ELEMENTARY
CORE Academy
UTAH STATE OFFICE OF EDUCATION & UTAH STATE UNIVERSITY

ELEMENTARY CORE ACADEMY • ELEMENTARY CORE ACADEMY • ELEMENTARY CORE ACADEMY •

3RD GRADE

PARTICIPANT HANDBOOK
2004

UTAH STATE OFFICE OF EDUCATION

UtahState UNIVERSITY

ELEMENTARY CORE ACADEMY

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Organizations:

Utah State Office of Education (USOE)
Utah State University (USU)
State Science Education Coordination Committee (SSECC)
State Mathematics Education Coordination Committee (SMECC)
Special Education Services Unit (USOE)
WestEd Eisenhower Regional Consortium

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Dear CORE Academy Teachers:

Involvement in the CORE Academy represents a significant investment by you, your school, and district in educational excellence for the students of Utah. The goal of the Academy is to provide a high quality opportunity for teachers to engage in meaningful professional growth.

The Academy will help you gain expertise in the collection and use of accurate data and analysis of each student's level of achievement, teach sound instructional methods specifically aligned to the state Core Curriculum, and provide an opportunity for collegial support.

I commend you for your dedication and willingness to engage in meaningful professional development. It is my belief that educators care deeply about their students and work hard to create successful experiences in the classroom. Despite some challenges facing our schools, dedicated and professional educators make profound differences each day.

Sincerely,

Patrick Ogden
Interim State Superintendent
of Public Instruction

Funding Sources

Appreciation is expressed for the tremendous educational input and monetary commitment of several organizations for the successful delivery of the Elementary CORE Academy. This year's Elementary CORE Academy was developed and funded through a variety of sources. The Utah State Office of Education (USOE), in collaboration with Utah State University (USU) and local school districts of Utah, have supported kindergarten through sixth grade teachers with professional development experiences that will enhance the educational experience for Utah children.

Major funding for the Academy comes from the following sources:

Federal/State Funds:

Utah State Office of Education
Staff Development Funds
Special Education Services Unit

ESEA Title II

Utah Math Science Partnership

WestED Eisenhower Regional Consortium

District Funds:

Various sources including Quality Teacher Block, Federal ESEA Title II, and District Professional Development Funds

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Trust land, ESEA Title II, and other school funds
Utah State Office of Education Special Education Services

The state and district funds are allocations from the state legislature. ESEA is part of the "No Child Left Behind" funding that comes to Utah.

Additionally, numerous school districts, individual schools, and principals in Utah have sponsored teachers to attend the Academy. Other educational groups such as the Utah Division of Water Resources, National Energy Foundation, Utah Energy Office, and the Utah Mining Association have assisted in the development and delivery of resources in the Academy.

Most important is the thousands of teachers who take time from their summer to attend these professional development workshops. It is these teachers who make this program possible.

Goals of the Elementary CORE Academy

Overall

The purpose of the Elementary CORE Academy is to create high quality teacher instruction and improve student achievement through the delivery of professional development opportunities and experiences for teachers across Utah.

The Academy will provide elementary teachers in Utah with:

1. Models of exemplary and innovative instructional strategies, tools, and resources to meet newly adopted Core Curriculum standards, objectives, and indicators.
2. Practical models and diverse methods of meeting the learning needs of all children, with instruction implementation aligned to the Core Curriculum.
3. Meaningful opportunities for collaboration, self-reflection, and peer discussion specific to innovative and effective instructional techniques, materials, teaching strategies, and professional practices in order to improve classroom instruction.

Learning a limited set of facts will not prepare a student for real experiences encountered in today's world. It is imperative that educators have continued opportunities to obtain instructional skills and strategies that provide methods of meeting the needs of all students. Participants of the Academy experience will be better equipped to meet the challenges faced in today's classrooms.

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Third Grade Mathematics and Science Core Curriculum

Utah Elementary Mathematics Core Curriculum

Introduction

Most students enter school confident in their own abilities; they are curious and eager to learn more. They make sense of the world by reasoning and problem solving. Young students are active, resourceful individuals who construct, modify, and integrate ideas by interacting with the physical world as well as with peers and adults. They learn by doing, collaborating, and sharing their ideas. Students' abilities to communicate through language, pictures, sound, movement, and other symbolic means develop rapidly during these years.

- **Mathematics instruction needs to include more than short-term learning of rote procedures.**

Young students are building beliefs about what mathematics is, about what it means to know and do mathematics, and about themselves as mathematical learners. Mathematics instruction needs to include more than short-term learning of rote procedures. Students must use technology and other mathematical tools, such as manipulative materials, to develop conceptual understanding and solve problems as they do mathematics. Students, as mathematicians, learn best with hands-on, active experiences throughout the instruction of the mathematics curriculum.

Recognizing that no term captures completely all aspects of expertise, competence, knowledge, and facility in mathematics, the term *mathematical proficiency* has been chosen to capture what it means to learn mathematics successfully. Mathematical proficiency has five strands: computing (carrying out mathematical procedures flexibly, accurately, efficiently, and appropriately), understanding (comprehending mathematical concepts, operations, and relations), applying (ability to formulate, represent, and solve mathematical problems), reasoning (using logic to explain and justify a solution to a problem), and engaging (seeing mathematics as sensible, useful, and doable, and being able to do the work).

The most important observation about the five strands of mathematical proficiency is that they are interwoven and interdependent. This observation has implications for how students acquire mathematical proficiency, how teachers develop that proficiency in their students, and how teachers are educated to achieve that goal. At any given moment during a mathematics lesson or unit, one or two strands might be emphasized. But all the strands must eventually be addressed so that the links among them are strengthened. The integrated and balanced development of all five strands of mathematical proficiency should guide the teaching and learning of

school mathematics. Instruction should not be based on extreme positions that students learn solely by internalizing what a teacher or book says or solely by inventing mathematics on their own.

The Elementary Mathematics Core describes what students should know and be able to do at the end of each of the K-6 grade levels. It was developed, critiqued, and revised by a community of Utah mathematics teachers, university mathematics educators, State Office of Education specialists, mathematicians, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of mathematics education that is expressed in national documents developed by the National Council of the Teachers of Mathematics, the American Association for the Advancement of Science, and the National Research Council. This Mathematics Core has the endorsement of the Utah Council of Teachers of Mathematics Association. The Core reflects high standards of achievement in mathematics for all students.

Organization of the Elementary Mathematics Core

The Core is designed to help teachers organize and deliver instruction.

- The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for mathematical skills and attitudes. They are found at the beginning of each grade level, are an integral part of the Core, and should be included as part of instruction.
- A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- An INDICATOR is a measurable or observable student action that enables one to assess whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Guidelines Used in Developing the Elementary Mathematics Core

The Core is:

Consistent With the Nature of Learning

The main intent of mathematics instruction is for students to value and use mathematics as a process to understand the world. The Core is designed to produce an integrated set of Intended Learning Outcomes for students.

Coherent

The Core has been designed so that, wherever possible, the ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of mathematical concepts, skills, and content. This spiraling is intended to prepare students to understand and use more complex mathematical concepts and skills as they advance through the learning process.

Developmentally Appropriate

The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core focuses on providing experiences with concepts that students can explore and understand in depth to build the foundation for future mathematical learning experiences.

Reflective of Successful Teaching Practices

Learning through play, movement, and adventure is critical to the early development of the mind and body. The Core emphasizes student exploration. The Intended Learning Outcomes are central in each standard. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should include recognition of the role of mathematics in the classroom, school, and community.

Comprehensive

The Elementary Mathematics Core does not cover all topics that have traditionally been in the elementary mathematics curriculum; however, it provides a comprehensive background in mathematics. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and

The Core is:

- **Consistent**
- **Coherent**
- **Developmentally Appropriate**
- **Reflective of Successful Teaching Practices**
- **Comprehensive**
- **Feasible**
- **Useful and Relevant**
- **Reliant Upon Effective Assessment Practices**
- **Engaging**

eminently forgettable facts. Teachers are free to add related concepts and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible

Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Handbook is also available for teachers and has sample lessons on each topic for each grade level. The Teacher Handbook is a document that will grow as teachers add exemplary lessons aligned with the new Core.

Useful and Relevant

This curriculum relates directly to student needs and interests. Relevance of mathematics to other endeavors enables students to transfer skills gained from mathematics instruction into their other school subjects and into their lives outside the classroom.

Reliant Upon Effective Assessment Practices

Student achievement of the standards and objectives in this Core is best assessed using a variety of assessment instruments. Performance tests are particularly appropriate to evaluate student mastery of mathematical processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform instruction. Sample test items, keyed to each Core Standard, may be located on the "Utah Mathematics Home Page" at http://www.usoe.k12.ut.us/curr/math. Observation of students engaged in instructional activities is highly recommended as a way to assess students' skills as well as attitudes toward learning. The nature of the questions posed by students provides important evidence of their understanding of mathematics.

Engaging

In the early grades, children are forming attitudes and habits for learning. It is important that instruction maximizes students' potential and gives them understanding of the intertwined nature of learning. Effective elementary mathematics instruction engages students actively in enjoyable learning experiences. Instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or describing a toad. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of learning.

Intended Learning Outcomes for Third Grade Mathematics

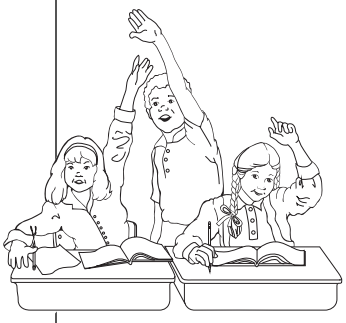
The main intent of mathematics instruction is for students to value and use mathematics and reasoning skills to investigate and understand the world.

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of mathematics instruction. They are an essential part of the Mathematics Core Curriculum and provide teachers with a standard for evaluation of student learning in mathematics. Significant mathematics understanding occurs when teachers incorporate ILOs in planning mathematics instruction.

- **ILOs describe the skills and attitudes students should learn as a result of mathematics instruction.**

By the end of third grade students will be able to:

1. **Demonstrate a positive learning attitude toward mathematics.**
   a. Display a sense of curiosity about numbers and patterns.
   b. Pose mathematical questions about objects, events, and processes.
   c. Demonstrate persistence in completing tasks.
   d. Apply prior knowledge and processes to construct new knowledge.
   e. Maintain an open and questioning mind toward new ideas and alternative points of view.
2. **Become mathematical problem solvers.**
   a. Determine the approach, materials, and strategies to be used in setting up a problem.
   b. Model problem situations in a variety of ways.
   c. Develop understanding of new mathematical concepts and vocabulary by answering questions such as: What made you think that? Did anyone think of this in a different way? Where have we seen a problem like this before?
   d. Construct and use concrete, pictorial, symbolic, and graphical models to represent problem situations.
   e. Know when to select and how to use grade-appropriate mathematical tools and methods as a natural and routine part of the problem-solving process.
   f. Build new mathematical knowledge through problem solving.
   g. Solve problems in both mathematical and everyday contexts.
   h. Recognize that there may be multiple ways to solve a problem.



3. **Reason mathematically.**
   a. Draw logical conclusions and make generalizations.
   b. Determine the approach, materials, and strategies to be used in solving problems.
   c. Use models, known facts, and relationships to explain reasoning.
   d. Make precise calculations and check the validity of the results in the context of the problem.
   e. Analyze mathematical situations by recognizing and using patterns and relationships.
   f. Justify answers and solution processes.
4. **Communicate mathematically.**
   a. Represent mathematical ideas with objects, pictures, and symbols.
   b. Express mathematical ideas to peers, teachers, and others through oral and written language.
   c. Engage in mathematical discussions through brainstorming, asking questions, and sharing strategies for solving problems.
   d. Explain mathematical work and justify reasoning and conclusions.
5. **Make mathematical connections.**
   a. Use one mathematical idea to extend understanding of another.
   b. Recognize the role of mathematics in the classroom, school, and community.
   c. Explore problems and describe and confirm results using various representations.
6. **Represent mathematical situations.**
   a. Create and use representations to organize and communicate mathematical ideas.
   b. Represent mathematical concepts using concrete, pictorial, and symbolic models.

Third Grade Mathematics Core Curriculum

Standard I: Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 1: Represent whole numbers in a variety of ways.

a. Model, read, and write *whole numbers* up to 10,000 using base ten models, pictures, and symbols.

b. Write a *numeral* when given the number of thousands, hundreds, tens, and ones.

c. Write a number up to 9,999 in expanded form (e.g., 6,539 is 6 thousands, 5 hundreds, 3 tens, 9 ones or 6000+500+30+9).

d. Identify the place and the value of a given digit in a four-digit numeral.

e. Demonstrate multiple ways to represent numbers using models and symbolic representations (e.g., fifty is the same as two groups of 25, the number of pennies in five dimes, or 75-25).

Objective 2: Identify relationships among whole numbers.

a. Use a variety of strategies to determine whether a number is even or odd.

b. Identify the number that is ten more, ten less, 100 more, or 100 less than any *whole number* up to 1,000.

c. Compare the relative size of numbers (e.g., 31 is large compared to 4, about half as big as 60, close to 27).

d. Compare whole numbers up to four digits using the symbols <, >, and =.

e. Order and compare whole numbers on a number line.

Objective 3: Model and illustrate meanings of the operations of addition, subtraction, multiplication, and division and describe how they relate.

a. Model addition and subtraction of two- and three-digit *whole numbers* in a variety of ways.

b. Model multiplication of a one-digit *factor* by a one-digit factor using various methods (e.g., repeated addition, rectangular *arrays*, manipulatives, pictures) and connect the representation to an *algorithm*.

Standard I:
Students will acquire number sense and perform operations with whole numbers and simple fractions.

c. Model division as sharing equally and as repeated subtraction using various methods (e.g., rectangular arrays, manipulatives, number lines, pictorial representations).

d. Demonstrate, using objects, that multiplication and division are inverse operations (e.g., 3x4=12; thus, 12÷4=3 and 12÷3=4).

e. Select and write an addition, subtraction, or multiplication sentence to solve a problem related to the students' environment, and write a story problem that relates to a given equation.

f. Demonstrate the effect of place value when multiplying whole numbers by 10.

Objective 4: Use fractions to communicate parts of the whole.

a. Identify the denominator of a fraction as the number of equal parts in the whole region or set.

b. Identify the numerator of a fraction as the number of equal parts being considered.

c. Divide *regions* and sets of objects into equal parts using a variety of objects, models, and illustrations.

d. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, sixths, and eighths.

e. Determine which of two fractions is greater using models or illustrations.

Objective 5: Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.

a. Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator).

b. Find the sum of any two *addends* with three or fewer digits, including monetary amounts, and describe the process used.

c. Find the *difference* of two-digit *whole numbers* and describe the process used.

d. Find the *products* for multiplication facts through ten times ten and describe the process used.

Standard II: Students will use patterns and relations to represent mathematical situations.

Objective 1: Recognize and create patterns with given attributes.

a. Create and extend *repeating* and *growing patterns* using objects, numbers, and tables.

b. Record results of patterns created using manipulatives, pictures, and numeric representations and describe how they are extended.

Objective 2: Recognize and represent mathematical situations using patterns and symbols.

a. Recognize that symbols such as ☐, △, or ◇ in an addition, subtraction, or multiplication equation, represent a value that will make the statement true (e.g., 5+7=△, ☐-3=6, ◇=2x4).

b. Solve equations involving equivalent expressions (e.g., 6+4 = ☐+7).

c. Use the >, <, and = symbols to compare two *expressions* involving addition and subtraction (e.g., 4+6 ☐ 3+2; 3+5 ◇ 16-9).

d. Demonstrate that grouping three or more *addends* does not change the sum (e.g., 3+(2+7)=12, (7+3)+2=12) and changing the order of *factors* does not change the *product* (e.g., 3x7=21, 7x3=21).

e. Use a variety of manipulatives to model the *identity property of addition* (e.g., 3+0=3), the identity property of multiplication (e.g., 7x1=7), and the *zero property of multiplication* (e.g., 6x0=0).

Standard II: Students will use patterns and relations to represent mathematical situations.

Standard III:
Students will use spatial reasoning to describe, identify, and create geometric shapes.

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Objective 1: Describe, identify, and create geometric shapes.

a. Identify and draw *points*, *lines*, *line segments*, and *endpoints*.

b. Identify and draw *lines of symmetry* on triangles, squares, circles, and rectangles.

c. Determine whether an angle is *right*, *obtuse*, or *acute* by comparing the angle to the corner of a rectangle.

d. Classify *polygons* (e.g., *quadrilaterals*, pentagons, hexagons, octagons) by the number of sides and corners.

e. Identify, make, and describe cubes (e.g., a cube has six square *faces*, eight *vertices*, and twelve *edges*).

Objective 2: Describe spatial relationships.

a. Give directions to reach a location.

b. Use coordinates (A, 1) or regions to locate positions on a map.

c. Demonstrate and use horizontal and vertical lines.

Objective 3: Visualize and identify geometric shapes after applying transformations.

a. Demonstrate the effect of a *slide* (*translation*) or *flip* (*reflection*) on a figure, using manipulatives.

b. Determine whether two polygons are *congruent* by sliding, flipping, or turning to physically fit one object on top of the other.

c. Identify *two-dimensional* shapes (*nets*) that will fold to make a cube.

d. Create a *polygon* that results from combining other polygons.

Standard IV: Students will understand and use measurement tools and techniques.

Objective 1: Identify and describe measurable attributes of objects and units of measurement.

a. Recognize the two systems of measurement: *metric* and *customary*.

b. Describe the relationship between metric units of length (i.e., centimeter, meter).

c. Describe the relationship among customary units of length (i.e., inch, foot, yard) and the relationship between customary units of *capacity* (i.e., cup, quart).

d. Estimate length, capacity, and weight using metric and customary units.

Objective 2: Use appropriate techniques and tools to determine measurements.

a. Measure the length of objects to the nearest centimeter, meter, half-inch, foot, and yard.

b. Measure *capacity* using cups and quarts, and measure weight using pounds.

c. Determine the value of a combination of coins and bills that total $5.00 or less and write the monetary amounts using the dollar sign and decimal notation.

d. Identify the number of hours in a day, the number of days in a year, and the number of weeks in a year.

e. Read, tell, and write time to the quarter-hour.

f. Identify any given day of the month (e.g., the third Wednesday of the month is the 18th).

g. Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer.

h. Estimate and measure the *perimeter* and *area* of rectangles by measuring with nonstandard units.

Standard IV: Students will understand and use measurement tools and techniques.

Standard V:
Students will collect and organize data to make predictions and identify basic concepts of probability.

Standard V: Students will collect and organize data to make predictions and identify basic concepts of probability.

Objective 1: Collect, organize, and display data to make predictions.

a. Collect, read, represent, and interpret data using tables, graphs, and charts, including keys (e.g., pictographs, bar graphs).

b. Make predictions based on a data display.

Objective 2: Identify basic concepts of probability.

a. Describe the results of events using the terms "certain," "equally likely," and "impossible."

b. Predict outcomes of simple activities (e.g., a bag contains three red marbles and five blue marbles. If one marble is selected, is it more likely to be red or blue?).

Utah Elementary Science Core Curriculum

Introduction

Science is a way of knowing, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands–on, active experiences throughout the instruction of the science curriculum.

- **Science is a way of knowing, a process for gaining knowledge and understanding of the natural world.**

The Elementary Science Core describes what students should know and be able to do at the end of each of the K–6 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, State Office of Education specialists, scientists, expert national consultants, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of science education that is expressed in national documents developed by the American Association for the Advancement of Science, the National Academies of Science. This Science Core has the endorsement of the Utah Science Teachers Association. The Core reflects high standards of achievement in science for all students.

Organization of the Elementary Science Core

The Core is designed to help teachers organize and deliver instruction.

The Science Core Curriculum's organization:

- Each grade level begins with a brief course description.
- The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for science skills and attitudes. They are found at the beginning of each grade, and are an integral part of the Core that should be included as part of instruction.
- The SCIENCE BENCHMARKS describe the science content students should know. Each grade level has three to five Science Benchmarks. The ILOs and Benchmarks intersect in the Standards, Objectives and Indicators.

- A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they are judged to have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- An INDICATOR is a measurable or observable student action that enables one to judge whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Guidelines

- **Reflects the Nature of Science**
- **Coherent**
- **Developmentally Appropriate**
- **Encourages Good Teaching Practices**
- **Comprehensive**
- **Feasible**
- **Useful and Relevant**
- **Encourages Good Assessment Practices**
- **The Most Important Goal**

Eight Guidelines Were Used in Developing the Elementary Science Core

Reflects the Nature of Science

Science is a way of knowing, a process of gaining knowledge and understanding of the natural world. The Core is designed to produce an integrated set of Intended Learning Outcomes (ILOs) for students. Please see the Intended Learning Outcomes document for each grade level core.

As described in these ILOs, students will:

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.
5. Demonstrate awareness of the social and historical aspects of science.
6. Understand the nature of science.

Coherent

The Core has been designed so that, wherever possible, the science ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of science concepts, skills, and content. This spiraling is intended to prepare students to understand and use more complex science concepts and skills as they advance through their science learning.

Developmentally Appropriate

The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core describes science language students should use that is appropriate to each grade level. A more extensive vocabulary should not be emphasized. In the past, many educators may have mistakenly thought that students understood abstract concepts (such as the nature of the atom), because they repeated appropriate names and vocabulary (such as electron and neutron). The Core resists the temptation to tell about abstract concepts at inappropriate grade levels, but focuses on providing experiences with concepts that students can explore and understand in depth to build a foundation for future science learning.

Encourages Good Teaching Practices

It is impossible to accomplish the full intent of the Core by lecturing and having students read from textbooks. The Elementary Science Core emphasizes student inquiry. Science process skills are central in each standard. Good science encourages students to gain knowledge by doing science: observing, questioning, exploring, making and testing hypotheses, comparing predictions, evaluating data, and communicating conclusions. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should connect lessons with students' daily lives. The Core directs experiential science instruction for all students, not just those who have traditionally succeeded in science classes. The vignettes listed on the "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science for each of the Core standards provide examples, based on actual practice, that demonstrate that excellent teaching of the Science Core is possible.

Comprehensive

The Elementary Science Core does not cover all topics that have traditionally been in the elementary science curriculum; however, it does provide a comprehensive background in science. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and eminently forgettable facts. Teachers are free to add related concepts and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible

Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Resource Book (TRB) is available for elementary grades and has sample lessons on each topic for each grade level. The TRB is a document that will grow as teachers add exemplary lessons aligned with the new Core. The middle grade levels have electronic textbooks available at the Utah State Office of Education's "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science.

Useful and Relevant

This curriculum relates directly to student needs and interests. It is grounded in the natural world in which we live. Relevance of science to other endeavors enables students to transfer skills gained from science instruction into their other school subjects and into their lives outside the classroom.

Encourages Good Assessment Practices

Student achievement of the standards and objectives in this Core are best assessed using a variety of assessment instruments. One's purpose should be clearly in mind as assessment is planned and implemented. Performance tests are particularly appropriate to evaluate student mastery of science processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform their instruction. Sample test items, keyed to each Core Standard, may be located on the Utah Science Home Page. Observation of students engaged in science activities is highly recommended as a way to assess students' skills as well as attitudes in science. The nature of the questions posed by students provides important evidence of students' understanding of science.

The Most Important Goal

Elementary school reaches the greatest number of students for a longer period of time during the most formative years of the school experience. Effective elementary science instruction engages students actively in enjoyable learning experiences. Science instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or holding a toad. Science is not just for those who have traditionally succeeded in the subject, and it is not just for those who will choose science–related careers. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of doing science.

Third Grade Science Core Curriculum

In third grade students learn about **interactions**, **relationships**, **relative motion**, **and cause and effect**. They study the movement of Earth and the moon. They begin to learn of forces that move things; they learn of heat and light. Third graders observe, classify, predict, measure, and record.

Third graders should be encouraged to be curious. They should be helped and encouraged to pose their own questions about objects, events, processes, and results. Effective teachers provide students with hands-on science investigations in which student inquiry is an important goal. Teachers should provide opportunities for all students to experience many things. Third graders should use their senses as they feel the warmth of the sun on their face, watch the moon as it seems to move through broken clouds, sort and arrange their favorite rocks, look for patterns in rocks and flowers, observe a snail move ever so slowly up the side of a terrarium, test materials for slipping and sliding, measure the speed of rolling objects, and invent ways to resist gravity. They should come to enjoy science as a process of learning about the world.

- **Personal relevance of science in students' lives is always an important part of helping students to value science, and should be emphasized at this grade level.**

Third grade Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing, and mathematics skills should be emphasized as integral to the instruction of science. Personal relevance of science in students' lives is always an important part of helping students to value science, and should be emphasized at this grade level.

This Core was designed using the American Association for the Advancement of Science's *Project 2061: Benchmarks For Science Literacy* and the National Academy of Science's *National Science Education Standards* as guides to determine appropriate content and skills.

The third grade Science Core has three online resources designed to help with classroom instruction; they include *Teacher Resource Book* –a set of lesson plans, assessment items and science information specific to third grade; *Sci-ber Text* –an electronic science text book specific to the Utah Core; and the science test item pool. This pool includes multiple-choice questions, performance tasks, and interpretive items aligned to the standards and objectives of the third grade curriculum. These resources are all available on the Utah Science Home Page at: http://www.usoe.k12.ut.us/curr/science

SAFETY PRECAUTIONS:

The hands–on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Third Grade Science

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

- **Instruction should include significant science experiences that lead to student understanding using the ILOs.**

By the end of third grade students will be able to:

1. **Use Science Process and Thinking Skills**
   a. Observe simple objects and patterns and report their observations.
   b. Sort and sequence data according to a given criterion.
   c. Make simple predictions and inferences based upon observations.
   d. Compare things and events.
   e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
   f. Conduct a simple investigation when given directions.
   g. Develop and use simple classification systems.
   h. Use observations to construct a reasonable explanation.
2. **Manifest Scientific Attitudes and Interests**
   a. Demonstrate a sense of curiosity about nature.
   b. Voluntarily read or look at books and other materials about science.
   c. Pose questions about objects, events, and processes.
3. **Understand Science Concepts and Principles**
   a. Know science information specified for their grade level.
   b. Distinguish between examples and non-examples of science concepts taught.
   c. Explain science concepts and principles using their own words and explanations.

4. Communicate Effectively Using Science Language and Reasoning

a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).

b. Report observation with pictures, sentences, and models.

c. Use scientific language appropriate to grade level in oral and written communication.

d. Use available reference sources to obtain information.

Third Grade Science Standards

Science Benchmark

Earth orbits around the sun, and the moon orbits around Earth. Earth is spherical in shape and rotates on its axis to produce the night and day cycle. To people on Earth, this turning of the planet makes it appear as though the sun, moon, planets, and stars are moving across the sky once a day. However, this is only a perception as viewed from Earth.

Standard I: **Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.**

Objective 1: Describe the appearance of Earth and the moon.

a. Describe the shape of Earth and the moon as spherical.

b. Explain that the sun is the source of light that lights the moon.

c. List the differences in the physical appearance of Earth and the moon as viewed from space.

Objective 2: Describe the movement of Earth and the moon and the apparent movement of other bodies through the sky.

a. Describe the motions of Earth (i.e., the rotation [spinning] of Earth on its axis, the revolution [orbit] of Earth around the sun).

b. Use a chart to show that the moon orbits Earth approximately every 28 days.

c. Use a model of Earth to demonstrate that Earth rotates on its axis once every 24 hours to produce the night and day cycle.

d. Use a model to demonstrate why it seems to a person on Earth that the sun, planets, and stars appear to move across the sky.

Science language students should use:

model, orbit, sphere, moon, axis, rotation, revolution, appearance

Standard I:
Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Science Benchmark

For any particular environment, some types of plants and animals survive well, some survive less well and some cannot survive at all. Organisms in an environment interact with their environment. Models can be used to investigate these interactions.

Standard II: Students will understand that organisms depend on living and nonliving things within their environment.

Standard II:
Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1: Classify living and nonliving things in an environment.

a. Identify characteristics of living things (i.e., growth, movement, reproduction).

b. Identify characteristics of nonliving things.

c. Classify living and nonliving things in an environment.

Objective 2: Describe the interactions between living and nonliving things in a small environment.

a. Identify living and nonliving things in a small environment (e.g., terrarium, aquarium, flowerbed) composed of living and nonliving things.

b. Predict the effects of changes in the environment (e.g., temperature, light, moisture) on a living organism.

c. Observe and record the effect of changes (e.g., temperature, amount of water, light) upon the living organisms and nonliving things in a small–scale environment.

d. Compare a small–scale environment to a larger environment (e.g., aquarium to a pond, terrarium to a forest).

e. Pose a question about the interaction between living and nonliving things in the environment that could be investigated by observation.

Science language students should use:

environment, interaction, living, nonliving, organism, survive, observe, terrarium, aquarium, temperature, moisture, small–scale

Science Benchmark

Forces cause changes in the speed or direction of the motion of an object. The greater the force placed on an object, the greater the change in motion. The more massive an object is, the less effect a given force will have upon the motion of the object. Earth's gravity pulls objects toward it without touching them.

Standard III: Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 1: Demonstrate how forces cause changes in speed or direction of objects.

a. Show that objects at rest will not move unless a force is applied to them.

b. Compare the forces of pushing and pulling.

c. Investigate how forces applied through simple machines affect the direction and/or amount of resulting force.

Objective 2: Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.

a. Predict and observe what happens when a force is applied to an object (e.g., wind, flowing water).

b. Compare and chart the relative effects of a force of the same strength on objects of different weight (e.g., the breeze from a fan will move a piece of paper but may not move a piece of cardboard).

c. Compare the relative effects of forces of different strengths on an object (e.g., strong wind affects an object differently than a breeze).

d. Conduct a simple investigation to show what happens when objects of various weights collide with one another (e.g., marbles, balls).

e. Show how these concepts apply to various activities (e.g., batting a ball, kicking a ball, hitting a golf ball with a golf club) in terms of force, motion, speed, direction, and distance (e.g. slow, fast, hit hard, hit soft).

Standard III: Students will understand the relationship between the force applied to an object and resulting motion of the object.

Standard IV: Students will understand that objects near Earth are pulled toward Earth by gravity.

Objective 1: Demonstrate that gravity is a force.

a. Demonstrate that a force is required to overcome gravity.

b. Use measurement to demonstrate that heavier objects require more force than lighter ones to overcome gravity.

Objective 2: Describe the effects of gravity on the motion of an object.

a. Compare how the motion of an object rolling up or down a hill changes with the incline of the hill.

b. Observe, record, and compare the effect of gravity on several objects in motion (e.g., a thrown ball and a dropped ball falling to Earth).

c. Pose questions about gravity and forces.

Science language students should use:
distance, force, gravity, weight, motion, speed, direction, simple machine

Standard IV: Students will understand that objects near Earth are pulled toward Earth by gravity.

Science Benchmark

Light is produced by the sun and observed on Earth. Living organisms use heat and light from the sun. Heat is also produced from motion when one thing rubs against another. Things that give off heat often give off light. While operating, mechanical and electrical machines produce heat and/or light.

Standard V: Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Standard V:
Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1: Provide evidence showing that the sun is the source of heat and light for Earth.

a. Compare temperatures in sunny and shady places.

b. Observe and report how sunlight affects plant growth.

c. Provide examples of how sunlight affects people and animals by providing heat and light.

d. Identify and discuss as a class some misconceptions about heat sources (e.g., clothes do not produce heat, ice cubes do not give off cold).

Objective 2: Demonstrate that mechanical and electrical machines produce heat and sometimes light.

a. Identify and classify mechanical and electrical sources of heat.

b. List examples of mechanical or electrical devices that produce light.

c. Predict, measure, and graph the temperature changes produced by a variety of mechanical machines and electrical devices while they are operating.

Objective 3: Demonstrate that heat may be produced when objects are rubbed against one another.

a. Identify several examples of how rubbing one object against another produces heat.

b. Compare relative differences in the amount of heat given off or force required to move an object over lubricated/non–lubricated surfaces and smooth/rough surfaces (e.g., waterslide with and without water, hands rubbing together with and without lotion).

Science language students should use:

mechanical, electrical, temperature, degrees, lubricated, misconception, heat source, machine

K-6 Elementary Mathematics Core Curriculum in Table Format

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard I: **Students will understand simple number concepts and relationships.**	**Standard I:** **Students will acquire number sense and perform simple operations with whole numbers.**	**Standard I:** **Students will acquire number sense and perform operations with whole numbers.**	**Standard I:** **Students will acquire number sense and perform operations with whole numbers and simple fractions.**	**Standard I:** **Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.**	**Standard I:** **Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.**	**Standard I:** **Students will acquire number sense and perform operations with rational numbers.**
Objective 1: **Identify and use whole numbers.** a. Relate a *numeral* to the number of objects in a set (e.g., ☐ ☐ ☐ = 3). b. Construct models of numbers to 10 with physical objects or manipulatives. c. Make pictorial representations of numbers to 10 (e.g., draw four circles, draw six squares). d. Recognize and write numerals from 0 to 10. e. Manipulate objects to demonstrate and describe multiple ways of representing a number (e.g., 5 can be 3 and 2 more, 5 can also be 2 and 2 and 1).	**Objective 1:** **Represent whole numbers in a variety of ways.** a. Relate number words to the *numerals* that represent the quantities 0 to 10. b. Sort objects into groups of tens and ones and write the numeral representing the set. c. Represent *whole numbers* up to 100 in groups of tens and ones using objects. d. Write a numeral when given the number of tens and ones. e. Write a numeral to 99 in *expanded form* (e.g., 39 is 3 tens and 9 ones or 30+9). f. Use zero to represent the number of elements in the empty set or as a placeholder in a two-digit numeral.	**Objective 1:** **Represent whole numbers in a variety of ways.** a. Relate number words to the *numerals* that represent the quantities 0-100. b. Represent *whole numbers* up to 1,000 in groups of hundreds, tens, and ones using base ten models, and write the numeral representing the set. c. Read and write a three-digit numeral, relating it to a set of objects and a pictorial representation. d. Write a numeral to 999 in *expanded form* (e.g., 539 is 5 hundreds, 3 tens, 9 ones or 500+30+9). e. Identify the place and the value of a given digit in a three-digit numeral (e.g., the two in 281 means 2 hundreds or 200). f. Demonstrate multiple ways to represent numbers using symbolic representations (e.g., thirty is the same as two groups of 15, the number of pennies in three dimes, or 58-28).	**Objective 1:** **Represent whole numbers in a variety of ways.** a. Model, read, and write *whole numbers* up to 10,000 using base ten models, pictures, and symbols. b. Write a *numeral* when given the number of thousands, hundreds, tens, and ones. c. Write a number up to 9,999 in expanded form (e.g., 6,539 is 6 thousands, 5 hundreds, 3 tens, 9 ones or 6000+500+30+9). d. Identify the place and the value of a given digit in a four-digit numeral. e. Demonstrate multiple ways to represent numbers using models and symbolic representations (e.g., fifty is the same as two groups of 25, the number of pennies in five dimes, or 75-25).	**Objective 1:** **Represent whole numbers and decimals in a variety of ways.** a. Model, read, and write numerals from tenths to 100,000. b. Write a *whole number* up to 99,999 in *expanded form* (e.g., 76,539 is 7 ten-thousands, 6 one-thousands, 5 hundreds, 3 tens, 9 ones or 70,000+6,000+500+30+9). c. Identify the place and the value of a given digit in a five-digit numeral, including decimals to tenths. d. Demonstrate multiple ways to represent numbers by using models and symbolic representations (e.g., 36 is the same as the square of six, three dozen, or 9x4). e. Identify *square numbers* using models.	**Objective 1:** **Represent whole numbers and decimals in a variety of ways.** a. Model, read, and write numerals from hundredths to one millions. b. Write a *whole number* up to 999,999 in *expanded form* (e.g., 876,539 = 8 hundred-thousands, 7 ten-thousands, 6 thousands, 5 hundreds, 3 tens, 9 ones or 8x100,000 + 7x10,000 + 6x1,000 + 5x100 + 3x10 + 9). c. Demonstrate multiple ways to represent whole numbers by using models and symbolic representations (e.g., 108=2x50+8; 108=10^2 + 8). d. Classify whole numbers from 2 to 20 as *prime* or *composite* and 0 and 1 as neither prime nor composite, using models. e. Represent repeated factors using *exponents* up to three (e.g., 8=2x2x2=2^3).	**Objective 1:** **Represent whole numbers and decimals in a variety of ways.** a. Change *whole numbers* with *exponents* to *standard form* (e.g., 2^4 = 2^4=16) and recognize that 10^0 = 1. b. Read and write *numerals* from thousandths to one billion. c. Write a whole number to 999,999 in *expanded form* using *exponents* (e.g., 876,539 = 8 x 10^5 + 7 x 10^4 + 6 x 10^3 + 5 x 10^2 + 3 x 10^1 + 9 x 10^0). d. Express numbers in *scientific notation* using positive powers of ten. e. Classify whole numbers to 100 as *prime*, *composite*, or neither. f. Determine the *prime factorization* for a whole number up to 50.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: Identify simple relationships among whole numbers. a. Develop strategies for *one-to-one* correspondence and keeping track of quantities. b. Compare two sets of objects to determine whether they have the same, fewer, or more elements. c. Order sets of objects from 1 to 9. d. Estimate quantities less than 10.	**Objective 2: Identify simple relationships among whole numbers.** a. Identify the number that is one more or one less than any *whole number* from 1 to 99. b. Use the vocabulary "greater than," "less than," and "equal to" when comparing sets of objects or numbers. c. Order sets of objects and numbers from 0 to 20. d. Use ordinal numbers 1st through 5th (i.e., 1st, 2nd, 3rd, 4th, 5th).	**Objective 2: Identify simple relationships among whole numbers.** a. Identify the number that is one more, one less, ten more, or ten less than any *whole number* up to 100. b. Write number sentences using the terms "greater than," "less than," or "equal to," to compare numbers. c. Order four whole numbers less than 100 from least to greatest and from greatest to least. d. Use *ordinal numbers* 1st through 10th.	**Objective 2: Identify relationships among whole numbers.** a. Use a variety of strategies to determine whether a number is even or odd. b. Identify the number that is ten more, ten less, 100 more, or 100 less than any *whole number* up to 1,000. c. Compare the relative size of numbers (e.g., 31 is large compared to 4, about half as big as 60, close to 27). d. Compare whole numbers up to four digits using the symbols <, >, and =. e. Order and compare whole numbers on a number line.	**Objective 2: Identify relationships among whole numbers and decimals.** a. Identify the number that is 100 more, 100 less, 1,000 more, or 1,000 less than any *whole number* up to 10,000. b. Compare the relative size of numbers (e.g., 100 is small compared to a million, but large compared to 5). c. Compare whole numbers up to five digits using the symbols <, >, and =. d. Identify a whole number that is between two given whole numbers. e. Order and compare whole numbers and decimals to tenths on a number line.	**Objective 2: Identify relationships among whole numbers, fractions, decimals, and percents.** a. Order and compare *whole numbers*, fractions (including mixed numbers), and decimals using a variety of methods and symbols. b. Rewrite mixed numbers and improper fractions from one form to the other. c. Find the least common denominator for two fractions. d. Represent commonly used fractions as decimals and percents in various ways (e.g., objects, pictures, calculators).	**Objective 2: Identify relationships among whole numbers, fractions (rational numbers), decimals, and percents.** a. Find the *greatest common factor* and *least common multiple* for two numbers using a variety of methods (e.g., list of multiples, prime factorization). b. Order and compare *rational numbers*, including mixed numbers, using a variety of methods and symbols. c. Locate positive rational numbers on a number line. d. Convert common fractions, decimals, and percents from one form to another (e.g., 3/4= 0.75 = 75%).

