Math Course Packet

EDN 325

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The NCTM *Principles and Standards for School Mathematics* is intended to provide guidance about the content and quality of a good mathematics program. The Principles describe the particular features of a high quality mathematics education. The Standards describe the mathematical content and processes that students should learn. Together, the Principles and Standards constitute a vision to guide educators as they strive for the continual improvement of mathematics education in classrooms, schools, and educational systems.

The six principles for school mathematics address overarching themes:

- **Equity.** Excellence in mathematics education requires equity—high expectations and strong support for all students.

- **Curriculum.** A curriculum is more than a collection of activities: it must be coherent, focused on important mathematics, and well articulated across the grades.

- **Teaching.** Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.

- **Learning.** Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.

- **Assessment.** Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.

- **Technology.** Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.

**URL for Principles and Standards**

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# Number and Operations

**Standard**

Instructional programs from prekindergarten through grade 12 should enable all students to—

<table>
<thead>
<tr>
<th>Pre-K–2 Expectations</th>
<th>Grades 3–5 Expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Understand numbers, ways of representing numbers, relationships among numbers, and number systems</strong></td>
<td><strong>Understand meanings of operations and how they relate to one another</strong></td>
</tr>
<tr>
<td>• count with understanding and recognize &quot;how many&quot; in sets of objects;</td>
<td>• understand various meanings of addition and subtraction of whole numbers and the relationship between the two operations;</td>
</tr>
<tr>
<td>• use multiple models to develop initial understandings of place value and the base-ten number system;</td>
<td>• understand the effects of adding and subtracting whole numbers;</td>
</tr>
<tr>
<td>• develop understanding of the relative position and magnitude of whole numbers and of ordinal and cardinal numbers and their connections;</td>
<td>• understand situations that entail multiplication and division, such as equal groupings of objects and sharing equally.</td>
</tr>
<tr>
<td>• develop a sense of whole numbers and represent and use them in flexible ways, including relating, composing, and decomposing numbers;</td>
<td><strong>Compute fluently and make reasonable estimates</strong></td>
</tr>
<tr>
<td>• connect number words and numerals to the quantities they represent, using various physical models and representations;</td>
<td>• develop and use strategies for whole-number computations, with a focus on addition and subtraction;</td>
</tr>
<tr>
<td>• understand and represent commonly used fractions, such as 1/4, 1/3, and 1/2.</td>
<td>• develop fluency with basic number combinations for multiplication and division and use these combinations to mentally compute related problems, such as 30 × 50;</td>
</tr>
</tbody>
</table>

**Understand meanings of operations and how they relate to one another**

<table>
<thead>
<tr>
<th><strong>Understand meanings of operations and how they relate to one another</strong></th>
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<tr>
<td>• understand various meanings of addition and subtraction of whole numbers and the relationship between the two operations;</td>
<td>• develop and use strategies for whole-number computations, with a focus on addition and subtraction;</td>
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<tr>
<td>• understand the effects of adding and subtracting whole numbers;</td>
<td>• develop fluency with basic number combinations for multiplication and division and use these combinations to mentally compute related problems, such as 30 × 50;</td>
</tr>
<tr>
<td>• understand situations that entail multiplication and division, such as equal groupings of objects and sharing equally.</td>
<td>• develop fluency in adding, subtracting, multiplying, and dividing whole numbers;</td>
</tr>
</tbody>
</table>

**Compute fluently and make reasonable estimates**

<table>
<thead>
<tr>
<th><strong>Compute fluently and make reasonable estimates</strong></th>
<th><strong>Understand meanings of operations and how they relate to one another</strong></th>
</tr>
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<tbody>
<tr>
<td>• develop and use strategies for whole-number computations, with a focus on addition and subtraction;</td>
<td>• develop use strategies to estimate the results of whole number computations and to judge the reasonableness of such results;</td>
</tr>
<tr>
<td>• develop and use strategies to estimate computations involving fractions and decimals in situations relevant to students' experience;</td>
<td>• select appropriate methods and tools for computing with whole numbers from among mental computation, estimation, calculators, and paper and pencil according to the context and nature of the computation and use the selected method or tool.</td>
</tr>
<tr>
<td>• use a variety of methods and tools to compute, including objects, mental computation, estimation, paper and pencil, and calculators.</td>
<td>• use visual models, benchmarks, and equivalent forms to add and subtract commonly used fractions and decimals;</td>
</tr>
</tbody>
</table>
### Algebra Standard

**Pre-K–2 Expectations**

- In prekindergarten through grade 2 all students should—
  - Understand patterns, relations, and functions:
    - sort, classify, and order objects by size, number, and other properties;
    - recognize, describe, and extend patterns such as sequences of sounds and shapes or simple numeric patterns and translate from one representation to another;
    - analyze how both repeating and growing patterns are generated.
  - Represent and analyze mathematical situations and structures using algebraic symbols:
    - illustrate general principles and properties of operations, such as commutativity, using specific numbers;
    - use concrete, pictorial, and verbal representations to develop an understanding of invented and conventional symbolic notations.
  - Use mathematical models to represent and understand quantitative relationships:
    - model situations that involve the addition and subtraction of whole numbers, using objects, pictures, and symbols.
  - Analyze change in various contexts:
    - describe qualitative change, such as a student’s growing taller;
    - describe quantitative change, such as a student’s growing two inches in one year.

**Grades 3–5 Expectations**

- In grades 3–5 all students should—
  - Understand patterns, relations, and functions:
    - describe, extend, and make generalizations about geometric and numeric patterns;
    - represent and analyze patterns and functions, using words, tables, and graphs.
  - Represent and analyze mathematical situations and structures using algebraic symbols:
    - identify such properties as commutativity, associativity, and distributivity and use them to compute with whole numbers;
    - represent the idea of a variable as an unknown quantity using a letter or a symbol;
    - express mathematical relationships using equations.
  - Use mathematical models to represent and understand quantitative relationships:
    - model problem situations with objects and use representations such as graphs, tables, and equations to draw conclusions.
  - Analyze change in various contexts:
    - investigate how a change in one variable relates to a change in a second variable;
    - identify and describe situations with constant or varying rates of change and compare them.
| **Geometry** |
| **STANDARD** |

Instructional programs from prekindergarten through grade 12 should enable all students to—

### Pre-K–2

**Expectations**

In prekindergarten through grade 2 all students should—

- recognize, name, build, draw, compare, and sort two- and three-dimensional shapes;
- describe attributes and parts of two- and three-dimensional shapes;
- investigate and predict the results of putting together and taking apart two- and three-dimensional shapes.

### Grades 3–5

**Expectations**

In grades 3–5 all students should—

- identify, compare, and analyze attributes of two- and three-dimensional shapes and develop vocabulary to describe the attributes;
- classify two- and three-dimensional shapes according to their properties and develop definitions of classes of shapes such as triangles and pyramids;
- investigate, describe, and reason about the results of subdividing, combining, and transforming shapes;
- explore congruence and similarity;
- make and test conjectures about geometric properties and relationships and develop logical arguments to justify conclusions.

### Specify locations and describe spatial relationships using coordinate geometry and other representational systems

- describe, name, and interpret relative positions in space and apply ideas about relative position;
- describe, name, and interpret direction and distance in navigating space and apply ideas about direction and distance;
- find and name locations with simple relationships such as "near to" and in coordinate systems such as maps.

- describe location and movement using common language and geometric vocabulary;
- make and use coordinate systems to specify locations and to describe paths;
- find the distance between points along horizontal and vertical lines of a coordinate system.

### Apply transformations and use symmetry to analyze mathematical situations

- recognize and apply slides, flips, and turns;
- recognize and create shapes that have symmetry.

- predict and describe the results of sliding, flipping, and turning two-dimensional shapes;
- describe a motion or a series of motions that will show that two shapes are congruent;
- identify and describe line and rotational symmetry in two- and three-dimensional shapes and designs.

### Use visualization, spatial reasoning, and geometric modeling to solve problems

- create mental images of geometric shapes using spatial memory and spatial visualization;
- recognize and represent shapes from different perspectives;
- relate ideas in geometry to ideas in number and measurement;
- recognize geometric shapes and structures in the environment and specify their location.

- build and draw geometric objects;
- create and describe mental images of objects, patterns, and paths;
- identify and build a three-dimensional object from two-dimensional representations of that object;
- identify and build a two-dimensional representation of a three-dimensional object;
- use geometric models to solve problems in other areas of mathematics, such as number and measurement;
- recognize geometric ideas and relationships and apply them to other disciplines and to problems that arise in the classroom or in everyday life.
## Measurement

### Standard

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements

### Pre-K–2

**Expectations**

In prekindergarten through grade 2 all students should—

- recognize the attributes of length, volume, weight, area, and time;
- compare and order objects according to these attributes;
- understand how to measure using nonstandard and standard units;
- select an appropriate unit and tool for the attribute being measured.

### Grades 3–5

**Expectations**

In grades 3–5 all students should—

- understand such attributes as length, area, weight, volume, and size of angle and select the appropriate type of unit for measuring each attribute;
- understand the need for measuring with standard units and become familiar with standard units in the customary and metric systems;
- carry out simple unit conversions, such as from centimeters to meters, within a system of measurement;
- understand that measurements are approximations and understand how differences in units affect precision;
- explore what happens to measurements of a two-dimensional shape such as its perimeter and area when the shape is changed in some way.

- measure with multiple copies of units of the same size, such as paper clips laid end to end;
- use repetition of a single unit to measure something larger than the unit, for instance, measuring the length of a room with a single meterstick;
- use tools to measure;
- develop common referents for measures to make comparisons and estimates.

- develop strategies for estimating the perimeters, areas, and volumes of irregular shapes;
- select and apply appropriate standard units and tools to measure length, area, volume, weight, time, temperature, and the size of angles;
- select and use benchmarks to estimate measurements;
- develop, understand, and use formulas to find the area of rectangles and related triangles and parallelograms;
- develop strategies to determine the surface areas and volumes of rectangular solids.
# Data Analysis and Probability

## Standard

Instructional programs from prekindergarten through grade 12 should enable all students to:

- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.
- Select and use appropriate statistical methods to analyze data.
- Develop and evaluate inferences and predictions that are based on data.
- Understand and apply basic concepts of probability.

### Pre-K-2 Expectations

- In prekindergarten through grade 2 all students should:
  - pose questions and gather data about themselves and their surroundings;
  - sort and classify objects according to their attributes and organize data about the objects;
  - represent data using concrete objects, pictures, and graphs.

### Grades 3–5 Expectations

- In grades 3–5 all students should:
  - design investigations to address a question and consider how data-collection methods affect the nature of the data set;
  - collect data using observations, surveys, and experiments;
  - represent data using tables and graphs such as line plots, bar graphs, and line graphs;
  - recognize the differences in representing categorical and numerical data.
  - describe the shape and important features of a set of data and compare related data sets, with an emphasis on how the data are distributed;
  - use measures of center, focusing on the median, and understand what each does and does not indicate about the data set;
  - compare different representations of the same data and evaluate how well each representation shows important aspects of the data.
  - propose and justify conclusions and predictions that are based on data and design studies to further investigate the conclusions or predictions.
  - describe events as likely or unlikely and discuss the degree of likelihood using such words as certain, equally likely, and impossible.
  - predict the probability of outcomes of simple experiments and test the predictions;
  - understand that the measure of the likelihood of an event can be represented by a number from 0 to 1.
Problem Solving

STANDARD

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Build new mathematical knowledge through problem solving
- Solve problems that arise in mathematics and in other contexts
- Apply and adapt a variety of appropriate strategies to solve problems
- Monitor and reflect on the process of mathematical problem solving

Reasoning and Proof

STANDARD

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Recognize reasoning and proof as fundamental aspects of mathematics
- Make and investigate mathematical conjectures
- Develop and evaluate mathematical arguments and proofs
- Select and use various types of reasoning and methods of proof

Communication

STANDARD

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Organize and consolidate their mathematical thinking through communication
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others
- Analyze and evaluate the mathematical thinking and strategies of others
- Use the language of mathematics to express mathematical ideas precisely

Connections

STANDARD

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Recognize and use connections among mathematical ideas
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
- Recognize and apply mathematics in contexts outside of mathematics

Representation

STANDARD

Instructional programs from prekindergarten through grade 12 should enable all students to—

- Create and use representations to organize, record, and communicate mathematical ideas
- Select, apply, and translate among mathematical representations to solve problems
- Use representations to model and interpret physical, social, and mathematical phenomena
Bloom's revised taxonomy for the cognitive domain

A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom’s Taxonomy of Educational Objectives. Allyn & Bacon

The development of instructional objectives as a means to support purposeful development of instructional content benefitted a great deal from Benjamin Bloom, when in 1956 he published a taxonomy of intellectual behaviors. For the next 40 years, the application of his work found its way into many instructional disciplines. A key milestone came in 2000, when Anderson and Krathwohl (see citation) revisited the taxonomy to make the model more appropriate to current audiences. In 2002, Barbara Clark, a researcher in educational practices of the gifted, adapted the revised taxonomy into roughly the circular graphic shown here. CDWS is still trying to contact Ms. Clark to obtain permission to add adjustments to the design, as represented in the included graphic.
### Common Uses for Math Manipulatives

