover a rectangular space

Sessions 2, 3: Slides, Flips, and Turns

Students form conjectures about certain tetrominoes and the spaces they cover; give explicit computer commands to move tetrominoes to completely cover a rectangle; visualize how one shape can be moved to fit into a spatial arrangement of shapes

Session 4: Rectangles with Different Shapes

Students compare areas of rectangles having different dimensions; explore how tetromino shapes fit in rectangles having different dimensions

Session 5: Final Challenges

Students reason about why certain shapes cover some areas, but not others; make generalizations by examining many examples; visualize whether or not two shapes are congruent

INVESTIGATION 2: *Finding Area* – Students measure area by covering a flat space with square units; compare the areas of two shapes by determining whether they cover the same amount of flat space; explore the relationships among shapes (e.g., by cutting a rectangle into two triangles); find the areas of complex shapes by cutting them into smaller units of area (such as square units and half-units)

Session 1: Triangles and Squares

Students explore relationships among geometric shapes; think about area as covering a space

Sessions 2, 3: A Poster of Four-Unit Shapes

Students make shapes with a given area; decide whether two shapes are congruent; gain experience with the relationships among squares and triangles

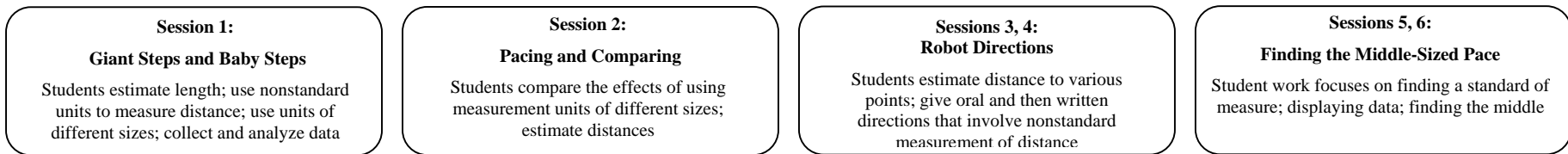
**Sessions 4, 5: Writing About Area
(Assessment)**

Students make a shape with a given area; explain and justify their solutions in writing

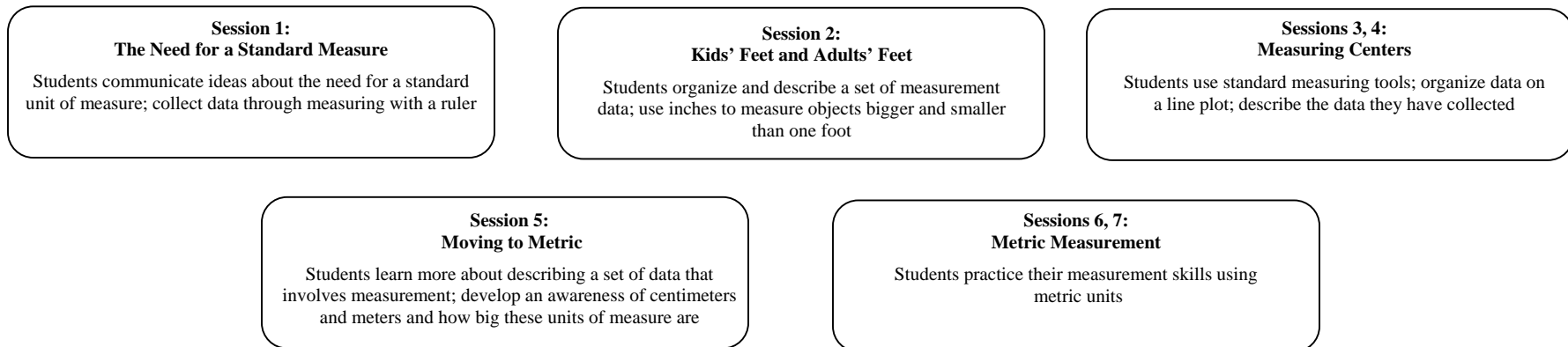
Concept Map for *From Paces to Feet* (Page 1 of 2)

Students explore both measurement and simple statistics; develop ideas about why we need to measure; learn to use different measuring tools and systems; interpret data they collect by measuring