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 3: **Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.** a. Demonstrate the joining and separating of sets of objects to solve problems. b. Describe the joining or separating of sets with informal language when using models. c. Record pictorially the results from the joining or separating of sets.	**Objective 3:** **Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.** a. Demonstrate the joining and separating of sets with twelve or fewer objects and record the results with pictures or symbols. b. Model two meanings of subtraction: separating of sets ("take away") and comparison of sets ("how many more/fewer") using objects, pictorial representations, and symbols. c. Use correct vocabulary and symbols to describe addition (i.e., add, "and," plus, +, sum), subtraction (i.e., subtract, minus, -, take away, how many more/fewer), and equals (i.e., =, same as). d. Use zero in addition and subtraction sentences.	**Objective 3:** **Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.** a. Demonstrate the joining and separating of sets with eighteen or fewer objects and record the results with pictures or symbols. b. Model three meanings of subtraction: separating of sets ("take away"), comparison of sets ("how many more/fewer"), and missing addends using objects, pictorial representations, and symbols. c. Separate a given set of objects into two, three, five, or ten groups of equal size. d. Model addition and subtraction of two-digit whole numbers in a variety of ways. e. Select an addition or subtraction sentence to solve a problem involving joining or separating of sets with eighteen or fewer objects. f. Recognize that addition number sentences have related subtraction sentences (e.g., 8-5=3, 3+5=8).	**Objective 3:** **Model and illustrate meanings of the operations of addition, subtraction, multiplication, and division and describe how they relate.** a. Model addition and subtraction of two- and three-digit *whole numbers* in a variety of ways. b. Model multiplication of a one-digit *factor* by a one-digit factor using various methods (e.g., repeated addition, rectangular *arrays*, manipulatives, pictures) and connect the representation to an *algorithm*. c. Model division as sharing equally and as repeated subtraction using various methods (e.g., rectangular arrays, manipulatives, number lines, pictorial representations). d. Demonstrate, using objects, that multiplication and division are inverse operations (e.g., 3x4=12; thus, 12÷4=3 and 12÷3=4). e. Select and write an addition, subtraction, or multiplication sentence to solve a problem related to the students' environment, and write a story problem that relates to a given equation. f. Demonstrate the effects of place value when multiplying whole numbers by 10.	**Objective 3:** **Model and illustrate meanings of the four operations and describe how they relate.** a. Use models to represent multiplication of a one- or two-digit *factor* by a two-digit factor (up to 30) using a variety of methods (e.g., rectangular *arrays*, manipulatives, pictures) and connect the representation to an *algorithm*. b. Recognize that division by zero is not possible (e.g., 6÷0 is undefined). c. Select and write a multiplication or division sentence to solve a problem related to the students' environment and write a story problem that relates to a given equation. d. Represent division of a two-digit *dividend* by a one-digit *divisor*, including whole number remainders, using various methods (e.g., rectangular arrays, manipulatives, pictures) and connect the representation to an algorithm. e. Demonstrate that multiplication and division are inverse operations (e.g., 3x4=12; thus, 12÷4=3 and 12÷3=4). f. Describe the effect of place value when multiplying whole numbers by 10 and 100.	**Objective 3:** **Model and illustrate meanings of operations and describe how they relate.** a. Identify the *dividend*, *divisor*, and *quotient* regardless of the division symbol used. b. Determine whether a whole number is divisible by 2, 3, 5, 9, and/or 10, using the *rules of divisibility*. c. Represent remainders as *whole numbers*, decimals, or fractions and describe the meaning of remainders as they apply to problems from the students' environment (e.g., If there are 53 people, how many vans are needed if each van holds 8 people?). d. Model addition, subtraction, and multiplication of fractions and decimals in a variety of ways (e.g., using objects and a number line). e Select or write the number sentences that can be used to solve a two-step problem. f. Model different strategies for whole number multiplication (e.g., partial product, lattice) and division (e.g., partial quotient). g. Describe the effect on place value when multiplying and dividing whole numbers and decimals by 10, 100, and 1,000.	**Objective 3:** **Model and illustrate meanings of operations and describe how they relate.** a. Represent division of a multi-digit *dividend* by two-digit *divisors*, including decimals, using models, pictures, and symbols. b. Model addition, subtraction, multiplication, and division of fractions and decimals in a variety of ways (e.g., objects, a number line). c. *Apply rules of divisibility*. d. Select or write a number sentence that can be used to solve a multi-step problem and write a word problem when given a two-step expression or equation.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
	Objective 4: **Use fractions to identify parts of the whole.** a. Share sets of up to ten objects between two students and identify each part as half. b. Divide geometric shapes into equal parts, identifying halves and fourths.	**Objective 4:** **Use fractions to identify parts of the whole.** a. Separate geometric shapes and sets of objects into halves, thirds, and fourths using a variety of models and illustrations. b. Specify a region of a geometric shape (e.g., as "___ out of ___ equal parts" when given four or fewer equal parts. c. Represent the unit fractions 1/2, 1/3, and 1/4 with objects, pictures, and symbols.	**Objective 4:** **Use fractions to communicate parts of the whole.** a. Identify the denominator of a fraction as the number of equal parts in the whole region or set. b. Identify the numerator of a fraction as the number of equal parts being considered. c. Divide *regions* and sets of objects into equal parts using a variety of models and illustrations. d. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, sixths, and eighths. e. Determine which of two fractions is greater using models or illustrations.	**Objective 4:** **Use fractions to communicate parts of the whole.** a. Divide regions and sets of objects into equal parts using a variety of models and illustrations. b. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, fifths, sixths, eighths, and tenths. c. Relate fractions to decimals that represent tenths. d. Determine which of two fractions is greater using models or illustrations. e. Find equivalent fractions for one-half, one-third, and one-fourth using manipulatives and pictorial representations.	**Objective 4:** **Use fractions to communicate parts of the whole.** a. Divide regions, sets of objects, and line segments into equal parts using a variety of models and illustrations. b. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, fifths, sixths, eighths, tenths, and twelfths. c. Represent the simplest form of a fraction in various ways (e.g., objects, pictorial representations, symbols). d. Represent mixed numbers and improper fractions in various ways (e.g., rulers, objects, number lines, symbols). e. Rename *whole numbers* as fractions with different denominators (e.g., 5=5/1, 3=6/2, 1=7/7). f. Model and calculate equivalent forms of a fraction and describe the process used.	**Objective 4:** **Use fractions and percents to communicate parts of the whole.** a. Divide regions, sets of objects, and *line segments* into equal parts using a variety of models and illustrations. b. Name and write a fraction to represent a portion of a unit whole for halves, thirds, fourths, fifths, sixths, eighths, tenths, twelfths, and sixteenths. c. Write a fraction or ratio in simplest form. d. Name equivalent forms for fractions (halves, thirds, fourths, fifths, tenths), ratios, percents, and decimals, including repeating or terminating decimals. e. Relate percents less than 1% or greater than 100% to equivalent fractions, decimals, *whole numbers*, and mixed numbers.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
	Objective 5: Solve whole number problems using addition and subtraction in horizontal and vertical notation. a. Compute addition and subtraction facts to twelve. b. Add three whole numbers with sums to twelve.	**Objective 5: Solve whole number problems using addition and subtraction in vertical and horizontal notation.** a. Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator). b. Compute accurately with basic number combinations for addition and subtraction facts to eighteen. c. Add three *whole numbers* with *sums* to eighteen. d. Find the sum of two-digit whole numbers and describe the process used.	**Objective 5: Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.** a. Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator). b. Find the sum of any two *addends* with three or fewer digits, including monetary amounts, and describe the process used. c. Find the *difference* of two-digit *whole numbers* and describe the process used. d. Find the *product* for multiplication facts through ten times ten and describe the process used.	**Objective 5: Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.** a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator. b. Find the sum and difference of four-digit numbers, including monetary amounts, and describe the process used. c. Multiply two- and three-digit *factors* by a one-digit factor and describe the process used. d. Divide a two-digit *whole number dividend* by a one-digit *divisor*, with a *remainder* of zero and describe the process used.	**Objective 5: Solve problems using the four operations with whole numbers, decimals, and fractions.** a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator. b. Use estimation strategies to determine whether results obtained using a calculator are reasonable. c. Multiply up to a three-digit *whole number* by a one- or two-digit whole number. d. Divide up to a three-digit whole number *dividend* by a one-digit *divisor*. e. Add and subtract decimals with digits to the hundredths place (e.g., 35.42+7.2; 75.2–13.45). f. Add, subtract, and multiply fractions. g. Simplify *expressions*, without *exponents*, using the *order of operations*.	**Objective 5: Solve problems using the four operations with whole numbers, decimals, and fractions.** a. Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator. b. Use estimation strategies to determine whether results obtained using a calculator are reasonable. c. Multiply up to a three-digit *factor* by a one- or two-digit factor including decimals. d. Divide up to a three-digit *dividend* by a one- or two-digit *divisor* including decimals. e. Add and subtract decimals to the thousandths place (e.g., 34.567+3.45; 65.3-5.987). f. Add, subtract, multiply, and divide fractions and mixed numbers. g. Solve problems using ratios and proportions. h. Simplify *expressions*, with *exponents*, using the *order of operations*.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
					Objective 6: **Model and illustrate integers.** a. Identify, read, and locate *integers* on a number line. b. Describe situations where integers are used in the students' environment.	**Objective 6:** **Model, illustrate, and perform the operations of addition and subtraction of integers.** a. Recognize that the sum of an *integer* and its opposite is zero. b. Model addition and subtraction of integers using manipulatives and a number line. c. Add and subtract integers.
Standard II: **Students will identify and use patterns to represent mathematical situations.**	**Standard II:** **Students will identify and use patterns and relations to represent mathematical situations.**	**Standard II:** **Students will identify and use patterns and relations to represent mathematical situations.**	**Standard II:** **Students will use patterns and relations to represent mathematical situations.**	**Standard II:** **Students will use patterns and relations to represent mathematical situations.**	**Standard II:** **Students will use patterns and relations to represent and analyze mathematical situations using algebraic symbols.**	**Standard II:** **Students will use patterns, relations, and functions to represent and analyze mathematical situations using algebraic symbols.**
Objective 1: **Identify and sort objects according to common attributes.** a. Sort objects into groups by color, shape, size, number, or other *attributes*. b. Identify which attribute was used to sort objects into a group. c. Find multiple ways to sort and classify a group of objects.	**Objective 1:** **Recognize and represent patterns with one or two attributes.** a. Sort and classify objects by one or two *attributes*. b. Identify, create, and label simple patterns using manipulatives, pictures, and symbolic notation (e.g., ABAB. . ., □ ○ △ □ ○ △ . . .). c. Identify patterns in the environment. d. Identify horizontal and vertical patterns on hundreds charts. e. Use patterns to establish skip counting by twos to 20 and by fives and tens to 100. f. Count backward from 10 to 0 and identify the pattern.	**Objective 1:** **Recognize and represent patterns having multiple attributes.** a. Sort, classify, and label objects by three or more *attributes*. b. Identify and label repeating and *growing patterns* using objects, pictures, and symbolic notation (e.g., ABAABBAAABBB...). c. Identify repeating and growing patterns in the environment. d. Construct models and skip count by twos, threes, fives, and tens and relate to repeated addition.	**Objective 1:** **Recognize and create patterns with given attributes.** a. Create and extend *repeating* and *growing* patterns using objects, numbers, and tables. b. Record results of patterns created using manipulatives, pictures, and numeric representations and describe how they are extended.	**Objective 1:** **Recognize, describe, and use patterns and identify the attributes.** a. Represent and analyze repeating and growing patterns using objects, pictures, numbers, and tables. b. Recognize and extend multiples and other number patterns using a variety of methods.	**Objective 1:** **Recognize, analyze, and use patterns and describe their attributes.** a. Analyze and make predictions about patterns involving *whole numbers*, decimals, and fractions using a variety of tools including organized lists, tables, objects, and variables. b. Extend patterns and describe a rule for predicting the next element.	**Objective 1:** **Recognize, analyze, and use multiple representations of patterns and functions and describe their attributes.** a. Analyze patterns on graphs and tables and write a generalization to predict how the patterns will continue. b. Create tables and graphs to represent given patterns and algebraic *expressions*. c. Draw a graph from a table of values or to represent an equation. d. Write an algebraic expression from a graph or a table of values.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Identify and use patterns to describe numbers or objects.** a. Use patterns to count orally from 1 to 20 and backward from 10 to 0. b. Identify simple patterns in the environment. c. Predict what comes next in an established pattern and justify thinking. d. Duplicate, extend, and create simple patterns using objects and pictorial representations.	**Objective 2:** **Recognize and represent relations using mathematical symbols.** a. Recognize that "=" indicates a relationship in which the quantities on each side of an equation are equal. b. Recognize that symbols such as □, △, or ◇ in an addition or subtraction equation represent a missing value that will make the statement true (e.g., □ + 3 = 6, 5 +7 = △, 4 = 5 – ◇). c. Demonstrate that changing the order of *addends* does not change the *sum* (e.g., 3+2+7=12, 7+3+2=12) and that changing the grouping of three or more addends does not change the sum (e.g., (2+3)+7=12, 2+(3+7)=12).	**Objective 2:** **Recognize and represent relations using mathematical symbols.** a. Recognize that "≠" indicates a relationship in which the quantities on each side are not of equal value. b. Recognize that symbols such as □, △, or ◇ in an addition or subtraction equation represent a value that will make the statement true (e.g., □ +3=6, 5+7=△, 7=9-◇). c. Demonstrate that changing the order of *addends* does not change the *sum* (e.g., 3+2+7=12, 7+3+2=12) and that changing the grouping of three or more addends does not change the sum (e.g., (2+3)+7=12, 2+(3+7)=12).	**Objective 2:** **Recognize and represent mathematical situations using patterns and symbols.** a. Recognize that symbols such as □, △, or ◇ in an addition, subtraction, or multiplication equation, represent a value that will make the statement true (e.g., 5+7=△, □-3=6, ◇=2x4). b. Solve equations involving equivalent expressions (e.g., 6+4 = □+7). c. Use the >, <, and = symbols to compare two *expressions* involving addition and subtraction (e.g., 4+6 □ 3+2; 3+5 ◇ 16-9). d. Demonstrate that grouping three or more *addends* does not change the *sum* (e.g., 3+(2+7)=12, (7+3)+2=12) and changing the order of *factors* does not change the *product* (e.g., 3x7=21, 7x3=21). e. Use a variety of manipulatives to model the *identity property of addition* (e.g., 3+0=3), the *identity property of multiplication* (e.g., 7x1=7), and the *zero property of multiplication* (e.g., 6x0=0).	**Objective 2:** **Recognize, represent, and solve mathematical situations using patterns and symbols.** a. Solve equations involving equivalent expressions (e.g., 6x2= □x3 or 6x□=9+9). b. Use the <, >, = symbols to compare two expressions involving addition, subtraction, multiplication, and division (e.g., 5x4◇9÷3). c. Recognize that a given variable maintains the same value throughout an equation or expression (e.g., □+□=8; □=4). d. Demonstrate that changing the order of *factors* does not change the *product* (e.g., 2x3=6, 3x2=6) and that the grouping of three or more factors does not change the product (e.g., (2x3)x1=6; 2x(3x1)=6). e. Demonstrate the distribution of multiplication over addition using a rectangular *array* (e.g., 8x14=8 rows of 10 plus 8 rows of 4).	**Objective 2:** **Represent, solve, and analyze mathematical situations using algebraic symbols.** a. Recognize a variety of symbols for multiplication and division including x, •, and * as symbols for multiplication and ÷, ⌐, and a fraction bar (/ or -) as division symbols. b. Recognize that a variable (◇, n, x) represents an unknown quantity. c. Solve one-step equations involving *whole numbers* and a single variable (e.g., n÷7=3). d. Recognize that the answer to a multiplication problem involving a factor of zero is equal to zero (e.g., 0x45=0). e. Use expressions or one-step equations to represent real-world situations. f. Use the *associative*, *commutative*, and *distributive properties* to compute with whole numbers.	**Objective 2:** **Represent, solve, and analyze mathematical situations using algebraic symbols.** a. Recognize that a number in front of a variable indicates multiplication (e.g., 3y means 3 times the quantity y). b. Solve two-step equations involving *whole numbers* and a single variable (e.g., 3x+4=19). c. Recognize that "≈" indicates a relationship in which the quantities on each side are approximately of equal value (e.g., π ≈3.14). d. Recognize that an *exponent* can be represented in the following ways: 4^3 or 4^3. e. Evaluate *expressions* and formulas, substituting given values for the variables (e.g., 2x+4; x=2; therefore, 2(2)+4=8). f. Recognize that if the *product* is zero, then one or more *factors* equal zero (i.e., if ab=0 then either a=0 or b=0 or a and b=0).

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard III: **Students will identify and create simple geometric shapes and describe spatial relationships.**	**Standard III:** **Students will describe, identify, and create and simple geometric shapes and describe spatial relationships.**	**Standard III:** **Students will describe, identify, and create geometric shapes and describe spatial relationships.**	**Standard III:** **Students will use spatial reasoning to describe, identify, and create geometric shapes.**	**Standard III:** **Students will use spatial reasoning to recognize, describe, and identify geometric shapes.**	**Standard III:** **Students will use spatial reasoning to recognize, describe, and identify geometric shapes and principles.**	**Standard III:** **Students will use spatial and logical reasoning to recognize, describe, and identify geometric shapes and principles.**
Objective 1: **Identify and create simple geometric shapes.** a. Identify circles, triangles, rectangles, and squares. b. Combine shapes to create *two-dimensional* objects. c. Draw circles, triangles, rectangles, and squares. d. Recognize circles, triangles, rectangles, and squares in the students' environment.	**Objective 1:** **Describe, identify, and create simple geometric shapes.** a. Identify, name, draw, create, and sort circles, triangles, rectangles, and squares. b. Identify circles, triangles, rectangles, and squares in the students' environment. c. Recognize that combining simple geometric shapes can create more complex geometric shapes.	**Objective 1:** **Describe, identify, and create geometric shapes.** a. Identify, name, draw, sort, and compare circles, triangles, and *parallelograms*. b. Identify and name spheres, cones, and cylinders. c. Find and identify familiar geometric shapes in the students' environment. d. Determine whether a circle, triangle, square, or rectangle has a *line of symmetry*.	**Objective 1:** **Describe, identify, and create geometric shapes.** a. Identify and draw *points*, *lines*, *line segments*, and *endpoints*. b. Identify and draw *lines of symmetry* on triangles, squares, circles, and rectangles. c. Determine whether an angle is *right*, *obtuse*, or *acute* by comparing the angle to the corner of a rectangle. d. Classify polygons (e.g., *quadrilaterals*, pentagons, hexagons, octagons) by the number of sides and corners. e. Identify, make, and describe cubes (e.g., a cube has 6 square *faces*, 8 *vertices*, and 12 *edges*).	**Objective 1:** **Describe, identify, and analyze characteristics and properties of geometric shapes.** a. Identify and draw *parallel lines* and *intersecting lines*. b. Identify and draw lines of symmetry on a variety of *polygons*. c. Identify and describe *quadrilaterals* (i.e., rectangles, squares, *rhombuses*, *trapezoids*, kites). d. Identify *right*, *obtuse*, and *acute* angles. e. Compare two polygons to determine whether they are *congruent* or *similar*. f. Identify and describe *cylinders* and *rectangular prisms*.	**Objective 1:** **Describe, identify, and analyze characteristics and properties of geometric shapes.** a. Identify and draw *perpendicular* lines. b. Draw, label, and describe rays and describe an angle as two rays sharing a common endpoint. c. Label an angle as acute, *obtuse*, *right*, or *straight*. d. Identify and describe *equilateral*, *isosceles*, *scalene*, *right*, *acute*, and *obtuse* triangles. e. Identify the *vertex* of an angle or the *vertices* of a polygon. f. Compare *corresponding angles* of two triangles and determine whether the triangles are *similar*. g. Identify and describe *pyramids* and *prisms*.	**Objective 1:** **Identify and analyze characteristics and properties of geometric shapes.** a. Identify the *midpoint* of a *line segment*. b. Identify concave and *convex polygons*. c. Identify the center, *radius*, *diameter*, and *circumference* of a circle. d. Identify the number of *faces*, *edges*, and *vertices* of *pyramids* and *prisms*.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Describe simple spatial relationships.** a. Visualize how to fit a shape into a design. b. Use and demonstrate words to describe position with objects (i.e., on, over, under, above, below, top, bottom, up, down, in front of, behind, next to, beside). c. Use and demonstrate words to describe distance with objects (i.e., far, near).	**Objective 2:** **Describe simple spatial relationships.** a. Use and demonstrate words to describe position (i.e., between, before, after, middle, left, right). b. Use and demonstrate words to describe distance (i.e., closer, farther).	**Objective 2:** **Describe spatial relationships.** a. Create and use verbal or written instructions to move within the environment. b. Find and name locations using coordinates (A, 1). c. Identify shapes in various orientations (e.g., △ and ▽).	**Objective 2:** **Describe spatial relationships.** a. Give directions to reach a location. b. Use coordinates (A, 1) or regions to locate positions on a map. c. Demonstrate and use horizontal and vertical lines.	**Objective 2:** **Specify locations and describe spatial relationships using grids and maps.** a. Locate positions on a map of Utah using coordinates or regions. b. Give the *coordinates* or *regions* of a position on a map of Utah.	**Objective 2:** **Specify locations and describe spatial relationships using coordinate geometry.** a. Locate points defined by ordered pairs in the first *quadrant*. b. Write an ordered pair for a point in the first quadrant. c. Specify possible paths between locations on a *coordinate grid* and compare distances of the various paths.	**Objective 2:** **Specify locations and describe spatial relationships using coordinate geometry.** a. Graph points defined by ordered pairs in all four quadrants. b. Write the ordered pair for a point in any quadrant.
			Objective 3: **Visualize and identify geometric shapes after applying transformations.** a. Demonstrate the effect of a slide (translation) or flip (reflection) on a figure, using manipulatives. b. Determine whether two polygons are *congruent* by sliding, flipping, or turning to physically fit one object on top of the other. c. Identify *two-dimensional* shapes (*nets*) that will fold to make a cube. d. Create a *polygon* that results from combining other polygons.	**Objective 3:** **Visualize and identify geometric shapes after applying transformations.** a. Identify a *slide* (*translation*) or *flip* (*reflection*) on a figure using manipulatives. b. Relate *cubes*, *cylinders*, *cones*, and *rectangular prisms* to the *two-dimensional* shapes (*nets*) from which they were created.	**Objective 3:** **Visualize and identify geometric shapes after applying transformations.** a. Identify a *slide* (*translation*) or *flip* (*reflection*) on a figure across a line. b. Demonstrate the effect of a *turn* (*rotation*) on a figure using manipulatives. c. Relate *pyramids* and *prisms* to the *two-dimensional* shapes (*nets*) from which they were created.	**Objective 3:** **Visualize and identify geometric shapes after applying transformations.** a. *Turn* (*rotate*) a shape around a point and identify the location of the new vertices. b. *Slide* (*translate*) a polygon either horizontally or vertically on a coordinate grid and identify the location of the new vertices. c. *Flip* (*reflect*) a shape across either the x- or y-axis and identify the location of the new vertices.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard IV: **Students will understand and use simple measurement tools and techniques.**	**Standard IV:** **Students will understand and use simple measurement tools and techniques.**	**Standard IV:** **Students will understand and use measurement tools and techniques.**	**Standard IV:** **Students will understand and use measurement tools and techniques.**	**Standard IV:** **Students will understand and use measurement tools and techniques.**	**Standard IV:** **Students will understand and apply measurement tools and techniques.**	**Standard IV:** **Students will understand and apply measurement tools and techniques.**
Objective 1: **Identify measurable attributes of objects and units of measurement.** a. Identify clocks and calendars as tools that measure time. b. Identify a day, week, and month on a calendar. c. Identify pennies, nickels, dimes, and quarters as units of money.	**Objective 1:** **Identify measurable attributes of objects and units of measurement.** a. Identify the appropriate tools for measuring length, weight, capacity, temperature, and time. b. Identify the values of a penny, nickel, dime, and quarter. c. Estimate the length of an object by comparing to a nonstandard unit (e.g., How many new pencils wide is your desk?).	**Objective 1:** **Identify measurable attributes of objects and units of measurement.** a. Sequence a series of events of a day in order by time (e.g., breakfast at 7:00, school begins at 9:00). b. Identify the name and value of a penny, nickel, dime, quarter, and dollar. c. Estimate length, *capacity*, and weight using customary units.	**Objective 1:** **Identify and describe measurable attributes of objects and units of measurement.** a. Recognize the two systems of measurement: *metric* and *customary*. b. Describe the relationship between metric units of length (i.e., centimeter, meter). c. Describe the relationship among customary units of length (i.e., inch, foot, yard) and the relationship between customary units of *capacity* (i.e., cup, quart). d. Estimate length, capacity, and weight using metric and customary units.	**Objective 1:** **Identify and describe measurable attributes of objects and units of measurement.** a. Describe the relationship among *metric* units of length (i.e., millimeter, centimeter, meter), between metric units of capacity (i.e., milliliter, liter), and between metric units of weight (i.e., gram, kilogram). b. Identify a mile as a measure of distance and its relationship to other *customary* units of length. c. Describe the relationship among customary units of *capacity* (i.e., cup, pint, quart, gallon). d. Estimate length, capacity, and weight using metric and customary units.	**Objective 1:** **Identify and describe measurable attributes of objects and units of measurement.** a. Describe the relationship among *metric* units of length (i.e., millimeter, centimeter, meter, kilometer). b. Describe the relationship among *customary* units of weight (i.e., ounce, pound). c. Identify the correct units of measurement for *volume*, *area*, and *perimeter* in both metric and customary systems. d. Estimate length, volume, weight, and area using metric and customary units. e. Convert units of measurement within the metric system and convert units of measurement within the customary system.	**Objective 1:** **Identify and describe measurable attributes of objects and units of measurement.** a. Compare a meter to a yard, a liter to a quart, and a kilometer to a mile. b. Identify *pi* as the ratio of the *circumference* to *diameter* of a circle. c. Explain how the size of the unit used in measuring affects the precision. d. Estimate length, volume, weight, and area using *metric* and customary units.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Use appropriate techniques and tools to determine measurements.** a. Compare two objects (e.g., shorter/longer, heavier/lighter, larger/smaller, more/less). b. Find the length of an object using nonstandard units (e.g., pencils, paper clips). c. Name the days of the week in order. d. Sort pennies, nickels, dimes, and quarters.	**Objective 2:** **Use appropriate techniques and tools to determine measurements.** a. Compare objects, using nonstandard units, according to their length, weight, or volume (e.g., pencils/length, books/weight, boxes/volume). b. Read and tell time to the nearest hour. c. Name the days of the week, months of the year, and seasons in order. d. Determine the value of a set of the same coins that total 25¢ or less (e.g., a set of 14 pennies equals 14¢, a set of 5 nickels equals 25¢, a set of 2 dimes equals 20¢).	**Objective 2:** **Use appropriate techniques and tools to determine measurements.** a. Compare and order objects, using nonstandard units, according to their length, weight, or capacity. b. Measure length using inches and feet, weight using pounds, and *capacity* using cups. c. Determine the value of a set of up to five coins that total $1.00 or less (e.g., two quarters and one dime equals 60¢; three dimes, one nickel, and one penny equals 36¢). d. Read, tell, and write time to the hour and half-hour. e. Use a calendar to determine the day of the week and date. f. Determine the *perimeter* of a square, triangle, and rectangle by measuring with nonstandard units.	**Objective 2:** **Use appropriate techniques and tools to determine measurements.** a. Measure the length of objects to the nearest centimeter, meter, half-inch, foot, and yard. b. Measure *capacity* using cups and quarts, and measure weight using pounds. c. Determine the value of a combination of coins and bills that total $5.00 or less and write the monetary amounts using the dollar sign and decimal notation. d. Identify the number of hours in a day, the number of days in a year, and the number of weeks in a year. e. Read, tell, and write time to the quarter-hour. f. Identify any given day of the month (e.g., the third Wednesday of the month is the 18th). g. Read and record the temperature to the nearest ten degrees using a Fahrenheit thermometer. h. Estimate and measure the *perimeter* and area of rectangles by measuring with nonstandard units.	**Objective 2:** **Determine measurements using appropriate tools and formulas.** a. Measure the length of objects to the nearest centimeter, meter, quarter-inch, foot, and yard. b. Measure *capacity* using milliliters, liters, cups, pints, quarts, and gallons and measure weight using grams, kilograms, and pounds. c. Read, tell, and write time to the nearest minute, identifying a.m. and p.m. d. Read and record the temperature to the nearest degree, in Fahrenheit, using a thermometer. e. Determine the value of a combination of coins and bills that total $20.00 or less. f. Count back change for a single-item purchase and determine the amount of change to be received from a multiple-item purchase. g. Determine possible *perimeters*, in whole units, for a rectangle with a fixed *area* and determine possible areas when given a rectangle with a fixed perimeter.	**Objective 2:** **Determine measurements using appropriate tools and formulas.** a. Measure length to the nearest 1/8 of an inch and to the nearest centimeter. b. Measure *volume* and weight using *metric* and *customary* units. c. Measure angles using a protractor. d. Calculate *elapsed time* within a.m. or p.m. time periods. e. Read and record the temperature to the nearest degree (above and below zero) when using a thermometer with a Celsius or Fahrenheit scale. f. Calculate the *perimeter* of rectangles and triangles. g. Calculate the *area* of squares and rectangles using a formula.	**Objective 2:** **Determine measurements using appropriate tools and formulas.** a. Measure length to the nearest one-sixteenth of an inch and to the nearest millimeter. b. Estimate and measure an angle to the nearest degree. c. Calculate the *circumference* of a circle using a given formula. d. Calculate *elapsed time* across a.m. and p.m. time periods. e. Calculate the *areas* of triangles, rectangles, and *parallelograms* using given formulas. f. Calculate the *surface area* and *volume* of right, rectangular prisms using given formulas.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Standard V: **Students will collect and draw conclusions from data and understand basic concepts of probability.**	**Standard V:** **Students will collect and draw conclusions from data and understand basic concepts of probability.**	**Standard V:** **Students will collect and draw conclusions from data and understand basic concepts of probability.**	**Standard V:** **Students will collect and organize data to make predictions and identify basic concepts of probability.**	**Standard V:** **Students will collect and organize data to make predictions and use basic concepts of probability.**	**Standard V:** **Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.**	**Standard V:** **Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.**
Objective 1: **Collect, organize, and display simple data.** a. Collect, organize, and record data using objects and pictures. b. Represent data in a variety of ways (e.g., graphs made from people, *pictographs*, bar graphs) and interpret the data (e.g., more people like red than blue).	**Objective 1:** **Collect, organize, and display simple data.** a. Collect physical objects to use as data. b. Collect, represent, and interpret data using tables, tally marks, *pictographs*, and bar graphs.	**Objective 1:** **Collect, organize, and display simple data.** a. Gather data by vote or survey. b. Sort, classify, and organize data in a variety of ways. c. Use a variety of methods to organize, display, and label information, including keys, using *pictographs*, tallies, bar graphs, and organized tables. d. Report information from a data display.	**Objective 1:** **Collect, organize, and display data to make predictions.** a. Collect, read, represent, and interpret data using tables, graphs, and charts, including keys (e.g., pictographs, bar graphs). b. Make predictions based on a data display.	**Objective 1:** **Collect, organize, and display data to make predictions and answer questions.** a. Identify a question that can be answered by collecting data. b. Collect, read, and interpret data from tables, graphs, charts, surveys, and observations. c. Represent data using tables, line plots, line graphs, and bar graphs. d. Identify and distinguish between *clusters* and *outliers* of a data set.	**Objective 1:** **Formulate and answer questions using statistical methods to compare data.** a. Formulate a question that can be answered by collecting data. b. Collect, compare, and display data using an appropriate format (i.e., *line plots*, bar graphs, pictographs, circle graphs, line graphs). c. Identify minimum and *maximum* values for a set of data. d. Identify or calculate the *mean*, *mode*, and *range*. e. Propose and justify inferences based on data.	**Objective 1:** **Design investigations to reach conclusions using statistical methods to make inferences based on data.** a. Design investigations to answer questions by collecting and organizing data in a variety of ways (e.g., bar graphs, line graphs, frequency tables, stem and leaf plots). b. Collect, compare, and display data using an appropriate format (i.e., bar graphs, line graphs, *line plots*, circle graphs, scatter plots). c. Compare two similar sets of data on the same graph and compare two graphs representing the same set of data. d. Recognize that changing the scale influences the appearance of a display of data. e. Develop and evaluate inferences and predictions based on data.

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
Objective 2: **Determine the likelihood of events.** a. Describe events encountered in books read as possible or not possible. b. Describe events as likely or unlikely (e.g., It is likely to snow today. It is unlikely an elephant will be in school).	**Objective 2:** **Determine the likelihood of an event.** a. Compare events to decide which are more likely, less likely, and equally likely. b. Relate past events to future events (e.g., The sun set about 6:00 last night, so it will set about the same time tonight).	**Objective 2:** **Determine the likelihood of an event.** a. Predict events that will be the same in one day or one week. b. Predict the outcome when there are only two possible outcomes (e.g., tossing a coin).	**Objective 2:** **Identify basic concepts of probability.** a. Describe the results of events using the terms "certain," "equally likely," and "impossible." b. Predict outcomes of simple activities (e.g., a bag contains three red marbles and five blue marbles. If one marble is selected, is it more likely to be red or blue?).	**Objective 2:** **Use basic concepts of probability.** a. Describe the results of investigations involving random outcomes as simple ratios (e.g., 4 out of 9, 4/9). b. Predict outcomes of simple experiments, including with and without replacement, and test the predictions.	**Objective 2:** **Apply basic concepts of probability.** a. Describe the results of investigations involving random outcomes using a variety of notations (e.g., 4 out of 9, 4/9, 4:9). b. Recognize that outcomes of experiments and samples are fractions between 0 and 1. c. Predict the probability of an outcome in a simple experiment.	**Objective 2:** **Apply basic concepts of probability.** a. Write the results of a probability experiment as a fraction, ratio, or percent between zero and one. b. Compare experimental results with anticipated results (e.g., experimental: 7 out of 10 tails; whereas, anticipated 5 out of 10 tails). c. Compare individual, small group, and large group results for a probability experiment.

Facilitated Activities

Developing Mathematical Thinking with Effective Questions

To help students build confidence and rely on their own understanding, ask…

- Why is that true?
- How did you reach that conclusion?
- Does that make sense?
- Can you make a model to show that?

To help students learn to reason mathematically, ask…

- Is that true for all cases? Explain.
- Can you think of a counterexample?
- How would you prove that?
- What assumptions are you making?

To check student progress, ask…

- Can you explain what you have done so far? What else is there to do?
- Why did you decide to use this method?
- Can you think of another method that might have worked?
- Is there a more efficient strategy?
- Why did you decide to organize your results like that?
- Do you think this would work with other numbers?
- Have you thought of all possibilities? How can you be sure?

To help students collectively make sense of mathematics, ask…

- What do you think about what_____said?
- Do you agree? Why or why not?
- Does anyone have the same answer but a different way to explain it?
- Do you understand what_____is saying?
- Can you convince the rest of us that your answer makes sense?

To encourage conjecturing, ask…

- What would happen if…? What if not?
- Do you see a pattern? Can you explain the pattern?
- What are some possibilities here?
- Can you predict the next one? What about the last one?
- What decision do you think s/he should make?

To promote problem solving, ask…

- What do you need to find out?
- What information do you need? How can you obtain it?

- What strategies are you going to use?
- Will you do it mentally? With pencil and paper? Using a number line?
- Will a calculator help?
- What tools will you need?
- What do you think the answer or result will be?

To help when students get stuck, ask…

- How would you describe the problem in your own words?
- What do you know that is not stated in the problem?
- What facts do you have?
- How did you tackle similar problems?
- Could you try it with simpler numbers? Fewer numbers? Using a number line?
- What about putting things in order?
- Would it help to create a diagram? Make a table? Draw a picture?
- Can you guess and check?
- Have you compared your work with anyone else's? What did other members of your group try?

To make connections among ideas and applications, ask…

- How does this relate to…?
- What ideas that we have learned before were useful in solving this problem?
- What uses of mathematics did you find in the newspaper last night?
- Can you give me an example of…?

To encourage reflection, ask?

- How did you get your answer?
- Does your answer seem reasonable? Why or why not?
- Can you describe your method to us all? Can you explain why it works?
- What if you had started with…rather than…?
- What if you could only use…?
- What have you learned or found out today?
- Did you use or learn any new words today? What do they mean? How do you spell them?
- What are the key points or big ideas in this lesson?

Name_____

My Favorite Candy Bar

Count and write how many of each candy bar was chosen.