<table>
<thead>
<tr>
<th>Manipulative</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attribute Blocks</td>
<td>Classification, sorting, ordering, counting, geometric concepts,</td>
</tr>
<tr>
<td></td>
<td>comparing, logic &amp; reasoning, probability</td>
</tr>
<tr>
<td>Cuisenaire rods</td>
<td>classification, sorting, ordering, counting, number concepts,</td>
</tr>
<tr>
<td></td>
<td>comparisons, fractions, ratio, proportion, place value, patterns,</td>
</tr>
<tr>
<td></td>
<td>even &amp; odd numbers, prime &amp; composite numbers, logical reasoning,</td>
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<tr>
<td></td>
<td>estimation, operations on whole numbers</td>
</tr>
<tr>
<td>Decimal squares</td>
<td>Decimals, place value, comparing, ordering, operations, classification,</td>
</tr>
<tr>
<td></td>
<td>sorting, number concepts, equality, inequality, percent, perimeter,</td>
</tr>
<tr>
<td></td>
<td>area</td>
</tr>
<tr>
<td>Digi Blocks</td>
<td>Counting, place value, modeling addition/subtraction, regrouping,</td>
</tr>
<tr>
<td></td>
<td>skip counting, modeling multiplication, decimals</td>
</tr>
<tr>
<td>Dominoes</td>
<td>counting, number concepts, fact strategies, classification, sorting,</td>
</tr>
<tr>
<td></td>
<td>patterns, logical reasoning, equality, inequality, mental math,</td>
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<tr>
<td></td>
<td>operations on whole numbers</td>
</tr>
<tr>
<td>Fraction models</td>
<td>fractions - meaning, recognition, classification, sorting,</td>
</tr>
<tr>
<td></td>
<td>comparing, ordering, number concepts, equivalence, operations,</td>
</tr>
<tr>
<td></td>
<td>perimeter, area, percent, probability</td>
</tr>
<tr>
<td>Geoboards</td>
<td>size, shape, counting, area, perimeter, circumference, symmetry,</td>
</tr>
<tr>
<td></td>
<td>fractions, coordinate geometry, slopes, angles, Pythagorean Theorem,</td>
</tr>
<tr>
<td></td>
<td>estimation, percent, similarity, congruence, rotations, reflections,</td>
</tr>
<tr>
<td></td>
<td>translations, classification, sorting, square numbers, polygons,</td>
</tr>
<tr>
<td></td>
<td>spatial visualization, logical reasoning</td>
</tr>
<tr>
<td>Geometric solids</td>
<td>shape, size, relationships between area &amp; volume, volume,</td>
</tr>
<tr>
<td></td>
<td>classification, sorting, measurement, spatial visualization</td>
</tr>
<tr>
<td>Math balance Invicta, number</td>
<td>equality, inequality, operations on whole numbers, open sentences,</td>
</tr>
<tr>
<td></td>
<td>equations, place value, fact strategies, measurement, logical</td>
</tr>
<tr>
<td></td>
<td>reasoning</td>
</tr>
<tr>
<td>Miras</td>
<td>symmetry, similarity, congruence, reflections, rotations, translations,</td>
</tr>
<tr>
<td></td>
<td>angles, parallel &amp; perpendicular lines, constructions</td>
</tr>
<tr>
<td>Money</td>
<td>money, change, comparisons, counting, classification, sorting,</td>
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<tr>
<td></td>
<td>equality, operations on whole numbers, decimals, fractions,</td>
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<tr>
<td></td>
<td>probability, fact strategies, number concepts</td>
</tr>
<tr>
<td>Number cubes /Dice</td>
<td>counting, number concepts, fact strategies, mental math, operations</td>
</tr>
<tr>
<td></td>
<td>on whole numbers, fractions, decimals, probability, generation of</td>
</tr>
<tr>
<td></td>
<td>problems, logical reasoning</td>
</tr>
<tr>
<td>Tool</td>
<td>Relevant Concepts</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Numeral cards</td>
<td>counting, classification, sorting, comparisons, equality, inequality, order, fact strategies, number concepts, operations on whole numbers, fractions, decimals, logical reasoning, patterns, odd &amp; even numbers, prime &amp; composite numbers</td>
</tr>
<tr>
<td>Pattern blocks</td>
<td>patterns, one-to-one correspondence, sorting, classification, size, shape, color, geometric relationships, symmetry, similarity congruence, area, perimeter, reflections, rotations, translations, problem solving, logical reasoning, fractions, spatial visualization, tessellations, angles, ratio, proportions</td>
</tr>
<tr>
<td>Pentominoes</td>
<td>Counting, logic/reasoning, problem solving, geometric concepts, spatial concepts, tessellations, symmetry, angles</td>
</tr>
<tr>
<td>Polyhedra models</td>
<td>shape, size, classification, sorting, polyhedra, spatial visualization</td>
</tr>
<tr>
<td>Protractors</td>
<td>constructions, angle measurement</td>
</tr>
<tr>
<td>Rulers/Tape measures</td>
<td>measurement, area, perimeter, constructions, estimation, operations on whole numbers, volume</td>
</tr>
<tr>
<td>Spinners</td>
<td>counting, number concepts, operations on whole numbers, decimals, fractions, fact strategies, mental math, logical reasoning, probability, generation of problems</td>
</tr>
<tr>
<td>Tangrams</td>
<td>geometric concepts, spatial visualization, logical reasoning, fractions, similarity, congruence, area: perimeter, ratio, proportion, angles, classification, sorting, patterns, symmetry, reflections, translations, rotations</td>
</tr>
<tr>
<td>Ten-frames</td>
<td>fact strategies, mental math, number concepts, counting, equality, inequality, place value, patterns, operations on whole numbers</td>
</tr>
<tr>
<td>Thermometers</td>
<td>temperature, integers, measurement</td>
</tr>
<tr>
<td>Two-color counters</td>
<td>counting, comparing, sorting, classification, number concepts, fact strategies, even &amp; odd numbers, equality, inequality, operations, ratio, proportions, probability, integers</td>
</tr>
</tbody>
</table>

This list was adapted from Kathy Ross & Renelee Hebert’s work.
TEXTBOOK REVIEW

Name ___________________________  Section __________  Date __________

Textbook Title ___________________  Grade Level _________

Publishing Company _______________  Date of Publication _________

******************************************************************************

Select the teacher’s edition of any K-6 mathematics textbook. After examining it closely, list five different NCTM standards which you find represented in this volume. You must include at least one process standard. On the form below, for each standard, list a sample page and justify your choice. On a separate sheet, assess 10 features you found in this textbook. Be sure to code the features as either positive or negative.

1. Standard ________________________________________________
   On page _____.

2. Standard ________________________________________________
   On page _____.

3. Standard ________________________________________________
   On page _____.

4. Standard ________________________________________________
   On page _____.

5. Standard ________________________________________________
   On page _____.
Ten Features

For example: This text includes a problem of the day aligned to the lesson topic which may be used for students who finish their work early. (Positive feature)

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.
Taking Away by Ones and Twos

This is a game for two people. Place 15 small objects in a pile. Take turns removing either one or two objects from the pile. The winner is the player who picks up the last one or two objects.

Play this game several times. Be sure to take turns going first. Try to develop a winning strategy.
Taking Away by Ones and Twos: A Closer Look

This activity is designed to help you discover some of the mathematics in the game you have been playing. The questions below should help you do this.

Does it make a difference who goes first? Why?

Are there some numbers of objects that you don't want to have when it's your turn? Why are these numbers problematic?

How would the game change if the person who takes the last object(s) loses?

Use what you have learned about this game to come up with a winning strategy. Describe your strategy using words and/or diagrams.

Challenges:
How would the game change if you started with a different number of objects? Try this and find out.

What would happen if you were allowed to take one, two, or three objects at a time? Play the game this way and see what differences it makes. List some of your findings.

Play this game at home with friends and family — see if they can come up with a similar strategy.
Video Analysis Worksheet

Part I:

As you watch the video, *How Long is a Minute*, make note of the different content and process standards that are addressed with this lesson. Beside each area, list specific examples that address the NCTM standard.

**Content Standards**

Number and Operations:

Algebra:

Geometry:

Measurement:

Data Analysis and Probability:

**Process Standards**

Problem Solving:

Reasoning and Proof:

Communication:

Connections:

Representation:

Part II:

Please respond to the following questions after watching the video:

1. In the lesson, students determined how many times they could perform an action in one minute. How does this lesson contribute to their concept of time?

2. How was estimation addressed in this lesson? How did it contribute to developing a concept of a minute?

3. Why is it important to have students generate and choose specific tasks? What types of activities did students suggest? What activities did they select? What similarities or differences did you notice in what they suggested and selected?
PROBLEM SOLVING IN MATHEMATICS

PROBLEM: A situation for which no immediate answer is available.

I. WHY ARE PROBLEMS HARD?
   A. No pat answer exists
   B. Higher order thinking is required
   C. Reading skills may be deficient
   D. Prerequisite math skills may be deficient
   E. Prior experience may be negative
   F. Problems often seem divorced from real life

II. WHAT ARE SOME CHARACTERISTICS OF GOOD PROBLEM SOLVERS?
   A. Skill in reading and mathematics
   B. Eagerness to learn and explore
   C. Responsiveness to print and non-print presentations
   D. Ability to act on partial data
   E. Organization
   F. Retentiveness
   G. Ability to critique ideas and explanations
   H. Resiliency
   I. Tolerance of own and others' actions
   J. Ability to generalize from a few examples
   K. Strong powers of concentration
   L. Self-confidence
   M. Reflective thought patterns
   N. Resourcefulness
   O. Ability to accept mistakes
   P. Experience in doing problems

III. WHAT DOES RESEARCH SUGGEST HELPS DEVELOP GOOD PROBLEM-SOLVERS?
   A. Providing many and varied experiences and situations (preferably using real-world data)
   B. Teaching strategies directly
   C. Suggesting student draw and diagram
   D. Stressing checking and estimation
   E. Using small numbers at first
   F. Having pupils write their own problems and share them with each other
   G. Presenting problems orally
   H. Displaying several solution strategies
   I. Stressing process over product
   J. Asking students to decide which data (if any) is relevant or excess or missing
   K. Asking students to determine and/or demonstrate that answers are reasonable
   L. Having students think aloud
   M. Letting pupils use calculators
   N. Giving students time to think
   O. Encouraging students to work in pairs and groups
   P. Praising partial successes
ACT OUT THE PROBLEM

1. Mary bought two pencils for ten cents each and an eraser for 15 cents. How much money did she spend? (An interest center with play money and objects to buy would be beneficial.)
2. Mrs. Jones needed to buy saucers and cups. Saucers are $2 and cups are $3. Each cup has a saucer but there are extra saucers. Mrs. Jones spent $27 for cups. How much will she have to spend for saucers?
3. There are three chairs in each corner of the room. How many children may sit in these chairs?
4. Mary hopped on her right foot three times. Joey hopped on his right foot six times. Fred hopped on his right foot two times. How many hops were hopped?
5. There are five people. Each person shakes hands with every other person. How many handshakes are there?

USE OBJECTS

1. Jim bought three packages of pencils. There are 15 pencils in all. How many pencils were in each package?
2. Mary put 16 stamps in a box. Sherry took out 11. Laura put in 25. How many are in the box?
3. A scout troop is going to the museum. The bus holds nine scouts. How many buses are needed for 26 scouts?
4. Jim can make four small statues out of a pound of clay. How many pounds of clay are needed to make 15 statues?
5. Both Fred and Joe live to the east of Mary. Fred lives six blocks east of Mary and Joe lives four blocks east of Mary. Which two people live farthest apart? The closest together? How far apart do they live?

GUESS—AND-CHECK

(Guess-and-check problems are when a number or numbers are arbitrarily chosen and put into positions to compare with other numbers to see if the answer works. Plug numbers in and, if they don't work, change them)

1. Greg had 2 more marbles than Sally. They have 14 marbles when they put them together. How many did Sally have?
2. The sum of 3 numbers in a row is 12. What are these numbers?
3. You want to buy some things at the toy store. They cost 52 cents, 28 cents, 55 cents, and 32 cents. Which items can you buy using exactly 4 coins?
4. Bert has 6 cards. Joe has 4. Tom has 7. Fred has 8. Carl has 9. Three boys put their cards together and have 17 cards. Who were the boys?
5. If you have 5 coins that add up to 70 cents, what coins do you have?
6. Draw 3 marks to show each score.

Score 22
Score 11
Score 18

7. Arrange the blocks so each pair will have a sum of 7.

\[1 \quad 5 \quad 3 \quad 2 \quad 4 \quad 6\]
USE LOGICAL REASONING

(Matrix logic problems are excellent for logical reasoning.)

1. Three children have 3 pets. The children are Ann, Bob, and Carl. The pets are an ant, a bobcat, and a canary. None of the children own a pet that has the same first letter as his/her name. Ann does not own the canary. Who owns which pet?
2. There are 4 cars—red, blue, yellow, and green. Three cars are parked in a line next to each other. The green is to the right of the red. Blue is in the middle. Which car is not in the parking lot?
3. There are 4 flowers—red, blue, yellow, and green. The flowers are not in a line. Blue is to the left of yellow. Green is in front of blue. Red is to the right of green. Arrange the flowers. For this activity the children may have to cut out flowers or pieces of paper.

WORK BACKWARDS

1. I had some money. I spent 45 cents on a drink. Now I have $1.25. How much did I start with?
2. Jim was given his allowance on Monday. On Tuesday, he spent $2. On Wednesday, Dana paid Jim the dollar she owed him. If Jim now has $4, how much did he get on Monday for his allowance?
3. \(? + 7 - 6 \times 2 = 8\)
4. Susan and her brother went to the game. Susan’s ticket cost $2. Her brother’s ticket cost $1.50. They bought 2 Cokes for $2. Susan now has $3. How much money did Susan come to the game with?

MAKE A LIST

1. How many different bike licenses can you make with the numbers 1, 2, 3, and 4?
2. Ann, Beth, Cathy, Dee, and Eve were playing in tennis matches in order to see who would play position 1, 2, 3, 4, or 5 on the girls’ tennis team. Each girl played each of the other girls once. How many matches were played?
3. A mother is 5 times as old as her daughter. The difference in their ages is 24 years. How old are they?
4. I have $1.20. I have quarters and dimes. What coins do I have?
5. Joe saved 1 cent on March 1\(^\text{st}\), 2 cents on March 2\(^\text{nd}\), and 4 cents on March 3\(^\text{rd}\). He continued to double the amount he saved each day. How much did he save in 10 days?