INVESTIGATION 1: *Measuring with Paces and Steps* – Students use nonstandard units to measure a distance; experience the iterative nature of measurement; estimate length; compare the effects of measuring using different-sized units; analyze data by describing their shape and patterns; write and follow directions that specify the number of paces and the direction of turns



INVESTIGATION 2: *From Paces to Feet* – Students come to understand the rationale for a standard measure (i.e., the need for consistency and accuracy); develop familiarity with inches, feet, and yards; develop an awareness of centimeters and meters; learn to describe a set of measurement data, first representing these data on a line plot and then describing the general features of the data set



Concept Map for *From Paces to Feet* (Page 2 of 2)

INVESTIGATION 3: *Measuring Project: Do Our Chairs Fit Us?* – Students use standard measures (either metric or U.S. Standard) in more-complex situations in order to gather and analyze data concerning size and proportion; collect, organize, represent, and analyze data

Session 1: What’s a Good Fit?

Students use measurement as a way of collecting data;
conduct a data-analysis project

Sessions 2, 3: Do Our Chairs Fit Us?

Students organize, represent, and analyze data they have collected; make
recommendations based on conclusions drawn from the data

INVESTIGATION 4: *Measuring Project: Balobbyland* – Students develop an awareness of centimeters and how to use centimeters to measure; take a “bird’s eye” perspective in looking at spaces; use centimeters in a more complex situation: constructing a fantasy land, where the relative size of objects is important

Sessions 1, 2, 3: Making a Small World

Students measure with centimeters; use measurement to
construct areas of different sizes

Concept Map for *Landmarks in the Hundreds*

Students work with 100, factors of 100, and multiples of 100 (up to 1000); use coins, 100 charts, and cubes to investigate these numbers; develop a sense of quantities by counting real objects; develop their own strategies—based on what they know about these landmark numbers—to solve multiplication and division problems

INVESTIGATION 1: *Finding Factors* – Students work on understanding the relationship between skip counting and grouping; become familiar with the relationships among commonly encountered factors and multiples; increase fluency in counting by single-digit numbers and useful two-digit numbers; develop familiarity with the factors of 100 and the use of 100 as an important landmark

**Session 1:
Skip Counting with Cubes**

Students find factors by making equal groups; record their work using pictures and numbers

Sessions 2, 3: Factors of 24, 36, and 48

Students find factors by skip counting; explore the relationship between a multiple and its factors; develop facility in counting by 2's, 3's, 4's, 6's, and 8's; use multiplication notation to record their work

Sessions 4, 5: Factors of 100

Students find factors of 100; skip count with factors of 100; figure out how many of a certain factor make 100

Sessions 6, 7: Dividing a Dollar

Students use coins to explore how to share a dollar equally among 5 people; investigate ways to divide a dollar evenly among different numbers of people

INVESTIGATION 2: *Using Landmarks to Solve Problems* – Students use their knowledge about factors of 100 to understand the structure of multiples of 100; develop strategies for solving problems in multiplication and division situations; estimate real quantities that are close to 200, 300, and 400; read and use standard multiplication and division notation to record problems and answers

**Sessions 1, 2, 3: Moving Beyond 100
(Assessment)**

Students use what they know about 100 to think about multiples of 100; prove how many groupings of a particular factor make 100

Session 4: Solving Problems with Money

Students work on multiplication and division problems that involve money, recording their solutions in ways that explain their thinking to others

Sessions 5, 6: Real-World Multiplying and Dividing

Students develop their own strategies to solve problems; use standard multiplication and division notation to record their work

INVESTIGATION 3: *Constructing a 1000 Chart* – Students continue to work with factors of 100, thereby building their understanding of the structure of 1000; estimate quantities up to 1000; use landmarks to calculate “distances” within 1000 (e.g., how far is it from 650 to 950?)