___ Snickers®
___ Dark Hershey's® Bar
___ Milky Way®
___ Baby Ruth
___ Light Hershey's® Bar
___ 3 Musketeers® Bar

1. Which candy bar was chosen the most?_____

2. Which candy bar was chosen the least? _____

3. How many fewer Snickers® were there than Baby Ruth? __

   How did you find the answer? _____

   _____

   Write a number sentence for your problem._____

4. What did you learn by doing this activity? _____

   _____

   _____

5. Why is it important to know about graphing? _____

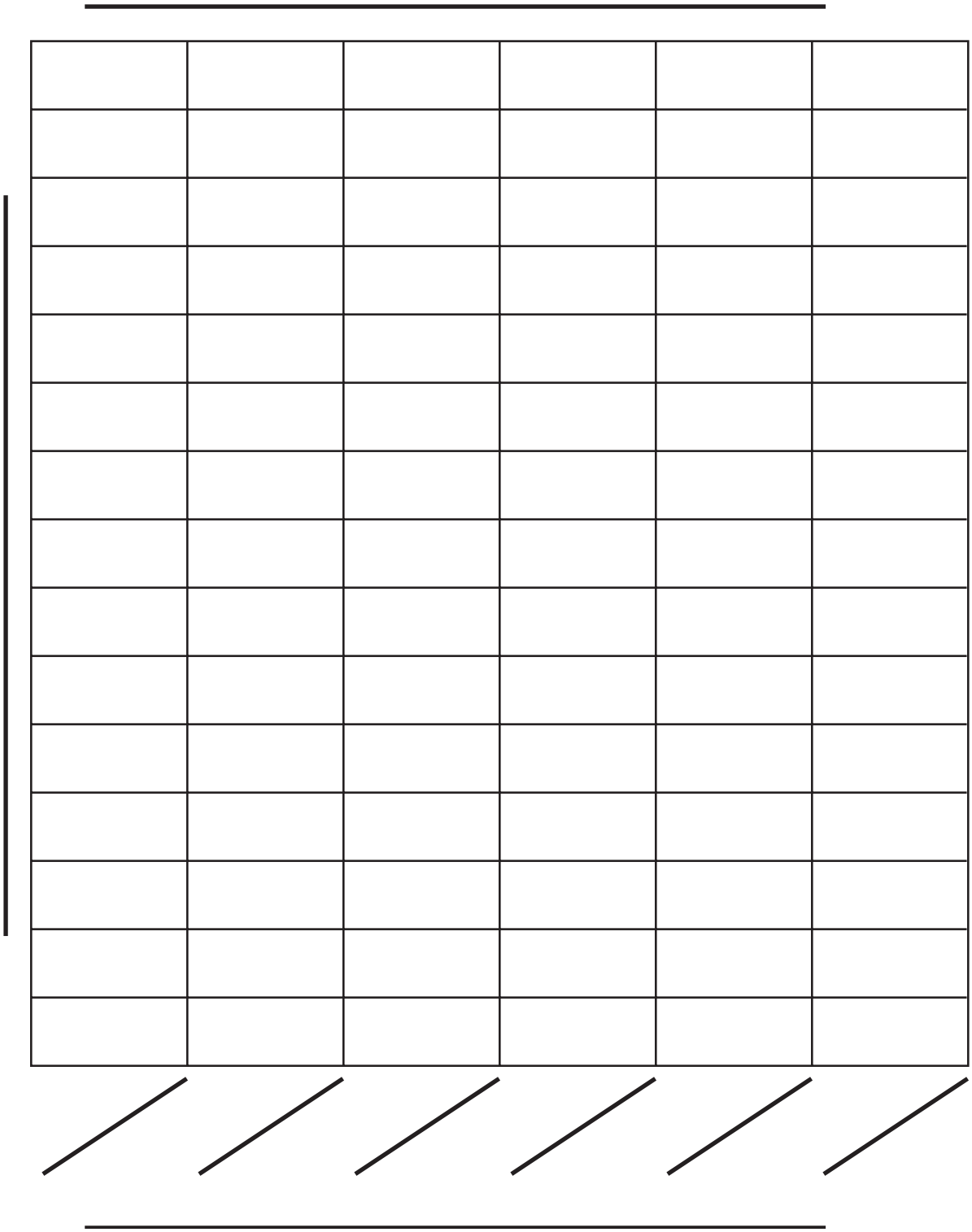
   _____

   _____

Name _____

My Favorite Candy Bar Pictograph

Using the data collected, complete the pictograph. Include title, label the vertical axis and horizontal axis, and write the scale on the lines.



Helpful Hints for Supporting All Learners

The following information is provided as a resource for teachers as they work with the diverse learners they encounter in their classrooms. Most ideas presented are for use in any content area and at any grade level, including the K-2 Content, Math, and Science Core curricula that are the focus of the 2004 Elementary CORE Academy.

Common barriers to learning and ways to overcome those barriers are presented, as well as the basic fundamentals of differentiating instruction. Also included is a checklist for highlighting appropriate student-specific adaptations and modifications designed to help struggling students, including the gifted.

There is also a chart that describes weaknesses in cognitive processes that could explain why a student struggles with particular reading or other academic skills. This information should be provided through formalized assessment.

For more information, please contact curriculum or special education specialists at the Utah State Office of Education or the specialists at the Utah Personnel Development Center.

- **Barriers Students Face**
- **Engaging All Learners**
- **Adaptation/ Modification Checklist**
- **Why Students Struggle in the Classroom**

Barriers Students Face

1. Barriers exist that encumber the path to academic achievement for students.
2. The way to get around the barriers is by employing effective instructional practices that utilize differentiation strategies.
3. Two elements of a learning setting can be points of differentiation.
   a. Person—learner
      These characteristics are out of the control of the teacher, but can be positively influenced by differentiation.
      - *Learning Preference* (style or strength)
      - *Learning Ability* (enhanced or impaired)

   b. Process—instruction
      These practices during the instructional cycle are within the control of the teacher and can positively influence student achievement.
      - *Input* (instructional delivery)
      - *Output* (demonstration of learning)

Common Barriers

PERSON—Student	What to do about it	PROCESS—Instruction	What to do about it
Limited language skills	Pre-teach critical or potentially troublesome vocabulary. Provide visual or kinesthetic cues.	**Unclear directions and expectations**	Reduce instructional clutter. Provide simple clear directions. Teach and maintain consistent routines.
Trouble maintaining attention	Provide short, intense learning sessions, vary tasks, break down complex tasks.	**Over-reliance on worksheets/bookwork**	Provide explicit instruction, examples, and relevant practice. Provide adequate guided practice.
Inadequate mastery of prerequisite skills	Provide experience or background knowledge Do not assume anything.	**Inadequate Guided Practice during lesson sequence**	Continue with guided practice until 90% of your students are performing skill at 80%-90% or better.
Inefficient processing skills	Allow think time, provide physical cue to respond, rehearse responses, use simple vocabulary, check for understanding, give one direction at a time, wait time.	**Use of abstract examples**	Use clear, easily recognizable examples during initial phases of instruction. Use visual, auditory, and kinesthetic representations. Relate to real-life.
Impaired academic learning ability	Make tasks less complex, reduce amount of content to be leaned, relate to real-life experience of student.	**Only one option for students to demonstrate learning**	Provide more than one way for students to show what they know. Same criteria, demonstration is different.
Advanced academic learning ability	Make tasks more complex. Increase amount of content to be learned.	**Inappropriate use of homework**	Homework is review, not new learning. Do not use as busy work. Provide feedback.

Engaging All Learners

Hints for Differentiating Instruction

1. **INPUT—instruction**

   Visual Learners—use pictures, videos, diagrams, maps, guided notes, flow charts, demonstration, flash cards, study cards

   Auditory Learners—use lecture, telling, discussion, audio tracks, read aloud, debate, listen to news reports

   Kinesthetic Learners—use underlining, manipulatives, tracing, highlighting, dramatize, pantomime, mimic actions, field trips, information walks, actions, sign language.

2. **OUTPUT—demonstration of learning**

   Visual Learners—allow collages, drawings, diagrams, symbols, posters, cartoons, photos, maps, flow-charts, video

   Auditory Learners—allow storytelling, debates, speech, song/rap, interview, newspaper article, discussion, essays, journaling

   Kinesthetic Learners—allow painting, dancing, molding, model building, role play, pantomimes, games, creations, raps

Hints for Extending Instruction: for Academically Advanced Students

1. **INPUT—instruction**

   More Content—more elements to master, more independent study, supplementary materials, use less obvious examples, give more abstract examples and ideas, less practice on material given

   More Complex Task—more responses, more complex directions, more examples, more opportunities to generalize, less teacher direction

2. **OUTPUT—demonstration of learning**

   More Content—more concepts to demonstrate, require broad generalization, group work, complex assignments, generation instead of recognition, proficiency on more skills

   More Complex Task—require more responses, increase number of examples demonstrated, student must reorganize information, student develops more strategies for remembering—shares with others, teaches others

Hints for Accommodating Instruction: for Academically Struggling Students (Spec. Ed, 504, ELL, other)

Changes HOW student accesses or demonstrates learning.

NO change in HOW MUCH learning is expected.

1. **INPUT—instruction**

   Math—provide photocopy of assignment to write on, break down complex tasks, allow calculator use, use fact charts, give prompts for remembering steps, "think" out loud when instructing, increase amount of guided practice, teach strategies, identify and teach critical elements, peer partners, relate to real-life, guided notes

   Science—provide text reader, graphic organizers, teach prerequisite vocabulary, read written directions aloud, provide guided notes, explanations, clear examples and non examples, identify and teach critical elements, cloze procedure note taking, experiential activities, chunk instructional periods, multi-sensory approach, break-down complex tasks, relate to real-life, teach memory strategies

2. **OUTPUT—demonstration of learning**

   Math—allow extra time, partial assignments, use calculator, give prompts for formula steps, use a "do/redo/turn-in" option, do not mix examples and non-examples without clear warning, photocopy of assignment to write answers on, a copy of book for home, mix current lesson with basic skill review problems, check for understanding, homework partner, accept work done in class

   Science—allow verbal responses, posters, models, reduce choices on matching, give more time, short answer instead of essay, type instead of write, proofreader, do not penalize for spelling errors, demonstrations, provide a task analysis or completion checklist, review needed materials or steps, reduce writing load on assignments, allow a "do/re-do" option

Hints for Modifying Instruction for students with disabilities (Spec. Ed-must have an IEP)

Changes in WHAT/HOW MUCH a student is expected to learn.

1. **INPUT—instruction**

   Less Content—instruct on one or two basic skills/ideas, parallel curriculum on same topic, use simple real-life examples, simplify guided notes, provide concept summaries with easy to understand words, provide more practice with less material, use more examples with less material, reduce content clutter in lessons

   Less Complex Task—use words with literal meanings, break tasks down then teach each part to mastery, provide more prompts during guided practice, highlight basic information, keep tasks to one to three steps, provide guidance for remembering/associating information, provide easy diagrams or templates

2. OUTPUT—demonstration of learning

Less Content—fewer elements to master, one or two concepts to demonstrate, reduce assignment length, relate assignment to functional/real-life skills, assign easiest job during group work, have students recognize instead of generate information, require proficiency on only one or two skills

Less Complex Task—break down task, require only one or two responses, limit choices on matching, provide high level of prompting, outline necessary steps, allow strategies for remembering, give fewer practice exercises, reduce number of test items, give a modified test, highlight basic information, allow student to point to or say instead of write out, give extra time

Adaptation/Modification Checklist

Student: _____ Teacher: _____

Testing Adaptations:	**Presentation of Subject Matter:**	**Assignment Accommodations:**
❑ Change essay questions to multiple choice. ❑ Reduce multiple choice to _____ choices. ❑ Avoid True or False questions. ❑ Avoid essay questions. ❑ Provide a word bank. ❑ Accept short answers. ❑ Give open book/notes tests. ❑ Allow student to record or dictate answers. ❑ Reduce spelling list for spelling tests. ❑ Extend time frame or shorten length of test. ❑ Avoid Scantron answer sheets. ❑ Read test to student. ❑ Provide study guide prior to test. ❑ Type tests and/or use large print. ❑ Test smaller units of material. ❑ Highlight key directions. ❑ Give test in an alternate site. ❑ Allow student to use calculator. ❑ Allow a test retake. ❑ Other: _____.	❑ Teach to the student's learning style: _____ ❑ Read text aloud. ❑ Provide small group instruction. ❑ Provide an accurate copy of notes or key points written on the board or overhead. ❑ Model lesson being taught. ❑ Utilize manipulatives. ❑ Highlight critical information. ❑ Pre-teach the vocabulary. ❑ Do not call on the student to read aloud in class. ❑ Check student's understanding during the lesson. ❑ Provide study guides. ❑ Assign a study buddy. ❑ Allow time for student to process directions/information. ❑ Other: _____.	❑ Give directions in writing and verbally. ❑ Avoid penalizing for spelling errors, except on spelling tests/assignments. ❑ Show an example of what the completed assignment should look like. ❑ Reduce assignment. ❑ Read written work to student. ❑ Provide alternate assignment/strategy when demands of assignment conflict with student capabilities. ❑ Allow student to word process assignment. ❑ Avoid penalizing for poor penmanship. ❑ Allow student to use manuscript. ❑ Communicate homework expectations with parents. ❑ Check for student's understanding of the task. ❑ Chunk tasks. ❑ Allow a scribe or note taker. ❑ Other: _____.
Materials:	**Grading:**	**Miscellaneous:**
❑ Taped textbooks or other class material. ❑ Highlighted textbooks. ❑ Special equipment: calculator, computer, word processor/spell checker, other _____ ❑ Large print books. ❑ Special paper (wide-lined, graph, etc.) ❑ Two sets of books; second one for home. ❑ Assignment sheet or planner. ❑ Behavior monitoring sheet. ❑ Other: _____	❑ Use pass/fail grading system. ❑ Use a modified scale. ❑ Give credit for partial completion. ❑ Consider effort in assigning grade. ❑ Give credit for participation. ❑ Give copies of midterms to parents. ❑ Notify special education teacher when grades drop below a C-. ❑ Other: _____	❑ Avoid timed activities. ❑ Implement preferential seating. ❑ Provide cues for staying on task. ❑ Provide a quiet place to work. ❑ Allow short breaks during assignments. ❑ Seat student next to a good role model. ❑ Provide daily check-in time with teacher. ❑ Consider Assistive Technology and Services. ❑ Other: _____.

Why Do Some Students Struggle in Your Classroom?

In explaining deficits in learning, there are weaknesses in cognitive processes that should be ruled in or ruled out through formalized assessment.

Cognitive Processes:	What it looks like in the classroom:
Auditory Processing—Perception, analysis, and synthesis of auditory stimuli.	❑ Confuses words and phrases that sound alike (e.g., "blue" with "blow" or "ball" with "bell"). ❑ Finds it hard to pick out an auditory figure from its background and it may seem that they are not listening or paying attention. ❑ Processes sound slowly and cannot keep up with the flow of conversation, inside or outside the classroom. ❑ Difficulty with phonics (decoding), spelling, and reading fluency.
Visual Perception—Recognizing the position and shape of what is seen (The "Mind's Eye").	❑ Reverses/rotates letters, jumps over words, reads the same line twice, or skip lines. ❑ Difficulty distinguishing a significant form from its background.
Short-Term Memory—Ability to hold information in immediate awareness and use it within a few seconds.	❑ Difficulty learning from lecture, listening and following directions. ❑ Cannot remember information long enough to process for comprehension and retrieval.
Long-Term Retrieval—Ability to store information and retrieve it later over extended time periods.	❑ "I know it but I can't think of it" phenomena. ❑ Demonstrate mastery of information one day and unable to recall it on test day (poor test performance/inconsistent grades).
Comprehension-Knowledge—Breadth and depth of acquired cultural knowledge and experience.	❑ Low vocabulary and reading comprehension. ❑ Difficulty in listening comprehension and in answering factual questions.
Processing Speed—Fluent performance of cognitive tasks automatically when under pressure to maintain attention.	❑ Can't process symbols fast enough to enhance decoding or comprehension. ❑ Does poorly on timed tasks.
Visual-Spatial Thinking—Perception, analysis, synthesis, and manipulation of visual stimuli.	❑ Weakness: rapid sound/symbol associations, copying tasks, and recognizing whole words.
Fluid Reasoning—Involves inductive and deductive reasoning, identifying relations, and drawing inferences.	❑ Difficulty in transfer and generalization. ❑ Poor flexibility in thinking. ❑ Low abstract problem solving.
Attention/Concentration—Ability to filter and prioritize external/internal stimuli to attend.	❑ Poor task/work completion. ❑ Assignments are partially completed, often items are skipped. ❑ Seems disorganized during instruction and practice.
Working Memory—Ability to temporarily store and perform a cognitive operation on a set of information.	❑ Problems with sequencing. ❑ Not flexible in use of strategies to solve problem/task. ❑ Attempts task but only understands a part of it. ❑ Seems unmotivated.
Cognitive Academic Language Proficiency—Proficiency in academic situations and those aspects of language that emerge from formal schooling.	❑ Understands more than can express. ❑ Difficulty in receptive and expressive language. ❑ Language "different" rather than language "disability". ❑ Poor vocabulary knowledge.

Mather, Nancy, Wendling, Barbara J., & Woodcock, Richard W. Essentials of WJ III Tests of Achievement Assessment. John Wiley & Sons, Inc. New York, 2001, pp. 111-112

Put Reading First: The Research Building Blocks of Reading Instruction, Second Edition, June 2003 [On-Line, PDF] http://www.nifl.gov/partnershipforreading/publications/k-3.html, page 2

Reading Fluency, Mather, N., & Goldstein, S. (2001). [On-Line] http://www.ldonline.org/ld_indepth/reading/reading_fluency.html

Silver, Larry B., M.D. A Look at Learning Disabilities in Children and Youth, [On-Line] http://www.ldonline.org/ld_indepth/reading/reading-2.html

Science
Standards I and II
Activities

How Big Are Earth, Sun, and Moon?

Science Standard I:
Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Objective 1:
Describe the appearance of Earth and the moon.

Intended Learning Outcomes:
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math IV-1

Science Standard I

Objective 1

Connections

Background Information

A star is a ball of hot, burning gases. The sun is the closest star to Earth (about 150,000,000 km/93,000,000 miles) away. Therefore, it looks bigger and brighter to those on Earth than other stars.

Earth spins on an imaginary line called an axis. A complete rotation takes about 24 hours (one day). The part of Earth facing the sun has daylight; the part facing away from the sun has night.

Earth revolves around the sun as it rotates on its axis.

One complete orbit, or revolution, of Earth around the sun takes about 365 days (one year). It actually takes 364 1/4 days to revolve around the sun. One-fourth of a day is equal to six hours. If you take a 24 hour day and divide it by six, you get four. Therefore, and extra day is added to the calendar every four years. Every fourth year is a leap year, which has 366 days.

The moon's diameter is about one-fourth that of Earth's.

Invitation to Learn

Pass out white boards and markers to each student. Have the students draw what they think exists in space. Walk around the room and assess each drawing. Make a list on the chalkboard of all the different responses. Students erase boards and draw what they think is in the center of our solar system. Again, walk around the room and make assessments. Discuss. Students erase boards and draw what else is out there besides Earth, the moon, and stars. Discuss.

Instructional Procedures

Materials

For each group

- ❑ Clear glass or beaker

For each student

- ❑ White boards
- ❑ Markers
- ❑ Eraser
- ❑ Water
- ❑ Rubbing alcohol
- ❑ Teaspoon oil
- ❑ Moon Boxes: clay, books, sun, moon, Earth orbit, Styrofoam ball three inches in diameter, flashlight, and hand lens or magnifying glass
- ❑ Compass

Where is the sun located in the solar system?

1. Pass out a beaker or clear glass to each group.
2. Fill the beaker half full with water.
3. Tilt the beaker slightly. Gently fill the beaker with rubbing alcohol. The alcohol is less dense than the water and therefore will float on the surface of the water. Slowly add a teaspoon of oil to the beaker. The oil will form spheres where the water and alcohol meet.
4. Questions to ask and discuss: What motion does Earth go through once a year? (It revolves around the sun once every year) Since Earth revolves around the sun, is Earth or the sun the center of the solar system? (Sun.) If the oil spheres represent the planets in the solar system, where would the sun be located? (In the center of the beaker.) How many planets are in our solar system? (Nine.) Like Earth, all the planets revolve around the sun. Do you think it takes all the planets one year (365 days) to make this journey? (No.)

Materials

- ❑ White paper
- ❑ 5 1/2 yds. of yarn
- ❑ Sidewalk chalk
- ❑ *Earth and Moon Diagram*

How big is Earth, moon, and sun?

1. Ask students to estimate the diameter of Earth, sun, and moon.
2. Explain to the students that you are going to help them to understand the sizes of Earth, sun, and moon by making a "scale model;" a model that will be smaller than the real thing, but that will maintain the size relationship between the three objects.
3. Using the *Earth and Moon Diagram* (p. 3-17), show them a circle of paper that is 4"(10 cm) in diameter. This will represent Earth. Now, ask them how big a paper circle you need to represent the moon. Have the students cut out a circle the size they think the moon should be and compare their estimates.
4. Give them the approximate diameters of the real moon and Earth.

   moon, about 2,000 miles (3,250 km)

   Earth, about 8,000 miles (13,000 km)

   Ask again, "For a 4" paper Earth, how big should we make our paper moon?" If they don't see the relationship, point out that 2,000 miles is one-fourth as big as 8,000 miles. Therefore, the paper moon should be 1" (2.5 cm) in diameter.
5. Cut out a paper moon of that size.

6. Have students estimate how big to make the sun before reviewing the size of the actual sun.
7. Approximate diameter of the real sun.

   sun, about 800,000 miles (1,300,000 km)

   Have them change their estimates based on this information.
8. How many times bigger will the paper sun need to be than the paper moon of 1"?

   800,000 divided by 2,000

   is the same as

   800 divided by 2 = 400

   So....if your paper moon is 1", the paper sun will be 400" (1,000 cm).

   400" divided by 36" gives you about 11 yards

   You don't have paper big enough to make that circle! Instead, use 5 1/2 yards of string to draw an 11 yard circle with chalk on the playground. Tie one end of the string to a piece of chalk. Have another student hold the other end. The student with the chalk will pull the string tight and draw a circle on the cement. Then, trace the paper Earth and the paper moon with chalk for comparison.

Possible Extensions/Adaptations/Integration

Estimation

1. Pass out gray or white Styrofoam balls and hand lens to each group. Have students make observations. Explain to the students this represents the moon. The moon is a gray sphere covered with many craters. Read *What the Moon Is Like* by Franklyn M. Branley. Discuss what the moon is like.
2. Color, cut out, and assemble *ABC Moon Book* (p. 3-8) created by Susan Tenhor and Colleen Davis.

Assessment Suggestions

1. Have students use clay from their moon boxes and make a scale model of Earth and the moon. (Remember, the moon is 1/4 the size of Earth.)
2. Pass out white boards again and have them draw answers to the same questions asked at the beginning of the lesson.

Additional Resources

The Moon Book, by Gail Gibbons; ISBN 0613128877

Handshake in Space, by Sheri Tan; ISBN 1568995350

One Giant Leap, by Dana Meachen Rau; ISBN 0613515765

What the Moon is Like, by Franklyn M. Branley; ISBN 0064451852

Family Connections

- Conduct the same experiment at home (water, rubbing alcohol, and oil).
- Check out a moon box to share with family.

Moon Boxes

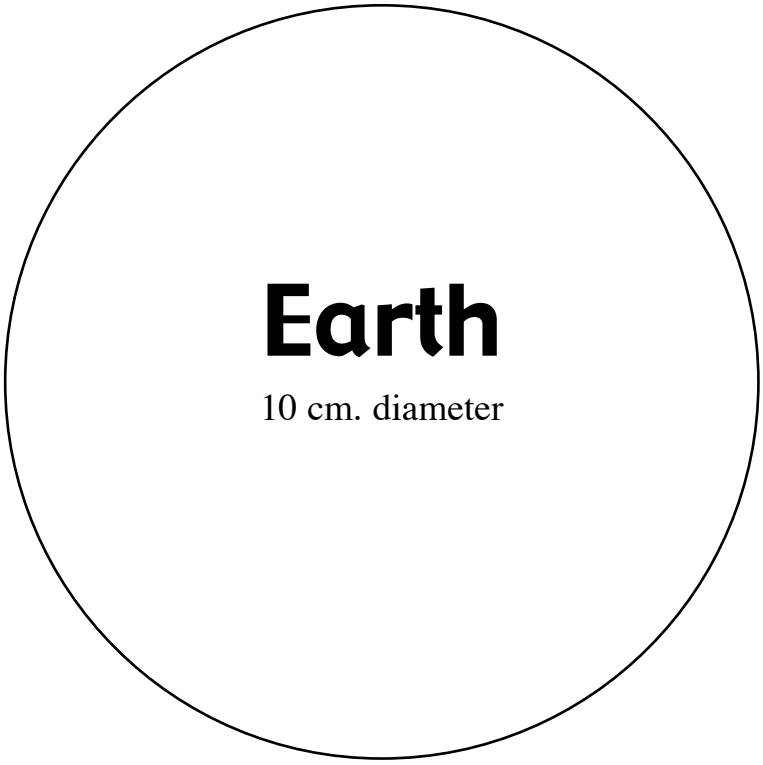
- Bowl with flour
- Rocks of different sizes
- Flashlight
- Mirror
- Styrofoam ball
- *My Book About The Moon* student activity book (p. 3-15)

How many people have walked on the moon? (Twelve astronauts have walked on the moon, the last in 1972.)

Here are the names of those astronauts listed chronologically by the date of their walk.

July 20, 1969	**Nov. 19, 1969**
Neil Armstrong Edwin "Buzz" Aldrin	Charles (Pete) Conrad Alan Bean
Feb. 5, 1971	**July 30, 1971**
Alan Shepard Edgar Mitchell	James Irwin David Scott
Apr. 21-23, 1971	**Dec. 11-13, 1972**
Charles Duke John Young	Harrison Schmitt Eugene Cernan

Earth and Moon Diagram



ABC Moon Book

By Susan Tenhor
and Colleen Davis

A is for astronauts like Neil Armstrong, the first man to walk on the moon.

B is for blue moon. When there are 2 full moons in one month, The second one is called a blue moon.

C is for craters on the moon, believed to be created by meteorites crashing onto the moon's surface.

D is for dust, which formed on the moon when meteorites crashed into the moon, and broke up pieces of the moon's surface.

E is for Earth, our moon's planet. It is four times larger than our moon. From space, it looks blue and white because of its atmosphere.

F is for the far side of the moon. It's the side that never faces Earth.

G is for gravity, the force that pulls objects in space toward each other. Because the moon is smaller than Earth, it has less gravity.

H is for high and low tides. The moon's gravity affects the level of our oceans.

I is for illuminate. The moon is illuminated by the sun's light.

J is for July, 1969, when astronauts Armstrong and Aldrin walked on the moon.

K is for Kangaroo hops that astronauts can take on the moon because of the low gravity.

L is for the lunar eclipse. This is when the moon is near its full phase and is blocked in Earth's shadow.

M is for moon, a natural, rocky object that goes around a planet. Some planets have many moons.

N is for new moon. This is when the sun is shining mostly on the side of the moon that faces away from Earth.

O is for orbit, the path an object in space follows as it revolves around another object. The moon orbits Earth. Earth orbits our sun.

P is for phases. A phase is part of a cycle. There are four main phases of the moon.

Q is for quiet. Because the moon has no atmosphere, there is no rain, snow or wind and is always quiet.

R is for rotation, the spinning of an object (planet) around its own axis. The moon only rotates every 28 days (about once a month), Earth rotates every 24 hours (once a day).

S is for sphere. Spheres are round like balls. The moon and Earth are both spheres.

T is for telescope. We use telescopes to view the moon and our night sky.

U is for universe. Earth and moon are part of our vast universe.

V is for volcanoes. You can see mountains made from volcanoes and dark patches made by lava on our moon's surface.

W is for waning and waxing crescent moons.

X is for extreme temperatures. Day temperatures on the moon reach 230° F. Night temperatures drop to –292° F.

Y is for year. In one Earth year, the moon goes around Earth 12 times.

Z is for astronaut Buzz Aldrin. He and Neil Armstrong were the first men to land on the moon.

My Book About The Moon

Student Activity Book

Name_____

Dear Parent,

Your child has checked out a Moon Box with materials included to conduct some science experiments at home. This kit is provided so that families may be actively involved in doing science together. This kit may be checked out for two days, and then needs to be returned to the classroom.

Please be sure that the flashlight, mirror, Styrofoam ball, bowl of flour, and small rocks are returned with the kit. Your child may keep the *My Book About The Moon* student activity book.

Suggestions for using the kit:

- Reserve 30 minutes for the kit activities during the week.
- Listen to each other.
- Offer assistance only when needed.
- Ask questions such as. . . .
  - **What** happened?
  - **Why** do you suppose that happened?
  - **Where** have you seen this happen before?
  - **What** do you think would happen if . . . . ?
- Accept answers your child gives.
- Enjoy the time together!

Moon Box Activities

Moon Phases

- Begin with the Styrofoam ball and pencil. Hold the ball with the X facing you.
- Have someone on the other side of the ball shine the flashlight on it. Do this in a really dark room. You will not see the lighted half of the ball. It is a new moon. Stand on one spot.
- Turn your body counter clockwise a bit while holding the ball in front of you and a bit above your head—always keeping the X toward you. You will see a small part of the lighted half. It is a crescent moon.
- Keep turning, and soon you will see more of the lighted half. It is the a first quarter moon.
- Keep the ball above your head and turn some more. Soon you will see all the lighted half of the ball. The moon is full.
- Keep turning and you will see less and less of the lighted part of the ball. You will see one quarter of it—the third quarter moon. Then you'll see a thin crescent.
- When you have turned all the way around, you have seen all the phases of the moon.

Day and Night

Materials: ball, flashlight, and a sticker placed on your ball

- Put the sticker on your ball to indicate where you live.
- Place the ball on a table or have someone hold it.
- Shine the flashlight on the ball where the sticker is. Is it day or night?
- Turn the ball counterclockwise until the sticker is away from you. Is it day or night?

Draw a picture of what you just did.

How Moon Craters are Made

Materials: Bowl of flour and rocks.

- Smooth out the flour with your hand.
- Drop a rock from different heights and record results.

Height in inches				
Draw a picture of your crater.				

What did you learn?_____

What is moonlight?

Materials: flashlight, mirror, Styrofoam ball, three people

- Make a triangle using your three helpers.
- One person will hold the mirror. (moon)
- One person will hold the Styrofoam ball. (Earth)
- One person will hold the flashlight. (sun)
- Turn out the lights. Observe the ball.
- Turn on the flashlight and shine the light on the mirror. Hold the mirror so the light is reflected to the ball.
- The moonlight we see from Earth comes from the sun.

Make a drawing of what you did.

Moon Observations

Science Standard I

Objective 2

Connections

Science Standard I:

Students will understand that the shape of Earth and the moon are spherical and that Earth rotates on its axis to produce the appearance of the sun and moon moving through the sky.

Objective 2:

Describe the appearance of Earth and the moon.

Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:

Math III; Visual Arts I-1; Language Arts I-1

Background Information

Because the moon rotates once on its axis every time it travels around Earth, we see only one side. The far side was not seen until the 1960's, when spacecraft were sent to orbit the moon and pictures were taken. One half of the moon is always fully illuminated and one half is always in shadow. The amount of illumination or shadowed areas we see depends on the position of Earth, the moon, and the sun.

The surface of the moon has mountains, valleys, craters, and plains. The moon has no atmosphere, but it does have traces of ice, possibly from an object that hit the moon.

As a satellite, the moon revolves around Earth. The moon actually takes 27 1/3 days to orbit Earth. This time is known as a sidereal month. However, it takes 29 1/2 days for a complete cycle of the moon phases to occur, when measured from new moon to new moon. This period is known as the synodic, or lunar month.

The moon rotates on its axis only once during it revolution around Earth.

The moon reflects sunlight. We see only the lighted part of the moon that faces Earth.

The moon appears to change shape because the sun lights the same side of the moon as it rotates and revolves around Earth, but varying portions of the lighted side face Earth at different times. The phases of the moon include the new moon, crescent moon, half moon, and full moon.

Science Language Students Should Use

model—small copy of something

orbit—the path followed by a heavenly body going around another

sphere—a space figure that has the shape of a round ball. A three-dimensional figure that has the shape of a ball.

moon—heavenly body that revolves around the Earth

axis—a real or imaginary straight line about which something turns

rotation—to turn around a center point or axis (spinning)

revolution—to move in an orbit while rotating to move around an object while rotating (spinning)

Invitation to Learn

Pass out *Word Cards* (p. 3-22) and *Picture Cards* (p. 3-23) to pairs of students. Have students match *Word Cards* to *Picture Cards*.

Instructional Procedures

1. Read *The Moon Seems to Change* by Franklyn M. Branley.
2. Work in groups of two or four. Give each group a Styrofoam ball, marker, and a pencil. Stick the pencil into the ball. Push it in far enough so the Styrofoam ball doesn't fall off. Draw a line all around the ball with the marker or use an elastic. Make a big X on one half of the ball.
3. The Styrofoam ball will be the moon, and your head will be Earth. The flashlight is the sun.
4. Hold the ball a bit above your head so that you have to look up to see it. Turn it so that the X is toward you. Have someone on the other side of the ball shine the flashlight on it. Do this in a dark room—the darker the better. You cannot see the lighted half of the ball. It is a new moon. Stand on one spot. Turn your body counter clockwise a bit while holding the ball in front of you and a bit above your head. Always keep the X toward you. You will see a small part of the lighted half. It is a crescent moon. Keep turning, and soon you will see more of the lighted half of the ball. It is a first quarter moon. Keep the ball above your head and turn some more. Soon you will see all the lighted half of the ball. The moon is full. Keep turning and you will see less and less of the lighted part of the ball. You will see one quarter of it—the third quarter moon. Then you'll see a thin

Materials

- ❑ *The Moon Seems to Change*
- ❑ *Word Cards*
- ❑ *Picture Cards*
- ❑ Styrofoam balls 3"
- ❑ Pencil
- ❑ Marker
- ❑ Flashlights
- ❑ Four Oreo cookies per student and a plastic knife or popsicle stick
- ❑ Chart paper
- ❑ *Phases of the Moon Animated Flip-book*

crescent. When you have turned all the way around, you have seen all the phases of the ball—the phases of the moon.

5. Color and cut out the *Phases of the Moon Animated Flip-book* (p. 3-24).

Possible Extensions/Adaptations/Integration

Read *Footprints on the Moon* or any other book about lunar modules. Discuss with the students how the lunar module *Eagle* was used to take astronauts to the moon's surface. Tell the students the lunar modules were used to carry astronauts from the command module to the surface of the moon. Then invite them to draw geometric lunar modules according to the directions below (review the italicized words). Give each student a ruler and a sheet of drawing paper. Instruct students to draw their modules as you read each step one at a time. Have students add details that show their modules being used for lunar exploration. Then, have them color their out-of-this-world scenes.

1. Draw a *trapezoid* in the center of your paper so that the top is the longest side.
2. Draw a *diamond* (*rhombus*) showing a point touching the top center of the trapezoid.
3. Draw a *hexagon* to the left of the diamond, each showing a side touching the trapezoid.
4. Draw two *triangles* to the right of the diamond, each showing a side touching the trapezoid.
5. Draw a small *circle* at the lower end of each rectangle.

Assessment Suggestions

- Give each student four Oreo cookies and a plastic knife. Students make a chart showing New Moon, Waxing Crescent, First Quarter, Full Moon, Third Quarter, and Waning Crescent. With their knives they scrap away the frosting to represent each phase.
- Have students write the phases of the moon on their *Phases of the Moon Animated Flip-books*.
- Make a miniature matchbook with pictures and vocabulary words.
  1. Fold a sheet of paper (8 1/2" x 11") in half like a hot dog.
  2. Cut the sheet in half along the fold line.
  3. Fold the two long strips in half like hot dogs, leaving one side 1/2" shorter than the other side.

4. Fold 1/2" tab over the shorter side on each strip.
5. Cut each of the two strips in half, forming four halves. Then cut each half into thirds making 12 miniature matchbooks.
6. Glue the 12 small matchbooks inside a hamburger folded piece of construction paper.

Additional Resources

Book

The Moon Book, by Gail Gibbons; ISBN 061312887

The Moon Seems to Change, by Franklyn M. Branley; ISBN 0690045859

Footprints on the Moon, by Alexandra Siy; ISBN 1570914095

CD

America's History Through The Twentieth Century (One Small Step For Man...) Classroom Classics (801) 489-5225

Web site

http://www.classroomclassics.com

Family Connections

Check out Moon Box to and share with family.

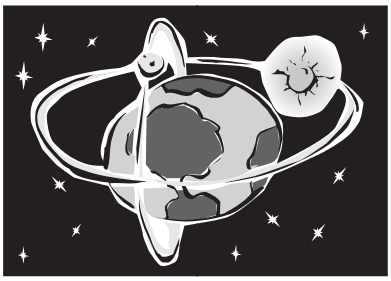
Flip book to share with family.

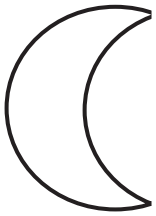
Oreo chart showing moon phases.