LOOK FOR A PATTERN

1. 2, 4, 6, 8, __, __, __.
2. Rita swam 3 laps on the first day of swimming practice. She swam 5 laps on the second day. The third day, she swam 7 laps and continued to progress at the same rate. How many laps did she swim on the seventh day?
3. 1, 4, 9, 16, __, __, __.
4. 1, 5, 2, 5, 3, 5, 4, 5, __, __, __.
5. a, ab, abc, __, __, __.
ACT OUT OR USE OBJECTS

MAKE A PICTURE OR DIAGRAM

USE OR MAKE A TABLE

MAKE AN ORGANIZED LIST

GUESS AND CHECK

USE OR LOOK FOR A PATTERN

WORK BACKWARDS

USE LOGICAL REASONING

MAKE IT SIMPLER

BRAINSTORM
ACT OUT OR USE OBJECTS

Some children may find it helpful to act out a problem or to move objects around while they are trying to solve a problem. It allows them to develop visual images of both the data in the problem and the solution process. By taking an active role in finding the solution, children are more likely to remember the process they used and be able to use it again for solving similar problems. The dramatizations and objects need not be elaborate: small scraps of paper and colored chips or counters will usually work quite well. This strategy is especially helpful when the problem solver wants to visualize relationships. For example:

Problem 26: Jumbo Circus has five very funny clowns. Right now they are climbing on a ladder. Millie is below Shorty. Beebo is above Shorty. Toto is below Millie. Cloe is way at the top. What is the name of each clown shown on the ladder?

MAKE A PICTURE OR DIAGRAM

For some children, it may be helpful to use an available picture or make one when trying to solve a problem. The pictures or diagrams need not be beautiful or well drawn. It is most important that they help the problem solver understand and manipulate the data in the problem. Using pictures is almost a necessity for some problems, particularly those which involve mapping. For example:

Problem 47: Stone Castle is where Princess Penny lives. There are four gates she can go through to get into her castle. All the gates open into a large garden. There are two winding stairways she can take from the garden up to the top of the castle. That’s where Penny likes to go. There’s a secret room up there. What are all the different paths Penny can take from outside the gates to the secret room?
USE OR MAKE A TABLE

A table is an orderly arrangement of data, such as numbers. Problem solvers find that making tables helps them keep track of data, spot missing data, and identify data that is asked for in the problem. Because patterns often become obvious when data is organized in a table, this strategy is often used in conjunction with other strategies. In the example below, the table is used to keep track of data and could also be used for identifying a number pattern.

Problem 29: Fran and Fred Fox like to eat chicken eggs! They lick their lips when they smell chicken eggs. Fran is smaller than Fred, so she eats fewer eggs than he does. For every meal, Fran eats 2 eggs and Fred eats 3 eggs. Fran just ate her 12th egg. How many eggs did Fred eat?

| Number of Eggs | Fran Ate | | | | | 2 | 4 | | | | | | | 3 | 6 | | | | | | | 000 | 000 | | | | | | | 000 | 000 | | | | | | | 000 | 000 | | | | | | | 000 | 000 | | | | | | | 000 | 000 |

MAKE AN ORGANIZED LIST

Making an organized list helps problem solvers organize their thinking about a problem. Recording work in an organized list makes it easy to review what has been done and to identify important steps that must yet be completed. It also provides a systematic way of recording computations made with given data or recording combinations of given items. For example:

Problem 4: Oscar the ostrich likes to show off his long neck and legs. When he goes to town, he puts on a necktie and a pair of socks. Oscar has a blue necktie and a red necktie. He has a pair of orange socks, a pair of green socks, and a pair of yellow socks. What are the 6 different sets of neckties and socks that Oscar can put on when he goes to town?

Color the pictures to show the answer:

1. and
2. and
3. and
4. and
5. and
6. and

neckties

socks
GUESS AND CHECK

Guessing and checking is helpful when a problem presents large numbers or many pieces of data, or when the problem asks the solver to find one solution but not all possible solutions to a problem. When problem solvers use this strategy, they guess the answer, test to see if it is correct, and make another guess if the previous one was incorrect. In this way, they gradually come closer and closer to a solution by making increasingly more reasonable guesses. Problem solvers can also use this strategy to get started, and may then find another strategy which can be used. Guessing and checking is particularly helpful when a problem presents so many pieces of data that making an organized list becomes a major task. For example:

Problem 20: “Bang!” The marble shot out and rolled around on the “Jungle” board. Joan was playing a marble game. She won points every time a marble rolled into a hole. She won a different number of points for each hole. Joan shot 4 marbles and won 25 points. Which holes could the marbles have rolled into?

Guess: 10 + 5 + 4 + 2 = 21 (No)
Guess: 11 + 5 + 4 + 9 = 29 (No)
Guess: 10 + 5 + 9 + 1 = 25 (Yes)

USE OR LOOK FOR A PATTERN

A pattern is a regular, systematic repetition. A pattern may be numerical, visual, or behavioral. By identifying the pattern, the problem solver can predict what will “come next” and what will happen again and again in the same way. Looking for patterns is a very important strategy for problem solving, and is used to solve many different kinds of problems. Sometimes students can solve a problem just by recognizing a pattern, but often they will have to extend a pattern to find a solution. Making a number table often reveals patterns, and for this reason is frequently used in conjunction with the “look for a pattern” strategy. For example:

Problem 40: The children in Ms. Fisher’s second grade class made puppets for people in a hospital. The children made 6 puppets on Monday. They made 11 puppets on Tuesday. On Wednesday they finished 16 puppets. They got better and better at making puppets. Every day they made the same number of puppets more than the day before. They followed a number pattern. How many puppets did they make on Friday?
WORK BACKWARDS

To solve certain problems, the solver must make a series of computations, starting with data presented at the end of the problem and ending with data presented at the beginning of the problem. For example:

**Problem 43:** Do big, red cherries taste good? Yes! Robin sang about the wonderful cherries hanging from the tree. Bluejay heard Robin sing and he told Wren. Wren ate 10 more cherries than Robin ate. Bluejay ate 6 more cherries than Wren did. Robin was so busy singing that she ate only 2 cherries. How many cherries did Bluejay eat?

Robin = 2 cherries

Wren 2 + 10 = 12 cherries

Bluejay 12 + 6 = 18 cherries

USE LOGICAL REASONING

Logical reasoning is really used for all problem solving. However, there are types of problems that include or imply various conditional statements such as: “if...then,” or “if...then...else,” or “if something is true, then...” or “if something is not true, then...” The data given in the problems can often be displayed in a chart or matrix. This kind of problem requires formal logical reasoning as the problem solver steps his or her way through the statements given in the problem. For example:

**Problem 1:** Kris likes caps! He wears caps to school. He wears caps to the park. He wears caps everywhere he goes. Today he found one more cap to wear.

- It covers his ears.
- It has two buttons on it.
- One of the buttons shows a picture of an animal.

Which cap did Kris find today?
MAKE IT SIMPLER

Students will find it helpful to be able to make problems simpler, especially when they begin to solve complex problems. Making a problem simpler may mean reducing large numbers to small numbers, or reducing the number of items given in a problem. The simpler representation of the problem, then, may suggest what operation or process can be used to solve the more complex problem. The simpler representation may even reveal a pattern which can be used to solve the problem. For example:

Problem 49: “Let’s all have our pictures taken together,” said Linda. She was with her friends Megan, Nora, Olga, and Pearl. Linda’s brother took pictures of them with his camera. He could only get two girls on each picture. So, each of the five girls had her picture taken with every other girl. How many pictures did Linda’s brother take in all?

How many pictures did Linda’s brother take for:

2 friends? __
3 friends? __
4 friends? __
5 friends? __

BRAINSTORM

This strategy is often used when all else fails. When the problem solver cannot think of a similar problem that he or she has solved before, and cannot think of another strategy to use, brainstorming is a good strategy to try. Brainstorming means looking at a problem in new and inventive ways. There are always problems that stretch people beyond their experience and expertise. When students encounter problems that they cannot solve, they must be encouraged to open up, stretch, allow for inspiration, be creative, be flexible, and keep on trying until a light goes on! For example:

Problem 54: You can hide a secret message under a pillow. You can hide a note behind a door. You can’t hide a note between pages 21 and 22 in most books. Why not?


**Mud Puddle Connections**

*Directions*: Begin by placing an attribute block in any mud puddle. Students take turns (but help each other) placing other attribute blocks on the gameboard, such that they are different from neighboring puddles by the number of lines connecting the puddles.
HUNDRED BOARDS ACTIVITIES

Cover-up. Call out 8-10 numbers one at a time and have students use cubes or disks to cover them on their hundreds chart. Then have volunteers name the numbers that are covered on their boards without removing the cubes. Ask questions such as: "What numbers between 30 and 40 are covered?" "What numbers less than 25 are covered?"

Continue the Pattern. Call out a set of numbers such as 1, 4, 6, 8 for students to cover. Have them determine the pattern and cover the next four numbers in the sequence.

Placing Value on Place Value. Provide directions such as:
A. Cover the number with 4 in the tens place and 3 in the ones place or
B. Cover all the numbers with three in the tens place or
C. Cover all the numbers with five in the ones place or
D. Cover all the numbers with more tens than ones.
Then have students check their answers with a partner.

I’m Thinking of a Number. Choose a number on a hundred board and write it down. Then have students ask questions which must be answered "yes" or "no" to see if they can guess the number. Challenge them to do so in fewer than 20 questions.

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a. Use your yellow crayon to color seven. Count by 10s beginning with seven and color the numbers yellow as you count by 10s.

b. Color the number four red. Count by 4s beginning with four and color the numbers red as you count.

c. Use your blue crayon to color the number that is 6 tens and 3 ones.

d. Use your black crayon to color the number that is 10 less than 75.

e. Use your pencil to circle every number that has a 3 in it. What two different ways are you counting when you follow the pattern across and when you follow the pattern going down?
The learner will demonstrate an understanding of patterns

E. Students will need hundreds boards and counters. Present guidelines and have them cover the answers and look for patterns. For example: Cover all the numbers that are multiples of 4. Erase board. Cover all numbers whose digits add up to an odd number. Erase board. Cover all numbers where the digit in the ones place is 1 more than the digit in the tens place. Erase board. Have children work in pairs and make up other directions.

A. Using a hundreds board, identify a starting point (i.e., 47). Use arrows to indicate movement on board. Have students determine where they end up. Look for patterns in movements. Try several and then allow the students to create their own problems. Before making the movements, have students predict where the marker will land by looking at the arrow pattern.

B. Explore number patterns on the blank side of a hundred board, e.g., teacher will direct student to place a marker on the square where 52 should be. Encourage students to explain the number patterns that help them locate the proper square. Try to locate other numbers.

G. Make number puzzles for students based on their hundreds boards. Once students have completed your samples, they can create puzzles for each other by cutting out shapes from grid paper.

How Many Patterns In 100?

Exploring a hundred chart can reveal countless patterns. Give each child a copy of the chart on page 54 and a supply of small manipulatives such as dried beans, buttons, or cubes. After several minutes of discovery time, give students the following oral directions and have them find the resulting patterns:

- Cover the numerals 11, 22, 33, 44, and 55. Evaluate the pattern. What number(s) will come next in this pattern?
- Cover the numerals 4, 8, 12, 16, 20, 24, and 28. Evaluate the pattern; then continue the pattern through 100.
- Cover the even (odd) numbers on the chart. What do you notice about the pattern(s)?
The Place-Value Game

- Play this game with a partner.
- Cut apart the two game boards and cut out the numbers at the bottom of the page. Mix the numbers and place them all face down.
- Player A draws a number and places it face up in any place on game board A.
- Player B draws a number and places it face up in any place on game board B.
- Take turns until the game boards are full.
- The winner is the one who has made the largest number and can read it correctly.

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6 7 8 9 0 1 2
3 4 5 6 7 8 9

Creative Teaching Press
Math & Literature 33
Bone Up

Directions: Use with two sets of number tiles (0-9). Take turns drawing a tile and filling a bone. Try to build the largest number. You must fill one bone before going to the next one. You may not move a tile after it has been placed. You may vary the game by building the smallest number.

Player 1

100's Tens Ones

100's Tens Ones

100's Tens Ones

100's Tens Ones

Player 2

100's Tens Ones

100's Tens Ones

100's Tens Ones

100's Tens Ones

100's Tens Ones

100's Tens Ones

Objective 1.09: Indicate the value of each digit in any 2- or 3-digit number.
NUTTY BUDDIES

Players: Two (squirrel and acorn)
Equipment: Gameboard and 2 dice
Directions:
- Place 15 counters on your side of the board in any way you want.
  More than one counter can be in a space.
- Decide who will go first.
- The first player rolls the 2 dice and calls out the sum.
- If the player has a counter on the sum, he or she removes it. (Only 1 counter can be removed at each turn.)
- The player passes the dice to his or her partner.
Winner: The player who empties the gameboard first.
Objective: Use cards and remove all face cards. Try to cover ten spots.

Instructions: First player to get eight markers on the board.

Directions: Roll two dice and add. Place a marker on your answer. The winner will be the one with the most markers on the board.

Materials: Two dice, two types of markers, game board.

Going Fishing
King Seven

Materials: Gameboard, two markers, pair of dice
Number of Players: Two
Directions: Take turns rolling dice and adding.
If the sum is larger than seven, player 1 moves one space.
If the sum smaller than seven, player 2 moves one space.
If the sum is seven exactly, no one moves.
The first person to reach the crown is the winner.
Materials: Gameboard, 8 red markers and 8 yellow markers, 2 dice.