Session 1: A 1000 Chart

Students count to 1000 by one of its factors; keep track of how many groups are needed to make 1000; organize and label groups clearly so that any number on the 1000 chart can be located easily

**Sessions 2, 3: Finding Large Quantities
(Assessment)**

Students locate numbers between 1 and 1000 on the 1000 chart; estimate and count real quantities up to 1000; find differences between two numbers by skip counting

Concept Map for *Up and Down the Number Line*

Students investigate and focus on ideas about addition and subtraction relationships; use games to practice computation; develop knowledge about numbers below zero, net change, the opposite effects of addition and subtraction, and the many ways to use addition and subtraction to reach a given number

INVESTIGATION 1: *Net Change* – Students develop the concept of net change; develop strategies for computing net change and for using net change to find a missing end point or starting point; develop strategies for adding a long sequence of changes (both positive and negative); construct different sequences of positive and negative numbers to produce the same net change

<p>Sessions 1, 2: Elevator Trips Up and Down</p> <p>Students find net change when given a starting point and an ending point; recognize direction of change; explore different trips that result in the same net change</p>	<p>Sessions 3, 4: Many Ways to Make One Net Change</p> <p>Students find many sets of changes that produce the same net change; recognize that the net change is the same regardless of the order of changes; add a series of integers; use subtraction to cancel addition</p>	<p>Session 5: Thirty Changes</p> <p>Students develop strategies for adding a long sequence of changes and for keeping track of partial calculations</p>	<p>Sessions 6, 7: Missing Information Problems (Assessment)</p> <p>Students solve changes problems in which critical information is missing; write about their strategies for finding the missing information</p>	<p>Session 8: Stopping at Many Floors (Excursion)</p> <p>Students work on recognizing that different orders of the same changes can take you to different intermediate places</p>
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INVESTIGATION 2: *Representing Elevator Trips* – Students represent numbers graphically; interpret changes in direction on a graph; understand how the passage of time is represented on graphs showing change over time; find net change on graphs; compare the overall shapes of graphs

<p>Session 1: Graphing Elevator Trips</p> <p>Students represent numbers graphically; construct their own representations of changes</p>	<p>Sessions 2, 3: Repeating Elevator Trips</p> <p>Students look at graphs that show change over time and discuss what they observe; find net changes on graphs</p>	<p>Session 4: Plus and Minus Graphs</p> <p>Students compare overall shapes of graphs; represent positive, negative, and zero changes on graphs</p>
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INVESTIGATION 3: *Inventing Board Games* – Students relate the direction of movement (left or right, up or down) to positive and negative numbers; use net change to determine an end point

<p>Session 1: Playing a Board Game</p> <p>Students work on relating the direction of movement to positive and negative numbers; use net change to determine an end point</p>	<p>Sessions 2, 3: Creating a Board Game</p> <p>Students design their own board games, based on the number line, to represent positive and negative changes</p>
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Concept Map for *Combining and Comparing*

Students solve problems that involve comparison and determine how different amounts of time, money, and measurement can be combined. The focus throughout the unit is on students developing their own addition and subtraction strategies that make sense to them, strategies that will move them toward computational fluency

INVESTIGATION 1: *Comparisons with Record Numbers* – Students compare two numbers and develop strategies for deciding the difference between them; combine numbers to get to 100; use landmark numbers to help in comparing two quantities

Sessions 1, 2: How Many Children in Your Family?

Students compare their own data and develop strategies for comparing two numbers; explore combinations of numbers that make 100

Session 3: More Record Comparisons

Students continue using landmark numbers and work on developing strategies for combining and comparing numbers

INVESTIGATION 2: *How Much Heavier or Lighter?* – Students develop conjectures about, and make comparisons of, how things change over time; compare weights with a balance; find how far a number is from the next multiple of 10 or 100

Session 1: Weighing Fruits and Vegetables

Students develop conjectures about how produce changes over time; learn to use a pan balance to weigh objects accurately

Session 2: Comparing the Weights

Students determine the difference between the beginning and ending weights of produce and develop theories to explain what happened to the weights; find combinations that make 100

INVESTIGATION 3: *Adding With Money, Inches, and Time* – Students solve addition problems having multiple addends and keep track of the steps; develop a repertoire of addition strategies; recognize and use standard notation; explore number relationships and use important equivalencies in time, money, and linear measure

Sessions 1, 2: Heights and Coupons

Students estimate the sum of several addends; use estimation to find an approximate solution that can be adjusted; develop and explain addition strategies

Session 3: Planning a Party (Assessment)

Students plan the activities and timing of a party that will last exactly 2 hours; focus on choosing quantities that are realistic when solving a problem