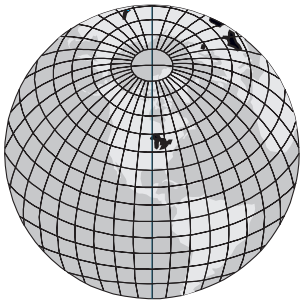
Word Cards
Earth and Moon

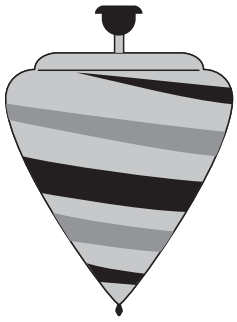
model small copy of something	**moon** heavenly body that revolves around the Earth
revolution to move in an orbit while rotating (spinning) around an object	**orbit** the path followed by a heavenly body going around another
axis a real or imaginary straight line about which something turns	**appearance** the way something looks
sphere a space figure that has the shape of a round ball	**rotation** to turn around a center point or axis (spinning)

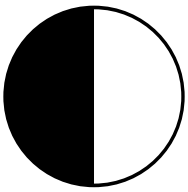
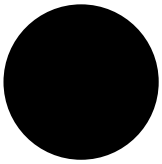
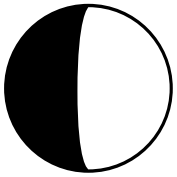
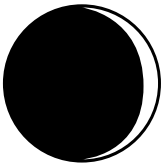
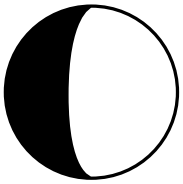
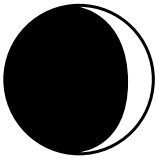
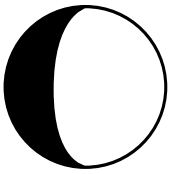
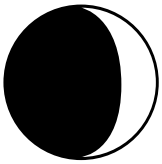
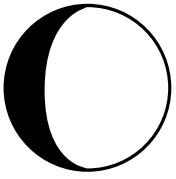
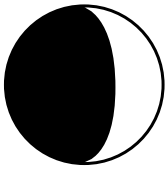
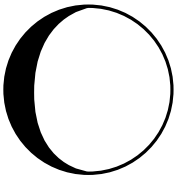
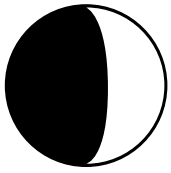
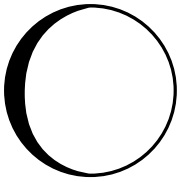
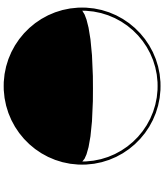
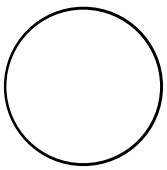
Picture Cards
Earth and Moon

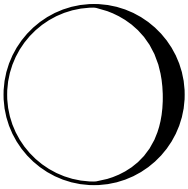
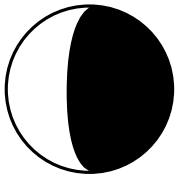
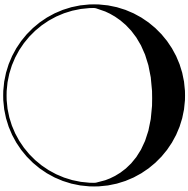
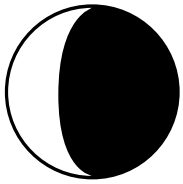
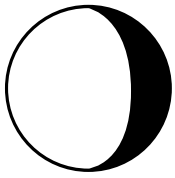
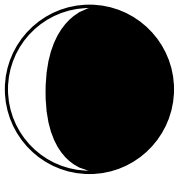
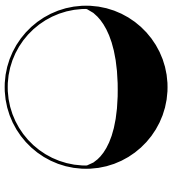
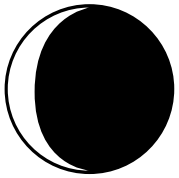
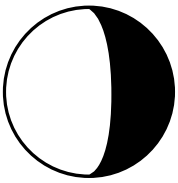
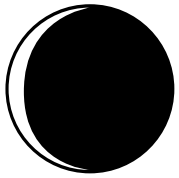
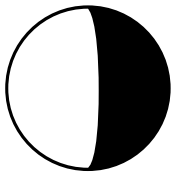
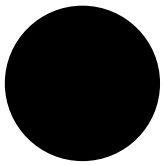
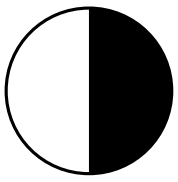
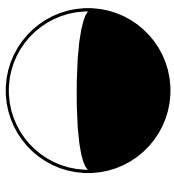


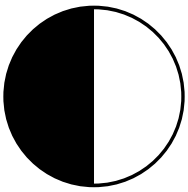
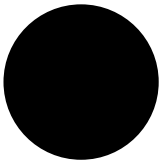
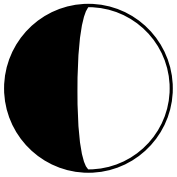
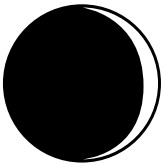
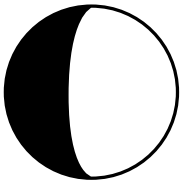
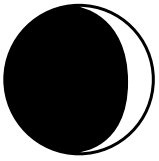
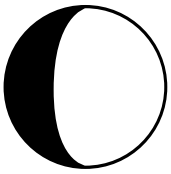
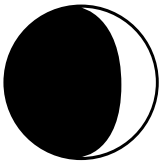
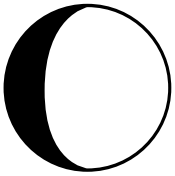
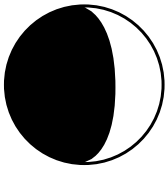
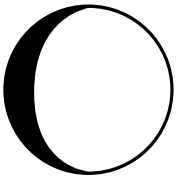
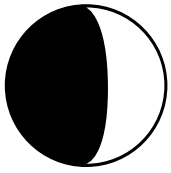
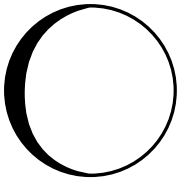
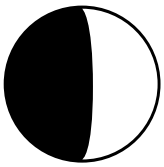
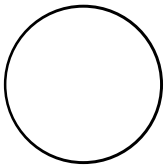


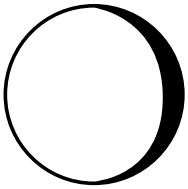
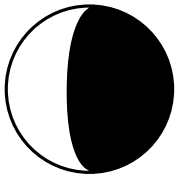
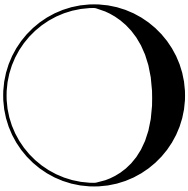
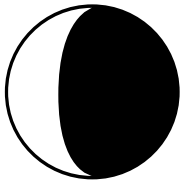
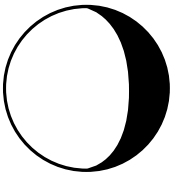
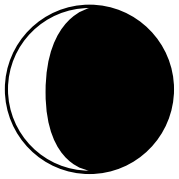
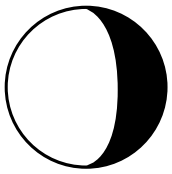
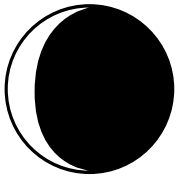
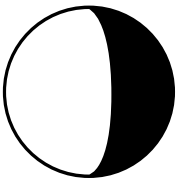
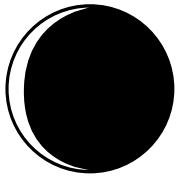
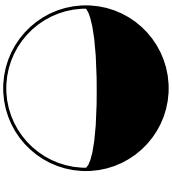
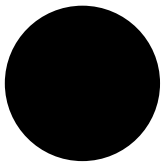
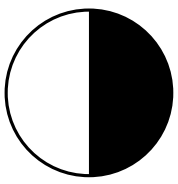
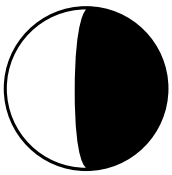




Phases of the Moon Animated Flip-book			8	_____	
1	_____		9	_____	
2	_____		10	_____	
3	_____		11	_____	
4	_____		12	_____	
5	_____		13	_____	
6	_____		14	_____	
7	_____		15	_____	

16	_____		24	_____	
17	_____		25	_____	
18	_____		26	_____	
19	_____		27	_____	
20	_____		28	_____	
21	_____		29	_____	
22	_____		**Instructions:** 1. Write the names of the moon phases on the correct cards. 2. Cut out numbered sections. 3. Put the cards in numerical order and staple book together. 4. Flip the pages with your thumb to see the moon shape change through each phase.		
23	_____				

Phases of the Moon Animated Flip-book			8	First Quarter	
1	New Moon		9	Waxing Gibbous	
2	Waxing Crescent		10	Waxing Gibbous	
3	Waxing Crescent		11	Waxing Gibbous	
4	Waxing Crescent		12	Waxing Gibbous	
5	Waxing Crescent		13	Waxing Gibbous	
6	Waxing Crescent		14	Waxing Gibbous	
7	First Quarter		15	Full Moon	

16	Waning Gibbous		24	Waning Crescent	
17	Waning Gibbous		25	Waning Crescent	
18	Waning Gibbous		26	Waning Crescent	
19	Waning Gibbous		27	Waning Crescent	
20	Waning Gibbous		28	Waning Crescent	
21	Waning Gibbous		29	New Moon	
22	Third Quarter		**Instructions:** 1. Cut out numbered sections. 2. Put the cards in numerical order and staple book together. 3. Flip the pages with your thumb to see the moon shape change through each phase.		
23	Waning Crescent				

Going on a Living and Nonliving Hunt

Science Standard II

Objective 1

Connections

Science Standard II:
Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1:
Classify living and nonliving things in an environment.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math V-1; Art IV-3

Background Information

Your students may have trouble distinguishing between living, nonliving, and once-living things. Children may consider everything that moves to be alive, including cars and clouds. Often children pretend that objects are alive so that they can talk to them. Children also have difficulty comparing once-living objects with objects that have never lived. Living and nonliving are scientific terms. Children are accustomed to hearing living or dead. By exploring various objects and organisms, your students can begin to distinguish between things that are living, things that were once-living, and things that are nonliving.

Characteristics of living things are: able to grow, reproduce (make more organisms like itself), eat and drink, move, and are made of cells. To be alive, an object must do *all five*.

Instructional Procedures

Materials

- ❑ One paper bag per group

1. Give each group a bag and have them go outside and collect ten items.
2. Have each group dump their bag on their desks and sort their items.
3. Discuss how each group has sorted their items.
4. Are there any other ways to sort them?
5. Read *Living and Nonliving* by Angela Royston.
6. Have groups sort their items again.
7. Discuss characteristics of living and nonliving things.

8. Graph results.
9. Create a compare and contrast Venn Diagram.

Possible Extensions/Adaptations/Integration

- Clean desks. Sort items into living, nonliving, and once-living. Put a small living animal (cricket, ant, beetle, ladybug, etc.) that is in a small clear box in a few desks.
- Living and Nonliving boxes.
- Provide magazines and have students cut out pictures of living, nonliving, and once-living things. Glue on a large piece of paper to make a collage.
- Sort *Picture Cards* (p. 3-30) into living, nonliving, and once-living groups.

Assessment Suggestions

- Make observations as students are working in their groups.
- Check collages for accuracy.

Additional Resources

Books

Living and Nonliving, by Angela Royston; ISBN 1403408548

What Is A Living Thing?, by Bobbie Kalman; ISBN 0613123352

Living Things, by Adrienne Mason; ISBN 0613260422

It's Alive!: All About the Living World, by Sunnie Kim; ISBN 1891418203

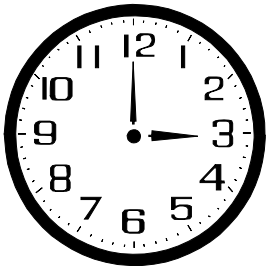
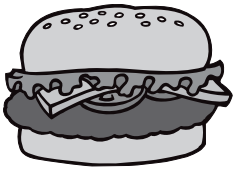
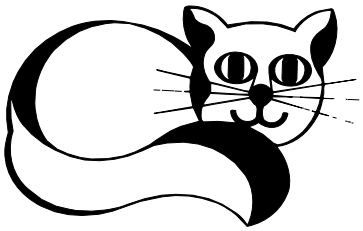
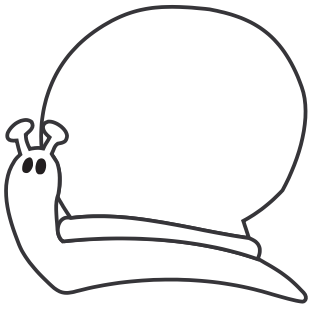
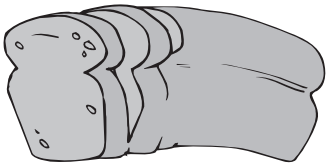
Web site

Is It Alive? www.newbridgeonline.com

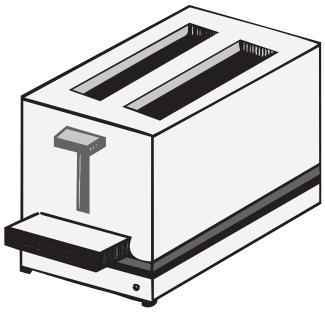
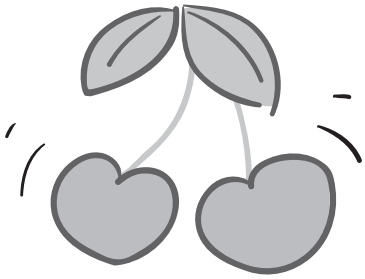
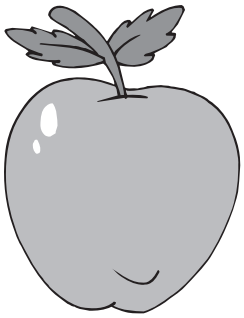
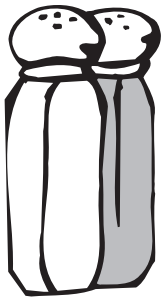
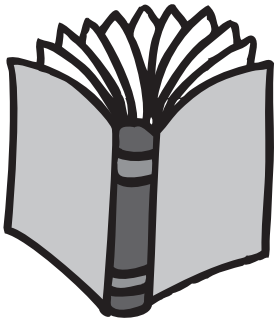
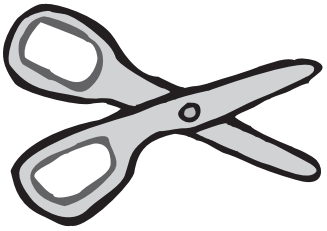
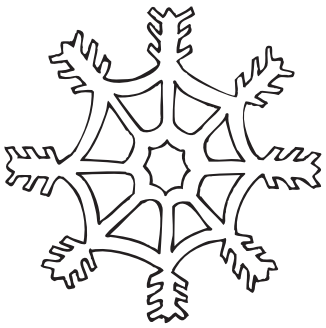
Family Connections

- Students share their collage pictures with their families.
- Students look for living, nonliving, and once-living things in their homes.

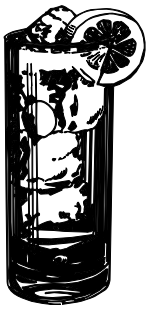
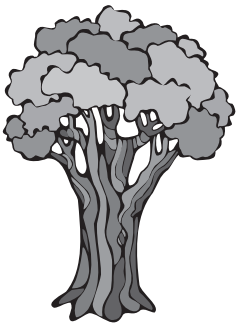
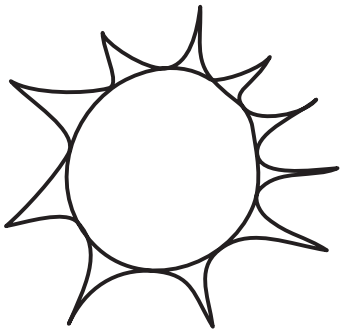
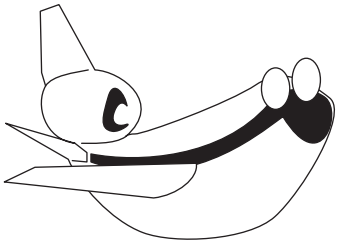
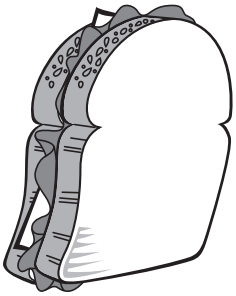
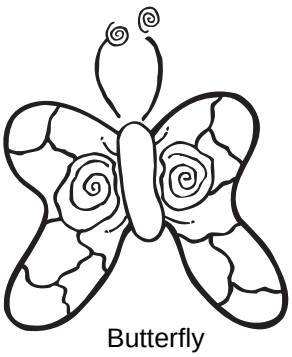
Picture Cards
Living and Nonliving

 Tiger	 Clock	 Hamburger
 Cat	 Dog	 Snail
 Fish	 Bread	 Cake
 Phone	 Sound	 Banana

Picture Cards
Living and Nonliving

 Hair	 Toaster	 Cherries
 Apple	 Salt and Pepper Shakers	 Soup
 Book	 Scissors	 Snowflake
 Computer	 Seahorse	 Detective

Picture Cards
Living and Nonliving

 Water	 Fire	 Tree
 Sun	 Rain	 Snowman
 Car	 Airplane	 Bee
 Cow	 Sandwich	 Butterfly

Cells

Science Standard II:
Students will understand that organisms depend on living and nonliving things within their environment.

Objective 1:
Classify living and nonliving things in an environment.

Intended Learning Outcomes:
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math IV-1

Science Standard II

Objective 1

Connections

Background Information

Cells are the building blocks of people and other living things. Cells are tiny, but you can see them through a microscope. Cells make up your muscles, skin, stomach, and every other part of you. Your cells are part of you, and they are alive, too. They need healthy food and oxygen so they can grow and divide to make more you.

Invitation to Learn

Read *What's Smaller Than a Pygmy Shrew?* by Robert Wells or any other book about cells.

Instructional Procedures

1. Ask students: What do you need to grow? (e.g., food)
2. With the groups, pour a yeast packet into a Ziploc bag. Ask: Is yeast a living thing? How can we find out? Record ideas. (Yeast is a one-cell fungus. It grows by dividing or pinching off new cells.)
3. Ask: If yeast is alive, will this yeast grow all alone? Leave your bagged yeast to observe.
4. Ask: What might you give yeast to make it grow? When kids say food, let groups add sugar to their bags. Ask: Will yeast and sugar grow alone? Make class yeast and sugar bag to observe.
5. Ask: Is water food? (No, but it's necessary for cells to function.) What will happen if we just add water to yeast? Make a class yeast and water bag.

Materials

For the class:

- ❑ Three 1-pint plastic Ziploc bags
- ❑ Three packets dried yeast (1 pkg.=2 1/4 tsp.)

For each group:

- ❑ 1-pint plastic Ziploc bag
- ❑ Packet of dried yeast (2 1/4 tsp.)
- ❑ Permanent marker

For the class and each group:

- ❑ 1 tsp. sugar
- ❑ 1/4 cup warm water (110 degrees)

For each student:

- ❑ *A Yeast Feast* worksheet

6. Ask: Do you need water to survive? If yeast is alive, does it need water? Let students add water to their yeast-sugar mix.
7. Have students observe and draw the yeast action. (Water activates yeast. Growing cells give off carbon dioxide gas, which inflates bags.)
8. Continue to observe. Ask: Is yeast alive? What is your evidence?

Possible Extensions/Adaptations/Integration

Pizza Party

Make pizza dough. Ask: What makes dough rise? (Carbon dioxide gas from the feeding yeast cells.)

Pizza Crust

6 cups flour	2 tsp. salt
2 cups water (warm)	4 Tbsp. yeast
4 Tbsp. oil	

Mix flour and salt. Dissolve yeast in warm water. Add oil to yeast mixture. Add yeast and oil mixture to the flour. Add 1/4 more cup of water and mix. Knead to smooth consistency. Let rise one hour. Grease four pizza pans and spread dough. Put pizza sauce, meat, and cheese on top. Bake at 425 degrees for 20 minutes.

Animal Cell Visual

Fill a five gallon glass fish tank with water-filled balloons. The tank represents the tiny part of an animal's body and the balloons represent its cells. You place the water filled balloons in the tank until the tank is full. The balloons should be tightly packed together with very little space between them. Then you pour water into the tank, over the balloons to cover them. Explain that in a living animal, fluid keeps the cells alive.

Plant Cell Visual

Cut a small square out of an onion, pulling away a thin film of the onion skin with a pair of tweezers, and pressing this onto a windowpane. The students can see the cells with a magnifying glass. This helps the students see that plant cells are not soft and flexible like animal cells and that they have a tough outer wall which helps them keep their shape. Plus, some plant cells are much bigger than animal cells, which makes them easier to see.

Look at different cells under a microscope.

Assessment Suggestion

- Check students' *A Yeast Feast* worksheet (p. 3-36).

Additional Resources

Books

I Know My Cells Make Me Grow, by Kate Rowan; ISBN 0744572347

The Reason For a Flower, by Ruth Heller; ISBN 0804566534

What's Smaller Than a Pygmy Shrew?, by Robert Wells; ISBN 0807588377

Web sites

http://www.cellsalive.com/index.htm

http://www.enchantedlearning.com/subject/animals/cells/

Family Connections

- Go on a yeast hunt in your kitchen. What things contain yeast? What food recipes use yeast as an ingredient? Make a pizza together.

Name _____

A Yeast Feast

How can YOU discover if yeast is a living thing?

Think About It

1. What do you think? Is yeast a living thing? ___yes ___no
2. How could you find out? _____

   _____

   _____
3. What are some things that all living things need? _____

   _____

   _____

What To Do

1. Pour the yeast into the Ziploc bag.
2. What will you add to find out if yeast is alive? _____

   _____

   _____
3. Seal the bag. Mark the level of the yeast at the start.
4. Observe, mark the level, and draw what happens at each observation.

Start	**After 20 minutes**	**After 40 minutes**	**After 60 minutes**

Wrap Up

1. Did the yeast grow? ___yes ___no
2. Is yeast a living thing? ___yes ___no
3. Write the reasons for your answer on the back.

Disguise! Disguise!

Science Standard II:
Students will understand that organisms depend on living and nonliving things within their environment.

Objective 2:
Describe the interactions between living and nonliving things in a small environment.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math V-1

Science Standard II

Objective 2

Connections

Background Information

Some animals are so cleverly disguised that enemies walk right past without seeing them. These disguises are part of their fight for survival. Animals whose disguises help them to avoid being discovered by their enemies will live longer and produce more offspring. Hunters can profit from disguise, too. If you can look like a dead leaf, your prey may well come within arm's reach.

Invitation to Learn

Pass out white boards or paper and have students draw or write how animals protect themselves in nature. Discuss what camouflage means (how animals disguise themselves by blending into their surroundings).

Instructional Procedures

1. Read a book about camouflage to the class.
2. Assign partners and pass out materials.
4. Have students predict how many squares they can pick up in five seconds on green paper, recording their predictions on the *Disguise! Disguise!* record page (p. 3-40). While one student closes his/her eyes, the other student places all of the colored squares onto the large green paper.
5. When the student opens his/her eyes s/he has five seconds to grab as many colored squares as s/he can. Record number of each color grabbed.
6. Students change jobs and do again. Repeat until they have done each color once.

Materials

For each pair of students:

- ❑ One of each color (yellow, green, and brown construction paper cut into 1 inch squares placed in a bag)
- ❑ 11" x 18" sheet of yellow, green, and brown construction paper
- ❑ *Disguise! Disguise!* record page

Possible Extensions/Adaptations/Integration

Goin' on a Worm Hunt

Materials

- ❑ 100 four inch pieces of yarn of each color (green, brown, tan, red, and yellow)

For each student:

- ❑ Plastic sandwich bag
- ❑ Pencil and paper
- ❑ *Disguise! Disguise!* record page

1. Sprinkle the worms (yarn pieces) in a grassy area of the schoolyard.
2. Have students predict how many worms of each color they will pick up using the *Disguise! Disguise!* record page (p. 3-40).
3. Send students on a worm hunt, challenging them to see how many worms they can find. Allow a short period of time for students to hunt for the worms and then end the hunt.
4. Students make a tally chart of the number of worms of each color they found.
5. Discuss with the students what they learned from the hunt? What color worms were most easily found?
6. Students graph their results using a pictograph to help illustrate how well camouflage works.

Camoubug Quest

Materials

For each student:

- ❑ *Camoubugs* pattern
- ❑ Crayons, markers, or colored pencils

1. Discuss with students how some animals use patterns to help them blend in with their environment. Show pictures if available.
2. Give each student a copy of the *Camobugs* pattern (p. 3-41).
3. Challenge each student to select a "hiding" spot somewhere in the classroom. They may decide on part of the wall, floor, a cabinet, shelf, book, bulletin board, etc. Encourage students to choose a location that has a color, texture, or pattern that they are able to copy. The goal is to disguise their camoubug so well that it can "hide" in this special classroom site.
4. Have students use crayons and scissors to camouflage their bug. Have students arrange books around the edges of their desktop to keep their camouflaging work a secret.
5. When the disguise is complete, have students cut out the bug, write their name on the back, and then line up in the hallway outside the classroom. Allow one, or as many students as you would like, to go back into the room and tape their bug to their chosen spot. When all the bugs have been attached, you are ready to go on a quest for the camoubugs.
6. At this point there are several ways you can go on your quest. A student may be selected to find a bug. When s/he finds a bug the student whose name is on the back looks for the next bug. Or, you can ask the principal to come in and see how many s/he can

find in a given amount of time. Or, have students silently locate as many bugs as possible within a set period of time, and list the location on a small sheet of paper. Analyze the results of the search using tally marks on the chalkboard—one mark for each time a bug was spotted. Were there any camoubugs that could not be found?

Assessment Suggestions

- Make observations of student's ability to camouflage his/her bug.
- Students work in groups to make a diaroma of an animal hiding in its surroundings.

Additional Resources

Books

Hide and Seek, by National Geographic; ISBN 0792271025

I See Animals Hiding, by Jim Arnosky; ISBN 0606196080

What Color is Camouflage?, by Carolyn B. Otto; ISBN 0064451607

Nature's Tricksters: Animals and Plants That Aren't What They Seem, by Marie Batten; ISBN 0316083712

Web sites

http://members.aol.com/Art1234567/Camo.html

http://www.muohio.edu/dragonfly/hide/index.htmlx

http://www.howstuffworks.com/animal-camouflage.htm/printable

http://www.educationworld.com/a_tsl/archives/001/lesson0002.shtml

http://www.zoomschool.com/coloring/camouflage.shtml

Family Connections

- Students share their camoubug with their families.
- Read books about camouflage.

Name _____

Disguise! Disguise!

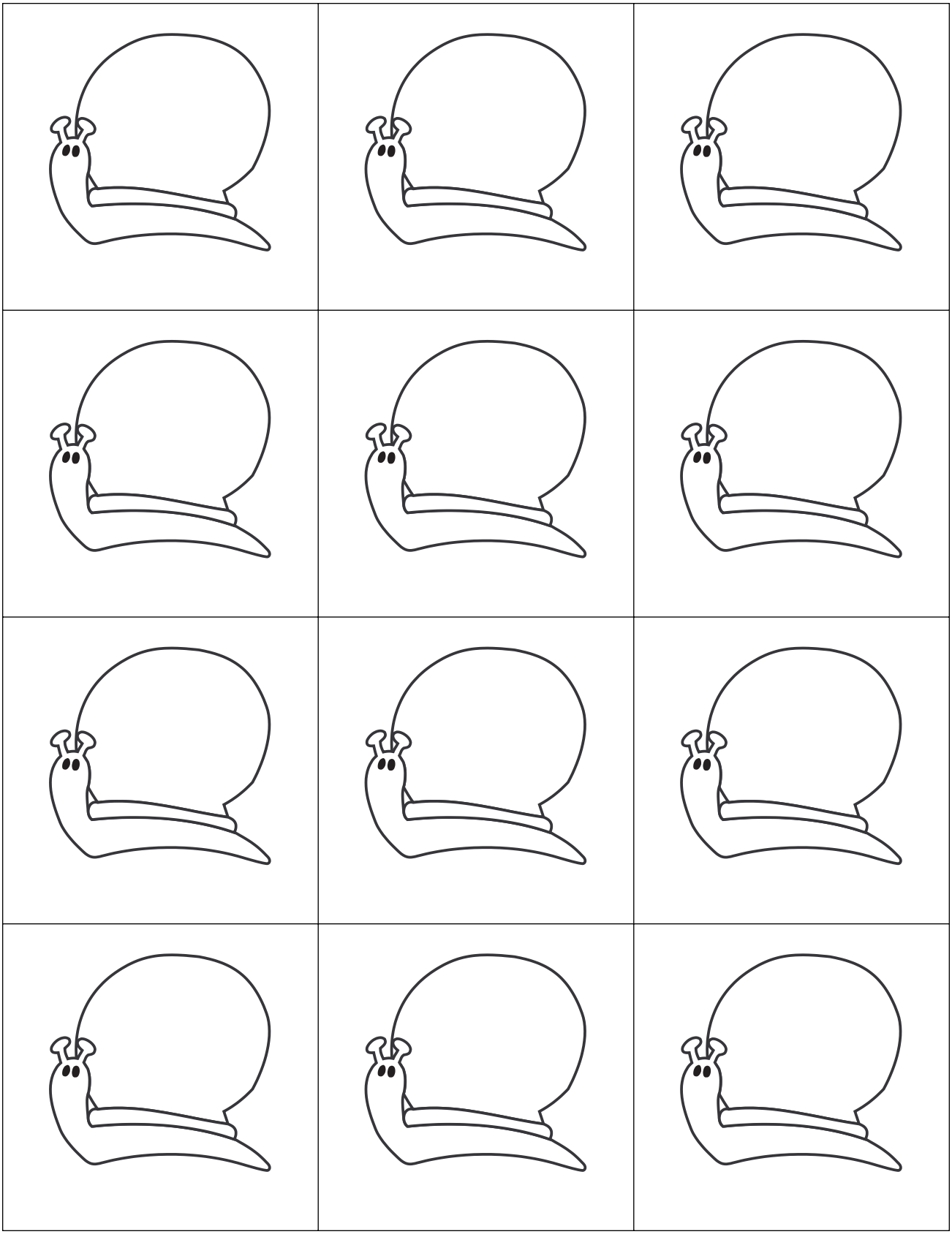
Predict how many of each color you will pick up on YELLOW paper by making tally marks by each color.	
YELLOW	
Predict how many you will pick up.	**How many did you pick up?**
Brown	Brown
Yellow	Yellow
Green	Green

Predict how many of each color you will pick up on GREEN paper by making tally marks by each color.	
GREEN	
Predict how many you will pick up.	**How many did you pick up?**
Brown	Brown
Yellow	Yellow
Green	Green

Predict how many of each color you will pick up on BROWN paper by making tally marks by each color.	
BROWN	
Predict how many you will pick up.	**How many did you pick up?**
Brown	Brown
Yellow	Yellow
Green	Green

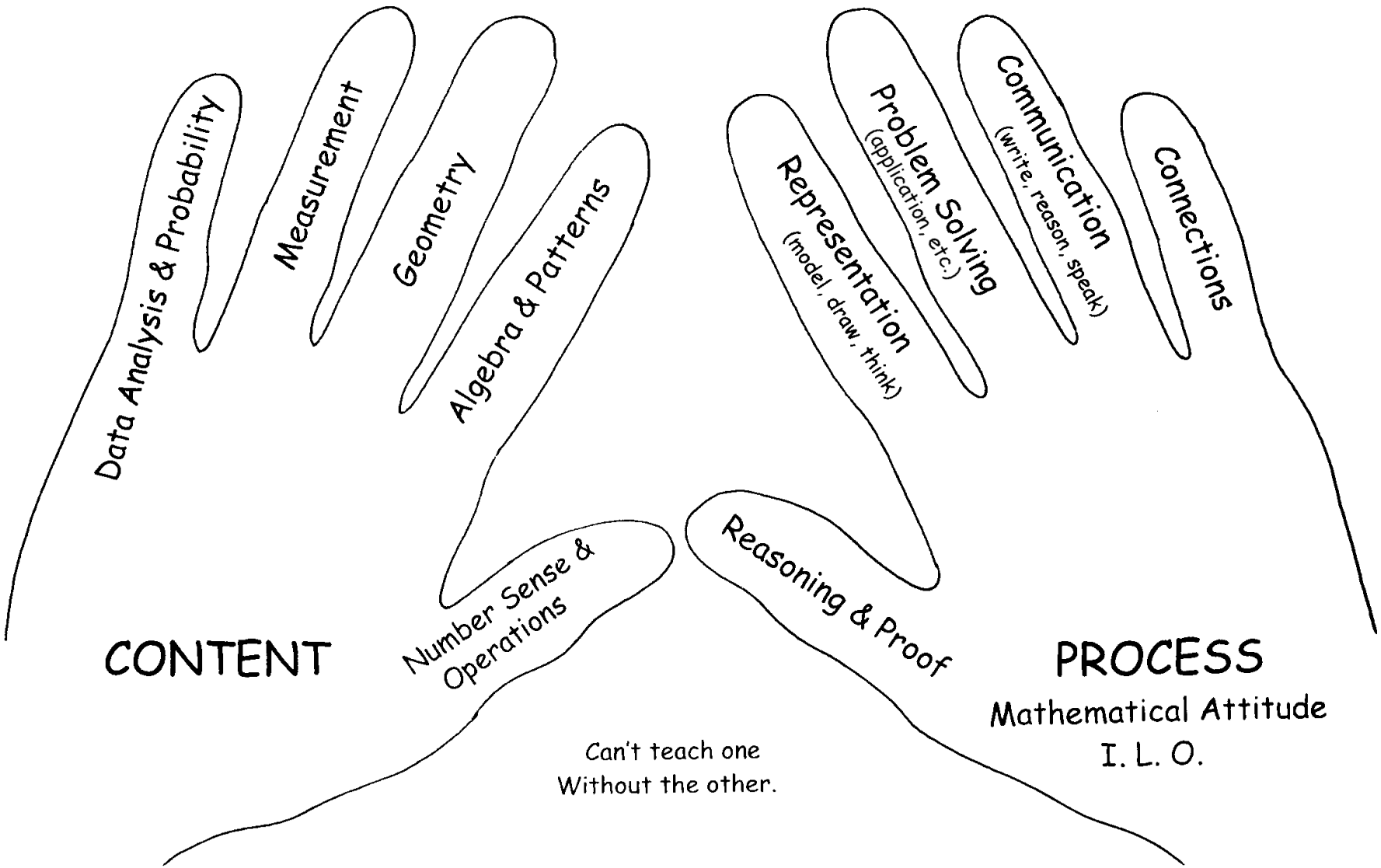
What did you learn? _____

Camoubugs



Math Standards I and V Activities

Math Standards



Expanded Form and Place Value

Math Standard I:
Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 1:
Represent whole numbers in a variety of ways.

Objective 2:
Identify relationships among whole numbers.

Intended Learning Outcomes:
3. Reason mathematically.
4. Communicate mathematically.
6. Represent mathematical situations.

Content Connections:
Math II-1

Math Standard I

Objectives 1 & 2

Connections

Background Information

This activity helps students to write numbers and understand place value up to 9,999.

Invitation to Learn

Today students will become "doctors" of numbers. They will "operate" on numbers and take them apart to better understand how they work.

Instructional Procedures

Begin by passing out envelopes of *Place Value Tents* (p. 4-7).

1. Teacher will say a number (start in the hundreds) and students must write the number in their journal (e.g., 372).
2. Students will use the *Place Value Tents* to make the number.
3. Pull the number apart and write the number in expanded form.
4. Ask students what they notice about the numbers.
5. Give students another number out loud (e.g., 4,906). Students write the number and show the number with their place value tents. Take the number apart and write the expanded form.
6. Ask the students to make their number ten more. They may check with their partner to see if they have the same number. Write it in expanded form.

Materials

- ❑ *Anno's Magic Seeds*
- ❑ *Place Value Tents* (made from cardstock)
- ❑ Math journal
- ❑ Pencil
- ❑ *Place Value Strips*
- ❑ Dice—three per two students: red, white, and green

7. Make the number 100 less, each time writing the number in expanded form. Ask students what connections they can make by making their number 100 more or less?
8. Make their number 1,000 more, 1,000 less. Notice if students start over each time or if they work with the number they already have set up.

Have students write the patterns and connections they found during the activity in their journal. Also have them explain how to add or subtract 100 from their number.

Read *Anno's Magic Seeds* by Mitsumasa Anno. Have the students use their journal and *Place Value Tents* to make the numbers. Make predictions for the next page or number of seeds Jack grows. Have students show the number on their cards, write the expanded notation and prediction for the next number.

Students will learn to double their number and subtract one. Ask how many seeds Jack will have in 30 years? 50 years? See if the students come up with a pattern.

Possible Extensions/Adaptations/Integration

- Use dice to show place value.
  1. Students pair up and roll three dice.
  2. Write the number, then roll the red or green die and add tens or hundreds.
  3. Students can use the *Place Value Tents* to add the numbers from the dice.
  4. Red, white, and green dice:

     White—ones place

     Red—tens place

     Green—hundreds place
- Folded *Place Value Strips* (p. 4-6) students cut strips and write numbers in the empty spaces to exchange hundreds for tens and tens for ones.
- Have students add a digit (4) to the hundreds place. What number are we adding? (400)
- What is the difference in adding a 4 to the hundreds place or adding a 4 to the number?

Assessment Suggestion

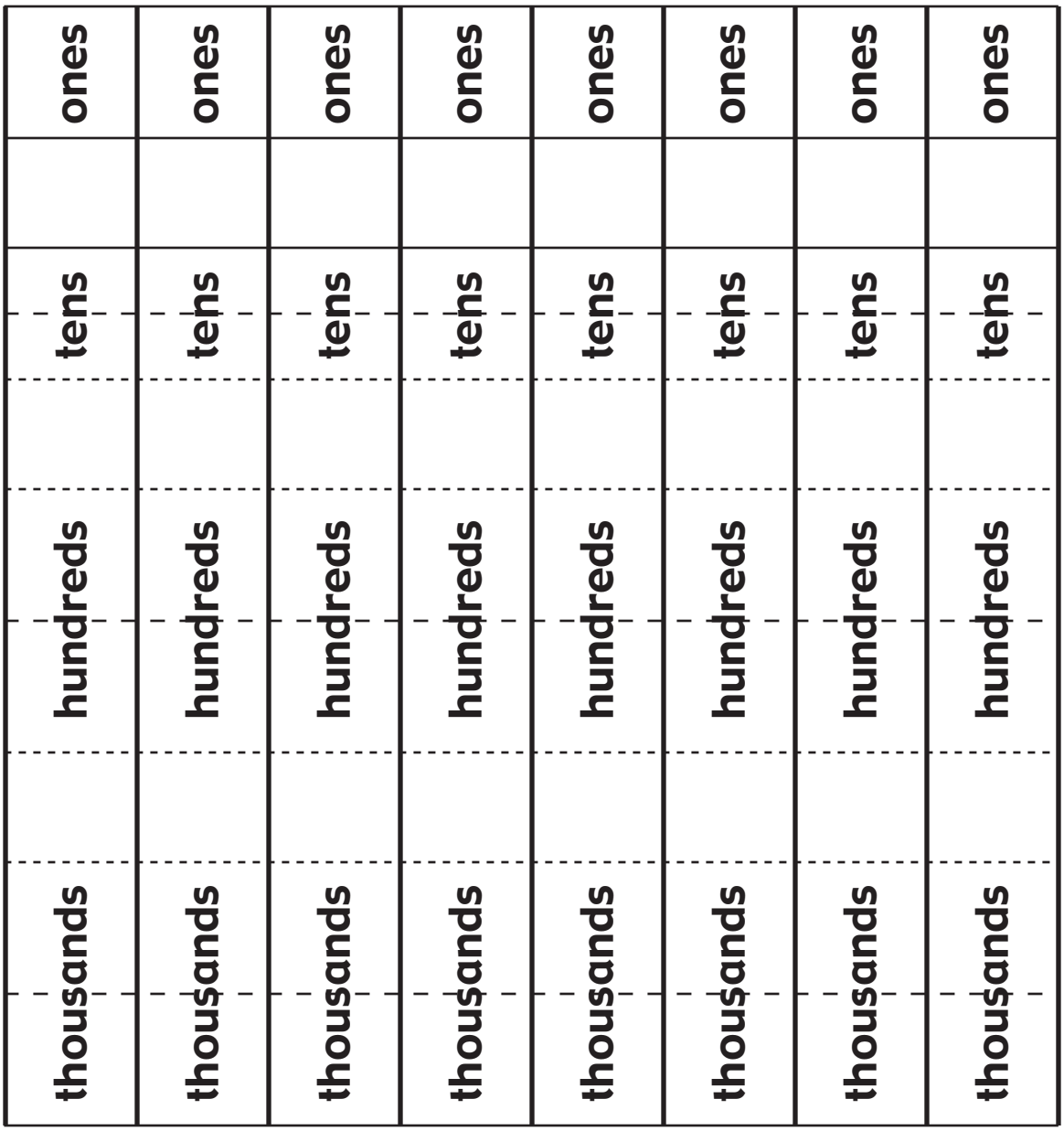
- Put the students into groups of two. Have students take turns telling their partner large numbers (thousands), and check each other for the expanded form. Students should say the number, write the number, and write it in expanded form.