Directions: Roll the two dice and subtract. Cover an answer. If it has an opponent's marker on it, you may "move" it off the board. The winner is the first person to use all their markers.
CIRCLES AND STARS

On a piece of construction paper, play the game Circles and Stars! Roll a die and one person draws that many circles on the paper. Roll a die the second time and another person draws that many stars inside each circle. Together, write the resulting multiplication fact.

1. [Dice] die Roll

2. Draw 5 Circles

3. Roll again

4. Draw two stars in each circle

5. Write your multiplication fact
   \[ 5 \times 2 = 10 \]

6. Start over and make a new fact!
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## Multiples

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The first player to get exactly 12 wins.

The number showing that product moves the number forward to the nearest spinner by the number on the number on the number on the one marker per player.

Two players:

1. Take turns spinning the spinner.
2. Multiply the number on the number on the number on the number on the number on the one marker per player.

Games from Basic Games, Book 8
Materials: Gameboard; Markers, 3 dice

Directions: Place markers on "Start." Take turns rolling the three dice. The sum of the three dice must be on the next footprint in order to move. The first person to "End" is the winner.
Different ways to make $1.00 with money combinations

Greater than $1.00 by 1 cent, less than by 1 cent, greater than by 10 cents, less than by 10 cents

Write a word program

$1 >

$1 <

Write in word form
Picking Grapes

Building Fluency: subtracting within 20

Materials: gameboard, one die, game markers

Number of Players: 2

Directions:
1. Players take turns rolling the die and subtracting the number on the die from 10.
2. Cover the difference on your bunch of grapes.
3. The winner is the person that covers all of their grapes first.

Variation/Extension: Use an additional game board with larger numbers and subtract from 20. You could vary using one or two dice. Students could create their own Picking Grapes gameboard.
Picking Grapes

PLAYER 1

14 17 19 15
16 18 17
14 19
18

PLAYER 2

14 17 19 15
16 18 17
14 19
18
Error Patterns in Addition

Error Pattern #1:

\[
\begin{array}{cccccccc}
74 & 35 & 67 & 56 & 43 & 88 \\
+56 & +92 & +18 & +97 & +65 & +39 \\
\hline
1210 & 127 & 715 & 1413
\end{array}
\]

Error Pattern #2:

\[
\begin{array}{cccccccc}
432 & 74 & 385 & 563 & 254 & 618 \\
+265 & +43 & +667 & +545 & +535 & +782 \\
\hline
697 & 18 & 9116 & 118
\end{array}
\]

Error Pattern #3:

\[
\begin{array}{cccccccc}
56 & 18 & 8 & 42 & 85 & 26 & 60 \\
+6 & +30 & +16 & +56 & +6 & +3 & +24 \\
\hline
17 & 48 & 15 & 98 & 19
\end{array}
\]

Error Pattern #4:

\[
\begin{array}{cccccccc}
175 & 167 & 84 & 59 & 46 & 98 \\
+8 & +4 & +9 & 6 & +8 & +3 \\
\hline
163 & 183 & 125
\end{array}
\]
Error Patterns in Subtraction

Error Pattern #1:

$$
\begin{array}{cccccc}
32 & 245 & 524 & 135 & 458 & 241 \\
-16 & -137 & -298 & -67 & -372 & -96 \\
\hline
244 & 112 & 374 & 132 \\
\end{array}
$$

Error Pattern #2:

$$
\begin{array}{cccccc}
8 & 6 & 384 & 273 & 285 \\
197 & 174 & -59 & -38 & -63 \\
-43 & -23 & \\
\hline
1414 & 1413 & 325 \\
\end{array}
$$

Error Pattern #3:

$$
\begin{array}{cccccc}
147 & 624 & 527 & 805 & 446 & 760 \\
-20 & -323 & -304 & -201 & -302 & -230 \\
\hline
120 & 301 & 203 & 604 \\
\end{array}
$$

Error Pattern #4:

$$
\begin{array}{cccccc}
8 & 825 & 512 & 434 & 436 & 625 \\
-248 & -151 & -349 & -276 & -172 & -348 \\
\hline
445 & 174 & 287 & 68 \\
\end{array}
$$
Carolina Clip-It

2 players
Materials: Gameboard, 2 paper clips, different colored markers

Directions: Player one places paper clips on two numbers at the bottom of the page. Player one multiplies the two numbers and places a marker on the correct product. Player two can move only one paper clip, multiply the two numbers, and place a marker on the correct product. Both paper clips may be placed on the same number. Play continues until one player has 4 in a row or diagonally.
**MUTIPLICATION MARK OFF**

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Use a regular deck of cards to play this game. Let Aces = 1, Jacks = 11, Queens = 12, and Kings = 0.

Each player has 10 markers. At a turn, the player draws two cards and multiplies. If the product is uncovered on the board, the player may capture the spot. The first player to capture 10 spots wins.
Charlotte Speedway Race

Materials: Gameboard, a marker for each player, one number cube or spinner labeled 1, 1, 2, 2, 3, 3
Number of Players: 2
Directions: Player rolls cube or spins and moves that number of spaces. Player must give a multiplication fact for the product in the space using 2 or 5 as one of the factors. If an incorrect answer is given, player loses turn, and returns to the previous position. Winner is the first to cross the finish line.

(Review multiplication facts)
**Multo Tic-Tac-Toe**

**Materials:** Gameboard, different colored markers  
**Number of Players:** 2 players  
**Directions:** This game is played like Tic-Tac-Toe. Each player takes turns calling out the multiplication fact and product for any of the 81 small spaces. If correct, the player puts his or hers in the space. If a player makes a mistake, then the other player wins that space. When a player gets three small spaces in a row, column, or diagonal, he or she wins the larger square. The winner is the first player who wins three LARGE squares in a row, column, or diagonal.

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<td>7</td>
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</tr>
</tbody>
</table>

(Review multiplication facts)
**Blackbeard Strikes!**

**Directions:** The first player chooses any square on the board and gives the factors and the product. If the player is correct, he places a marker on that space. If the player is incorrect, he loses a turn. The second player takes a turn. The winner is the first player to cover 5 squares in a row, column, or diagonal. Players may not cover any square already covered.

<table>
<thead>
<tr>
<th></th>
<th>5 x 9</th>
<th>3 x 8</th>
<th>4 x 5</th>
<th>3 x 8</th>
<th>5 x 8</th>
<th>2 x 4</th>
<th>3 x 7</th>
</tr>
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<tbody>
<tr>
<td>6 x 4</td>
<td>5 x 4</td>
<td>5 x 8</td>
<td>4 x 4</td>
<td>5 x 3</td>
<td>4 x 7</td>
<td>5 x 7</td>
<td></td>
</tr>
<tr>
<td>2 x 9</td>
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<td>4 x 6</td>
<td>2 x 2</td>
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<td>3 x 4</td>
<td>5 x 2</td>
<td>3 x 5</td>
<td>5 x 6</td>
<td>4 x 8</td>
<td></td>
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<td>6 x 6</td>
<td>4 x 3</td>
<td>6 x 7</td>
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<tr>
<td>3 x 8</td>
<td>3 x 9</td>
<td>6 x 5</td>
<td>6 x 9</td>
<td>6 x 8</td>
<td>2 x 5</td>
<td>6 x 4</td>
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<tr>
<td>4 x 2</td>
<td>6 x 7</td>
<td>4 x 7</td>
<td>2 x 6</td>
<td>3 x 6</td>
<td>4 x 8</td>
<td>3 x 6</td>
<td></td>
</tr>
</tbody>
</table>
Sakes Alive, Go for Fives!!

Number of Players:  Two or three
Materials:  Gameboard, two number cubes, colored counters for each player
Directions:  Each player in turn rolls the number cubes and covers the product or any two factors of the product.  If the product of factors has been covered, the player loses a turn.  The first player to cover five squares in a row vertically, horizontally or diagonally wins the game.

```
<table>
<thead>
<tr>
<th>24</th>
<th>5</th>
<th>16</th>
<th>3</th>
<th>18</th>
<th>2</th>
<th>20</th>
<th>12</th>
<th>4</th>
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<td>8</td>
</tr>
<tr>
<td>18</td>
<td>1</td>
<td>36</td>
<td>4</td>
<td>30</td>
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<td>24</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>18</td>
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<td>16</td>
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<tr>
<td>5</td>
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<td>1</td>
<td>15</td>
<td>5</td>
<td>18</td>
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<td>4</td>
<td>24</td>
<td>3</td>
<td>2</td>
<td>24</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
<td>25</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>15</td>
<td>1</td>
<td>20</td>
<td>9</td>
<td>18</td>
<td>3</td>
<td>6</td>
<td>24</td>
<td>36</td>
</tr>
</tbody>
</table>
```
**Race to the Resort**

**Directions:** Players take turns rolling a number cube. Move that many spaces if you can answer all of the facts along the way. If you land on the same square as your opponent, you can send that player back to start!
### Four Quotients

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>5/24</td>
<td>7/35</td>
<td>9/81</td>
<td>4/24</td>
<td>8/64</td>
<td>8/32</td>
</tr>
<tr>
<td>4</td>
<td>9/36</td>
<td>8/72</td>
<td>5/30</td>
<td>7/49</td>
<td>5/35</td>
<td>7/42</td>
</tr>
<tr>
<td>5</td>
<td>9/54</td>
<td>8/56</td>
<td>5/40</td>
<td>4/28</td>
<td>9/72</td>
<td>4/36</td>
</tr>
</tbody>
</table>

**Materials:** You need 2 number cubes and 10 markers (like cm cubes) for each player, a different color for each player.

**Directions:** Players take turns. The first player rolls the cubes and locates the space(s) on the grid named by them. A roll of a 3 and a 5 could be space (3, 5) or (5, 3). The player chooses either division problem and places a marker on the answer on the quotient (in one space only).

The object of the game is to get four markers in a row in any direction. The first player to get four in a row is the winner.
**Mount Mitchell Rock**

**Number of Players:** 2

**Materials:** You will need a number cube and a different colored marker for each player.

**Directions:** Follow the path to the top of the mountain. Place your marker on start. Take turns rolling the cube. Divide the number on the rock under your marker by the number on the cube. The remainder tells the number of spaces you may move. The first player to reach the top of the mountain is the winner.
Error Patterns in Multiplication

Error Pattern #1:

\[
\begin{array}{cccccc}
46 & 76 & 48 & 98 & 86 \\
\times 24 & \times 32 & \times 57 & \times 56 & \times 45 \\
184 & 152 & 336 & & \\
1204 & 228 & 250 & 2836 & \\
\end{array}
\]

Error Pattern #2:

\[
\begin{array}{cccccc}
27 & 34 & 345 & 68 & 29 \\
\times 4 & \times 4 & \times 7 & \times 5 & \times 3 \\
108 & 304 & 495 & & \\
\end{array}
\]

Error Pattern #3:

\[
\begin{array}{cccccc}
313 & 210 & 524 & 433 & 621 & 517 \\
\times 4 & \times 15 & \times 34 & \times 224 & \times 23 & \times 463 \\
1252 & 210 & 1576 & 878 & & \\
\end{array}
\]
Error Patterns in Division

Error Pattern #1:

\[
\begin{array}{c}
44 \\
2) 88 \\
\hline
8 \\
\hline
8 \\
\hline
8
\end{array}
\quad \quad \quad
\begin{array}{c}
14 \\
4) 164 \\
\hline
14 \\
\hline
4
\end{array}
\quad \quad \quad
\begin{array}{c}
67 \\
3) 228 \\
\hline
21 \\
\hline
45 \\
\hline
15
\end{array}
\quad \quad \quad
\begin{array}{c}
39 \\
5) 465 \\
\hline
45 \\
\hline
15
\end{array}
\quad \quad \quad
\begin{array}{c}
75 \\
3) 75
\end{array}
\]

Error Pattern #2:

\[
\begin{array}{c}
233 \\
2) 176 \\
\hline
8 \\
\hline
18
\end{array}
\quad \quad \quad
\begin{array}{c}
221 \\
4) 824 \\
\hline
45 \\
\hline
16
\end{array}
\quad \quad \quad
\begin{array}{c}
231 \\
3) 713 \\
\hline
21 \\
\hline
639 \\
\hline
518
\end{array}
\quad \quad \quad
\begin{array}{c}
54 \times 3 \\
8) 4035 \\
\hline
40 \\
\hline
35 \\
\hline
32 \\
\hline
3
\end{array}
\]

Error Pattern #3:

\[
\begin{array}{c}
65 \times 1 \\
7) 456 \\
\hline
42 \\
\hline
36 \\
\hline
35 \\
\hline
1
\end{array}
\quad \quad \quad
\begin{array}{c}
94 \times 2 \\
6) 5426 \\
\hline
54 \\
\hline
24 \\
\hline
24
\end{array}
\quad \quad \quad
\begin{array}{c}
167 \times 4 \\
8) 4860 \\
\hline
48 \\
\hline
60 \\
\hline
56 \\
\hline
4
\end{array}
\quad \quad \quad
\begin{array}{c}
54 \times 3 \\
8) 4035 \\
\hline
40 \\
\hline
35 \\
\hline
32 \\
\hline
3
\end{array}
\]

9) 2721 

6) 4250
Products and Sums (Videotape Analysis)

1. Students are investigating sums and products in the lesson. What mathematical ideas are being developed through this activity?

2. Ms. Doolittle gave students an organized arrangement of the sums and products. How did this arrangement affect the students' discoveries of patterns?

3. How is mathematical understanding revealed in the patterns the students discovered? What is the value of devoting an entire lesson to searching for patterns and relationships among numbers?