INVESTIGATION 4: *Working with Hundreds* – Students develop and communicate strategies for combining and comparing quantities in the hundreds and thousands; use standard addition and subtraction notation; collect, predict, record, graph, and make predictions about data

Session 1: Handfuls of Beans

Students develop strategies for comparing two numbers; organize a task to ensure accuracy; use a line plot

Session 2: More Handfuls

Students continue to solve comparison problems; relate standard addition and subtraction notation to comparison situations; describe their strategies in writing

Sessions 3, 4: Hundreds of Paper Clips

Students combine hundreds; read and write hundreds and thousands; add to and subtract from multiples of 100

INVESTIGATION 5: *Calendar Comparisons* – Students explore mathematical characteristics of the calendar and use them to add and subtract; solve complex problems by breaking them into manageable parts; examine how parts and the whole are related in addition and subtraction

Session 1: How Much Longer?

Students do time comparisons that answer the question, “How much longer?”; use a calendar to find and compare two dates

Sessions 2, 3: School Days

Students continue to use the calendar to compare two quantities; consider the relationship between a whole year and its parts

Concept Map for *Turtle Paths*

Students explore problems involving paths, lengths of paths, perimeter, and turns; create commands to describe paths, including measures of distances and turns in paths; solve missing-measures problems (which include work with perimeter)

INVESTIGATION 1: *Paths and Length of Paths* – Students begin to understand paths as representations or records of movement; describe paths using mathematical language; find several paths that meet certain geometric constraints; apply mathematical processes such as addition, subtraction, and estimation to paths

Session 1: Walking Paths

Students walk paths; describe them using mathematical ideas and language; develop understanding of what paths are; describe movements and give commands to create paths with certain shapes

Session 2: Commanding the Turtle

Students find alternative solutions to path problems that pose specific geometric constraints; apply mathematical processes such as addition, subtraction, and estimation to figure out the most efficient way to move on a map

Sessions 3, 4: Mazes and Maps

Students continue to work on using mathematical processes and finding alternative solutions to path problems that pose specific geometric constraints

INVESTIGATION 2: *Turns in Paths* – Students use degrees to measure turns (e.g., 90°, 180°, 360°); describe the properties of triangles; identify the properties of equilateral triangles; continue to build and apply mathematical skills of addition, subtraction, estimation, and logic to find missing measures of figures

Sessions 1, 2: Turns

Students understand a turn as a change in orientation or heading; explore what happens when turns are repeated; estimate turn measures

Session 3: Turns, Turtles, and Triangles

Students discuss the properties of triangles and build a definition of triangles based on working with examples and applying the definition to new figures

Session 4: Equilateral Triangles

Students identify the properties of equilateral triangles; write about triangles

Sessions 5, 6: Missing Measures

Students analyze geometric situations; apply mathematical processes such as quantitative reasoning, mental arithmetic, and logic to find missing measures of figures

INVESTIGATION 3: *Paths with the Same Length* – Students construct geometric figures that satisfy given criteria; understand that shapes can be moved in space without losing their geometric properties; estimate and measure the perimeters of various objects; pose and solve original geometric problems

Sessions 1, 2: The 200 Steps

Students construct rectangles that each have a perimeter of 200 steps; use analysis of geometric figures, arithmetic, and problem-solving strategies

Sessions 3, 4, 5: Facing Problems

Students construct rectangles, squares, and triangles of given perimeters; estimate and measure the perimeters of various objects; continue work on moving shapes in space

Sessions 6, 7: Designing a *Geo-Logo* Project (Excursion)

Students create their own projects, utilizing their understanding of various geometric shapes; focus on analyzing geometric figures; pose and solve their own mathematical problems

Concept Map for *Fair Shares*

Students use fractions and mixed numbers as they solve sharing problems and build “wholes” from fractional parts; decide which of two shares is larger; decide how to share things that are not easily divided; and share dollars by converting them to cents

INVESTIGATION 1: *Sharing Brownies* – Students realize that fractional parts must be equal; develop familiarity with conventional fraction words and notation; become familiar with the idea and process of grouping unit fractions

Sessions 1, 2: Making Fair Shares

Students understand that fractions are equal parts; partition area into equal parts; make list of fraction facts