Additional Resource

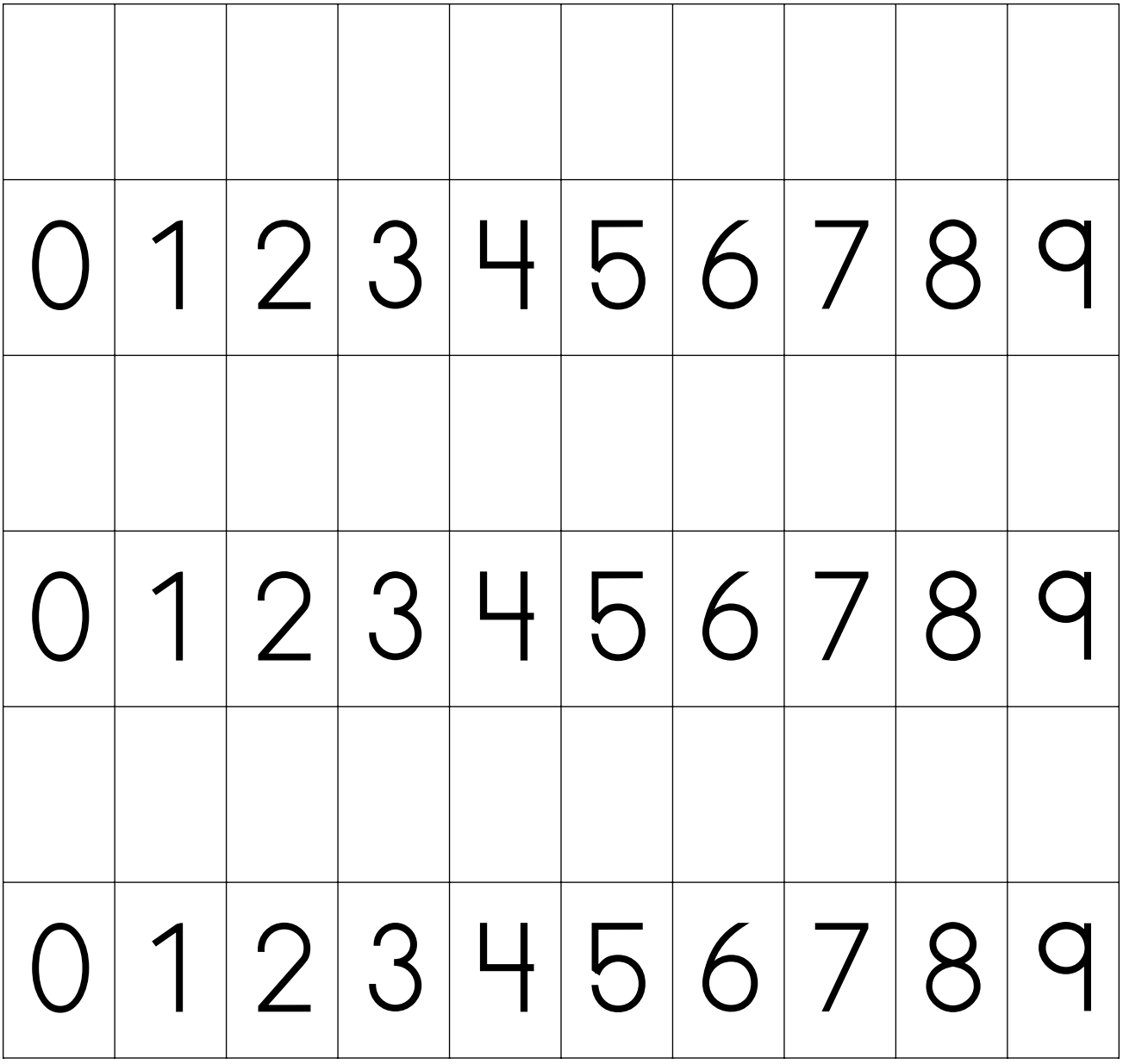
Book

Anno's Magic Seeds, by Mitsumasa Anno; ISBN 0-698-11618-6

Place Value Strips



Place Value Tents

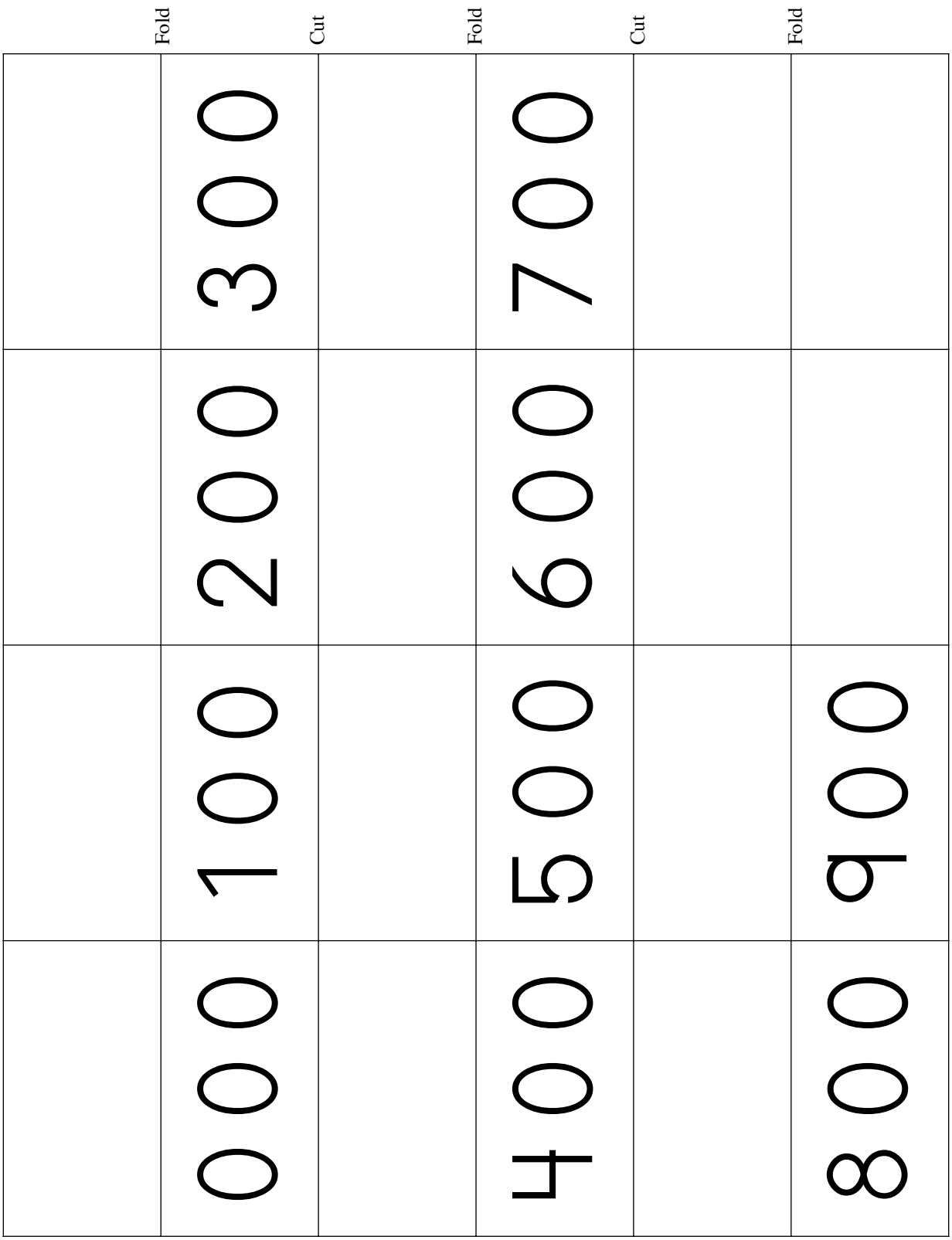


Copy on pink card stock. Cut on vertical lines.

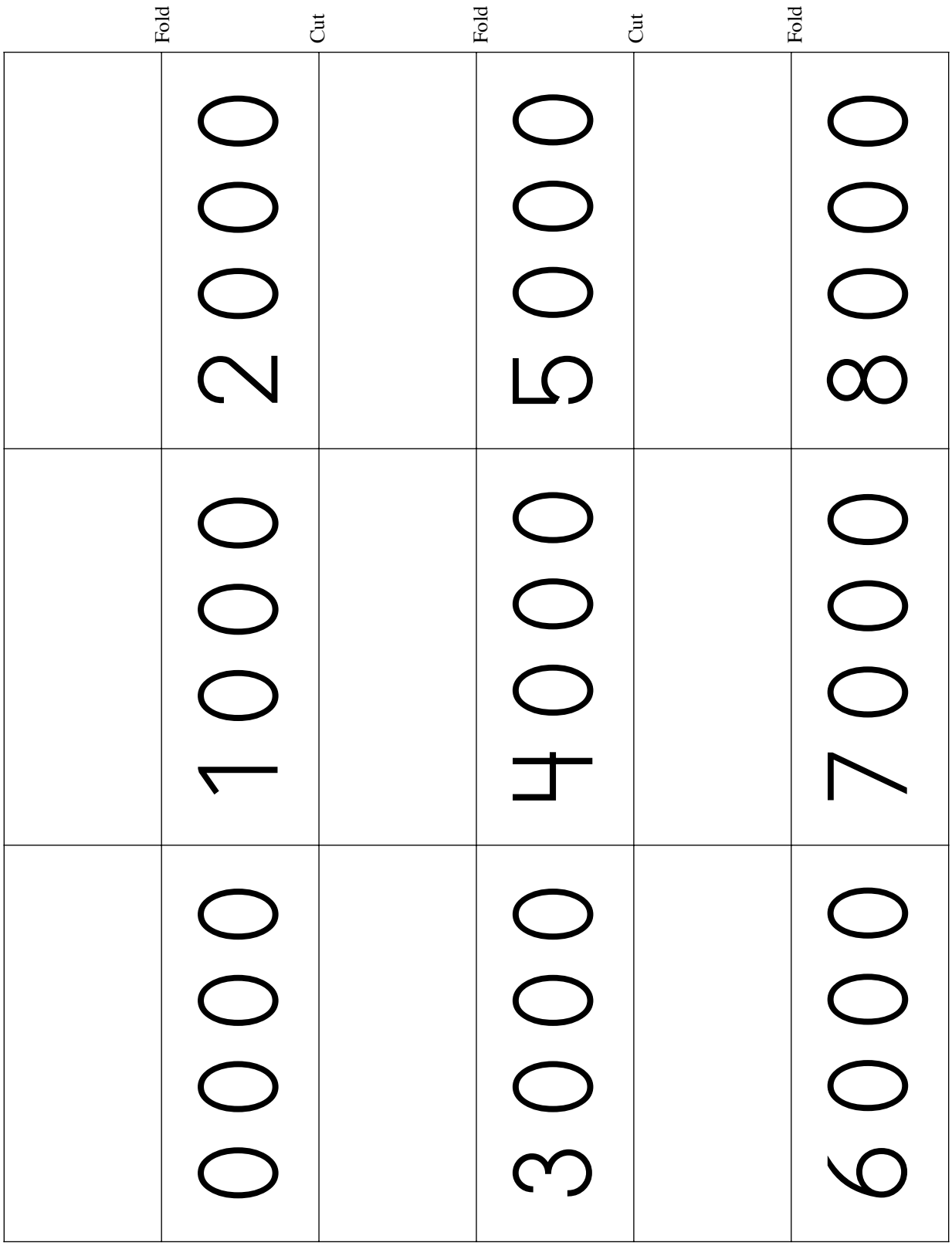
0 0	1 0	2 0	3 0	4 0
5 0	6 0	7 0	8 0	9 0
0 0	1 0	2 0	3 0	4 0
5 0	6 0	7 0	8 0	9 0

Fold
Cut
Fold
Cut
Fold
Cut
Fold

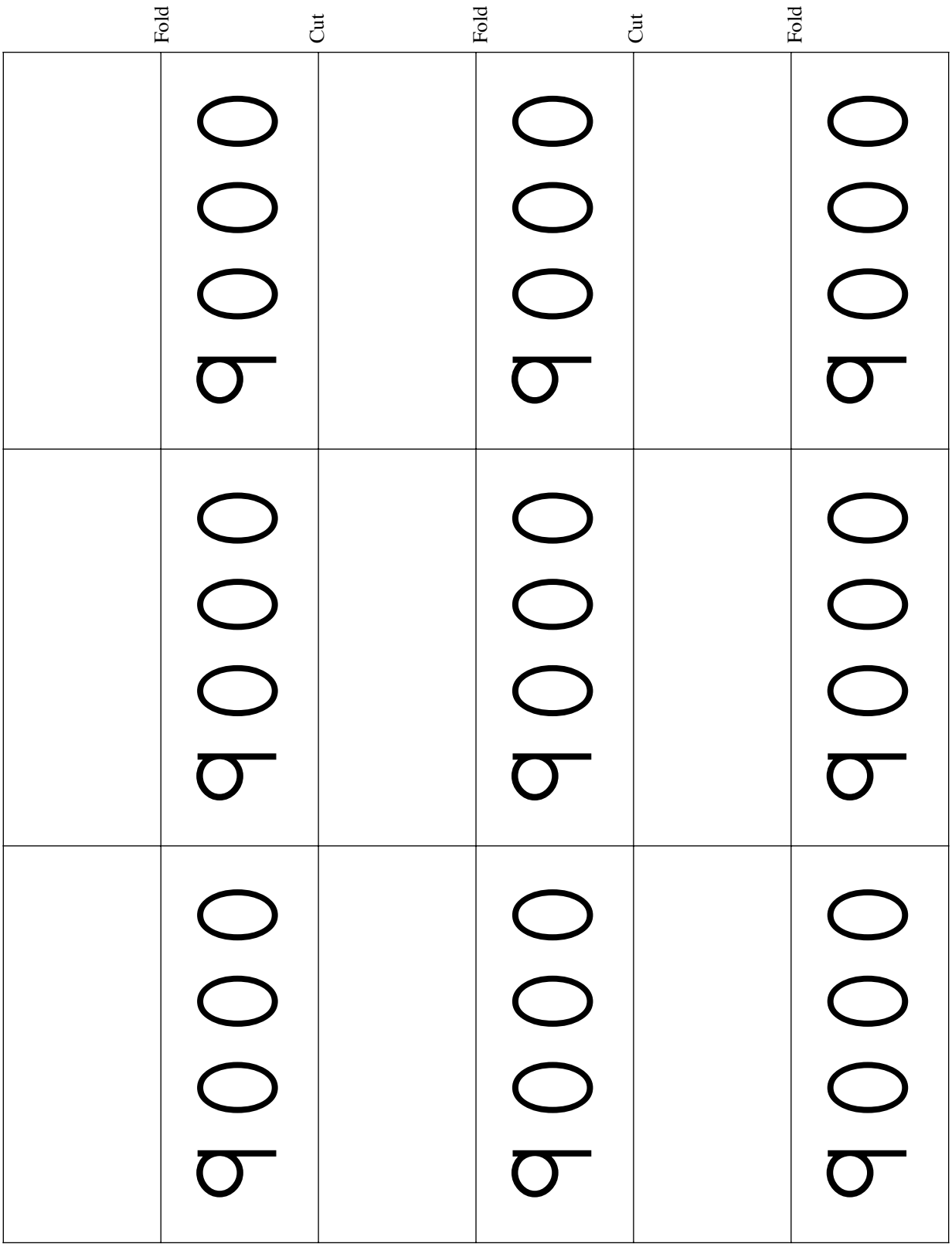
Copy on blue card stock. Cut on vertical lines.



Copy on yellow card stock. Cut on horizontal lines.



Copy on green card stock. Cut on horizontal lines.



Copy on green card stock. Cut on horizontal lines.

Tricky Triangles

Math Standard I

Objective 5

Connections

Math Standard I:
Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 5:
Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.

Intended Learning Outcome:
4. Make mathematical connections.

Content Connections:
Math I-1

Background Information

Students must be able to know how to write a number from hearing it, write the number, and round the number. Additionally, it is important to explain that 78 is closer to 80 than 70, thereby gaining number sense concepts as well as rounding principles.

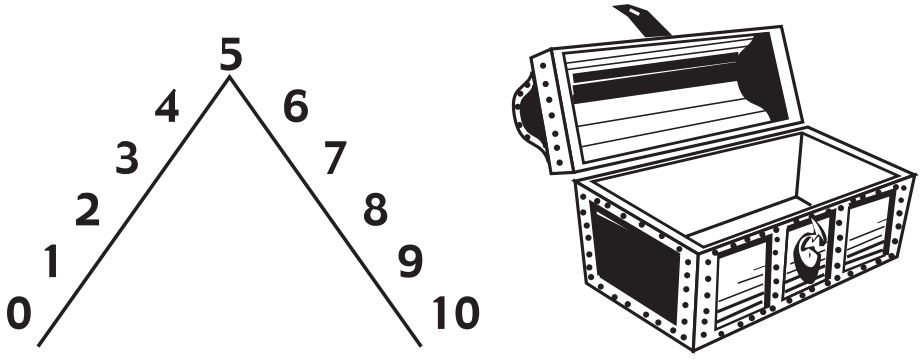
Invitation to Learn

Today we are going to play a game of *Tricky Triangles*. Let's review rounding by "going over the mountain."

Ask the students if they like to go mountain climbing. Well, today we are going to go hiking up the mountain to see what is on the other side. Are you ready to start climbing?

One, two, three, four, five! Oh my we made it to the top of the mountain!

We get the treasure! If 78 is our number then the ones place drops to zero, the tens place grabs the treasure, and gets one digit larger.



Instructional Procedures

Review "going over the mountain" concept for rounding for the number 54. If rounding to the tens place, touch the tens place and walk next door and sing: (The students can ask or sing to the song, *The Bear Went Over the Mountain*.) "Did the number four go over the mountain?" If it didn't, then the number drops to zero and there is no treasure. (If it did go over the mountain, then we slide down to the bottom of the mountain and grab the treasure.) The largest placeholder gets one digit larger.

Rounding Mountains

Students will take turns rounding numbers.

- Each of the dashes on the line is one number.
- Give the number 67.
- Students will start with the number 30 at the bottom of the zigzag line, 40 at the bottom of the next zigzag, until the number 80 is written.
- Go to the number 60, count by ones until getting to the number 67. Did the number seven go over the mountain?
- Yes, so it drops down to the next number—70.
- Round the number 376 to the nearest hundred.
- Round the number 4,523 to the nearest 10, 100, 1000.
- Using the skills of rounding, now play the *Tricky Triangle* game.

Materials

- ❑ *Rounding Mountains* handout

Tricky Triangle Game

1. Play this first as a whole class and read the cards. The students should write what they hear. Then read the number and round it accordingly. This is great for students to be able to hear and write numbers. Then turn them loose to do it as a class.
2. Pass out *Tricky Triangle Game Boards* (p. 4-16), cards, wooden cube, and one to six markers. Place students in groups of two to four players. Place number cards face down. In turn, each player draws a card, rolls the cube, and rounds the number to the place indicated on the cube and covers the rounded number on the game board. If the rounded number is already covered, the player forfeits the turn. The card is returned to the bottom of the card pile at the end of the player's turn. The first player to cover four *Tricky Triangles* in a row is the winner.

Materials

- ❑ *Tricky Triangle Game Board*
- ❑ Markers to cover triangles
- ❑ One wooden cube labeled with 10's, 100's, and 1,000's each written on two of the sides
- ❑ 20 number cards to round.

Possible Extensions/Adaptations/Integration

- Give students reasons for using rounding (e.g., going to the store to buy several items). Rounding is a better "estimation" than front end estimation especially when rounded numbers are added to estimate a sum. However, sums of rounded numbers ARE NOT NECESSARILY THE EXACT SUMS OF THE ORIGINAL NUMBERS. They are only a reasonable "guesstimation."
- Students can use dice to roll numbers and then round them.

  White dice—ones place

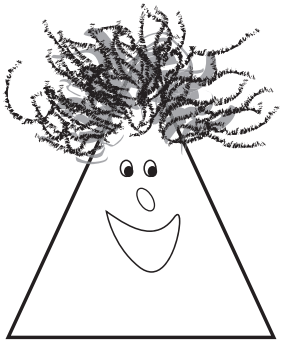
  Red dice—tens place

  Green dice—hundreds place

Assessment Suggestion

- Use three dice (red for hundreds, green for tens, and white for ones). Have the students roll the three dice and write the number. Round to the nearest 10s or the nearest 100s.

Tricky Triangle



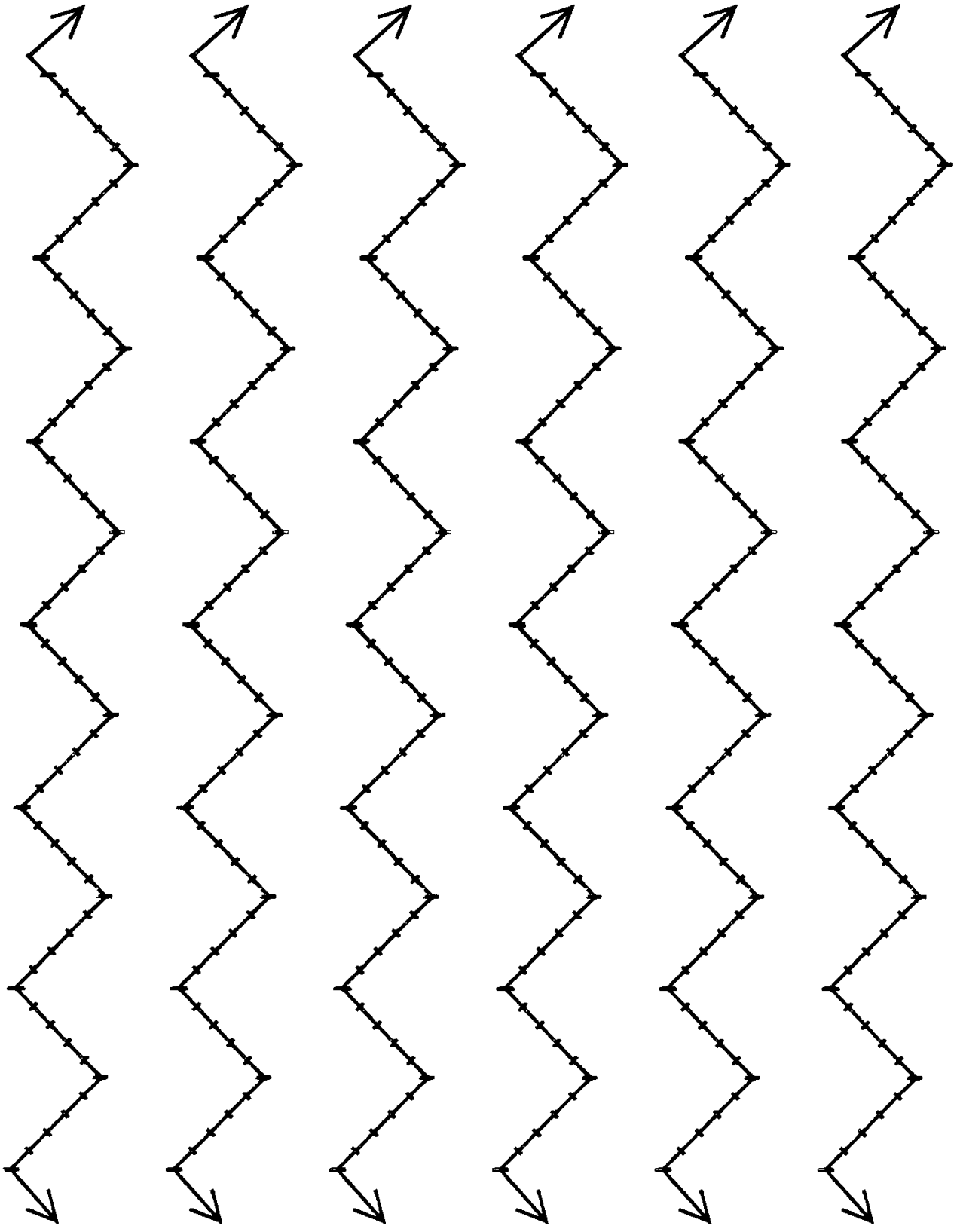
Materials

- ❑ 20 number cards
- ❑ One cube labeled 10, 100, 1,000
- ❑ Markers

Procedures

Place the number cards face down. In turn, each player draws a card, rolls the cube, rounds the number on the card to the place indicated on the cube, and covers that rounded number on the game board. If the rounded number is already covered, the player forfeits the turn. The card is returned to the bottom of the card pile at the end of the player's turn. The first player to cover four *Tricky Triangles* in a row is the winner.

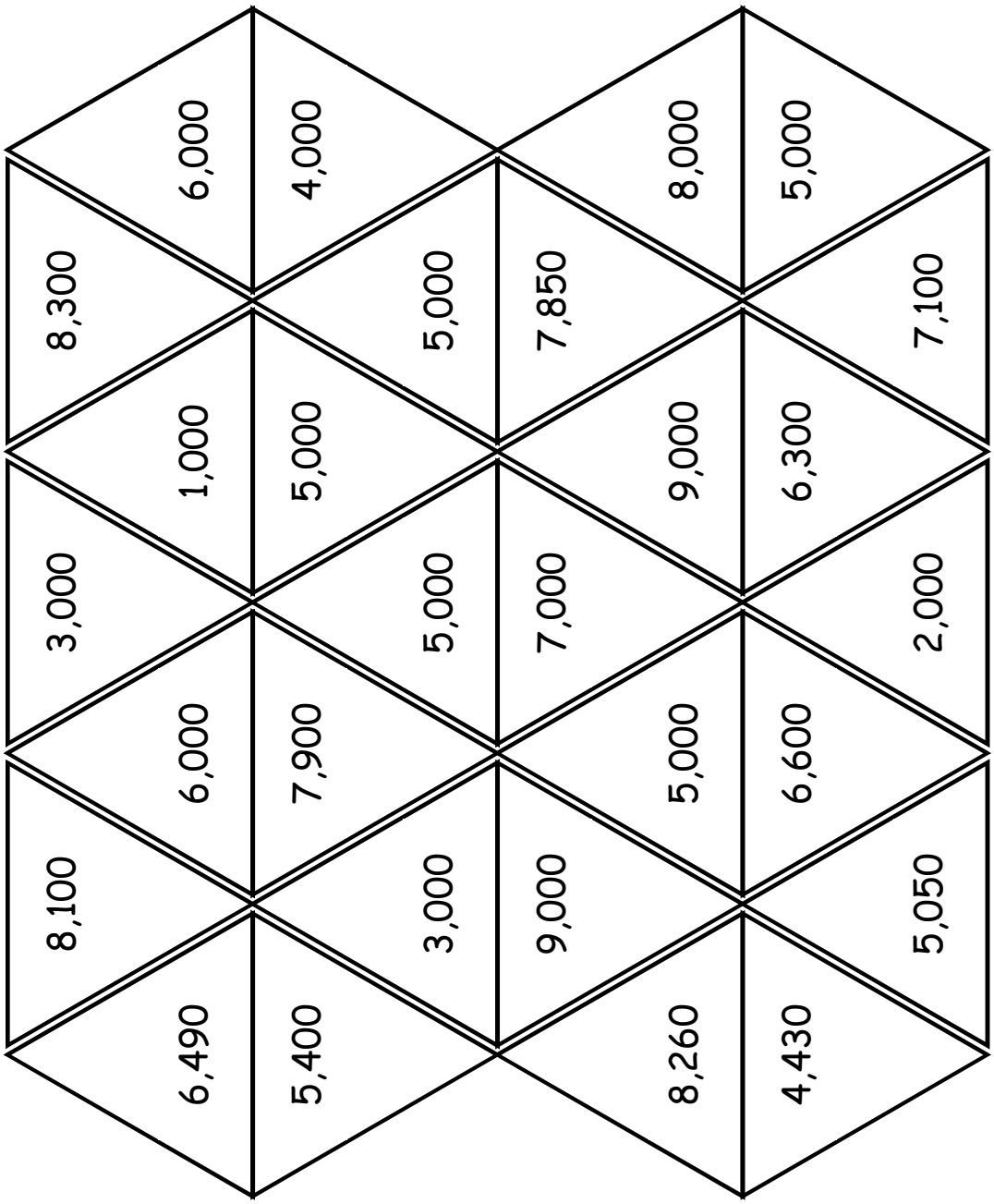
Rounding Mountains



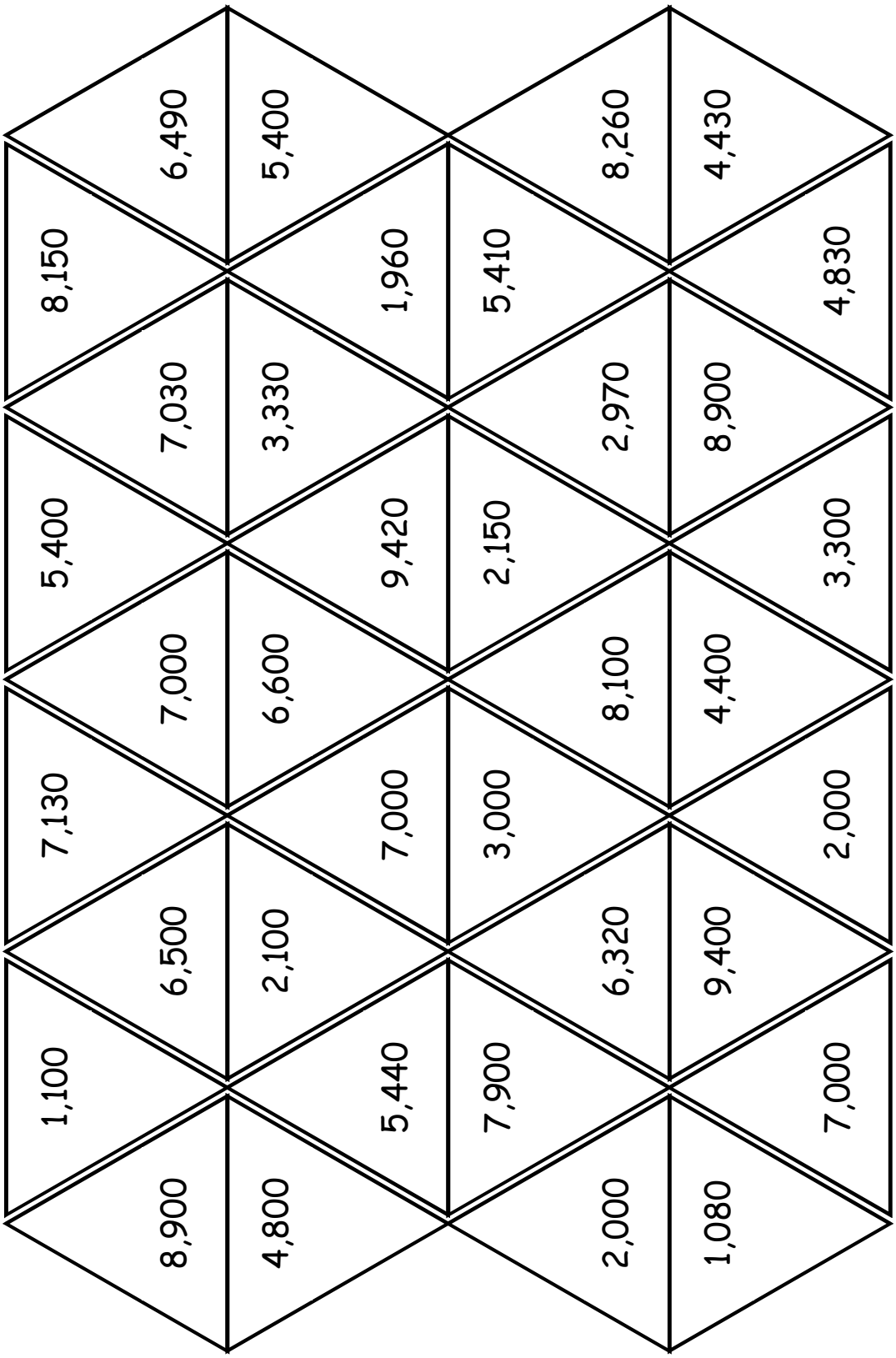
Number Cards

7,125	5,414	2,149	4,829	7,030
6,489	6,601	5,049	8,145	5,435
1,076	7,853	2,972	1,961	4,431
8,904	9,421	3,333	8,264	6,315

Tricky Triangle Game Board (right side)



Tricky Triangle Game Board (left side)



Multiplication Strategies and Writing Story Problems

Math Standard I:
Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 5:
Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.

Intended Learning Outcome:
2. Become mathematical problem solvers.

Content Connections:
Art I-1, II-2, IV-3; Language Arts VIII-3, 6

Math Standard I

Objective 5

Connections

Background Information

Students need to use a variety of methods and tools to facilitate computation of numbers. Rounding is one method for estimation. Students need to practice mental math strategies to help approximate correct answers.

Invitation to Learn

We will model some multiplication problems. Students will configure number sentences using Unifix cubes.

Instructional Procedures

Materials

- ❏ *The Best of Times*
- ❏ Art paper
- ❏ Unifix cubes
- ❏ Corner pieces
- ❏ Crayons

1. Placing a corner piece on the overhead, place six Unifix cubes (2 x 3) in the center of the corner piece. What is the multiplication problem these cubes show?
2. Place Unifix cubes on the outside of the corner piece and on the top of the corner piece to show the multiplication problem.
3. Ask what the difference is between 2 x 3 and 3 x 2. Have students demonstrate the difference on the overhead and explain why it is the correct answer.
4. After a couple of problems, ask if the students like riddles.
5. Read the book *The Best of Times*.
6. Together have the class come up with a multiplication problem and write the problem on the board.
7. Have the students come up with ideas for a story to go with the problem. Some students could make it a riddle.
8. Illustrate the problem.

9. Show several examples explaining how the numbers represent groups.
10. Pass out art paper for each student. Have the students each make a page for the class book discussed in *Assessment Suggestion*.

Possible Extensions/Adaptations/Integration

- Students roll two dice to come up with numbers to multiply together and illustrate in their journals.
- May use die-cut paper, stickers, or punches to represent items in word problems.
- Introduce the *Nada* activity having students engage in continued review and practice.

Assessment Suggestion

- Make a class book. Each student may be graded on the page s/he turns in for the book. The page will demonstrate what they know about representing a problem with words.

Additional Resources

Books

The Grapes of Math, by Greg Tang; ISBN 0-439-21040-2

Math for All Seasons, by Greg Tang; ISBN 0-439-44440-3

Math Appeal, by Greg Tang; ISBN 0-439-21045-5

Too Many Kangaroo Things To Do, by Stuart J.Murphy; ISBN 0-590-10060-2

Hershey's Kisses Multiplication and Division, by Jerry Pallotta; ISBN 0-439-56009-8

The Best of Times, by Greg Tang; ISBN 0-439-52918-2

Web site

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

Nada

Materials

- ❑ Six dice
- ❑ Paper and pencil

Object of the game

The first person to reach 5000 points is the winner.

Directions

1. To play *Nada* the numbers on the dice are used to collect points.
2. To begin play, everyone rolls a die. The person with the largest number begins. Each person then proceeds going clockwise.
   - Ones are worth 100 points each.
   - Fives are worth 50 points each.
   - Other numbers do not count as any points unless you get groups of three of a kind.
   - Three dice of any number equals ten times the number on the dice.

   Example: Three dice with six = 60 points, three dice with two = 20
3. A person must have 250 points to begin collecting points and writing down a score.
4. If you don't get a one or a five on the first roll, your turn is over. You have *Nada*.
5. If you get a one or a five you can continue to roll as many rolls as you dare. If you roll without getting any additional ones or fives you loose all the points you have gained during your turn.
   - You must have a one or a five each roll to continue play.
   - A straight 1-2-3-4-5-6 is worth 1,500 points and must be made in one roll.
   - The game is over if any player who gets six of any one number, and that player automatically wins.

Have fun playing *Nada*!

Nada

Name:			

Name:			

Name:			

Name:			

Fractions

Math Standard I:
Students will acquire number sense and perform operations with whole numbers and simple fractions.

Objective 4:
Use fractions to communicate parts of the whole.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers.

Content Connections:
Math IV; Language Arts VIII-3, 6

Math Standard I

Objective 4

Connections

Background Information

With students, make fraction strips (1-1/2 inch) from 9" x 12" construction paper in red (whole), orange (half), yellow (thirds), green (fourths), blue (sixths), and purple (eighths) for each student using rulers and black crayons.

Invitation to Learn

Who can tell me what a fraction is?

A fraction is a part of a whole or part of a set.

Today we are going to do some investigating with fractions. But before we do, we need to make our own fraction strips.

Instructional Procedures

1. Pass out the 1-1/2" x 12" strip of red construction paper. Have the students write *1 whole* on the strip with a black crayon.
2. Pass out the 1-1/2" x 12" strips of orange construction paper. Measure or fold in half. (Half of 12 inches is what?" Six inches.) With a black crayon write *1/2* on each of the two strips. Cut strip in half.
3. Pass out the 1-1/2" x 12" strips of yellow. Divide 12 inches into thirds (4") and mark the strips with a black crayon. Write *1/3* on each piece and cut strip on lines.
4. Pass out the 1-1/2" x 12" strips of green construction paper. Have the students divide into fourths (3"). Write *1/4* on each piece and cut strips on the lines.

Materials

- ❑ Scissors
- ❑ Black crayon
- ❑ Ruler in inches
- ❑ Envelope or plastic Ziploc bag
- ❑ *Order the Fractions, Fraction War,* and *Fraction Concentration* game cards
- ❑ *My Book About Fractions*
- ❑ Fraction strips

5. Pass out the 1-1/2" x 12" strips of blue construction paper. Divide into sixths (2"). Write *1/6* on each piece and cut the strip on the lines.
6. Pass out the 1-1/2" x 12" strips of purple construction paper. Divide into eighths (1-1/2"). Write *1/8* on each piece and cut on the lines to make strips.
7. Students will use the strips to play *Order the Fractions* (p. 4-31) and *Fraction War* (p. 4-31).
8. After playing the games, discuss how the students knew which fraction was larger, 1/2 or 1/3? They should discover that the larger the denominator, the smaller the piece.

Possible Extensions/Adaptations/Integration

- *Fraction Concentration* (p. 4-32) [Grade 4—Equivalent Fractions]

Assessment Suggestions

- Have students complete *My Book About Fractions* (p. 4-25) to assess whether they gained conceptual understanding of fractions.
- With two dice, have the students roll fractions—red = numerator, green = denominator—and draw pictures to illustrate fraction of a set or whole.

Additional Resources

Books

Eating Fractions, by Bruce McMillan; ISBN 0-590-43771-2

Give Me Half, by Stuart J. Murphy; ISBN 0-066-446701-5

The Hershey's Milk Chocolate Bar Fractions Book, by Jerry Pallotta; ISBN 0-439-13519-2

Cook-a-doodle-doo!, by Janet Stevens and Susan Stevens Crummel; ISBN 0-15-201924-3

Web site

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

Family Connections

Cook-a-doodle-doo! by Janet Stevens and Susan Stevens Crummel
Parents can cook the strawberry shortcake by doubling the recipe and adding fractions.

Fraction Quiz

Circle true or false (**T** **F**) for the following questions.

1. The denominator is found on the bottom of the fraction. **T** **F**

2. The numerator is found on the bottom of the fraction. **T** **F**

3. A fraction cannot be used to show equal parts of the whole. **T** **F**

4. Two different fractions can show the same amount. **T** **F**

5. One-fourth is larger than one-third. **T** **F**

6. When the numerator is the same, the bigger the denominator the bigger the fraction. **T** **F**

7. When the numerator is the same, the smaller the denominator the bigger the fraction. **T** **F**

8. Fractions can be used to show a part of a set. **T** **F**

My Book About Fractions

_____

Name

Fraction Vocabulary:

A ***fraction*** is a <u>part</u> of whole or part of a set. The symbol used to represent a fraction has one number over the other. The bottom is called the denominator. The top is the numerator.

$\frac{\textbf{2}}{\textbf{3}}$ = **numerator**

= **denominator**

The **denominator** tells the number of equal parts in the whole or equal parts in the set.

The **numerator** tells how many equal parts are being considered.

Example 1:

$\frac{2}{3}$

Example 2:

$\frac{2}{4}$

Make Your Own Fraction

Write and draw your own fraction.

Describe what your fraction represents.

_____

_____

_____

_____

How do you know it is a fraction? _____

_____

_____

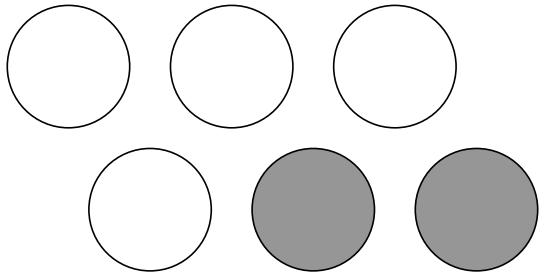
_____

Fractions in Your World

Where in your world would you find fractions? Tell an example of one.

Explain why everyone should learn about fractions?

Name the fraction below. _____



Explain how you wrote the fraction above.