4. Ms. Doolittle was a facilitator of classroom discourse. What kinds of questions and responses did she use to promote discourse? What other questions might you have asked?

5. The students and teacher talked about models. What is a model? How does using models promote discourse?

6. Why did Ms. Doolittle say “Write down anything you see” before the groups began their work?
A. Give each student a copy of the blackline master that has six grids (one with the unit divided into 10 parts and five with a hundred parts). On the first grid ask students to color a stripe pattern using only two colors. Stripes may be narrow or wide. (Use the back of the hundred board and Unifix cubes for a concrete experience.) Write the decimal and fraction which shows how much of the total is covered by each color. Ask students what they might write if they were to divide the unit into 10 parts horizontally as well as vertically.

Directions for the other grids might include...

1. **Color your initials.** Write the decimal and the fraction to show what part of the unit is your first initial, your last initial, the total uncolored, the total colored. What do you notice about the totals together?

2. **Color a pattern** that might have been used by North Carolina native Americans. Tell about each color you have used by writing the decimals and fractions.

3. **Color a symmetrical design.** Write the fraction and decimal numbers which tell about each color.

   - Suppose you asked 10 people to name a single digit number. What do you think that would be? Make a design with that number in the center and some decoration in the corners. Write the decimals and fractions to tell about the colors you used. Make a graphic display to show everyone's numbers.

4. **Make a picture of a North Carolina product** inside a frame. Write the appropriate decimals and fractions to tell how much of the total grid is not colored, how much is the frame and how much is the product.

5. **Make a design that is** .28 red, .14 blue, and .30 yellow. How much of the total is not colored? Write the answer in three ways—words, decimal, fraction.

6. **Make a design in which** .60 is colored and .40 is not colored. How much of the total is each color you used?
Decimal Models - Tenths
Decimal Models - Hundredths

Sheet C
The Decimal 500

In auto racing, a driver can win or lose by just one hundredth of a second—so every second counts! Get in on the race at the Decimal 500 and go for a fantastic finish!

Directions: Cut out the track, race cars, and lap cards. Give a different race car to each player to color. Put the lap cards in the center of the track. Place each car on the Start block. Each player, in turn, should roll a die, move the correct number of spaces, and then add or subtract the time as directed on that gameboard space. Do all calculations on loose-leaf paper. Each time a player completes a lap, he or she should take a lap card. The player with the lowest total time after five laps is the winner.

<table>
<thead>
<tr>
<th>Event</th>
<th>Time Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helmet slides over your eyes</td>
<td>Add 0.43 seconds</td>
</tr>
<tr>
<td>Make headway on the straightaway</td>
<td>Subtract 1.31 seconds</td>
</tr>
<tr>
<td>Sideswipe another car</td>
<td>Add 1.52 seconds</td>
</tr>
<tr>
<td>Oil spill causes slick conditions</td>
<td>Add 1.2 seconds</td>
</tr>
<tr>
<td>Hit side of the racetrack</td>
<td>Add 0.26 seconds</td>
</tr>
<tr>
<td>Miss a crashed car</td>
<td>Subtract 0.43 seconds</td>
</tr>
<tr>
<td>Avoid debris on the track</td>
<td>Add 2.04 seconds</td>
</tr>
<tr>
<td>Make pit stop for repairs</td>
<td>Add 5.17 seconds</td>
</tr>
<tr>
<td>Driving full throttle!</td>
<td>Subtract 2.24 seconds</td>
</tr>
<tr>
<td>Swerve to miss another car</td>
<td>Add 1.77 seconds</td>
</tr>
<tr>
<td>Wet pavement ahead!</td>
<td>Add 0.56 seconds</td>
</tr>
</tbody>
</table>

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Note To The Teacher: Provide each student with scissors, a different-colored crayon or marker, a sheet of loose-leaf paper, and a pencil. After the group completes each round, have the players check one another's answers for accuracy.
Stampers

Write your answers on a separate piece of paper in both number and word form; for example, 14.37 (number form), fourteen and thirty-seven hundredths (word form).

A. Who Am I?
1. I have 4 digits, and they all are different.
2. All of my digits are odd.
3. I have a 1 in the hundredths place.
4. I have a 7 in the ones place.
5. The number in the tens place is less than the number in the tenths place.
6. None of my digits are 9.

B. Who Am I?
1. I have 4 digits.
2. Each digit is either a 2 or a 4.
3. The numbers in the ones place and tenths place are the same.
4. The numbers in the tens place and hundredths place are the same.
5. I have a 4 in the hundredths place.

C. Who Am I?
1. I have 4 digits, and they are all odd.
2. The number in the tenths place is greater than 3. It is a factor of 36.
3. The number in the hundredths place is less than 4 and greater than 1.
4. The numbers in the ones and tens places are the same and are also factors of 25.

D. Who Am I?
1. I have 4 digits, and they are all odd.
2. The 2-digit whole number is greater than 10 and less than 20. When this number is divided into 121, the quotient is also that number.
3. The digit in the tenths place is 3.
4. Add 4 to the number in the tenths place and you will have the number in the hundredths place.

E. Who Am I?
1. I have 4 digits, and they are all different and even.
2. The number in the hundredths place is half of the number in the tenths place.
3. The number in the hundredths place is greater than 3.
4. The number in the ones place is 6.
5. The number in the tens place is 2.

F. Who Am I?
1. I am a whole number.
2. I am greater than 50.
3. I am equal to the number of days in 9 weeks, minus 48 hours.

G. Who Am I?
1. I have 3 even digits.
2. The number in the tenths place when subtracted from 3 equals 1.
3. The number in the ones place is 8.
4. Divide the number in the ones place by 2 and you will have the number in the hundredths place.

H. Who Am I?
1. I have 4 digits.
2. The numbers in the tenths and hundredths places are the same.
3. The numbers in the ones place and tenths place are the same.
4. The number in the tenths place when added to 4 and subtracted from 10 is 0.
5. The number in the ones place is 4.
### Deci-Moves

**Number of Players:** 2 players  
**Materials:** You need 4 colored markers (cm cubes are good) for each player and a coin.

<table>
<thead>
<tr>
<th>0.7</th>
<th>0.8</th>
<th>0.5</th>
<th>0.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.62</td>
<td>0.88</td>
<td>0.60</td>
<td>0.15</td>
</tr>
<tr>
<td>0.09</td>
<td>0.67</td>
<td>0.72</td>
<td>0.02</td>
</tr>
<tr>
<td>0.4</td>
<td>0.81</td>
<td>0.3</td>
<td>0.27</td>
</tr>
<tr>
<td>0.04</td>
<td>0.75</td>
<td>0.1</td>
<td>0.91</td>
</tr>
<tr>
<td>0.49</td>
<td>0.05</td>
<td>0.57</td>
<td>0.25</td>
</tr>
<tr>
<td>0.31</td>
<td>0.95</td>
<td>0.13</td>
<td>0.65</td>
</tr>
<tr>
<td>0.3</td>
<td>0.4</td>
<td>0.5</td>
<td>0.6</td>
</tr>
</tbody>
</table>

**Directions:**
1. Each player chooses one side of the board and places her or his cubes on the 4 triangles on that side.
2. Take turns tossing the coin.
3. If the coin comes up **heads,** move one of your markers to a space having a number **larger** than the number your cube is on.
4. If the coin comes up **tails,** move one of your cubes to a space having a number **smaller** than the number your cube is on.
5. You can move up or down, left or right, or diagonally, one space only:

![Diagram](image)

6. If your cube can move to a space occupied by your opponent's cube, his or her cube moves back to a beginning triangle. Only one cube may be on a space at one time.
7. If you are able to move one of your cubes, you must do so, no matter what the direction. If the only move you can make is away from a triangle on your opponent's side, you must make that move.
8. If you have no move within the rules, you lose your turn.
9. The winner is the first player to get all of her or his cubes to the triangles on the other side of the board.
Decimal Dynamo
(Your Goal: the smallest sum of 6 products)

Directions:

1. Roll 4 number cubes (or one cube 4 times). Use these numbers to create a 2-digit number and a whole number with a decimal. For example, 
   \[
   \begin{array}{cccc}
   6 & 4 & 2 & 5 \\
   \end{array}
   \]
   62 and 5.4 or 46 and 2.5

Record the numbers you create for each round.

2. Multiply these numbers and record the product for each round.

3. At the end of 6 rounds, add the products.

The winner is the player with the smallest sum of the 6 products.

Variation: The winner with the greatest sum.
DECI-MILL DUNK

Number of Players: 2 to 4
Materials: You need 2 dice and markers (like cm cubes) for each player
(a different color for each player).

Directions: 1. Take turns rolling the dice. Choose either space on the grid
named by the dice i.e. (4,5) or (5,4).
2. Place a marker on any open space with a number less than the number
in the space named by your roll. (If the space you roll is covered,
look under the marker.)
3. If there is no open space with a number less than your roll, you lose a turn.
4. Continue taking turns until one player has four in a row in any direction. If all spaces
are filled with no color in a row of four, the player with the most markers on the board
is the winner.
Fraction on the Fringe
Cutting Edge

Topic
Fractions: length model
fair shares
equivalency

Learning Goals
- To understand relative size of fractions by direct comparison using a linear model
- To recognize and name fractions as fair shares of a linear unit
- To construct a linear model that represents equivalent fractions and proportionality

Guiding Document
NCTM Standards
- Develop number sense for fractions and decimals (K-4)
- Develop concepts of fractions, mixed numbers, and decimals (K-4)
- Understand, represent, and use numbers in a variety of equivalent forms (5-8)
- Develop number sense for whole numbers, fractions, and decimals (5-8)

Background Information
A useful model for exploring equivalency is based on a line or bar that represents the whole. In this activity a set of colored papers that share a common linear measure become a tool for comparing relative sizes of fractions and also for recognizing and naming equivalent fractions.

When students use this model to find the missing number in two equivalent fractions (see Fringe Benefits), they have the opportunity to discover some number patterns and relationships. These include: numerator is to numerator in the same relationship as denominator is to denominator; numerator and denominator of one fraction is in the same relationship as numerator and denominator of second fraction; and cross products are equal.

Procedure
1. Distribute seven lengths of brightly colored paper and four pieces of black paper to each pair of students.
2. Have students separate colors into two sets: one of three colors and the other of four colors.
3. Tell them to begin with the four color stack. Direct them to stack four colors on top of one another and bend into a curve so that the ends of the layers of color are off-set by about 1/2" at each end.

4. Tell them to hold papers in position and fold entire set in half and cut along fold line.

5. Now there are two sets of four colors — one set per student.
6. Have each student place a piece of black paper beneath the colored stack in such a way that a 1/2" black border is formed at the layered end. Staple in two places at the opposite end.

7. Tell them to turn or rotate the stapled stack so that black is on the bottom and the stapled part is at the top. The black band represents the whole number one and is never cut.

Materials
Duplicating paper (8 1/2" X 11") in 7 bright colors
- cut into 4 1/4" X 11" pieces
Black construction paper 12" X 18" cut into 4 1 1/4" X 6" pieces
Scissors
Staplers
Rulers

FABULOUS FRACTIONS

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8. Tell them to use scissors to cut all colored layers (not the black) in half vertically to about the middle of the top sheet.

9. Have students cut ONLY second, third, and fourth colored layers in half again. Check to make sure top three layers are now cut into four equal pieces.

10. Have students cut ONLY third and fourth layers in half again thus resulting in eight equal pieces in each layer.

11. Have students cut ONLY the top layer (fourth layer) in half again resulting in sixteen equal pieces.

12. Inform the students that they are going to repeat the entire procedure with the set of three colors and cutting in thirds, then in half (for sixths), and finally in half again to produce twelfths.

13. Have students use the model to complete the proportional reasoning problems in *Fringe Benefits*. Notice that one page is designed for use with each model and one is for mixed use.

**Discussion**

1. What part of the layered paper model is uniform or the same for all layers? [the 4 1/4" edge]

2. How are the layers different? [Each layer has more parts and the parts are smaller.]

3. How could you explain the relationship of one layer to its immediate neighbor above or below it? [The pieces are half the size if the layer is above it and double the size if the layer is beneath it.]

4. What is the relationship of the numerator and the denominator to this model? [The numerator describes the number of parts under consideration and the denominator tells the size of the parts or the number of parts in the whole.]

5. What number patterns or relationships did you discover when using your fraction fringe to complete *Fringe Benefits*? (See Background Information. Students may notice that one numerator is twice the size of the other numerator and that the denominators are likewise. Answers will vary.)

6. How could you solve a similar problem which is not represented by the paper model? For instance, 4/12 = ?/24. (If the relationship is understood, it could be applied to any problem. Since 12 is half of 24, then 4 must be half of the missing number. Since 4 is 1/3 of 12, then the missing number must be 1/3 of 24, or 8. Or the cross products are equal and 4 times 24 is 96, therefore something (8) times 12 is 96.)

**Evaluation**

Since three pages of *Fraction Fringe* are included with this lesson, any of the sets could be used as an independent evaluation of understanding.

**Evidence of Learning**

1. Look for accuracy of missing numbers in ratios.

2. Listen for intelligent questions. Thinkers ask good questions that demand thoughtful answers beyond yes or no. Acknowledge good questions from students.

3. Listen for insight about relationships among numbers that shows connections to past learning or to new ideas. For instance, recognizing a relationship already learned in a multiplication table of whole numbers and now applied to numerators or denominators of fractions is a good example of connecting to prior learning in a new setting.