Sessions 3, 4: More Brownies to Share

Students share several “brownie” rectangles equally and name the rectangle shares using fraction sentences

INVESTIGATION 2: *Pattern-Block Cookies* – Students develop familiarity with common equivalents, especially relationships among halves, thirds, and sixths; understand that what occurs between 0 and 1 also occurs between 1 and 2, and between any consecutive whole numbers

Sessions 1, 2: Making Cookie Shares

Students find shapes to cover one whole; identify fractional parts that add to one whole; write fraction expressions

Session 3: Comparing Shares

Students work with fractions and mixed numbers; determine fair shares; compare shares; prove which of two fractions is larger

Session 4: The Fraction Cookie Game

Students identify fraction parts; exchange equivalent fractions; add and subtract fractions

**Sessions 5, 6:
Backward Sharing**

Students put pieces together to make “wholes” and look for number patterns

**Session 7: Half Yellow
(Excursion)**

Students create a design that is half yellow; draw and color the design; recognize other fractional parts of a whole

INVESTIGATION 3: *Other Things to Share* – Students begin to understand the relationship between fractions and division by solving problems in which the whole is a number of things rather than a single thing; relate notation for common fractions to notation for decimals on the calculator; use different notations for the same problem

Sessions 1, 2: How Can We Split Balloons?

Students relate meanings for division and fractions; relate notation for money to decimal notation on the calculator

Session 3: Sharing Many Things

Students identify the fraction that represents equal shares and use fractions for division

Concept Map for *Exploring Solids and Boxes*

Students sort, build, and describe different kinds of polygons and common geometric solids so that they become familiar with the components of the shapes and how the components are related

INVESTIGATION 1: *Sorting and Describing Solids* – Students explore, sort, and describe common geometric solids; analyze how the solids are alike and different; investigate, analyze, and describe the parts of solids

Session 1: Sorting Polyhedra

Students sort geometric solids and describe how groups are alike and different; attend to the components and properties of different classes of solids

Session 2: What’s My Shape?

Students continue their work describing the components and properties of different classes of solids and grouping them in different ways

INVESTIGATION 2: *Building Polygons and Polyhedra* – Students recognize the components of polygons (sides and corners) and polyhedra (faces, vertices, and edges), and how the components can be put together to form whole shapes

Sessions 1, 2: Building Polygons

Students find the numbers of sides and corners in polygons and investigate relationships between lengths of sides

Session 3: Building Polyhedra

Students build polyhedra while looking at pictures or models; reflect on the parts of the figure and their relationships to one another

Sessions 4, 5: Building Polyhedra from Descriptions

Students determine spatial relationships among parts of polyhedra in order to visualize and then build them

INVESTIGATION 3: *Making Boxes* – Students explore 2-D geometric patterns that fold to make 3-D shapes; investigate the interrelationships between parts of solids; work on improving spatial-visualization skills; solve problems that require searching for all possible configurations/solutions that satisfy given constraints

Session 1: Making Boxes for a Cube

Students determine the shape, number, and spatial relationships of faces of a cube; find and use patterns to design open boxes for a cube

Session 2: Patterns for Other Solids

Students continue their work determining the shape, number, and relationships between faces of solids and look for multiple solutions to problems

INVESTIGATION 4: *How Many Cubes in a Box?* – Students work on predicting the number of cubes that will fit in a box and on understanding the structure of rectangular-prism arrays of cubes

Session 1: Finding the Number of Cubes in a Box

Students find methods to predict the number of cubes that will fit in the box made from a given pattern on a square grid

Session 2: Twelve-Cube Boxes

Students design patterns for boxes that will hold a given number of cubes

Session 3: Patterns from the Bottom Up

Students work on understanding the relationship between the configuration of cubes that fit in a box and the location of squares that appear on the sides and bottom of the box

INVESTIGATION 5: *Building a City* – Students’ problem-solving work involves planning, trial-and-error processing, analysis, and visualization as they build a model city and use appropriate computation techniques as they work

Sessions 1, 2, 3, 4: Making a Box City

Students build a city of open-box buildings made from patterns they draw on graph paper; submit their sets of patterns; write descriptions of their city plans