Halves

Draw a picture that shows one- half of a whole.

Draw a picture that shows one-half of a set.

What do two halves represent?

Story Problem

Jan had eight cups of juice (apple and orange). Three cups were apple juice. What fraction of the cups had orange juice? Draw a picture and explain your work.

Thirds

Draw a shape that shows thirds.
Shade two thirds of the shape.

Which fraction is greater,
one-half or one-third?
Explain how you know.

Eighths

Draw a picture that shows two-eighths.

What is another way to draw two-eighths?

Fourths

Name and label a fraction for two-fourths.

Is there another way to show two fourths? Explain ***and*** draw what it looks like.

Sixths

Draw a set that shows sixths. Shade three of the parts.

Write a story problem for your fraction.

Order the Fractions

Players: two players

Materials: Fraction strips and 24 (3" x 5") cards marked as follows: 1/1, 1/2, 2/2, 1/3, 2/3, 3/3, 1/4, 2/4, 3/4, 4/4, 1/6, 2/6, 3/6, 4/6, 5/6, 6/6, 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 8/8.
(Same as *Fraction War.*)

Directions:

1. Shuffle the cards.
2. Deal four cards in a row, face up, to each player.
3. Put remaining cards in a pile between the two players. Turn the top card over.
4. In turn, players replace one of their cards with the card that is face up or with the top card from the pile.
5. Put extra card on discard pile.

Winner:
First player to arrange their cards so that each card is greater or equal to the one on the left.

Check:
Use fraction pieces to show it is correct.

Fraction War

Players: two to four players

Materials: Fraction strips and 24 cards (3" x 5") marked as follows: 1/1, 1/2, 2/2, 1/3, 2/3, 3/3, 1/4, 2/4, 3/4, 4/4, 1/6, 2/6, 3/6, 4/6, 5/6, 6/6, 1/8, 2/8, 3/8, 4/8, 5/8, 6/8, 7/8, 8/8.
(Same as *Order the Fractions.*)

Directions:

1. The dealer shuffles the cards and deals them face down to all players.
2. Each player places his cards in a pile in front of him in the order in which the cards were received.
3. Play begins by the dealer saying "go" and each player turning over his/her top card. The player whose card has the largest fraction wins the round and retains the cards.
4. If players turn over equivalent fractions, another round is played for possession of all the cards.
5. Play continues until all cards are gone.
6. The winner is the player with the most cards at the end of the game.

Fraction Concentration

Players: two to four players

Materials: Fraction cards and 11 cards (3" x 5") marked as follows: 1/2, 3/6, 4/8, 1/3, 2/6,1/4, 2/8, 2/3, 4/6, 3/4, 6/8.

Directions:

1. Arrange the cards on the floor or table in four rows of six.
2. Play will pass to the right.
3. Each player in turn will turn over two cards. If the fractions are equivalent, the player removes the pair from the board and keeps them.
4. When the cards have all been removed, the winner is determined by the player who has the most pairs.

Spinning Odds and Evens

Math Standard V:
Students will collect and organize data to make predictions and identify basic concepts of probability.

Objective 1:
Collect, organize, and display data to make predictions.

Objective 2:
Identify basic concepts of probability.

Intended Learning Outcomes:
2. Become mathematical problem solvers.
3. Reason mathematically.

Content Connections:
Math I-2

Math Standard V

Objectives 1 & 2

Connections

Background Information

Students will determine what "fair" is and how to create a game that is fair.

Invitation to Learn

How many of you like to win at playing games? Has anyone ever played a game that wasn't fair? What are the aspects of a fair game? Today you will determine if a game is fair. Then you will design your own game and try to make it fair.

Instructional Procedures

1. Pass out *Odds and Evens* handout (p. 4-35) with paper clips. (Even though spinners **look** different, they are the same.)
2. Explain that the students will determine whether or not the game is fair.
3. Using the spinner, or pencil and paper clip, play the game several times.
4. Explain in writing whether or not the game is fair. If it is not fair, design a game that would be fair.

Materials

- ❑ Paper
- ❑ Pencil
- ❑ Paper clip or spinners
- ❑ *Odds and Evens* handout

Possible Extensions/Adaptations/Integration

- Ask the students if they can design a game using dice that is fair. Have students use dice to design a game that is fair. What numbers are rolled most often? What numbers are rolled least often?

Assessment Suggestion

- Students should be able to report the game is not fair. There are more even sums than odd. Even plus even has an even sum. Odd plus odd has an even sum. Odd plus even has an odd sum.

Additional Resources

Book

No Fair!, by Caren Holtzman; ISBN 0-590-92230-0
Two children play several games of chance trying to figure out what is mathematically fair.

Web site

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

Name _____

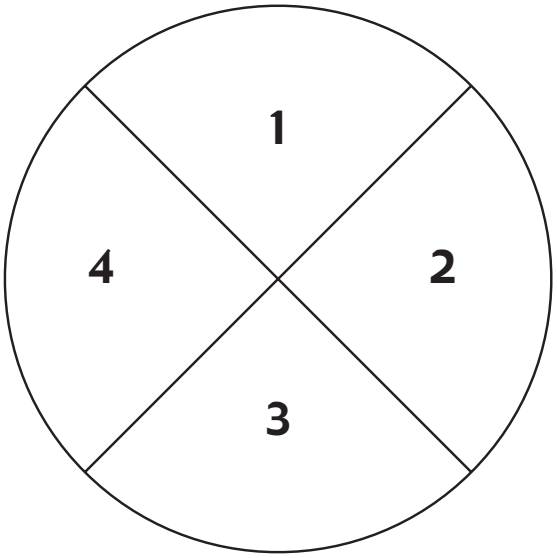
Odds and Evens

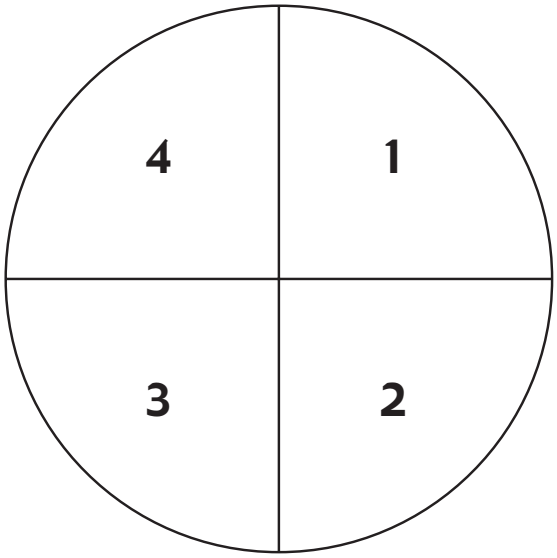
Players

two players

Directions

- Players determine who will be *even* or *odd*.
- Spin both spinners and add the numbers together. If the sum is even, the even player gets a point. If the sum is odd, the odd player gets a point.
- The player with the most points at the end is the winner.





Spin the spinner for three minutes. Tally the points on the lines provided. Determine who the winner is.

Odds	Evens
_____	_____
_____	_____
_____	_____

1. Was the game fair? Explain your thinking of why it was or was not fair.

_____

_____

_____

_____

2. If the game is not fair, what can be done to make it fair?

_____

_____

_____

_____

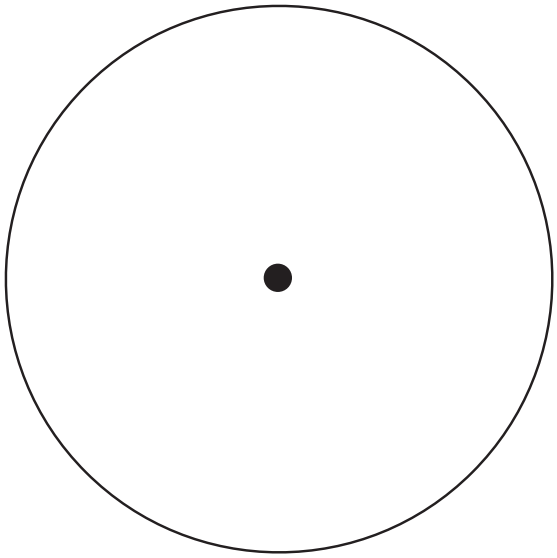
3. Design a new game that is fair. Explain how you know it is a fair game.

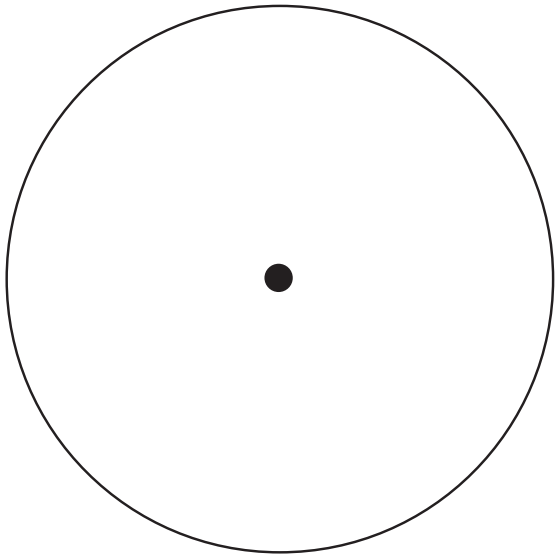
_____

_____

_____

_____





Science Standards III and IV Activities

Simple Machines

Science Standard III:
Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 1:
Demonstrate how forces cause changes in speed or direction of objects.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math VI-1, 2

Science Standard III

Objective 1

Connections

Background Information

Objects at rest will remain at rest unless acted upon by an unbalanced force. Objects in motion will remain in motion at the same speed and direction unless acted upon by an unbalanced force. A force is a push or a pull.

A simple machine is a device that makes work easier. The six simple machines are: *inclined plane, wedge, screw, lever, wheel and axle,* and *pulley*. All simple machines transfer force. Some *change the direction of force*, while others *change the strength of the force*. Still others change *both* the direction and the strength. Most simple machines make work easier by allowing you to use less force over a greater distance to move an object. Some machines make work easier by allowing you to move things farther and/or faster. In these machines, a larger force is required, but over a shorter distance.

Invitation to Learn

Peaceful Penny

Set an index card over the mouth of a glass/cup. Set a penny on the card directly over the mouth. Have the students predict the movement/action of the penny if the paper is flicked off the glass/cup. Flick the card with your finger. Where does the penny go? Why? (The penny is at rest and wants to remain at rest. The flicking force is applied to the card, so the card moves and the penny drops into the glass/cup.)

Materials
- ❑ Drinking glass or cup
- ❑ Index card
- ❑ Penny

Sudden Stop!

Materials

- ❑ One clay marble
- ❑ Ruler
- ❑ One small toy car
- ❑ Masking tape
- ❑ One pencil
- ❑ Three books (about 1" thick)
- ❑ *Paper Grid*

1. Place one end of the ruler ramp onto one book.
2. Place the *Paper Grid* (p. 5-11) about two car lengths away from the bottom end of the ramp.
3. Tape a pencil along the edge of the *Paper Grid* closest to the ramp/book.
4. Position the car, with the clay marble sitting on top, at the top of the raised ramp.
5. Have the students predict what will happen to the car and the clay marble when the car hits the pencil.
6. Let go of the car and allow it to roll down the ramp and collide into the pencil.
7. Measure how far the clay marble falls from the car.
8. Repeat the procedure using two books, then three books.
9. Discuss what happened and why.

   (The car stops when it hits the pencil, but the clay marble continues to move forward until the force of gravity and air molecules brings it to a stop. Raising the height of the ramp causes the car to reach a higher speed before it hits the pencil. Therefore, the clay marble moves at a higher speed and will move farther before the force of gravity and air molecules brings it to a stop.)

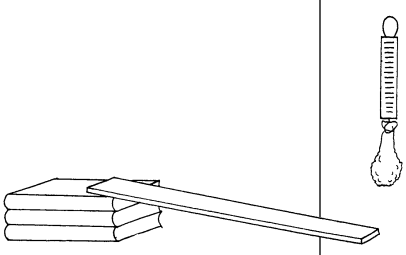
Moving Possibilities

Materials

- ❑ Penny or paper clip

1. Remind the students that objects will only move when a force is applied. A force is either a *push* or a *pull*.
2. The students will write down many, varied, and unusual ways to move a penny (or a paper clip, etc.) one foot (12 inches).
3. The students will categorize their ideas into pushing forces, pulling forces, or both.

Uphill—Inclined Plane



Materials

- ❑ Plank of wood
- ❑ Spring scale (0-500g)
- ❑ Rubber band
- ❑ Five thick books
- ❑ One cup of rice
- ❑ Tube sock
- ❑ *Uphill-Inclined Plane* worksheet

1. Pour the rice into the sock. Close the end with a rubber band or string.
2. Attach the spring scale to the rubber band or string and lift the rice-filled sock straight up to the height of *three* books.
3. Observe how much force is needed and record on the *Uphill-Inclined Plane* worksheet (p. 5-12).

4. Place one end of the plank of wood on top of *five* books and the other end on the table to form a ramp.
5. Place the sock (with the spring scale attached) on the bottom part of the ramp. Pull the sock to the top of the ramp.
6. Observe and record how much force is needed.
7. Repeat steps 4 – 6 using *three* books
8. Repeat steps 4 – 6 using *one* book.
9. Analyze the results and discuss how they relate to F = W x D. (The ramp is an inclined plane. It is used to move an object to a higher level with less force than lifting straight up. When using an inclined plane, you must move the object a greater distance than if you lifted it straight up, but it takes less force.)

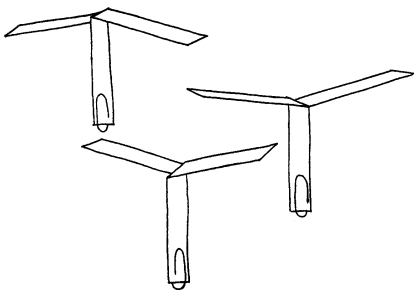
Twirling Helicopter Toy—Screw

Materials

For each student:

- ❑ *Toy Helicopter Pattern*
- ❑ One large paper clip
- ❑ One small paper clip
- ❑ Scissors

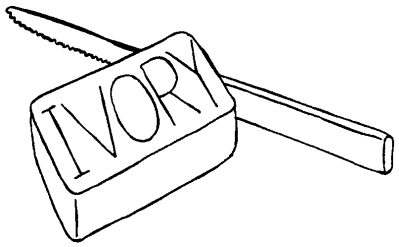
1. Print the *Toy Helicopter Pattern* (p. 5-13) on both regular weight paper and cardstock.
2. Give each student one pattern printed on regular weight paper, one pattern printed on cardstock, one large paper clip, and one small paper clip.
3. Tell the students that they are going to be making helicopters that require one pattern and one paper clip each. Ask the students to come up with all the different possible combinations and write them on the board.
4. Have the students predict which combination will produce the gentlest decent. (*Option:* Record the number of predictions for each combination by using tally marks.)
5. Instruct the students to cut out the patterns on solid lines A, B and F and to fold on dotted lines C and D. Then, fold along dotted line E.
6. Have each student test each of the possible combinations by lifting his/her toy helicopter up high and letting go.
7. Review student predictions. Were they correct?
8. Analyze how the helicopter is acting as a simple machine. (The toy helicopter twirls in a spiral as it drops. The twirling blades act as a screw that helps you lower (or lift) things with less force. Turning in a spiral allows the helicopter to drop with less force. It lands softly instead of crashing down.)



Soap Carving—Wedge

Materials

- ❑ IVORY soap
- ❑ Plastic knife
- ❑ Paper (cut into 4 1/4" x 5 1/2")
- ❑ Paper towels
- ❑ Pencils
- ❑ Scissors

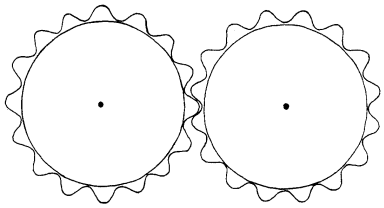


1. Unwrap the bar of soap.
2. Trace around the bar of soap onto the paper.
3. Draw a simple design onto the paper (no larger than the bar of soap).
4. Cut out the design.
5. Lay the cut-out design onto the bar of soap and trace around the design.
6. Turn the bar of soap over and lay the design onto the side of the bar of soap (being careful of the placement) and trace around the design again.
7. Place the bar of soap onto a paper towel.
8. Carefully carve the design out of the soap by first cutting the soap into a "block," followed by rounding the edges, and finally carving the details (encouraging the students to try to keep the shavings on the paper towel).
9. The soap can be smoothed by rubbing the surface with a small amount of water.
10. Analyze how the knife was being used as a simple machine to make work easier. (The knife is a wedge shaped like two inclined planes back-to-back. The narrow edge of the knife blade enters and makes a path for the larger part of the knife that follows. Once an opening is made, the soap is easily pried apart by the gradually widening body of the knife blade.)

All Geared Up—Wheels and Axles (Gears)

Materials

- ❑ Two plastic milk caps
- ❑ One lid that is larger than a milk cap (e.g., a yogurt cup lid, cottage cheese container lid, or a Cool Whip lid)
- ❑ Three strips of corrugated cardboard (1/2" x perimeter of each lid)
- ❑ Glue
- ❑ Scissors



1. Glue the strip of cardboard around the edge of each lid.
2. Trim the cardboard to the correct length.
3. Interlock the two milk cap lid gears and gently rotate each.
4. Analyze the direction that each gear turns.
5. Interlock two different sizes of lids. Mark each gear where they originally touch. Gently rotate each. Count how many times the small gear rotates for each single rotation of the large gear.

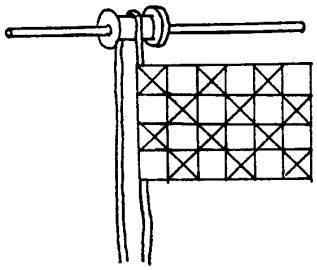
6. Analyze how the gears are working like a simple machine. (Gears are wheels with teeth that turn and work together. Different sizes and arrangements of gears do different jobs. A large gear turning a smaller one will give you more speed. A small gear turning a large one will give you more power.)

Flag Raiser—Fixed Pulley

Materials

- ❑ Thread spool
- ❑ Pencil or wooden dowel (small enough to slide through the hole in the thread spool)
- ❑ String (4 ft. in length)
- ❑ Scissors
- ❑ Paper for flag (4 1/4" x 5 1/2")
- ❑ Crayons

1. Decorate/color a flag created using the 4 1/4" x 5 1/2" paper.
2. Place the pencil/wooden dowel through the hole in the thread spool, making sure that the spool can turn easily.
3. Tie the ends of the string together.
4. Tape one side of the flag to the string.
5. Place the loop of the string over the spool, with the flag hanging near the bottom of the loop.
6. Have one student hold the ends of the pencil/wooden dowel high over his/her head.
7. Have the other student pull down on the string opposite the flag.
8. Observe the distance the string is pulled and the distance and direction the flag moves up. Relate this to simple machines. (The spool is a fixed pulley that allows you to pull down on the string and raise the flag upward. Placing a fixed pulley at the top of a tall flagpole makes the job of raising a flag easier than if you had to carry the flag up the pole. A fixed pulley makes work easier by changing the direction of the force. Pulling down is easier because you can use the weight of your body and the force of gravity to help you.)



Weighty Mistakes—Levers

See *3rd Grade CORE Academy Resource Book, 2003.*

Rolling Along—Wheels and Axles

See *3rd Grade CORE Academy Resource Book, 2003.*

Possible Extensions/Adaptations/Integration

Physical Education

Tool Box—To be played similar to "Fruit Bowl"

Writing

- Research a simple or compound machine. Write a report detailing when, where, why, how, and by whom the machine was invented. The student may also include technological advances in the machine since its original invention.
- Make a classroom book entitled *The ABC's of Simple Machines.*

Creative Dance

Divide the students into groups of four. Instruct the students to explore movements representative of simple machines. Each group will become a compound machine. When the machine is "turned on," one part (one student) of the machine begins operating. In a sequential order, each part (student) is activated by the part (student) next to them by pushing or pulling on him/her.

Theatre

Pantomime activities that involve a push, a pull, or push. The rest of the class has to guess the activity and the force involved.

Assessment Suggestions

Push/Pull Spoons

Give each student a spoon labeled "Push," a spoon labeled "Pull," and a spoon labeled "Push and Pull." Instruct the student to hold up the correct spoon(s) that identifies the force(s) being used in various situations (e.g., hitting a baseball, sharpening a pencil in a manual crank machine, opening the drapes, etc.).

Science Journal Writing

Have the students write in their science journals about each of the simple machines and explain how each simple machine makes work easier.

Additional Resources

Books

3rd Grade CORE Academy Resource Book, 2003

Push and Pull, by Patricia J. Murphy; ISBN 0516268643

Pushing and Pulling (Science For Fun), by Gary Gibson; ISBN 0761304614

How Do You Lift A Lion?, by Robert E. Wells; ISBN 0807534218

The New Way Things Work, by David Macauley (1998); ISBN 0395938473

Simple Machines, by Deborah Hodge; ISBN 1550743996

Machines—Spectacular Science Projects, by Janice Van Cleave; ISBN 0471571083

Physics Lab in the Hardware Store, by Bob Friedhoffer; ISBN 0531158233

Playground Physics—Simple Machines, by Bob DeWeese; ISBN 1557993017

Science Experiments With Simple Machines, by Sally Nanivell-Aston; ISBN 0531154459

Laser discs

Windows on Science, Primary Vol. 3, Force and Motion, Lessons 1-3, 5

Windows on Science, Primary Vol. 3, Work and Machines, Lesson 1

Science Alliance # 3, Machines

Web sites

http://www.enc.org/weblinks/science/0,1578,1%2DForces,00shtm

http://www.enc.org/weblinks/science/0,1578,1%2DMotion,00shtm

http://www.fi.edu/qu97/spotlight3/spotlight3.html

http://www.ed.uri.edu/SMART96/ELEMSC/SMARTmachines/machine.html

http://www.stemnet.nf.ca/CITE/machinessimple.htm

http://www.mikids.com/Smachines.htm

http://www.mos.org/sln/Leonardo/InventorsToolbox.html

http://www.san-marino.k12.ca.us/~summer1/machines/simplmachines.html

http:ww.northcanton.sparcc.org/~greentown/simpmach.htm

Family Connections

Simple Machine Hunt

Have the students, with the help of their family, identify and classify simple machines found in and around their homes. Students record their findings on the *Simple Machine Hunt* worksheet (p. 5-14).

Peaceful Penny

Have the students share this activity with their family and the scientific principle involved.

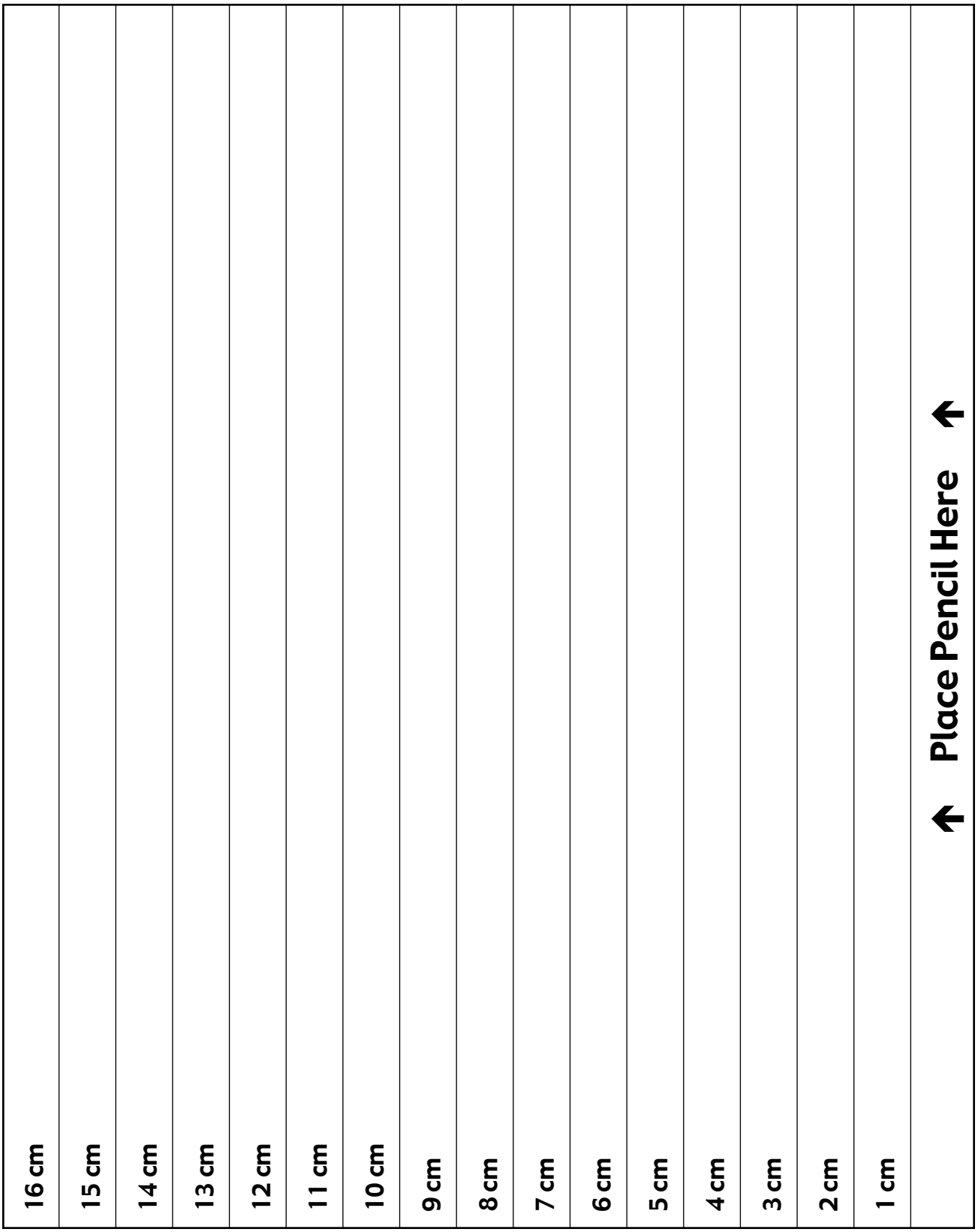
Simple Machines Bingo

Family members take turns spinning the *Simple Machine Bingo Spinner* (p. 5-15) and marking a corresponding spot on his/her *Simple Machine Bingo Card* (p. 5-16).

Mouse Trap Game

Purchase a *Mouse Trap* game for the class. Have the students take turns taking it home to play with their family. Have the family work together to write down the different pushes and pulls *or* simple machines incorporated in the game.

Paper Grid


16 cm
15 cm
14 cm
13 cm
12 cm
11 cm
10 cm
9 cm
8 cm
7 cm
6 cm
5 cm
4 cm
3 cm
2 cm
1 cm
Place Pencil Here

NAME_____

Uphill - Inclined Plane

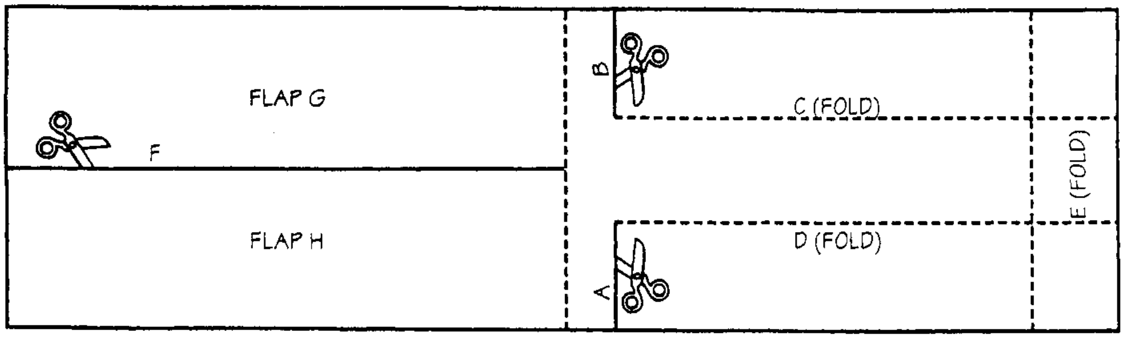
	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
Straight Up ----------g											
5 Books ----------g											
3 Books ----------g											
1 Book ----------g											

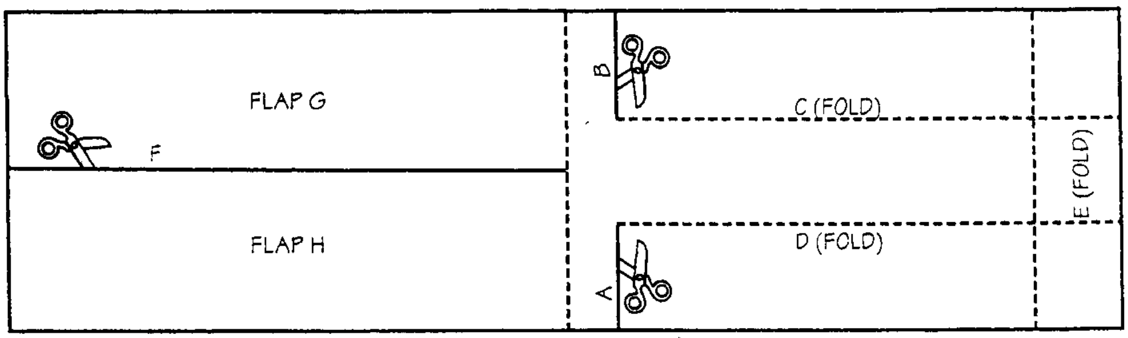
NAME_____

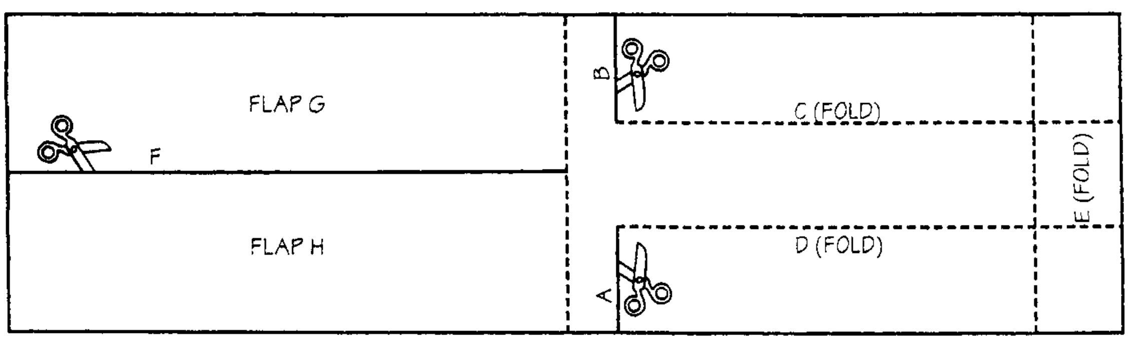
Uphill - Inclined Plane

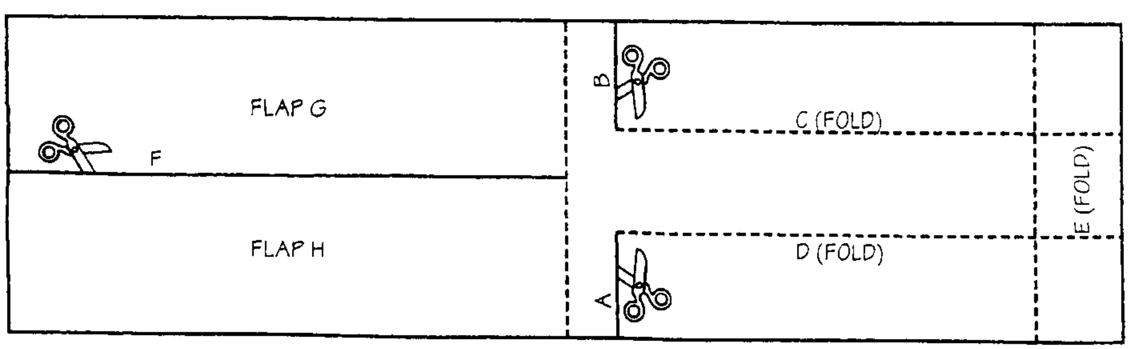
	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
Straight Up ----------g											
5 Books ----------g											
3 Books ----------g											
1 Book ----------g											

Toy Helicopter Pattern









Name _____

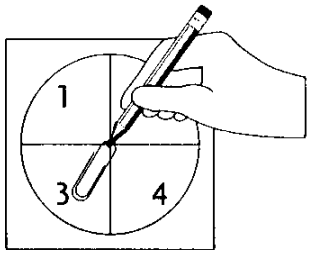
Simple Machine Hunt

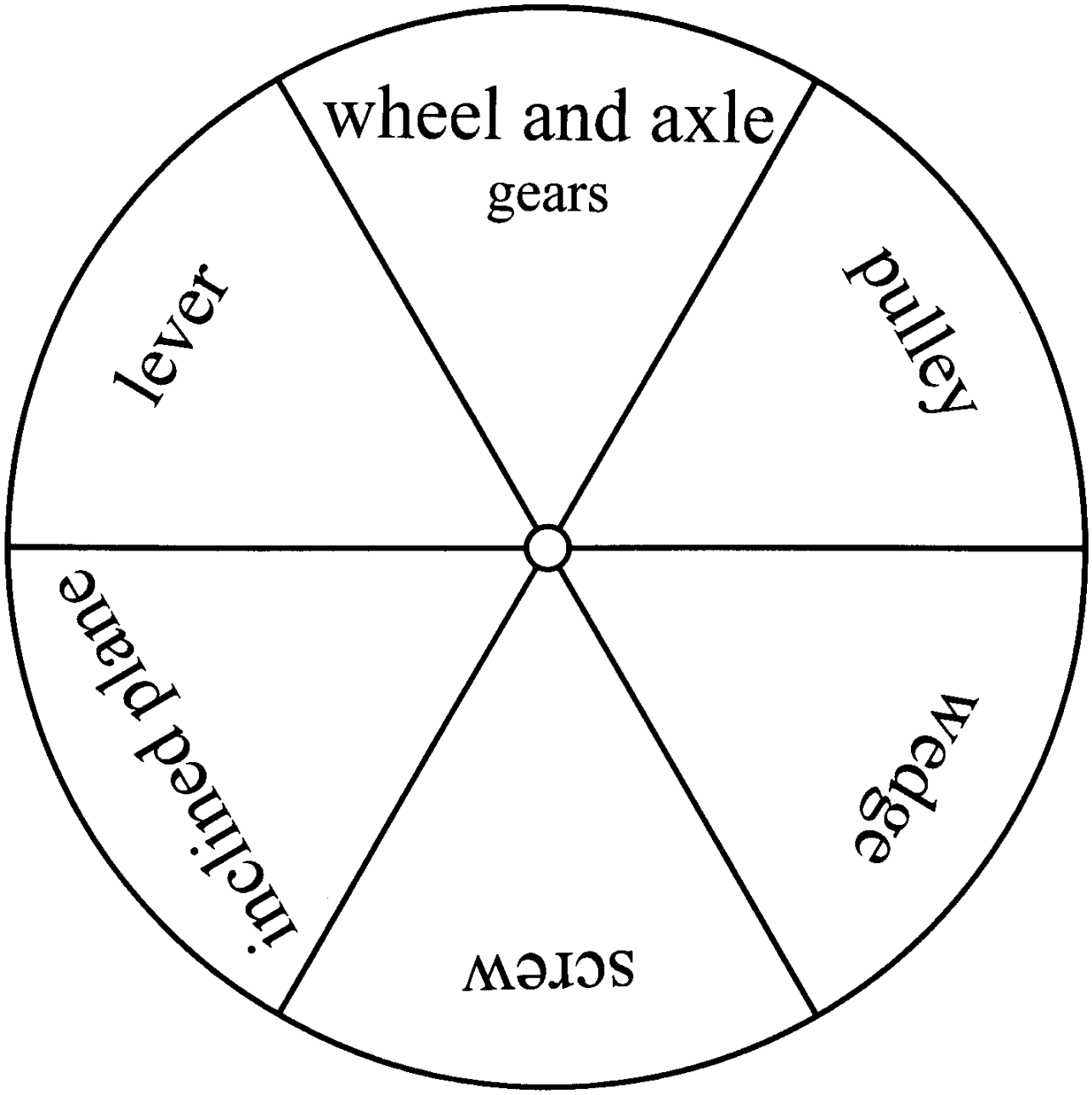
Find and classivy simple machines found around your home.