4. Look for pictures that match accurately the ratio and proportion.

5. Watch faces for expressions of frustration or satisfaction.
Seeing
FRACTIONS
Among Ourselves

Topic
Fractions: Group/Set Model

Learning Goals
- To recognize and name fractions as representative of a counted part of a group or set of objects
- Understanding the meaning of numerator and denominator in the symbolic form of a fraction

Guiding Document
NCTM Standards
- Develop number sense for fractions and decimals (K-4)
- Develop concepts of fractions, mixed numbers and decimals (K-4)
- Understand, represent and use numbers in a variety of equivalent forms (integer, fraction, decimal, etc.) (5-8)
- Develop number sense for whole numbers, fractions, decimals (5-8)

Background Information
A group of people or a set of objects may represent a whole and any part of the group or set may be expressed as a fraction where the denominator represents the total number in the group or set and the numerator represents the number of part of the set that shares a common attribute or characteristic being described. The size of the group is a counted number. In other fraction models, size is determined by a measured number.

Materials
For each group of 3-6 students:
- one sheet of chart paper
- colored marking pens

Procedure
1. Distribute colored marking pens and chart paper to each group of 3-6 students.
2. Explain that each group will be illustrating themselves and calling attention to special characteristics that they may have in common with each other.
3. In small groups, have students observe and discuss features and attributes of each member paying attention to those that are in common among the group. Attributes should be observable or verifiable through discussion. For instance, wearing glasses or a watch is observable. Having a cat or dog for a pet is verifiable through conversation.
4. On chart paper, direct students to draw simple stick figures to represent each person in their group.
5. Have them write five true statements about the group using fractions to express what they have observed.
6. Tell them to illustrate each statement by exaggerating the attribute or characteristic featured. For example:

7. Advise students to be prepared to share with the class their discoveries and observations and to participate in class discussion.

Discussion
1. How are all the fractions alike? [same denominator] Why is this so? [The denominator tells how many are counted in the whole group. Denominator also comes from Latin "de nom" and means to give a name.] 
2. How are some of the fractions different? [different numerators] Why is this the case? [Numerator comes from the Latin that means number and the numerator tells how many share one attribute.]
3. When the denominators of several fractions are the same, what do you know about the groups or sets of objects represented? [They are the same size or number.]
4. When the numerators of several fractions are the same, but the denominators are different, such as 2/3 and 2/5, what do you know about the groups or sets represented? [The groups are different...]

FABULOUS FRACTIONS 1
© 1999 AIMS Education Foundation
sizes but the number of objects sharing a common attribute are the same in each set.)

Evaluation
Display picture of a group of six. See Group Pictures You Can Count On.

Group evaluation
Picture may be enlarged for group evaluation. Each student writes one fraction sentence describing an observed characteristic in the picture. Post number sentences on the board.

Independent evaluation
If used as an independent evaluation or as an extended experience at home, duplicate the picture as is and have each student write five fraction sentences about the picture.

Evidence of Learning
1. Look for accurate representation of numerator and denominator connected to the picture.
2. Listen for appropriate explanation of reasoning in response to class discussion.
3. Ask for an example of a fraction in the real world that shows understanding of the meaning of numerator and denominator.
Write five (5) true statements using fractions to describe the group picture.

Think of another group of people or objects and write a fraction sentence that shows you understand the meaning of the numerator and denominator.
Half for You, Half for Me

Areas of Emphasis
- Number
- Mathematical Language

Group Size
- Pairs of students

Teacher Materials
- cats master (page 128)

Student Materials
For each pair
- 8½" x 11" paper
- self-lock bag
- cat pictures
- scissors
- crayons
- assorted objects (optional)

Introduction
This lesson offers students some practical experience with the term half. Sometimes we think students understand a term when they give a rote definition. We are surprised when they don't use that knowledge to solve a problem. This lesson will give them many chances to apply their knowledge of one half.

Procedure
Divide the class into pairs. Give each pair a piece of 8½" x 11" paper, a self-lock bag, a set of cat pictures, scissors, and crayons. Instruct students to work together and carefully cut out the cats. Tell them to store the cats in the bag. Then have them make a "Half Mat" by folding the paper into two equal parts. Discuss what the term equal means. Tell them to color each half a different color.

Say: "We found four beautiful cats near the park." Have student pairs get four cats from their bag. Tell them to use the half mat to divide the cats. Ask: "How many cats are in your half of the mat?" "Did you both end up with the same number of cats? Remember, you should each get an equal number of cats." Record the results on a table. Explain that mathematicians record the results of their investigations as if they were detectives. Use descriptive language as you model recording on the table: "We found four cats. We divided them into two equal groups, and each group had two cats."

Continue with the following investigations and record the results on the table.

1. Say: "We were hiking on the mountain and found six cats. My mother said I could keep half of the cats. How many cats did I take home?"
2. Say: "My neighbor is going on vacation. I always take care of his cats. He has eight cats. I feed half of them in the morning. I feed the rest at night. How many cats do I feed at night?"
3. Say: "Carol works at the animal hospital. She saw ten cats this morning. She gave half of them shots. How many cats got a shot this morning?"

<table>
<thead>
<tr>
<th>Number of Cats</th>
<th>Half Is</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>

Let the student pairs have 5–10 minutes to make up some of their own investigations. You can use this time to assess students' comprehension of the material. Remind them to record the results so that they can share with the rest of the class. Praise good mathematical language. Store the cats in the bags with the partners' names on them. They will be used in the next exploration, "Graph That Cat!"
The large square represents one unit.

Complete:

D = __ of ___ = ___
A = \( \frac{1}{4} \) of 1 = \( \frac{1}{4} \)
B = \( \frac{1}{2} \) of \( \frac{1}{2} \) = \( \frac{1}{16} \)
C = \( \frac{3}{4} \) of \( \frac{1}{4} \) = ___
E = __ of ___ = ___
F = __ of ___ = ___
G = __ of ___ = ___
H = __ of ___ = ___
I = __ of ___ = ___
J = __ of ___ = ___
K = __ of ___ = ___
L = __ of __ of ___ = ___
M = __ of __ of ___ = ___
Fractions in Color

Color $\frac{3}{5}$ of the circle yellow.

Color $\frac{1}{3}$ of the yellow part blue.

What part of the circle is green? 

Color $\frac{5}{8}$ of the square red.

Color $\frac{4}{5}$ of the red part yellow.

What part of the square is orange? 

Color $\frac{9}{12}$ of the rectangle blue.

Color $\frac{5}{9}$ of the blue part yellow.

Color $\frac{2}{5}$ of the green part red.

What part of the rectangle is brown?
\[
\frac{1}{4} \times \frac{1}{2} = \underline{\,} \\
\frac{2}{3} \times \frac{1}{2} = \underline{\,} \\
\frac{2}{3} \times \frac{4}{5} = \underline{\,} \\
\frac{1}{2} \times \frac{7}{8} = \underline{\,} \\
\frac{6}{7} \times \frac{3}{4} = \underline{\,} \\
\frac{4}{5} \times \frac{4}{5} = \underline{\,} \\
\frac{7}{8} \times \frac{7}{4} = \underline{\,} \\
\frac{3}{9} \times \frac{3}{9} = \underline{\,} \\
\frac{7}{8} \times \frac{8}{2} = \underline{\,} \\
\frac{10}{6} \times \frac{10}{6} = \underline{\,} \\
\frac{8}{6} \times \frac{8}{6} = \underline{\,} \\
\frac{5}{10} \times \frac{5}{10} = \underline{\,} \\
\underline{\,} \times \underline{\,} = \underline{\,} \\
\underline{\,} \times \underline{\,} = \underline{\,} \\
\underline{\,} \times \underline{\,} = \underline{\,} \\
\underline{\,} \times \underline{\,} = \underline{\,}
\]
Exploring Dividing Fractions using Pattern Blocks

ONE WHOLE

1) \(1 \div \frac{1}{2}\) means In one whole, there are how many halves?

needs how many to cover it? 

So, \(1 \div \frac{1}{2} = \)

2) \(\frac{1}{2} \div \frac{1}{6}\) means In one half, there are how many sixths?

needs how many to cover it? 

So, \(\frac{1}{2} \div \frac{1}{6} = \)

3) \(\frac{1}{3} \div \frac{1}{6}\) means In one-third, there are how many sixths?

needs how many to cover it? 

So, \(\frac{1}{3} \div \frac{1}{6} = \)
**Figuring Fourths**

Number of Players: Two

Materials: Four two-color counters, one small cup, one gameboard, two place-makers of different colors.

Directions: Each player chooses one color of the two-color counter and one place-marker. First player shakes and spills the two-color counters. Players decide what part of the set each color shows. Player #1 moves to the first space that shows his color’s fractional part of the spill. Second player shake counters and spills. Second player moves to first space on board that shows his color’s fractional part of the spill. Alternate turns. Player loses turn if there is no move. First player to land exactly on FINISH wins.
NAME THAT RULE!

Discover that words – as well as numbers – can be used to predict patterns.

1. Study the three figures in "Pyramid," below.
2. Build or draw the three figures that should come next. In the table, record the number of blocks needed to make each figure.
3. Look for a pattern in the numbers, then state that pattern as a rule.
4. Use the rule to predict the number in the last column.
5. Check your prediction by completing the table – without making any more drawings.
6. Study the three figures in "Hexagon Fences." Test your predicting skill by repeating steps 2 to 5 with this series of fence patterns.

**Pyramid**

1 triangle at the base
1 triangle in the pyramid

2 triangles at the base
4 triangles in the pyramid

3 triangles at the base
9 triangles in the pyramid

<table>
<thead>
<tr>
<th>Triangles at the base</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triangles in the pyramid</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rule:

**Hexagon Fences**

1 hexagon
perimeter = 6

2 hexagons
perimeter = 10

3 hexagons
perimeter = 14

<table>
<thead>
<tr>
<th>Hexagons</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perimeter</td>
<td>6</td>
<td>10</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rule:
PATTERNING SUGGESTIONS

1. Give children a line of dots on a posterboard strip, and ask them to copy or create a set of repetitive symbols such as

The pattern may be read “hop, slide, hop, slide, hop, slide”; “seagull, seagull, seagull,” or any other way which describes the resulting design.

2. Have children copy a necklace of wooden beads or colored macaroni, by stringing wooden beads or colored macaroni making an identical necklace.

3. Have children analyze strips of fabric on wallpaper (red stripe, blue stripe, red stripe, blue stripe) or find others of the same pattern type (a b a b).

4. Given children 8 unifix cube trains and ask them to match pairs of identical trains.

5. Clap your hands and snap your fingers in a pattern several times. Ask children to join in as they recognize the pattern.

6. After four children have been placed in a pattern, suggest additional children join the row and continue the pattern.

7. Have children make patterns using nuts and bolts, shells, buttons, yarn counter rings, macaroni, beans or keys. Then ask them to guess each other’s patterns.

8. Use pattern blocks to make walls, then cover part of the wall and ask a child what has been covered.

9. Ask children to copy the pattern block walls on paper using templates or glue-backed shapes.

10. Have children use ceramic tiles to make a pattern, then have a friend translate the pattern into other colors or shapes.

11. Ask children to reproduce a pattern they hear with unifix cubes, buttons or pattern blocks.

12. Take turns translating a “clap and snap” pattern into large body movements such as touch knees, turn around, touch knees, turn around.

<table>
<thead>
<tr>
<th>Pattern Possibilities</th>
<th>color</th>
<th>size</th>
<th>texture</th>
</tr>
</thead>
<tbody>
<tr>
<td>a b a a a b a a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a b a a b a a b a</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a b b a b a b a b</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

*Modalities:
- V: Visual
- K: Kinesthetic
- A: Auditory
- V-V: Visual and Visual
- A-V: Auditory and Visual

168
<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pink</strong></td>
<td><strong>Yellow</strong></td>
<td><strong>Green</strong></td>
<td><strong>Blue</strong></td>
<td><strong>Gray</strong></td>
<td><strong>Red</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Square Sense

Using colored squares, students find the order of colors given the clues.

4 colors: pink, yellow, green, blue

Clue:
- Green is second.
- Yellow is before green.
- Blue is not last.

Where is pink? 4th

6 colors: pink, gray, blue, green, yellow, red

Clue:
- Red if fifth
- Pink is less than red
- Gray is the 1st even number
- Green is less than gray
- Pink is not next to red
- Blue is not the largest number

Where is blue? 3rd
3 colors: orange, green, yellow

Clue:

- Green is second
- Yellow is not the largest

Where is orange?  $3^{rd}$

[Diagram showing positions for orange, green, and yellow]
What's My Number?

(You can make the number a letter like x, y, z, or a shape like an apple, orange)

Have students take a number strip and tear or cut a part where they will have 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and place the numbers face up in order.

What is apple 🍎?

Apple 🍎 is less than a nickel.

(Student turn over numbers that are the value of a nickel and more)

Flip over 5, 6, 7, 8, 9

Apple 🍎 is not the number of sides on a rectangle.

(Student turn over the number of sides on a rectangle)

Flip over 4

Apple 🍎 is an even number.

(Student turn over the numbers that are not even)

Flip over 1, 3

Apple 🍎 is not the number of straight edges on a circle.

(Student turn over the number of straight edges on a circle)

Flip over 0

What is apple 🍎? 🍿
What is letter \( \text{a} \)?

Letter \( \text{a} \) is more than 6.

(Students turn over numbers less than 6)

Flip over 0, 1, 2, 3, 4, 5, 6

Letter \( \text{a} \) is not the number of sides on an octagon.

(Students turn over the number of sides on an octagon)

Flip over 8

Letter \( \text{a} \) is not the sum of 6 and 3.

(Students turn over the number that is \( 6 + 3 \))

Flip over 9

What is letter \( \text{a} \)?
What is ▼?

▼ is between 3 and 9.

Flip 0, 1, 2, 3, 8, 9

▼ is not the value of 5 pennies.

Flip 5

▼ is less than 3 + 3.

Flip 6, 7

What is ▼?

4
Materials Needed by the Teacher:
   Pawns and cubes as above, but larger;
   A stationary physical scale

**Lesson #1**

In the first lesson, the teacher displays on the physical scale in front of the classroom, problems such as

\[ \triangle \quad \square \]

and

\[ \triangle \quad \triangle \quad \square \]

**FOR HOME USE:**
Please display these problems on the enclosed laminated balance scale.

Once students grasp the concept that both sides of the scale must have the same value for the scale to balance, they see that the pawn in the first problem is worth 5, and that in the second problem it is worth 4. Students can then be presented with other “physical equations” which they are to solve by trial and error methods.

\[ \triangle \quad \square \quad \square \quad \square \]

Ex. \[ \triangle \quad \triangle \quad \square \]

The students see that “1” does not work since both sides are not equal. “2” does not work, etc. “6” does work since the left side is now 14 and so is the right side. The students are informed that the pawn has a special name, “\(x\),” and that there is a special way of writing the answer:

\[ x = 6, \text{ check: } 14 \leq 14. \]

The students are given Student Kits so that they can set up the worksheet problems at their desks. (On the student setup, it is helpful if the number-cubes are facing upward, i.e., facing the ceiling, so that the teacher can easily see if the students have the correct setup.)
Find the value of the pawn in each of the following problems and write the check:

1. \[ \text{△ △} \quad 10 \quad x = \quad \text{Check:} \]

2. \[ \text{△ 2} \quad 9 \quad X = \quad \text{Check:} \]

3. \[ \text{△ △ △} \quad 7 \quad x = \quad \text{Check:} \]

4. \[ \text{△ △ △ △} \quad x = \quad \text{Check:} \]

5. \[ \text{△ △ △} \quad 4 \quad X = \quad \text{Check:} \]

6. \[ \text{△ △ △ △} \quad 10 \quad x = \quad \text{Check:} \]

7. \[ \text{△ △ △} \quad 4 \quad x = \quad \text{Check:} \]

8. \[ \text{△ △ △ △ △ 2} \quad 7 \quad x = \quad \text{Check:} \]

9. \[ \text{△ △ △ △} \quad 10 \quad x = \quad \text{Check:} \]

10. \[ \text{△ △ △ △ △} \quad 10 \quad x = \quad \text{Check:} \]

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Use your Hands-On Equations Kit to solve:

<table>
<thead>
<tr>
<th>New Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $2x = x + 3$</td>
</tr>
<tr>
<td>2. $3x = x + 4$</td>
</tr>
<tr>
<td>3. $x + 4 = 2x + 3$</td>
</tr>
<tr>
<td>4. $4x = 2x + 6$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Previous Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>5. ▲▲▲</td>
</tr>
<tr>
<td>6. ▲▲</td>
</tr>
<tr>
<td>7. ▲ ▇</td>
</tr>
<tr>
<td>8. ▲▲ ▇</td>
</tr>
<tr>
<td>9. ▲▲ ▇</td>
</tr>
<tr>
<td>10. ▲▲ ▇</td>
</tr>
</tbody>
</table>

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You’re On A Roll!

Directions: Cut out the cube pattern at the bottom of this sheet; then fold and tape the pattern along its sides to make a die. Roll the die 20 times, recording the result of each roll in the tally chart below. Then color the bar graph below the tally chart to show your results.

<table>
<thead>
<tr>
<th>Tally Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>〇 △ □ ★ ○</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bar Graph</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
</tr>
<tr>
<td>19</td>
</tr>
<tr>
<td>18</td>
</tr>
<tr>
<td>17</td>
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<tr>
<td>16</td>
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<tr>
<td>4</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>1</td>
</tr>
</tbody>
</table>
Using each space to represent one hour, label each activity in the group. Use a different color to highlight each activity.

a. How many hours do you spend sleeping? Eating? Watching TV?
b. For which activity do you spend the most amount of time?
c. For which activity do you spend the least amount of time?
d. After analyzing how you spend your time on Saturday, is there anything you would like to change? If so, what and how?
e. How would a weekday graph be different from this one?
f. How would a summer day graph be the same/different as compared to this graph?
g. Think of a question that you can ask.

Name

Date
Are You Square?

I. Predict your arm span and height in centimeters.

Arm Span = ________ cm
Height = ________ cm

II. Measure your arm span and height in centimeters.

Arm Span = ________ cm
Height = ________ cm

III. Determine whether you are a square, tall rectangle or short rectangle. Round to the nearest centimeter.

Square  height = arm span
Tall Rectangle  height > arm span
Short Rectangle  height < arm span

IV. Create a set of ordered points for your arm span and height. Arm span = x and Height = y

x , y
____ , ____

V. Complete group data sheet.

VI. Using cm graph paper, plot class data points.

What can you infer about a square’s placement on the graph?

Where are “tall rectangles” and “short rectangles” positioned on the graph?
Shape Up!

Choose an exercise you can do in one minute here in the classroom.
(run in place, clap your hands over your head, jumping jacks, picking
strawberries)

Name your exercise ___________________________________________

Take your pulse. Your pulse is the number of times your heart beats a
minute.

Your pulse ________________________

To find your pulse in this activity, count the beats for 15 seconds. Ask someone to look at
the clock and tell you when to stop. Use a calculator (optional) to add the number (or
multiply) 4 times.

Do the exercise. Then count your pulse once for each minute for the next 5
minutes. Record the data in a table.

<table>
<thead>
<tr>
<th>Minutes after exercising</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heartbeats in a Minute</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use the table to make a line graph.
Choose a title and labels. To label the beats, count by 10's, from 70
through 130. Label the minutes through 6.

To graph your pulse, draw dots and connect them.

Write 2 questions that can be answered with your graph.
1.
2.

Compare your graph with your partners.
How are they alike?
Different?
Roll the Dice

This game is for two or more players. Each player has his/her own game board and 12 counters.

Directions:

1. Place all 12 of your counters on the spaces on your game board. You may leave spaces blank, and you may put one or more counters on any space.

2. Take turns rolling the dice.

3. As each player rolls, find the sum.

4. Each player may remove one counter from the space with this sum. Only one counter may be removed at a time. If there are no counters in the space, no counters are removed. The goal of the game is to empty your board.

Analyzing the Game:

- Which sums were rolled most often?

- Which sums were never rolled, or not rolled very often?

- Why do you think some sums came up more often than others?

- Can you prove which sums are most likely to occur?

- What do you think is a good strategy for placing your counters on the game board? Why?
Probability Experiment
Listing Outcomes

** Probability can help you predict what the results of an experiment might be.
** Outcomes are a possible result in an experiment.

1. With your partner, place all the squares from your bag on the table.
   - How many paper squares are there?_______
   - Are all of the paper squares the same color?_______

2. Make a chart. List the paper squares by color. Leave room for making tally marks.

<table>
<thead>
<tr>
<th>Color</th>
<th>Tallies</th>
</tr>
</thead>
<tbody>
<tr>
<td>red</td>
<td></td>
</tr>
<tr>
<td>blue</td>
<td></td>
</tr>
<tr>
<td>yellow</td>
<td></td>
</tr>
<tr>
<td>green</td>
<td></td>
</tr>
<tr>
<td>orange</td>
<td></td>
</tr>
</tbody>
</table>

3. Place all the paper squares in the bag.
   - Name the possible different outcomes in this experiment.___________
   - Name an impossible outcome.______________
   - How many different outcomes are there?______________
   - How likely is it that you will choose a red?______________
     a purple?_________

4. Without looking, reach into the bag and draw a paper square. On your chart, make a tally mark for the color drawn. Then place the square back in the bag and repeat the activity until you have drawn a square of each color at least once. Record the outcome each time.
   - How many total tries did it take you to obtain every outcome?______
   - How are your results different from your partners results?__________

** How would the results of your experiment change if you didn't replace the paper square each time?__________________________________________
In The Bank
Probability

A.) Which coin is likely to come out first?

Use spinner A
Take turns spinning the spinner 10 times.
Tally the results.

Did the outcome turn out as you predicted?

Why?

There are 5 sections on the spinner. Why is only one section marked 10 cents?
On the scale show the chance of: - a 25 cents coin - a 10 cents coin
B) Is any coin in this bank more likely to come out first?

Use spinner B.
Take turns spinning the spinner 16 times.
Tally the results.

Did the outcome turn out as you predicted?
Why?

Why does spinner B model the bank?
On the scale show the chances of getting: a 25 cent coin, a 10 cent coin.
C) Which coin is most likely to come out first in this bank?

Use spinner C
Take turns spinning the spinner 24 times.
Tally your results.

Inside the Bank:
• 4
• 1
• 1

C.

Did the outcome turn out as you predicted?
Why?

Why does the spinner model the 3 coin bank?
On the scale show the chances of getting: - a 5 cent coin - a 10 cent coin - a 25 cent
Bag-Tile Draw

Materials:  Lunch bags  
            Red/Blue/Yellow Tiles

Objective:  There are 12 tiles in each bag.  They are red, blue, and yellow.  Different numbers of each color are in each bag.  Your task is to take one bag, and without looking inside, predict its contents.

Plan:  
1) Take one bag.  Record whether it is A, B, or C.  
2) Without looking inside, reach in and take out one tile.  Record its color.  Then put it back in the bag and shake the bag to mix the tiles.  Do this 12 times.  
3) Repeat step 2 two more times.  
4) Now, still without looking, predict whether you think the bag has:  
   6 red, 3 blue, 3 yellow OR  
   2 red, 8 blue, 2 yellow OR  
   1 red, 2 blue, 9 yellow  
   Explain your prediction.  
5) Finally, check your prediction by looking.  Then put the bag back for another group to use.

Work Space Sheet    Work with a partner

Tony Spears, Fresno County Office of Education
CHIP FLIP

Name: ____________________________ A Game for Four Players

Directions: Each group of 4 needs 3 two-color chips (red on one side and yellow on the other), a playing board with 4 grids, and crayons. Players take turns tossing the three chips. (Flip all three chips at the same time.) Each player is assigned one of the four boards and colors in a square on that board when the appropriate combination is flipped. For example, if the three chips come up all red (RRR), the player with that board would color in a square. If two yellows and a red (RYY) are flipped, then that player colors a square on his/her board. Players continue taking turns flipping the three chips until one player has completely colored in his/her board.

## The winner is the first player to completely color in his/her board.##

***Before you begin flipping the chips, make a PREDICTION:
Who do you think will win the game? ____________________________
Why?

Do you think this will be a fair game? ______
Why or why not?

Play the game two or three times. Then CONSIDER what happened by thinking about these questions:

Who won the game(s) your group played? ____________________________

Did each player seem to have an equal chance to win? ______
Why or why not?

Is this a fair game? __________
Why or Why not?

Which board would you like to have next time? ____________________________
Why?
<table>
<thead>
<tr>
<th>Red Red Red</th>
<th>Red Red Yellow</th>
</tr>
</thead>
</table>

| Red Yellow Yellow | Yellow Yellow Yellow |

**CHIP FLIP**
Panther Nim

Materials: Pattern blocks (trapezoids, hexagons, triangles, and blue parallelograms) and a game board for two players

Directions: Players take turns placing a pattern block on the game board. The player who places the final block wins!
TANGRAM TALLY

Which shapes can you make with one set of tangram pieces? Sketch in each square the ones you are able to do. What can you say about the relationships the pieces have to each other?

Can you make the shapes with this many pieces?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>square</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rectangle (not a square)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>triangle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>trapezoid</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>parallelogram</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pentagon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>rhombus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Try to make all of these shapes and fill in the grid.

Date / / 

Name
**Triangles Have Three Sides**

**Needed:** Pieces of uncooked spaghetti (or thin strips of paper or Cuisenaire rods) that are 2, 3, 4, 5, 6, 7, 8, and 9 cm long. Label with tape each piece to tell how long it is.

1. Make at least ten triangles using the strips. Record the length of the sides in the table to the right.

<table>
<thead>
<tr>
<th>Triangle</th>
<th>Longest Side</th>
<th>Shortest Side</th>
<th>Other Side</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Which of these will make a triangle? Use your strips to decide.

<table>
<thead>
<tr>
<th>Triangle</th>
<th>Longest Side</th>
<th>Shortest Side</th>
<th>Other Side</th>
<th>Triangle Yes or No</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. Study the two tables. For the strips to form a triangle, what has to be true?

4. Use the rule you wrote to help you write the lengths of the sides for 5 more triangles you can make with the strips. Sketch these and label them. Then make each with the strips to check yourself.
Heart-To-Heart

You've got to have heart—and an eye for congruent shapes—to find the matching pairs below. This page is filled with 12 pairs of congruent hearts. Congruent means having the same size and shape. In the box at the bottom of the page, list the 12 pairs of hearts that match.

Matches

1. _______  5. _______  9. _______
2. _______  6. _______ 10. _______
3. _______  7. _______ 11. _______
4. _______  8. _______ 12. _______

Bonus Box: Look around your classroom and list three things that have vertical symmetry, three things that have horizontal symmetry, and three things that have both vertical and horizontal symmetry.
9-Square Toothpick Challenge

Arrange 24 toothpicks on your desk in the shape shown below.

Challenges:

1. Move 12 toothpicks and make two congruent squares.
2. Remove four toothpicks leaving one large and four small squares.
3. Remove four, six, or eight toothpicks leaving 5 unit squares.
4. Remove eight toothpicks leaving four unit squares.
5. Remove six toothpicks leaving three squares.
6. Remove eight toothpicks leaving five squares.
7. Remove eight toothpicks leaving two squares.
8. Remove eight toothpicks leaving three squares.
9. Remove four toothpicks leaving nine squares.
10. Remove six toothpicks leaving two squares and two congruent hexagons.