PUSH	PULL	PUSH and PULL

Simple Machines Bingo Spinner

- Students can use a paper clip and pencil





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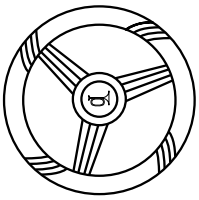
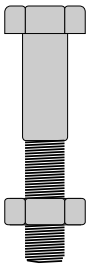
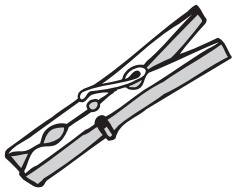
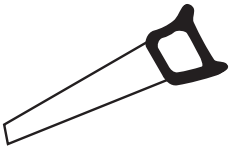
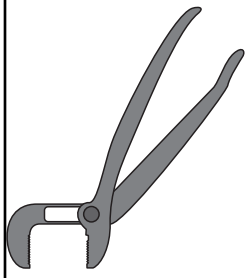
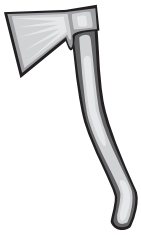
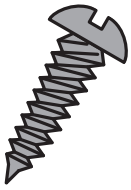
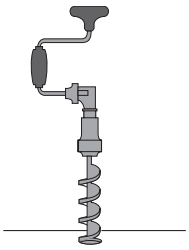
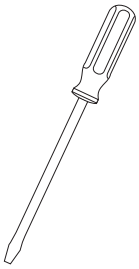
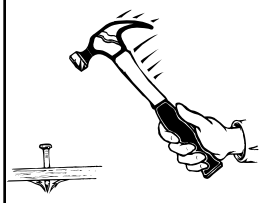
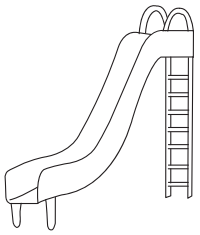
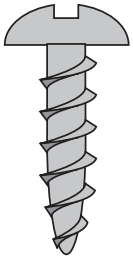
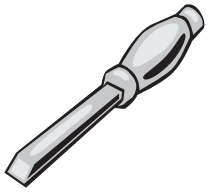
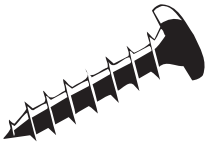
				
				
		**FREE**		
				
				

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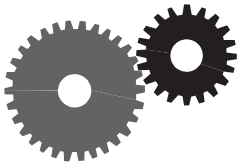
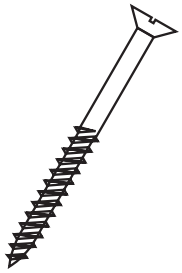
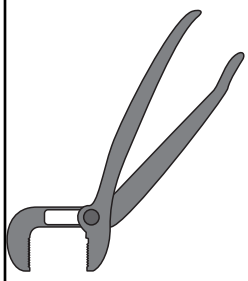
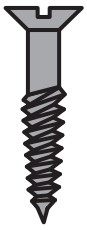
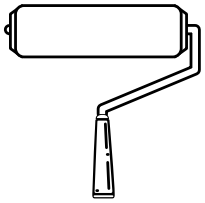
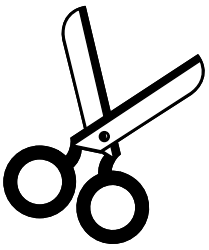
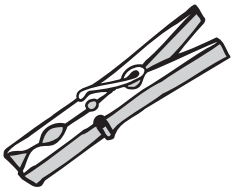
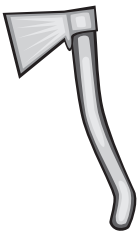
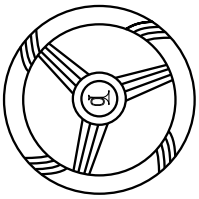
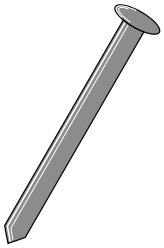
				
				
		**FREE**		
				
				

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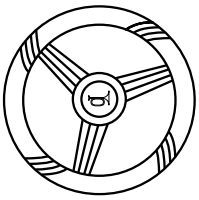
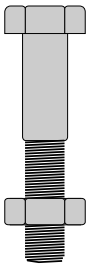
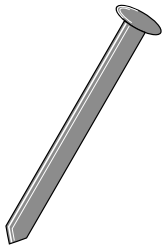
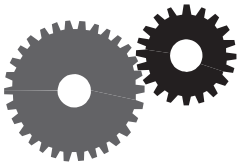
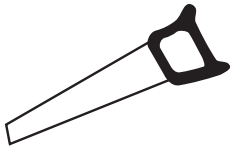
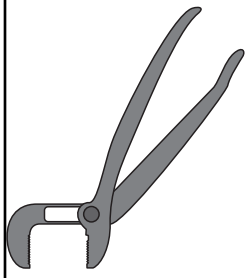
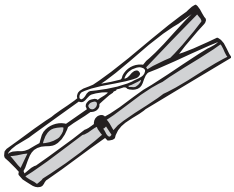
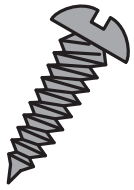
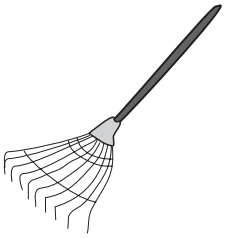
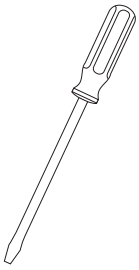
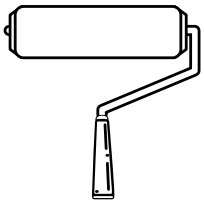
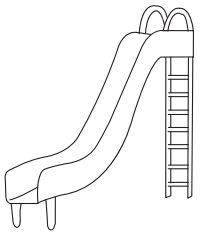
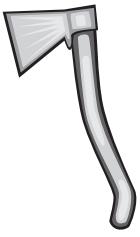
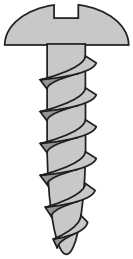
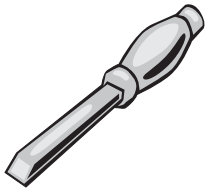
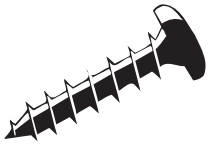
				
				
		**FREE**		
				
				

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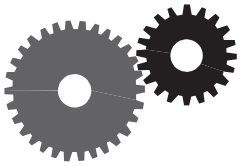
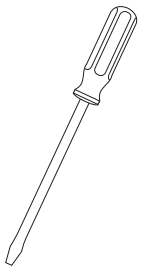
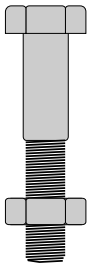
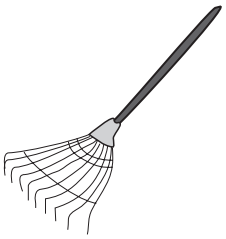
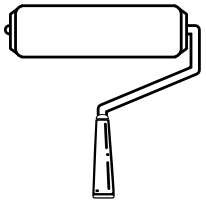
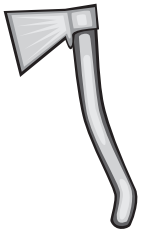
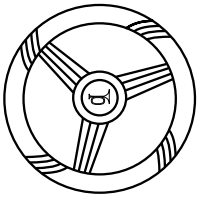
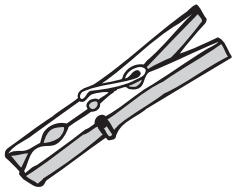
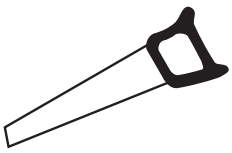
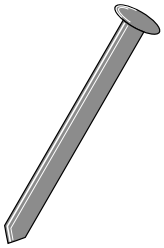
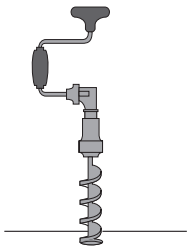
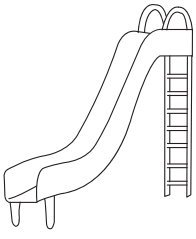
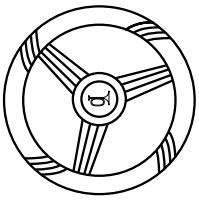
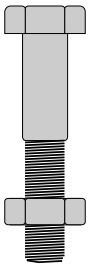
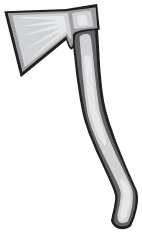
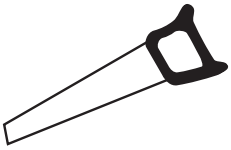
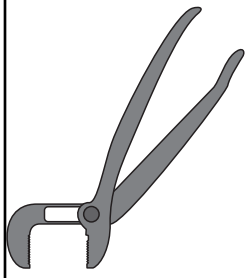
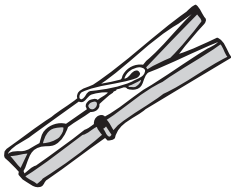
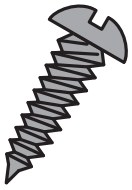
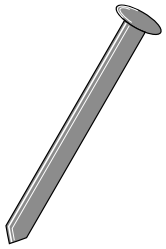
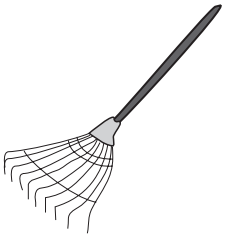
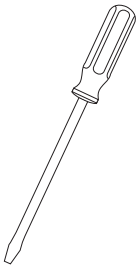
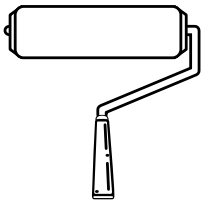
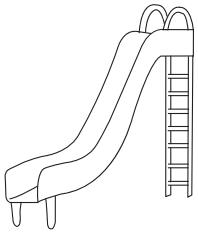
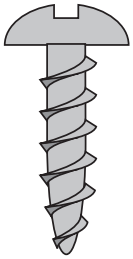
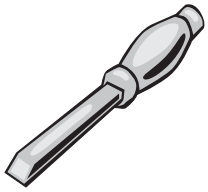
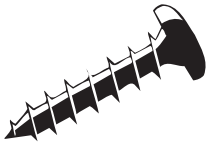
				
				
		**FREE**		
				
				

Simple Machines Bingo

				
				
		**FREE**		
				
				

May the Force Be With You

Science Standard III:
Students will understand the relationship between the force applied to an object and resulting motion of the object.

Objective 2:
Demonstrate that the greater the force applied to an object, the greater the change in speed or direction of the object.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math III-2, VI-1, 2, V-1

Science Standard III

Objective 2

Connections

Background Information

Force causes changes in the speed or direction of the motion of an object. The greater the force placed on an object, the greater the change in motion. The more massive an object is, the less effect a given force will have upon the motion of the object. Therefore, the greater the mass of an object, the greater the force needed to change its motion.

Invitation to Learn

Wind Wheel

1. Have students create *Wind Wheels* using the pattern on p. 5-25.
2. Blow on the wind wheel gently.
3. Blow on the wind wheel with a lot of force.
4. Have the students observe, analyze, and discuss what is happening, and why.

Instructional Procedures

Marshmallow Launcher

Question: I wonder if there is a correlation between one's lung capacity and the distance s/he can propel a marshmallow with the PVC marshmallow launcher.

Hypothesis: The greater one's lung capacity, then the greater distance one can propel a marshmallow with the PVC marshmallow launcher.

Materials

- ❑ 24" of 1/2" PVC pipe and accessories: two 45° elbow joints, one T-Joint, 1 end cap
- ❑ Thin plastic
- ❑ Mini marshmallows
- ❑ Long tape measurer
- ❑ *Marshmallow Launcher* data recording sheet
- ❑ *Classroom Grid*
- ❑ Peak flow meter

Experiment:

1. Have each student measure his/her lung capacity using a peak flow meter and record his/her individual results on the *Marshmallow Launcher* data recording sheet (p. 5-26).
2. Have each student propel a marshmallow, using the PVC Marshmallow Launcher and measure and record his/her individual results.
3. Graph the results for each student onto the *Classroom Grid* (p. 5-27). (For accuracy, have each student repeat both measurements three times and then calculate his/her average measurement.)

Analyze the results: What do the results show?

Conclusion: Was my hypothesis correct or incorrect?

Further Research: Where do I go from here?

Skimmer Kit—World in Motion

See p. 5-30 for directions.

Materials

Skimmer Kit
A World in Motion

- ❑ Classroom Materials Kit order form (p. 5-28)

Possible Extensions/Adaptations/Integration

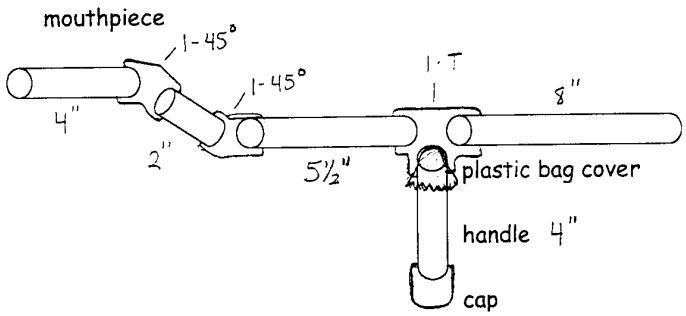
Art—Blown Pictures

- Put droplets of paint on sheet of paper. Use a straw to blow air (force), moving the paint into various directions and designs.

Physical Education

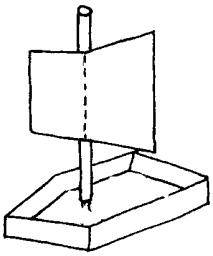
- Use different amounts of force to hit, kick, and/or bat a ball. Observe, analyze, and discuss how the amount of force applied affects the ball.
- Use a different ball than normally used in a variety of games. Observe, analyze, and discuss how the "new" ball affects the game in regards to force, motion, speed, direction, and distance (e.g., nerf sponge ball in baseball, a tennis ball in basketball, a cage ball in dodge ball, etc.).

Assessment Suggestions



Marshmallow Launcher

- Did the student accurately read his/her lung capacity?
- Did the student accurately measure the distance his/her marshmallow was launched?
- Did the student correctly record the data on his/her data recording sheet?
- Did the student accurately analyze the results and draw a correct conclusion based on the data? (This could be written in students' science journals)



Skimmer Kit

- Did the student work cooperatively in groups?
- Was the student able to analyze any defect(s) in his/her design and come up with the proper solution(s)?
- Was the student able to design and construct a successful skimmer?
- The student will write about the experience in his/her science journal.

Additional Resources

Books

The Gadget War, by Betsy Duffey; ISBN 0141307080

Tell Me How Fast It Goes (Whiz Kids), by Shirley Willis; ISBN 0531159760

Feel the Wind, by Arthur Dorros; ISBN 00644450953

The Berenstain Bear's Science Fair, by Stan and Jan Berenstain; ISBN 0394866037

Gizmos and Gadgets (Creating Science Contraptions that Work and Knowing Why), by Jill Frankel Hauser; ISBN 1885593260

Forces, by Graham Peacock; ISBN 1568471920

Video

Lift-Off to Learning, Newton in Space, NASA, 13:00

Laser disc

Windows on Science, Primary Vol. 3, Force and Motion, Lessons 6-10, 14-17

Web sites

http://www.enc.org/weblinks/science/0,1578,1%2DForces,00shtm

http://www.enc.org/weblinks/science/0,1578,1%2DMotion,00shtm

Family Connections

Marshmallow Catapult

Read *The Gadget War* to the class. Have the students create a catapult at home with family that will launch a large marshmallow onto a designated target (such as the center circle on the gym floor from ten feet away).

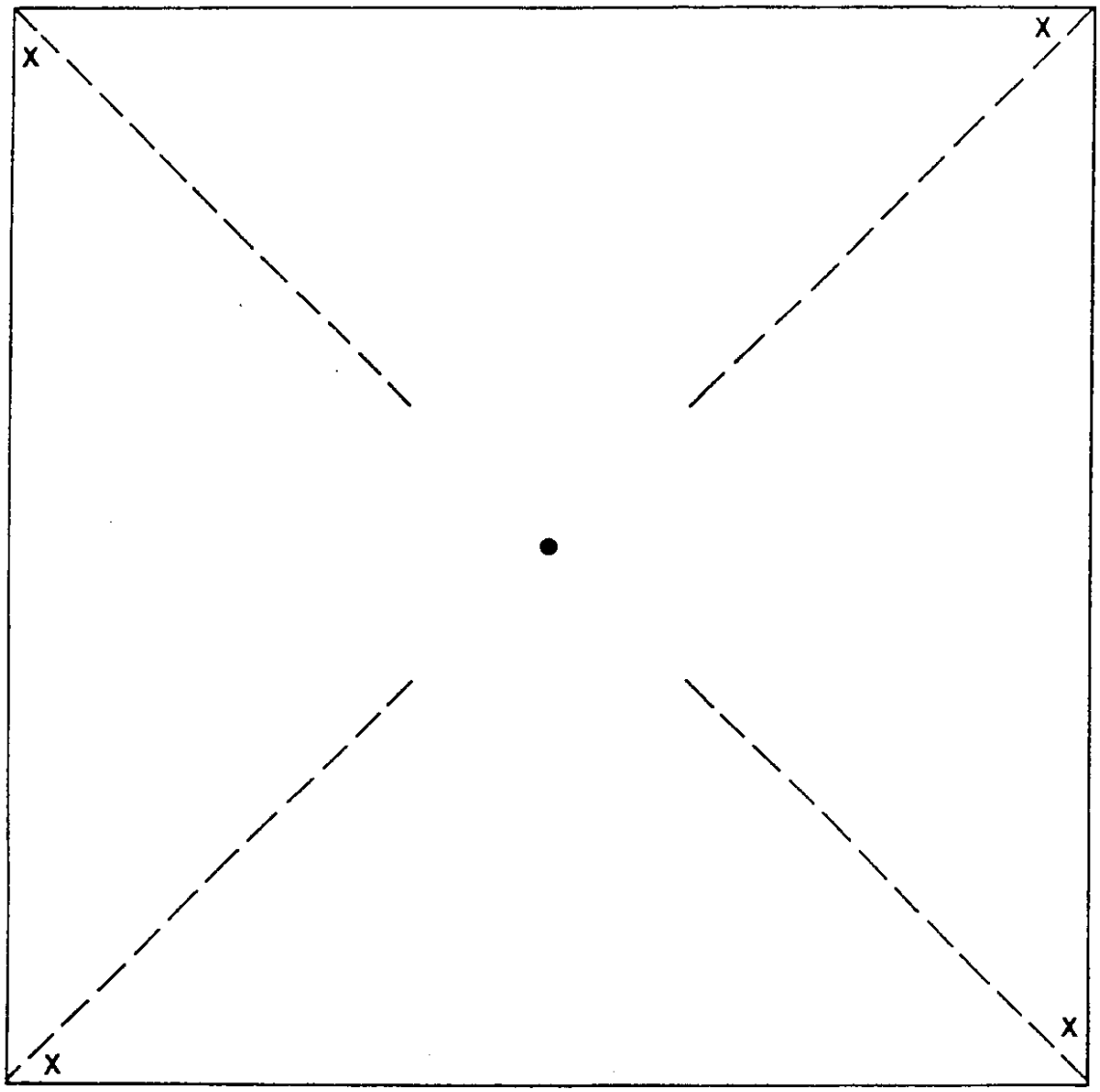
Wind Wheel

Have the students share this activity and the scientific principle involved with family. Wind wheels may be constructed in school or at home.

Skimmer

Have the students design a skimmer at home with the help of family. The skimmer will move successfully from one end of the bathtub to the opposite end of the bathtub by blowing on it or using a fan (if available).

Make a Wind Wheel



Materials: scissors, pins, pencils or straws

1. Cut in at each corner.
2. Take the corners marked X and fold up to center.
3. Pin all corners to the center.
4. Pin on eraser of pencil or plastic straw.

*Teacher: Run this on heavy paper such as oaktag.

Your wind wheel should look like this:

NAME_____

Marshmallow Launcher

My lung capacity is_____

I launched my marshmallow_____

NAME_____

Marshmallow Launcher

My lung capacity is_____

I launched my marshmallow_____

NAME_____

Marshmallow Launcher

My lung capacity is_____

I launched my marshmallow_____

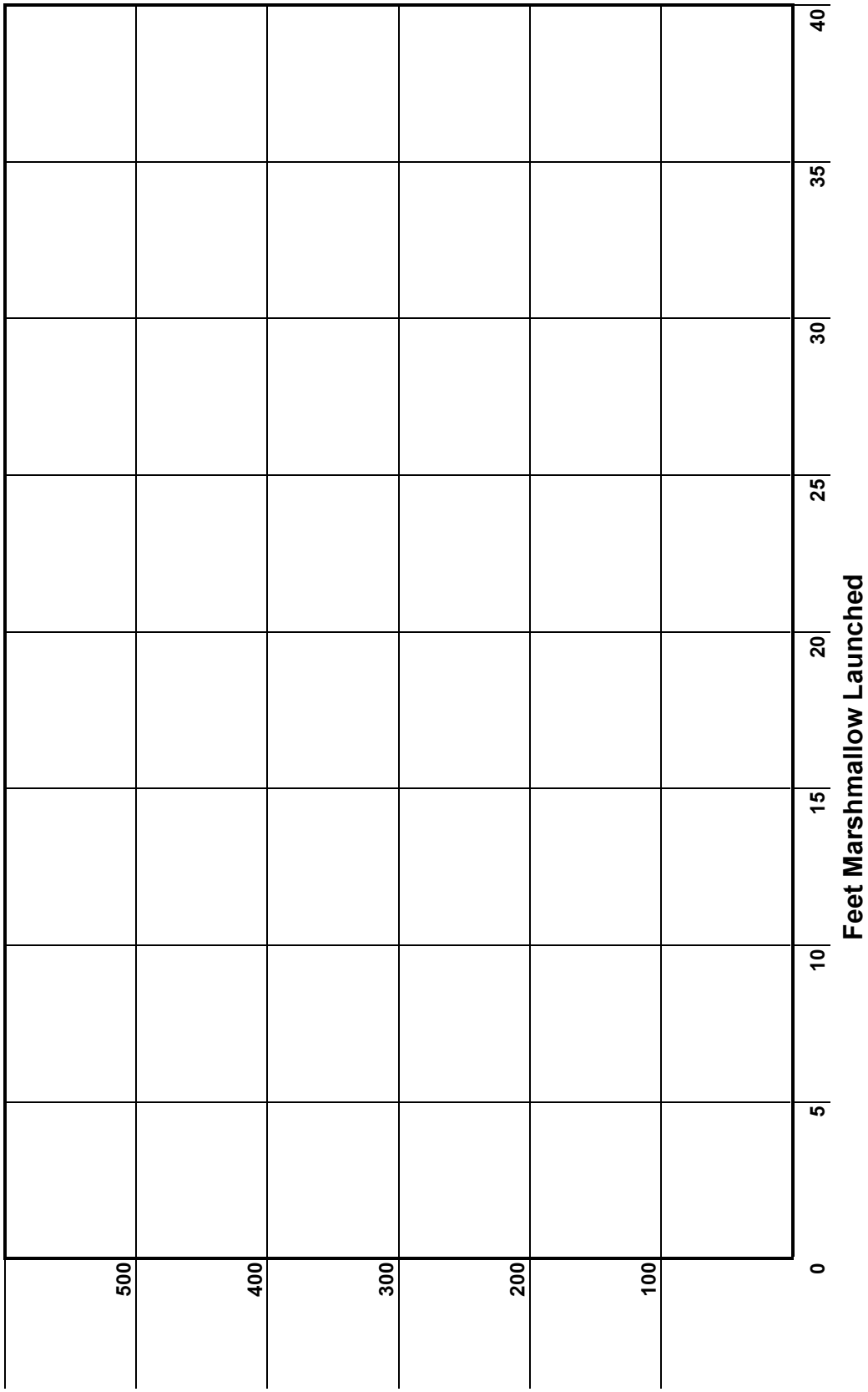
NAME_____

Marshmallow Launcher

My lung capacity is_____

I launched my marshmallow_____

Classroom Grid



Statement of PARTNERSHIP

SAE
Society of Automotive Engineers

A WORLD IN MOTION

THE DESIGN EXPERIENCE
CHALLENGE 1

Classroom Materials Kit Order Form

Name _____Grade_____

School _____Subject_____

School Address (Cannot be a P.O. Box) _____

City, State, Zip_____

School Phone (_____)_____Fax (_____) _____

Home Phone (_____) _____

E-mail Address_____

The Society of Automotive Engineers Foundation will provide one classroom materials kit for each classroom teacher who has returned this completed Statement of Partnership form.

Please check appropriate boxes

- ❑ Skimmer Materials Kit – Grade 4
- ❑ JetToy Materials Kit – Grade 5
- ❑ Steel Can Rover Materials Kit – Grade 6

School Location: ❑ urban ❑ suburban ❑ small city ❑ rural

Approximate # students in your school that will be using *A World In Motion*, _____ of which:

male students _____ # Hispanic students _____ # Native American students _____
female students _____ # Asian students_____ # African American students _____
White students _____ # Other (non-white) _____

Teacher's Signature _____ Principal's Name _____

Date _____ **Signature** _____

Date _____

Please complete both sides of this form

SECTION II: Partner

(Note: A partner is a representative of a business or organization with staff or members that can contribute to the students' understanding of the engineering design, scientific, or technology experience.)

Name _____

Telephone _____

Fax _____ E-mail address _____

Occupation: ❑ Engineer – type _____ ❑ Scientist – discipline _____

❑ Professor – discipline _____ ❑ Other _____

❑ College Student – major _____ ❑ Retired – occupation _____

Employer Name _____

Department _____

Job Title _____

Address _____

_____

_____

I am an SAE member: ❑ No ❑ Yes, Section _____

Please Note: It is not SAE's intention that any partner be bound to any further specific course of action in regards to commitment of finances, resources, and /or personpower. This Statement of Partnership is a statement of your good faith to work together for the good of education.

SECTION III:

RETURN FORM TO:

SAE International
A World In Motion
400 Commonwealth Drive
Warrendale, PA 15096-0001

OR FAX TO:

A World In Motion
Education Program Assistant
724-776-0890

If you have questions regarding *A World In Motion: The Design Experience*, please leave a message on the AWIM Hotline at **1-800-457-2946**, or e-mail us at **awim@sae.org**

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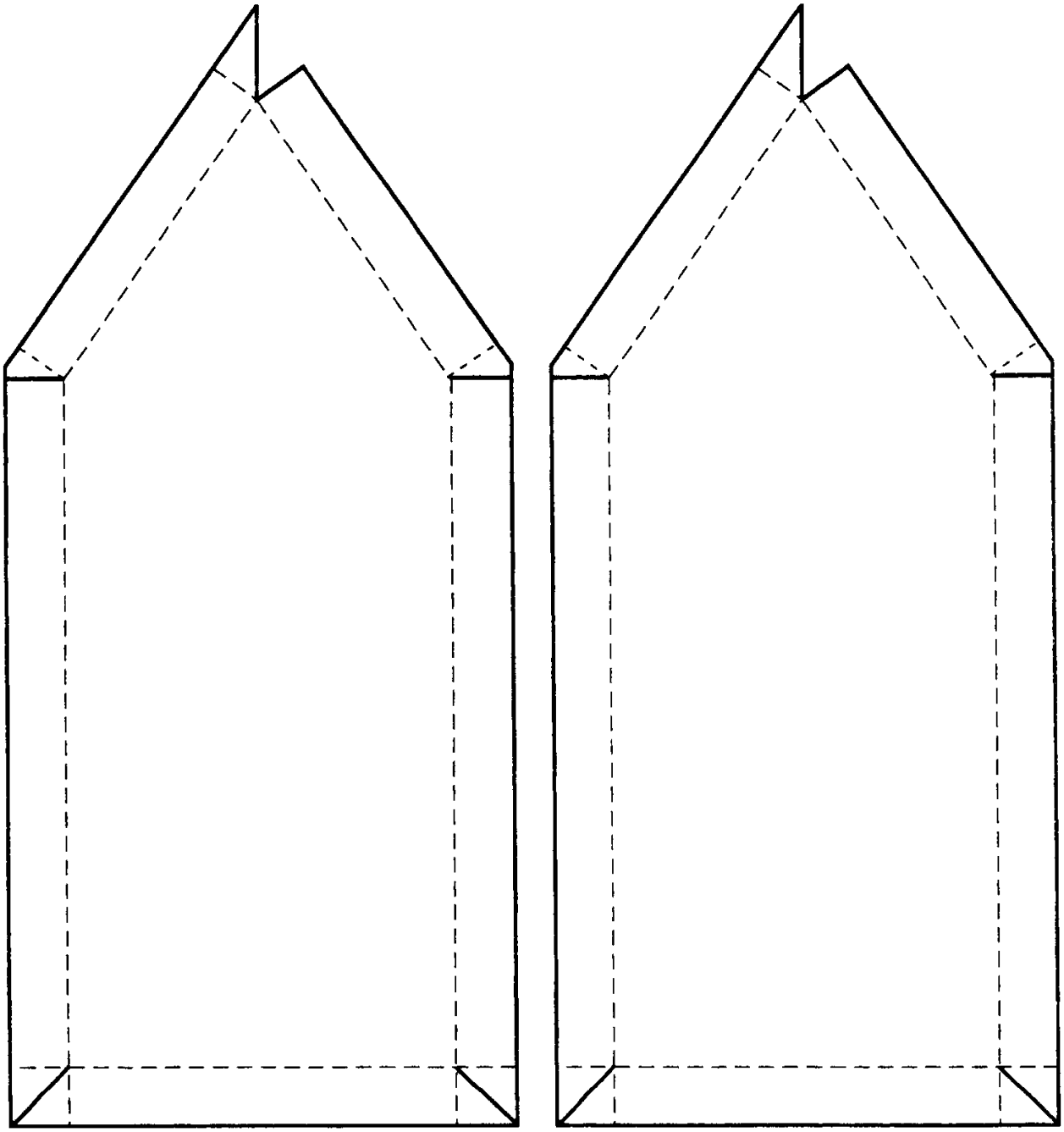
Skimmer Hull Pattern

Follow the directions on *Building the Skimmer Hull.*



Reproducible Master 4

Building the Skimmer Hull

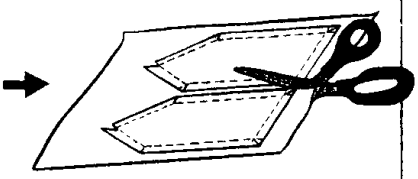
Materials

- Skimmer Hull Pattern
- scissors
- ballpoint pen
- masking tape

IMPORTANT: To build a skimmer that performs well, be sure to work *slowly* and *carefully*.

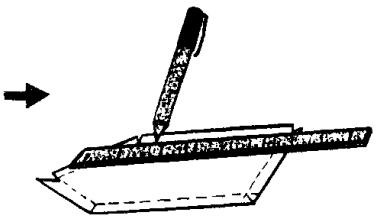
Procedure

1. Every other team, get a Skimmer Hull Pattern. Cut the two hulls apart and give one to another team.

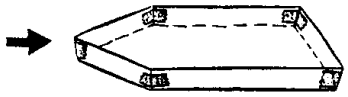


2. Each team, cut out the Skimmer Hull Pattern along the solid lines. Be especially careful at the corners.

3. To fold each dotted line:
   a. Place a ruler on the dotted line.
   b. Use a ballpoint pen to mark a heavy dark line over the dotted line.
   c. Without moving the ruler, carefully fold up the skimmer's sides against the ruler.



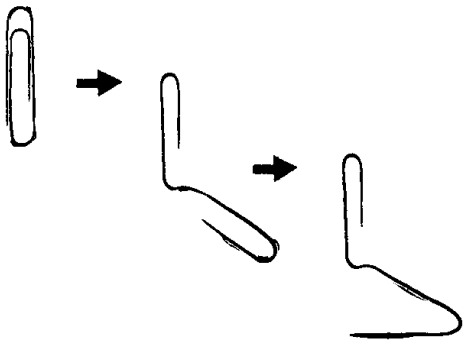
4. Holding the skimmer flat against the table, use small pieces of masking tape to tape the flaps closed. Be sure that no tape is touching the bottom of the skimmer.



5. Check to see that the bottom of the skimmer is flat against the table. If it is not flat, tape the corners again.

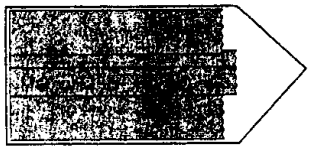
Making a Sail Stand

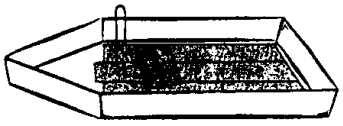
1. Pull the two loops of a large paper clip apart so that they form an "L" shape.



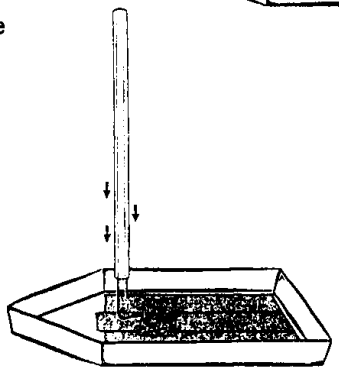
2. Open up the larger loop of the paper clip into a "V" shape.

3. Put three lengths of masking tape in the hull lengthwise. Mark a centimeter number line like this on the middle piece of masking tape:





4. Use a piece of masking tape to attach the V-shaped part of the stand to the skimmer.



5. To mount a sail, push the straw over the loop of the sail stand.

It's A Weighty Matter

Science Standard IV:
Students will understand that objects near Earth are pulled toward Earth by gravity.

Objective 1:
Demonstrate that gravity is a force.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Math I-2, VI-1, 2

Science Standard IV

Objective 1

Connections

Background Information

Earth's gravity pulls everything towards its center. Gravity gives objects their weight. The weight of an object is a measure of the pull of gravity on that object. Matter is anything that takes up space and has weight. Mass is the amount of matter something has. Weight is the pull of gravity on the mass. More mass means more weight, because there's more for gravity to pull on.

Invitation to Learn

Race with Gravity *(to be done with a partner)*

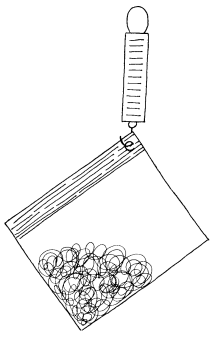
Ask your partner to hold the ruler, hanging down (with 1 on the bottom and 12 on the top), just above your outstretched hand. When your partner releases the ruler, try to catch the ruler as quickly as you can. (By the time the message has traveled from your brain to your hand, gravity has already begun to pull the ruler down). Have a contest to see who in the class is the quickest to respond.

Materials
- ❑ Ruler

Instructional Procedures

Prior to the activity, place one cup of various objects into individual Ziploc bags. Paper punch a hole in the top corner of each Ziploc bag.

1. Estimate the order of the weights of the objects in the Ziploc bags from lightest to heaviest.
2. Measure the weight of each object using the spring scale.



Materials
- ❑ Ziploc bags (sandwich or quart size)
- ❑ One cup each of various items (marshmallows, gravel, rice, beans, cereal, etc.)
- ❑ Spring scale
- ❑ *It's a Weighty Matter* worksheet

3. Place the objects in the correct order from lightest to heaviest.
4. Graph the weights of the objects on *It's a Weighty Matter* worksheets (p. 5-36).

Possible Extensions/Adaptations/Integration

Art

- Make a flip book illustrating the effects of gravity on an object.

Writing

- Write a story about a day without gravity.
- Pretend that you are Sir Issac Newton and write a letter to a friend explaining your new discovery—gravity.

Assessment Suggestions

- Did the student accurately read the spring scale?
- Did the student place the objects in the correct sequence from lightest to heaviest?
- Can the student accurately replicate the activity with different objects?

Additional Resources

Books

Gravity, by Dan Greenberg (Newbridge Education Publishing, 1999, Item CA09660); ISBN 1582730245

The Magic School Bus Plays Ball, by Joanna Cole: ISBN 0590922408

Gravity: Simple Experiments for Young Scientists, by Larry White; ISBN 0761300899

Bowled Over: The Case of the Gravity Goof-Up, by Chuck Harwood; ISBN 007007555

Why Doesn't the Earth Fall Up?, by Vicki Cobb; ISBN 0525672532

Which Way Is Up?, by Gail Kay Haines; ISBN 0689312857

Video

Gravity is Attractive: What is Gravity? Produced by TMW Media Group

Laser disc

Windows on Science, Primary Vol. 3, Force and Motion, Lessons 12 + 13

Web sites

http://www.enc.org/weblinks/science/0,1578,1%2DGravity,00shtm

http://www.lessonplanspage.com/ScienceSSmars7

Family Connections

Race With Gravity

Have the students share this activity and the scientific principle involved at home with family.

A Homemade Scale

Materials

- ❑ Pencil
- ❑ Elastic
- ❑ Large paper clip
- ❑ Ruler
- ❑ Various objects to be weighed

1. Tape the pencil to a table, so half of the pencil is hanging over the edge.
2. Hang the rubber band on the pencil.
3. Open the paper clip so it looks like an "S."
4. Attach the small loop of the "S" to the rubber band.
5. Compare the weight of different objects by hanging them from the large loop of the "S" in the paper clip. Observe and measure the length of the rubber band with each object.

Critter Catch

Materials

- ❑ Toilet paper tube
- ❑ 18 inches of string
- ❑ 6" x 6" piece of aluminum foil
- ❑ Tape
- ❑ 2" square of paper

1. Cover the bottom end of the toilet paper tube with paper and tape securely.
2. Tape one end of a string onto the piece of aluminum foil.
3. Crumble the piece of aluminum foil into a ball (critter) around the string so the foil ball fits easily into the hole of the tube.
4. Attach the loose end of the string to the open end of the tube.
5. While holding onto the tube, swing the aluminum ball into the air. Try to catch the aluminum foil ball in the tube.
6. Bring the critter catchers to school and share designs with classmates.
7. Discuss what is happening. Gravity is pulling the aluminum foil ball down, toward the center of Earth.

Variation

Use a cup in place of the toilet paper tube and 2" square of paper.

NAME_____

It's a Weighty Matter

	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
----------g											
----------g											
----------g											
----------g											

NAME_____

It's a Weighty Matter

	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
----------g											
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The Force of Gravity

Science Standard IV:
Students will understand that objects near Earth are pulled toward Earth by gravity.

Objective 2:
Describe the effects of gravity on the motion of an object.

Intended Learning Outcomes:
1. Use Science Process and Thinking Skills
2. Manifest Scientific Attitudes and Interests
3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

Content Connections:
Theatre II-1; Math I-1, 2, 5, VI-1, 2

Science Standard IV

Objective 2

Connections

Background Information

If you throw a ball into the air, the force you exert pushes the ball forward and/or up. The ball continues to move in that direction until the effect of gravity becomes stronger than the force of your throw. Gravity pulls the ball downward toward Earth.

Invitation to Learn

Bicycle Ride Pantomime

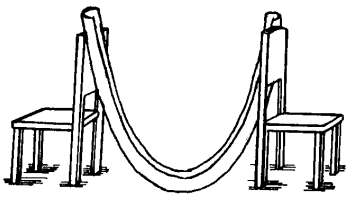
Tell the students they are going to pretend to go on a bike ride and they need to listen carefully as you describe the terrain and respond appropriately.

"It is a nice spring day—great for a bike ride. You put on your helmet and pull your bike to the end of the driveway. You carefully climb onto your bike. After looking both ways, you start pedaling and turn right onto the road. The road is nice and flat for awhile. Now, you are approaching a small hill. To get to the top you have to push a little harder and faster on your pedals. The road levels off and then disappears. You suspect that the road goes downhill. You are correct. It is a long gentle slope. As you go down the hill, you can coast instead of pedal. You turn right at the bottom of the hill where the road flattens out. A nice steady even pedaling keeps you going at a constant speed. You spot a steep ravine up ahead. As you approach, you sigh before starting downhill. You have to apply the brakes to prevent yourself from going too fast. As soon as you reach the bottom, you start to climb uphill. It is so steep; you have to pedal really hard and fast. Once on top, you stop to catch your breath. The flat terrain is inviting. You pedal along at a steady speed. You turn left at the

corner and continue your steady pedaling until you reach your friend's house. You turn left into their driveway, stop, get off your bike, lean your bike against the wall, and take off your helmet."

What would you tell your friend about your bike ride and the effect of gravity as you went up and down the hills?

Instructional Procedures



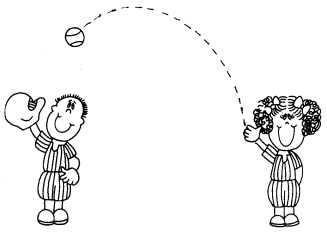
Materials

- ❑ Pipe insulator (cut in half lengthwise)
- ❑ Marble
- ❑ 2 chairs
- ❑ *It's an Uphill Battle* data recording sheet

It's An Uphill Battle

1. Place the chairs approximately 24" apart.
2. Place the pipe insulator between the two chairs, forming a "U" and extending 36" off the floor at both ends. Tape the pipe onto the chairs.
3. Explain to the students that you are going to release a marble from various starting points. Have the students predict how far up on the other side the marble will roll.
4. Place the marble on the pipe insulator 30" from the floor and release it.
5. Observe how far up the other side the marble traveled. Record your observations on the *It's an Uphill Battle* data recording sheet (p. 5-41).
6. Repeat steps four and five from a height of 24", 18", 12" and 6".
7. Analyze the results.

   Relate this activity to "Roller Coaster" (See *3rd grade CORE Academy Resource Book, 2003*.)



Materials

- ❑ Tennis ball
- ❑ *Throwing Balls* overhead transparency

Ball Throwing

1. Display the *Throwing Balls* overhead transparency (p. 5-42) showing three scenarios of a thrown ball.
2. Have students predict which scenario is correct.
3. Watch the video: *Lift-Off to Learning, Space Basics*
4. Go outside and have the students experiment throwing a ball. Instruct the students to observe and analyze the forces acting on the ball and the results of those forces.
5. Have the students discuss and analyze the overhead transparency pictures again and reach a conclusion of what happens to a ball that is thrown in the air.