Use the back of this paper to sketch each solution you get.

From: AIMS Puzzle Corner, http://www.aimsedu.org
What is the code for your friends name? Try writing a secret message for a friend.
Expressions of Appalachian Mountain Folk

1. Decode to find the word which is defined for you.

<table>
<thead>
<tr>
<th>8</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>X</td>
<td>H</td>
<td>L</td>
<td>R</td>
<td>C</td>
<td>N</td>
<td>B</td>
<td>O</td>
</tr>
<tr>
<td>S</td>
<td>A</td>
<td>K</td>
<td>Y</td>
<td>J</td>
<td>G</td>
<td>P</td>
<td>E</td>
<td>V</td>
</tr>
<tr>
<td>M</td>
<td>T</td>
<td>I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(1,7)</th>
<th>(2,5)</th>
<th>(4,7)</th>
<th>(4,7)</th>
<th>(1,1)</th>
<th>(6,7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A small valley</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2,2)</th>
<th>(3,4)</th>
<th>(3,6)</th>
<th>(4,1)</th>
<th>(1,1)</th>
<th>(6,7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To look at</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(4,2)</th>
<th>(2,5)</th>
<th>(1,3)</th>
<th>(1,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper Bag</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(1,3)</th>
<th>(7,1)</th>
<th>(2,1)</th>
<th>(2,1)</th>
<th>(1,1)</th>
<th>(6,7)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cover; a lid for a pot or a blanket</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(0,4)</th>
<th>(4,0)</th>
<th>(3,4)</th>
<th>(2,6)</th>
<th>(1,3)</th>
<th>(4,1)</th>
<th>(3,4)</th>
<th>(5,6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>On the dot, exactly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2,1)</th>
<th>(7,1)</th>
<th>(6,0)</th>
<th>(6,0)</th>
<th>(4,7)</th>
<th>(1,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0,4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(4,2)</th>
<th>(2,8)</th>
<th>(6,7)</th>
<th>(4,2)</th>
<th>(7,1)</th>
<th>(1,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2,6)</td>
<td>(1,1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(6,5)</th>
<th>(2,8)</th>
<th>(6,7)</th>
<th>(4,2)</th>
<th>(7,1)</th>
<th>(1,1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A great distance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(4,2)</th>
<th>(2,8)</th>
<th>(6,0)</th>
<th>(2,5)</th>
<th>(2,8)</th>
<th>(6,0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angry or annoyed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Interview people in your neighborhood to find other expressions from different parts of the country. Write the definitions for those words on another sheet of paper and use this code to write the coordinates.
**DIRECTIONS:**

The answer to this riddle is written in a special code at the bottom of the page. Each pair of numbers stands for a point on the coordinates below. Write the letter that appears at that point above each pair of numbers. **KEEP WORKING UNTIL YOU DISCOVER THE ANSWER TO THE RIDDLE.**

---

<table>
<thead>
<tr>
<th>(5,7)</th>
<th>(6,3)</th>
<th>(3,6)</th>
<th>(7,5)</th>
<th>(0,0)</th>
<th>(2,3)</th>
<th>(3,2)</th>
<th>(0,5)</th>
<th>(8,7)</th>
<th>(7,0)</th>
<th>(2,4)</th>
<th>(9,6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0,2)</td>
<td>(5,1)</td>
<td>(7,9)</td>
<td>(1,7)</td>
<td>(5,9)</td>
<td>(4,4)</td>
<td>(9,2)</td>
<td>(4,0)</td>
<td>(0,4)</td>
<td>(6,6)</td>
<td>(2,8)</td>
<td></td>
</tr>
<tr>
<td>(4,5)</td>
<td>(7,2)</td>
<td>(4,8)</td>
<td>(8,3)</td>
<td>(9,9)</td>
<td>(8,1)</td>
<td>(1,0)</td>
<td>(6,4)</td>
<td>(1,9)</td>
<td>(5,3)</td>
<td>(8,8)</td>
<td>(1,3)</td>
</tr>
</tbody>
</table>

---

mathematician
1. From the column marked Morris 1, plot the points on the grid paper. Connect the points in the first set with lines. Do the same for sets II & III.

2. When you finish Morris 1, do the others on the corresponding grid paper. Write in all the pairs of numbers in the column first.

3. For the others, go back to Morris 1 to get the points.

<table>
<thead>
<tr>
<th>Points</th>
<th>Morris 1 $(x, y)$</th>
<th>Morris 2 $(2x, 2y)$</th>
<th>Morris 3 $(3x, 3y)$</th>
<th>Boris $(3x, y)$</th>
<th>Doris $(x, 3y)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set I</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>5, 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>7, 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>7, 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>6, 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>5, 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>2, 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>1, 10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>0, 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0, 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>2, 0</td>
<td></td>
<td></td>
<td></td>
<td>Connect to A</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Start Over</td>
<td></td>
</tr>
<tr>
<td>Connect to A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set II</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>1, 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>2, 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>5, 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>6, 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Start Over</td>
<td></td>
</tr>
<tr>
<td>Set III</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>3, 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>4, 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>4, 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>3, 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Connect to O</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set IV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>5, 6 (DOT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Set V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>2, 6 (DOT)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Morris</td>
<td>Rule</td>
<td>Bottom Edge</td>
<td>Side Edge</td>
<td>Ratio: Bottom/Side</td>
<td>Area</td>
</tr>
<tr>
<td>-------</td>
<td>----------</td>
<td>-------------</td>
<td>-----------</td>
<td>--------------------</td>
<td>------</td>
</tr>
<tr>
<td>1</td>
<td>$(x, y)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$(2x, 2y)$</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Do Boris and Doris fit the same patterns as Morris 1, 2, and 3? 

Does Morris 99 fit in the same patterns as Morris 1, 2, and 3? 

Fill in the missing spaces on the rows with perimeter 42 and bottom edge 10.
<table>
<thead>
<tr>
<th>Points</th>
<th>Morris 1 ((x, y))</th>
<th>Morris 99 ((2x + 4.2y + 6))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Set I</td>
<td>A 5.0</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B 7.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C 7.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>D 6.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>E 5.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>F 2.7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>G 1.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H 0.7</td>
<td>Connect to A</td>
</tr>
<tr>
<td></td>
<td>I 0.2</td>
<td>Start Over</td>
</tr>
<tr>
<td></td>
<td>J 2.0</td>
<td></td>
</tr>
<tr>
<td>Set II</td>
<td>K 1.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>L 2.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M 5.2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N 6.3</td>
<td>Start Over</td>
</tr>
<tr>
<td>Set III</td>
<td>O 3.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>P 4.3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Q 4.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R 3.5</td>
<td>Connect to O</td>
</tr>
<tr>
<td>Set IV</td>
<td>S 5.6 (DOT)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>T 2.6 (DOT)</td>
<td></td>
</tr>
<tr>
<td>Set V</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Worksheet 2-2
RAGING RECTANGLES

Number of Players: Two
Materials: Two number cubes, gameboard, crayon per player
Directions: In turn each player rolls the cubes. A player outlines and colors a rectangle on the gameboard to match the cubes. (Ex. a roll of 6 and 3 = a 6 x 3 rectangle or a 3 x 6 rectangle). Player writes the total number of squares (area) in the center of the rectangle. A player loses a turn when he rolls and cannot fit his rectangle on the gameboard. Game is over when neither player can draw a rectangle. Winner is the player with the most squares colored on the gameboard.
Tangram Triffles

Names: ____________________

(1.02b, 3.01)

Complete these charts. Be certain both partners agree with the answers placed in the charts.

If the entire tangram = 1, then . . .

<table>
<thead>
<tr>
<th>Piece</th>
<th>Fraction Name</th>
<th>Decimal Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entire Figure</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Bonus:** Suppose the value of the entire tangram is $32.00. What would be the value of the middle-sized triangle?

How did you know this?

If part D is equal to 5/10, then . . .

<table>
<thead>
<tr>
<th>Piece</th>
<th>Fraction</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>$\frac{5}{10}$</td>
<td>0.5</td>
</tr>
<tr>
<td>Entire Figure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If part B is equal to 1, then . . .

<table>
<thead>
<tr>
<th>Piece</th>
<th>Fraction</th>
<th>Decimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>$1$ or $\frac{1}{1}$</td>
<td>1 or 1.0</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entire Figure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Colorful Clues

Use a different color to shade in or trace around the following figures. Color-code your answers to match the directions.

1. a rectangle
2. a parallelogram that is not a rectangle
3. an isosceles triangle
4. a quadrilateral that does not have symmetry
5. a trapezoid
6. a different-shaped trapezoid
7. a pentagon
8. an acute angle
9. a hexagon
10. a heptagon
11. an octagon
12. a scalene triangle
13. a square
14. an obtuse angle
15. a right angle
16. perpendicular lines
Worksheet 1

Introduction to the Mira

1. Use the Mira to put the child on the swing. Then reach behind the Mira and trace the child on the swing.
**REFLECTIONS IN A MIRA OR ONE MIRROR**

| Predict what you will see in the mira when you place your curlicue rectangle next to it. Draw your prediction and use words to describe your drawing. |
| After you have made a prediction, use the mira and draw what you see. Use words to describe your drawing. |

| Mira |
| Mira |

---

**Note:**

Worksheet 14

Congruence

1. Use the Mira to answer the following questions.
   a. Which circles are congruent to circle 1?
   b. Which circles are congruent to circle 2?
   c. Which circles are congruent to circle 3?
   d. Which circles are congruent to circle 4?

2. Use the Mira to decide which of the segments pictured are congruent to $\overline{AB}$.

© 1992 J. Weston Walch, Publisher 56 Geometric Constructions and Investigations with a Mira
Use a Mira to draw at least one line of symmetry in each shape.

Use a Mira to draw multiple lines of symmetry in each shape.

Circle one of the shapes above and describe its symmetry.
Alphabet Symmetry

Name ____________________________

Draw the lines of symmetry on each of the letters.
Sweet Measurement!

For each line, estimate the length from • to •. Then measure.

<table>
<thead>
<tr>
<th>Estimate</th>
<th>Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>B.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>C.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>D.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>E.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>F.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>G.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
<tr>
<td>H.</td>
<td></td>
</tr>
<tr>
<td>candies</td>
<td>candies</td>
</tr>
</tbody>
</table>
Roll for the Gold

Players: Two or three
Materials: Gameboard, number cube, inch ruler, colored pencils or pens
Directions: Players take turns rolling the number cube, measuring that number of inches along the path and marking the place with their colored pencil. The first player to reach the gold is the winner.
Centimeter Crawl

Players: Two
Materials: Gameboard, colored pencil for each player, centimeter ruler, one number cube
Directions: Roll the number cube. Draw a line that number of centimeters long toward the next leaf (A, B, C, D, End). Player must reach inside the leaf with a roll before moving on to the next leaf. If a roll is too much, player may draw two zigzag line segments equal to the roll. The winner is the first player to reach the End Butterfly.
Measurement

Estimate in centimeters the following:
10. the height of your face
11. the width of your face (ear to ear)
12. distance between your eyes
13. width of your eyes
14. length of your nose
15. width of your nose
16. distance from your nose to mouth
17. width of your mouth
18. height of your ears

Use your ruler to draw your face and features according to your estimated measurements. The drawings must be accurate to the estimated measurements. Tomorrow you will check your estimations with a partner.
How Do You Measure Up?

“Estimate your measurements in metric; then use a tape measure to find your actual measurements.”

Put in your own face!

Around head est. actual
Ear length est. actual
Nose length est. actual
Height est. actual
Around neck est. actual
Chest est. actual
Arm length est. actual
Around ring finger est. actual
Leg length est. actual
Width of calf est. actual
Around Big Toe est. actual
Big Toe length est. actual
Foot length est. actual

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RACE TO MIDNIGHT

Number of Players: Two or three
Materials: Clock with moveable hands per player, gameboard with spinner, pencil and paper, clip for spinner, scrap paper to record.
Directions: Each player sets a clock at 8:00 p.m. and records 8:00 on his scrap paper. In turn players spin and move the hands of their clocks to show the time that passes. They record each spin on their paper and the new time the clock shows. The winner is the first player to reach 12:00 midnight.

Sample Recording Sheet

8:00
+ 10 minutes
8:10
+ half an hour
8:40
Tick Tock Clock  3-In-A-Row

Materials: Two sets of time cards and ten markers of one color for each player.
Number of players: Two

Directions: Two students take turns drawing a time card from the deck and covering that time on the gameboard with a marker. If no clock with that time is available, the player loses a turn. The winner is the first to get three markers in a row.
Count the Minutes

* The piglets got ready for the beach from 11:30 to 11:40. How much time passed?
  _____ minutes

* Mrs. Pig got ready for the beach from 11:30 to 11:45. How much time passed?
  _____ minutes

* Mrs. Pig and the piglets waited on the couch for Mr. Pig from 11:45 to 12:30. How much time passed?
  _____ minutes

* Mr. Pig looked for his car keys from 12:45 to 1:45. How much time passed?
  _____ minutes

* Mr. Pig stood in line at the snack bar from 3:30 to 4:30. How much time passed?
  _____ minutes

* The Pigs ate their snack from 4:30 to 4:40. How much time passed?
  _____ minutes
Draw the Hands on the Clock

At 11:30 the Pigs decided to go to the beach.

The piglets were ready at 11:40.

Mrs. Pig was ready at 11:45.

Mr. Pig wasn't ready until 12:30.

The Pigs looked for the lost keys until 1:45.

The Pigs were stopped at the railroad crossing until 2:55.
Sharing Time & Tip
From the 5th Grade Teachers at
Bradley Creek
Try using this visual with your students to help them form a mental image of the relationship between gallons (G), quarts (Q), pints (P), and cups (C).