Possible Extensions/Adaptations/Integration

Writing

Have the students select and research an amusement park ride of their choice. Write a report detailing when, where, why, how, and by whom the ride was invented. The student may also include technological advances in the ride since its original invention. Include what forces are involved.

Music

Sing *Gravity* (p. 5-40).

Assessment Suggestions

It's an Uphill Battle

- Did the student accurately fill in the information on his/her data recording sheet?
- Can the student explain (written or orally) why the ball does not travel up as far on the opposite side compared to the spot from which it was released? This may be illustrated and explained in his/her science journal.

Ball Throwing

- Students draw a diagram of what happens when a ball is thrown in their science journals. Label the forces and direction of the forces acting upon the ball.

Additional Resources

Books

3rd grade Elementary CORE Academy Handbook (2003); ISBN 1-890563-78-1

Looking Inside Sports Aerodynamics (X-Ray Vision), by Ron Schultz; ISBN 0753453487

Experiments with Gravity (True Books), by Salvatore Tocci, Robert Gardner, Nancy R. Vargus; ISBN 051629348

The Science Book of Gravity, by Neil Ardley; ISBN 0385253877

Videos

Roller Coaster! (1993, WGBH Educational Foundation)

Lift-Off to Learning, Space Basics, NASA, 21:00

Laser disc

Windows on Science, Primary Vol. 3, Force and Motion, Lesson 11

Web sites

http://www.enc.org/weblinks/science/0,1578,1%2DGravity,00shtm

http://www.lessonplanspage.com/ScienceSSmars7

Family Connections

Play Ball

Play a game with family that requires a ball. Instruct students to discuss the effect of forward momentum and gravity on the ball.

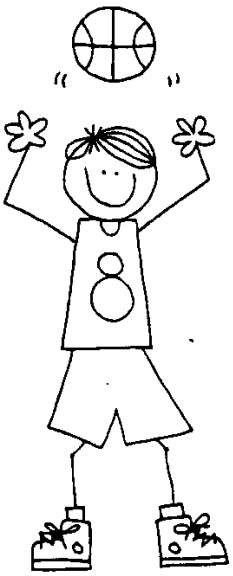
Family Bike Ride

Go on a family bike ride. Discuss how it requires more force to go up a hill than down a hill.

Amusement Park

Design (and construct) an amusement park ride at home with the help of family. Bring the ride to school and set up a class amusement park.

Gravity



(sung to *London Bridge is Falling Down*)

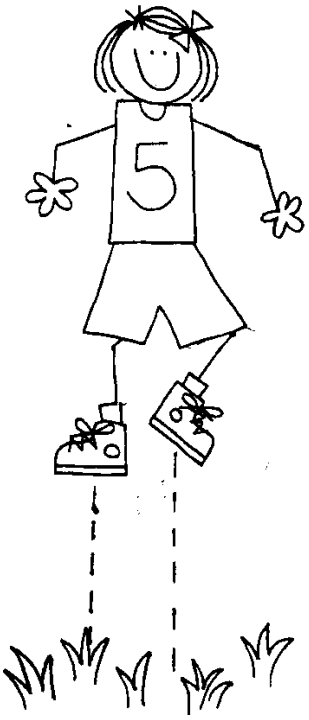
CHORUS
Gravity is pulling down,
Pulling down, pulling down,
Gravity is pulling down
All around you!

Take a ball and toss it high.
Will it stay in the sky?
Gravity will pull it down
All around you.

CHORUS

Jump up high and down you'll go.
There's a force down below.
Gravity is pulling down
All around you.

CHORUS



SOURCE: 101 Science Poems & Songs for Young Learners, by Meish Goldish, Scholastic, Inc., 1996

NAME_____

It's an Up Uphill Battle

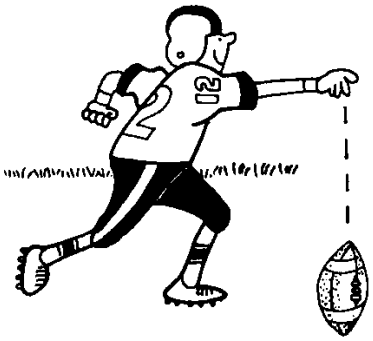
A: Starting Point	B: How far up the other side the marble traveled	Difference A-B=____
24 Inches		
18 Inches		
12 Inches		
6 Inches		

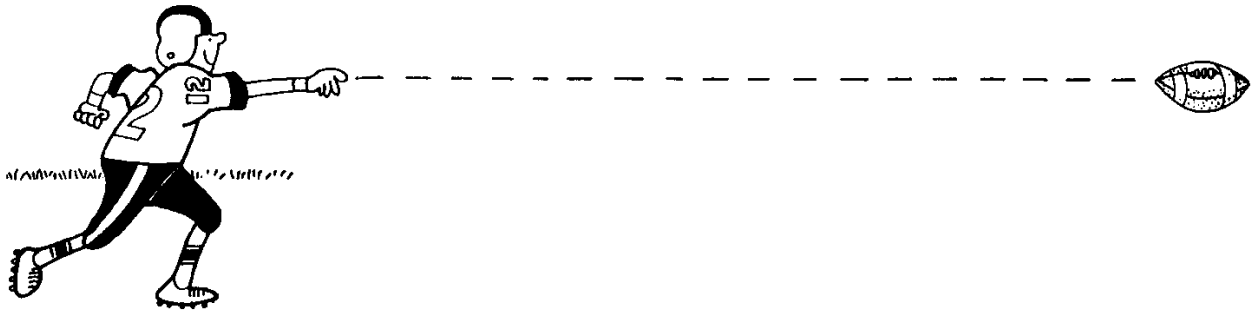
NAME_____

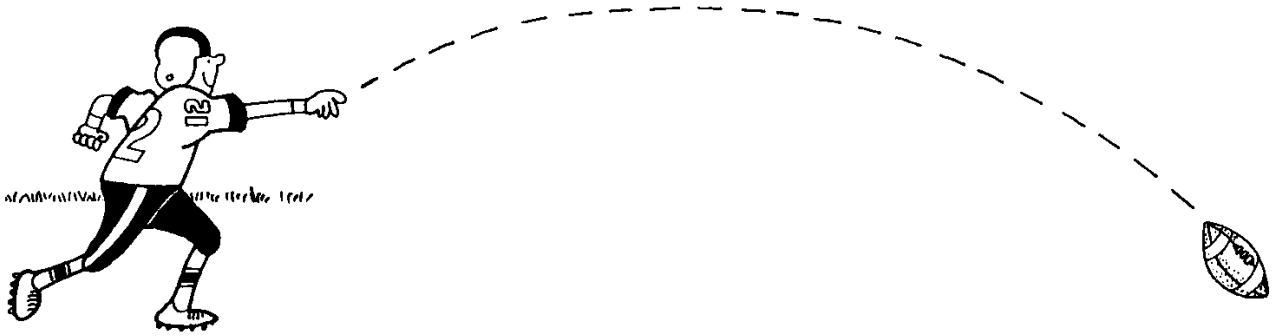
It's an Up Uphill Battle

A: Starting Point	B: How far up the other side the marble traveled	Difference A-B=____
24 Inches		
18 Inches		
12 Inches		
6 Inches		

Throwing Balls







Math Standard II Activities

Patterns Around Us

Math Standard II:
Students will use patterns and relations to represent mathematical situations.

Objective 1:
Recognize and create patterns with given attributes.

Intended Learning Outcome:
3. Reason mathematically.

Content Connections:
Dance III-1, 2; Math III-1

Math Standard II

Objective 1

Connections

Background Information

This lesson establishes background information for patterns.

Invitation to Learn

Go on a pattern hunt. Have students use a journal to identify patterns in the classroom and outside and draw them in their journals.

Instructional Procedures

1. After the pattern hunt, ask the students what patterns they found. Represent the patterns they found mathematically using symbols, numbers, and letters. Emphasize terminology you want them to know such as ABAB, repeating, increasing, decreasing, etc. Some students will notice some patterns that we consider to be "random" patterns and not predictable, repeating patterns. Point out the difference between the two.
2. Play *Pattern Connect Four.*

   Object: To be the first player to get four spaces in a row (up, down, or diagonally) marked with your game pieces.

   Before Playing: Either color the game boards yourself, or instruct the students in coloring them. This could be a further extension of the students' learning of patterns to color the game boards. Use the *Pattern Connect Four Game Boards* (p. 6-5) marked with the colors they should be (Br= Brown, G=Green, Bl =Blue, R=Red, O= Orange , Y=Yellow). Have the students make the *Pattern Connect Four Dice* (p. 6-6).

   To Play: This game is for two players. One player uses white Unifix cubes as his/her markers. The other player uses black. The tallest person goes first. Each person roles the dice and

Materials

- ❏ Pattern journal
- ❏ Unifix cubes (21 red, 13 blue, 14 brown, 8 yellow, 12 green, 12 orange, 10 white, 10 black X the number of games)
- ❏ *Pattern Connect Four* game boards, paper dice, and pattern train mat
- ❏ Overhead projector

takes the Unifix cubes indicated. If the player can make one of the pattern trains with the cubes s/he has taken, then s/he marks the space with one of his/her markers and puts the pattern train on the *Used Pattern Train Mat* (p. 6-8). The next player does the same. The game continues until one player has four markers in a row up, down, or diagonally. More than one pattern train can be made per turn. If a player already has the color of Unifix cubes or nothing else can be made with the color indicated on the dice, s/he can opt not to take them. If no pattern train can be made, the player looses his/her turn. If there are no longer any Unifix cubes in the color rolled on the dice and your opponent has them, you may use the color you need from your opponent.

Possible Extensions/Adaptations/Integration

- Read various pattern books and represent their patterns mathematically.
- Adaptations for learners with special needs: *Pattern Connect Four* could be played in two teams instead of individually. Notify aides of special needs students in advance to come prepared with patterns for the pattern hunt.

Additional Resources

Books

The Important Book, by Margaret Wise Brown; ISBN 0064432270

Goldilocks and the Three Bears (multiple versions available)

Other fairy tales

Web sites

http://www.mathcats.com (Tessellation Town activity)

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

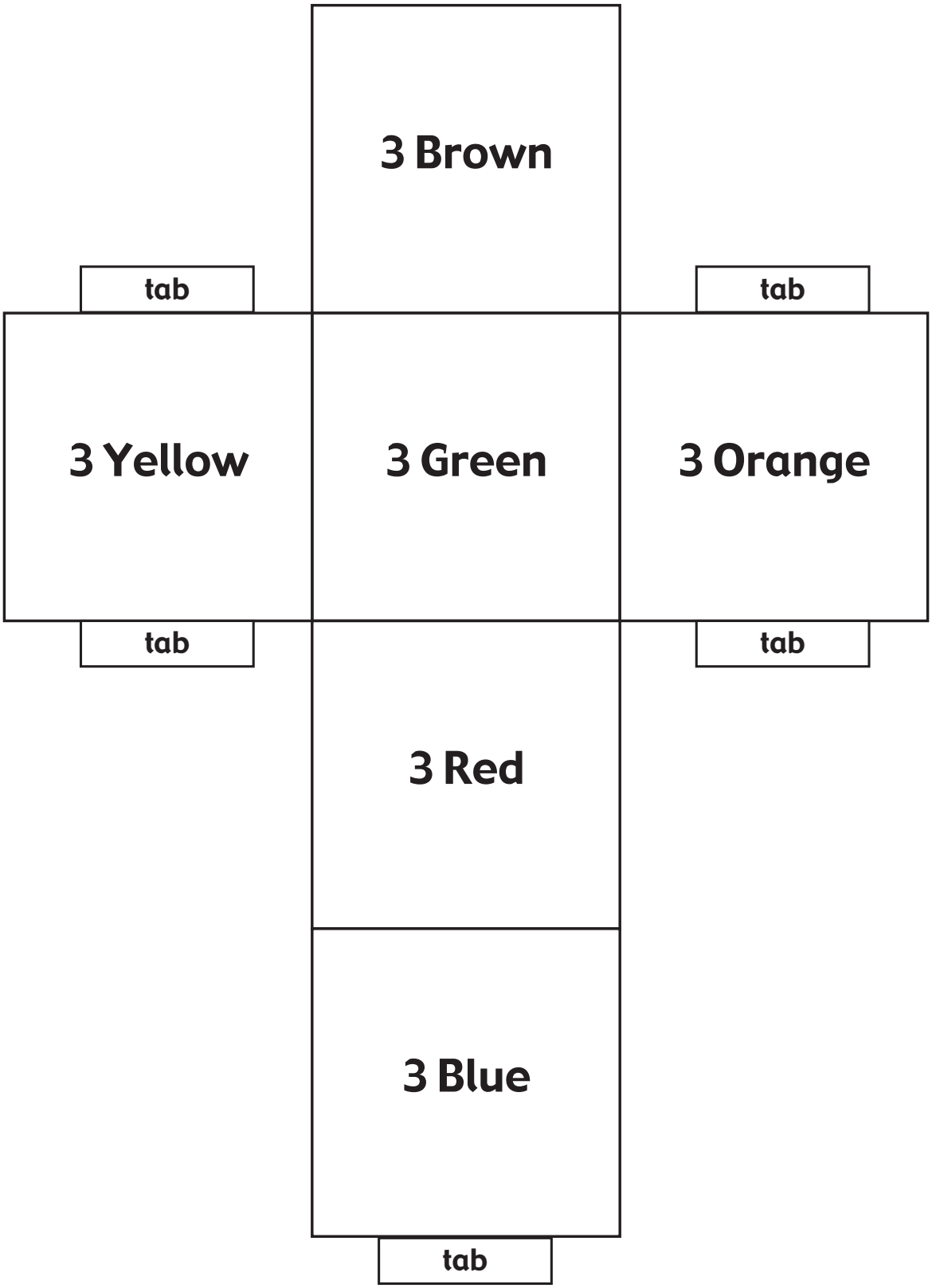
Family Connections

- Look for patterns around the house and record them in a journal.
- Read pattern books to family members.
- Send *Pattern Connect Four* home to play for homework. You may want to use paper Unifix cubes rather than sending yours home.

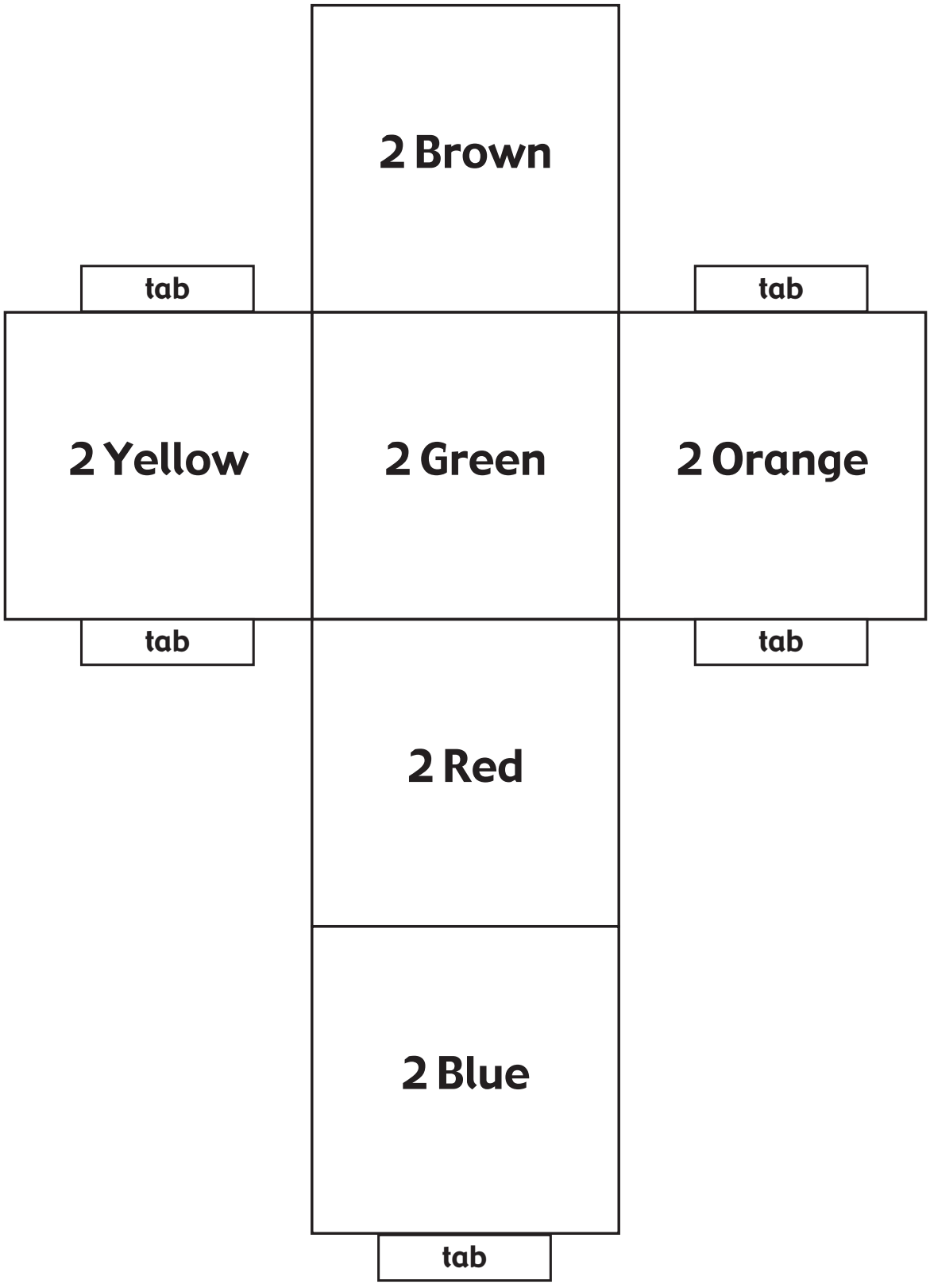
Pattern Connect Four Game Board

R Bl R Bl	R Y Y R	O R R O	Br O O Br	Y Y Bl Bl
Br G Br G	R R G R	Br Br G G	O Bl O Bl	R Br R Br
Br Bl Bl O	R Bl R Bl	Y Br Br R	O G O R	G Y G G
O Bl O O	R Bl R Bl	R R G G	Y R Y R	G Br Br Br

Pattern Connect Four Dice Pattern #1



Pattern Connect Four Dice Pattern #2



Used Pattern Train Mat

Place used pattern trains here.

Patterns That Grow

Math Standard II:
Students will use patterns and relations to represent mathematical situations.

Objective 1:
Recognize and create patterns with given attributes.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics.
3. Reason mathematically.

Content Connections:
Dance III-1, 2

Math Standard II

Objective 1

Connections

Background Information

Students need to know how to add money amounts on the calculator using a decimal point. Since the *Invitation to Learn* is a whole group activity, students will not need to show mastery before this lesson. The constant button on a calculator will be used and demonstrated in this lesson.

Invitation to Learn

Your wealthy neighbor wants you to walk her dog after school every day for a month. She has offered to pay you either one million dollars or one penny on the first day, and every day you walk the dog after that your pay doubles. Which is the better deal? Use the *Walk the Dog* table transparency (p. 6-12) to figure out how much money you would get each day and what the total pay would be if you took the second deal. Point out patterns you are noticing in the table. You may want to finish the table entirely, or you can stop after several days on the table and read *One Grain of Rice* or another book that shows the same idea.

Instructional Procedures

1. Read the book *One Grain of Rice*, a story of a doubling pattern.
2. Talk about how some patterns don't just repeat, they grow. Sing the song *There Was A Little Ford*. Illustrate the pattern in the song with symbols, numbers, or letters on the board or overhead projector.

Calculator Constant Button Activity

1. Show the students how to use the constant button on the calculator. Use the constant button to create addition patterns that

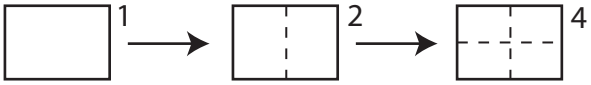
Materials

- ❑ *One Grain of Rice*
- ❑ Calculators
- ❑ *Walk the Dog* table on overhead transparency
- ❑ *There Was a Little Ford*
- ❑ Pattern Worksheets

grow on the board. Don't complete the patterns on the board. Show the students how to use their calculators to find the change in the numbers and complete the patterns.

2. Draw six short horizontal lines on the board.
   _____ _____ _____ _____ _____ _____
3. Given the first three numbers, use your calculator to determine the next three lines of the pattern.
   6 12 18 _____ _____ _____
4. Ask students for possible strategies. Some students may subtract (e.g., 12 - 6 = 6) to see that the pattern is changing by sixes. Then use the calculator constant key to find the last three numbers in the pattern.
5. Pass out the *Calculator Pattern* worksheets (p. 6-13). Have the students make six patterns, filling in the first three lines, for a partner to complete. When they are finished, they trade papers with a partner, and complete their partner's patterns.

Possible Extensions/Adaptations/Integration

- Learn a line dance.
- Sing songs that have growing patterns in them such as *There Was An Old Lady Who Swallowed a Fly*, *The Bear Went Over The Mountain*, *The Twelve Days of Christmas* (depending on the season), etc.
- Some students could use a 100s chart instead of a calculator to make their patterns.
- Students can be paired randomly, but in some cases it is important to group by ability. Some students will make harder patterns to figure out making it difficult for those struggling with the concept to be able to complete the assignment.
- Paper folding 

Assessment Suggestion

- Give the students a pattern to complete using calculators and a personal white board.

Additional Resources

Books

One Grain of Rice, by Hitz Demi; ISBN 059093998X

The Mitten, by Jan Brett; ISBN 075002867X

King Bidgood's in the Bathtub, by Audrey and Don Wood; ISBN 0152427309

The Napping House, by Audrey and Don Wood; ISBN 0152026320

Family Connections

- Have the students share a growing pattern book with family.
- Have the students show parents or siblings how to use the constant key on a calculator.
- Send home the lyrics to songs with growing patterns.

Walk the Dog

Day Number	Pay for That Day	Total Pay
1	$.01	$.01
2	$.02	$.03
3	$.04	$.07
4	$.08	$.15
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

Name _____

Calculator Patterns

Directions

Use the constant key on your calculator to make an addition pattern that increases. Find the first three numbers in the patterns, then trade with a partner to solve the rest of the patterns.

1. _____ _____ _____ _____ _____ _____

   What is the pattern? _____

2. _____ _____ _____ _____ _____ _____

   What is the pattern? _____

3. _____ _____ _____ _____ _____ _____

   What is the pattern? _____

4. _____ _____ _____ _____ _____ _____

   What is the pattern? _____

5. _____ _____ _____ _____ _____ _____

   What is the pattern? _____

6. _____ _____ _____ _____ _____ _____

   What is the pattern? _____

There Was a Little Ford

There was a little Ford, the cutest little Ford, the sweetest little Ford that you ever did see.
The Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Honkety, honk, honk, beep, beep!

There was a little seat, the cutest little seat, the sweetest little seat that you ever did see.
The seat was on the Ford, the Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Honkety, honk, honk, beep, beep!

There was a little girl, the cutest little girl, the sweetest little girl that you ever did see.
The girl was on the seat, the seat was on the Ford, the Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Honkety, honk, honk, beep, beep!

There was a little hat, the cutest little hat, the sweetest little hat that you ever did see.
The hat was on the girl, the girl was on the seat, the seat was on the Ford, the Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Honkety, honk, honk, beep, beep!

There was a little flower, the cutest little flower, the sweetest little flower that you ever did see.
The flower was on the hat, the hat was on the girl, the girl was on the seat, the seat was on the Ford, the Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Honkety, honk, honk, beep, beep!

There was a little fly, the cutest little fly, the sweetest little fly that you ever did see.
The fly was on the flower, the flower was on the hat, the hat was on the girl, the girl was on the seat, the seat was on the Ford, the Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Honkety, honk, honk, beep, beep!

There was a little speck, the cutest little speck, the sweetest little speck that you ever did see.
The speck was on the fly, the fly was on the flower, the flower was on the hat, the hat was on the girl, the girl was on the seat, the seat was on the Ford, the Ford was on the wheels, the wheels were on the ground, and the engine in the Ford made the wheels go round.
Match in the gas tank. No Ford!

Patterns Called Strategy

Math Standard II:
Students will use patterns and relations to represent mathematical situations.

Objective 1:
Recognize and create patterns with given attributes.

Intended Learning Outcomes:
2. Become mathematical problem solvers.
3. Reason mathematically.

Math Standard II

Objective 1

Connections

Background Information

Students should have a basic knowledge of patterns to enhance the learning of strategies.

Invitation to Learn

If you and I were going to play Tic-Tac-Toe, how would you go about beating me?

During the invitation to learn, help students identify how looking for patterns can be a strategy in being successful at various games.

Instructional Procedures

NIM—This activity requires students to find a pattern for winning.

1. Start with 11 discs or pennies. Each player on his/her turn can take one, two, or three discs. The object of the activity is to force your opponent to take the last disc. The pattern in this activity is to end your turn with five discs left in order to win. The longer students play, the more apparent the pattern will become.
2. To introduce the activity, play *NIM* on the overhead with the whole class, asking for volunteers to challenge the teacher. Show the students that you can win every time. Then challenge them to find the strategy/pattern with their partners.

Black Magic—To play this game, there must be two people who know how to play. Choose a student volunteer who either already knows how to play *Black Magic* or agrees to learn how to play the game but not tell anyone. Try to include everyone who already knows how to play so they will not divulge the secret.

Materials

- ❑ 11 counters or round discs per partner

1. After instructing the student how to play the game, ask him/her to leave the classroom while the other students choose an object in the room for the player to guess. This could be any object: a pencil, marker, poster etc.
2. Call the player back to the room and begin asking him/her questions, trying to get him/her to guess what the chosen object is. (Example—Teacher: "Is it this chair?" Player: "No." Teacher: "Is it Ashley's pencil?" Player: "No." Teacher: "Is it my shirt?" Player: "No.")
3. The question before the chosen object must be about a black object, telling the player the next question will be the correct object. (Example—Teacher: "Is it the television?" Player: "No." Teacher: "Is it this marker?" Player: "Yes." Teacher: "You are right.")
4. Ask if any other students have figured out how to play the game. Continue playing the game until more students have figured out the strategy.

   If you use this game to show a pattern you need to eventually tell those who haven't figured out the pattern how to play. However, some teachers like to use this game throughout the year, and prefer not to tell anyone the pattern who hasn't figured it out for themselves.

I'm Going On Vacation—The teacher tells the class that the object of this game is to figure out what they can bring on vacation.

1. The teacher begins this game by saying, "I'm going on vacation, and I'm taking an (item spelling with double letters) apple." "Who wants to come with me?"
2. Students raise their hands. The teacher chooses one and says, "What will you bring?"
3. If the student says something that is spelled with double letters the teacher says "Okay, you can come."
4. If the student says something that doesn't fit the pattern, the teacher says, "You can't bring that on our vacation."
5. Continue this game until many students have figure out the pattern.

Possible Extensions/Adaptations/Integration

- *NIM Extension*—Ask, "Is there a way for the first player to win if there are 12, 13, 14… counters?" What is the pattern? Draw a T-chart.
- Use the week's spelling patterns or phonics lessons to choose a pattern for *I'm Going On Vacation*.
- *Adaptations for learners with special needs*—If you want to build confidence for a slower learner that you feel will not figure out the patterns on their own, use them as an example of how to play by filling them in on the strategies before hand.

Assessment Suggestion

- Students will be able to successfully participate in the games.

Additional Resource

I Hate Mathematics, by Marilyn Burns; ISBN 0590480146

Family Connections

- Have the students play one or all of the games with family. Tell them to remember to let family members have the fun of discovering the patterns like they did.
- Find a game that has a strategy at home. Bring the game to show and tell the class about the strategy.
- Have the students ask their parents about strategies they use in everyday tasks. Record the strategies in a journal to share with the class.

The Commutative Cookie

Math Standard II

Objective 2

Connections

Math Standard II:
Students will use patterns and relations to represent mathematical situations.

Objective 2:
Recognize and represent mathematical situations using patterns and symbols.

Intended Learning Outcomes:
3. Reason mathematically.
5. Make mathematical connections.

Content Connections:
Math I-5; Social Studies VI-1

Background Information

An array is a rectangular arrangement of objects in rows and columns. Arrays can be used to illustrate multiplication facts. Some multiplication facts create a square. Their products are called square numbers. Prime numbers can only be made in a rectangular array with one row or one column.

Invitation to Learn

Show pictures of rows and columns in the real world. Tell the students that rows and columns combined are called arrays. Ask the students to look for arrays in the classroom. Where could they find them at home? How about on the playground?

Instructional Procedures

Materials
- ❑ Unifix cubes
- ❑ *Cookie Sheet Mat* (one per partner)
- ❑ *Cookie Sheet* overhead
- ❑ *Cookie Sheet* worksheet
- ❑ Dice

1. Tell the students to imagine they work in a bakery. They have been asked to bake a dozen cookies. Ask them how many cookies are in a dozen. Then tell the students the manager of the bakery wants the cookie dough to be organized on the trays in equal numbers of rows and columns, or in other words, arrays. How could the cookie dough be arranged on the cookie sheet? (Find all possibilities.)
2. Have the students work in pairs or individually with paper *Cookie Sheet Mats* (p. 6-20) and Unifix cubes (representing cookie dough).
3. Ask for the results of their findings to be shared with the class. As each way is suggested, show the students how to write this as a multiplication problem. Also, switch the order of the factors. For example, when three rows of four is suggested (3 x 4) ask the students if four rows of three (4 x 3) is the same number of cookies. Rotate the array to show four rows of three. Tell them

that multiplication factors can trade places like this without changing the total. This is called the commutative property of multiplication.

4. Ask the students, "What if the manager wanted us to bake 16 cookies, what would that look like?"
5. For more guided practice as a group or in partners, roll a pair of dice to give you two factors to work with. Have the students show the two arrays for those factors on their *Cookie Sheets Mats*. Then, have them work individually with the *Cookie Sheet* worksheet (p. 6-21) and dice.

Possible Extensions/Adaptations/Integration

- Have the students write in a learning journal about the commutative property of multiplication and explain how it works.
- The gradual release structure of this lesson lends itself well to accommodations for students with special needs. Give more time for partners to work with the dice and cookie sheet mats when needed rather than individual practice.

Assessment Suggestion

- Have the students write a paragraph explaining why multiplication facts can switch the factor's places and still get the same answer (commutative property).

Additional Resources

Books

The Grapes of Math, by Greg Tang; ISBN 043921033X

Hershey's Milk Chocolate Multiplication Book, by Jerry Pallotta, Rob Bolster, illustrator; ISBN 0439254124

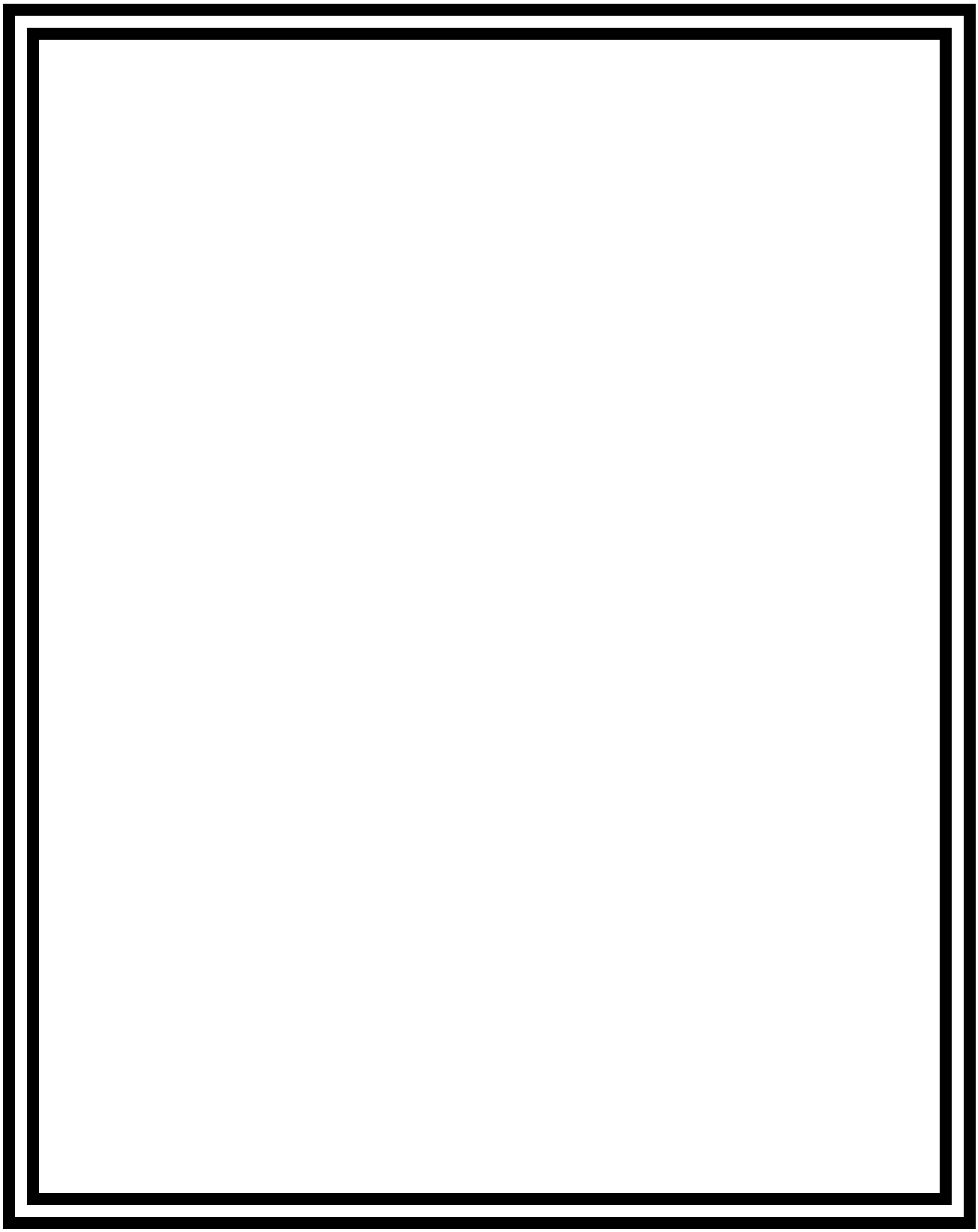
Web site

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

Family Connections

- Have the students look for arrays at home. Draw these and record the multiplication facts illustrated. Show the corresponding fact using the commutative property.
- Families can make a batch of cookies at home arranged in arrays. Or, what else can be cooked in an array? Try something and report your findings.

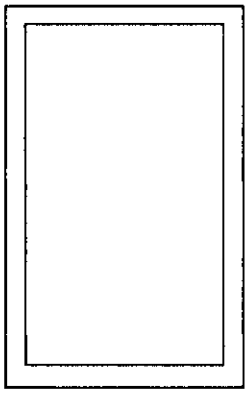
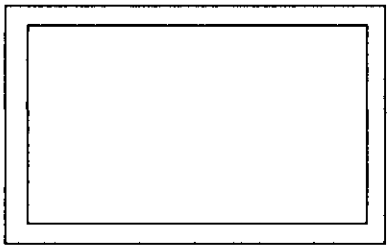
Cookie Sheet Mat



Name _____

Cookie Sheet

Directions: Roll the dice. Use the numbers on the dice as your factors. Show the two arrays that go with the factors by drawing cookies on the cookie sheets. Write both multiplication facts.

1.   ☐ x ☐ = ☐

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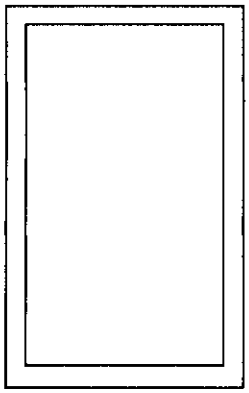
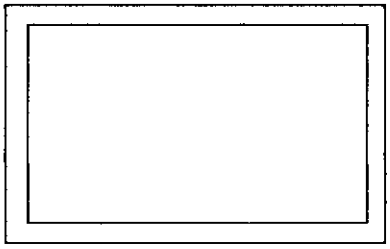
2.   ☐ x ☐ = ☐

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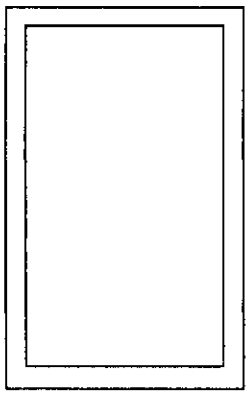
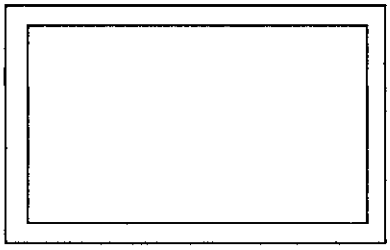
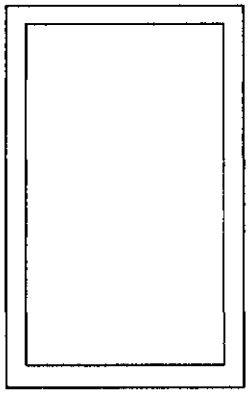
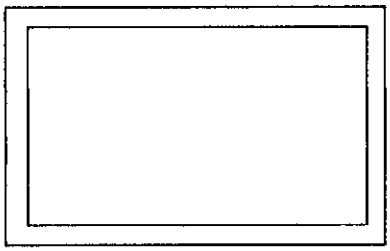
3.   ☐ x ☐ = ☐

   ☐ x ☐ = ☐

4.  

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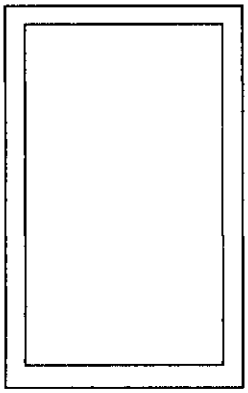
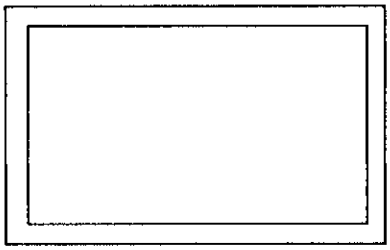
5.  

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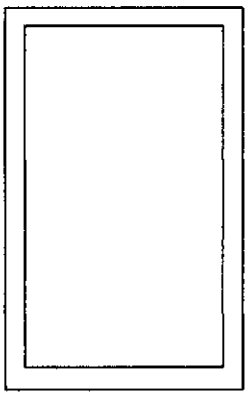
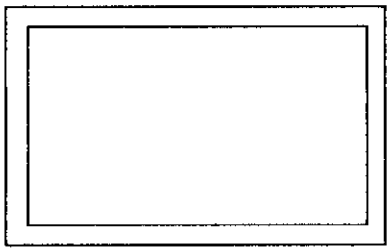
6.  

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Science
Standard V
and
Math
Standard IV
Activities

Don't Marry the Mole!

Science Standard V:
Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1:
Provide evidence showing that the sun is the source of heat and light for Earth.

Intended Learning Outcomes:
1: Use Science Process and Thinking Skills
2: Manifest Scientific Attitudes and Interests
3: Understand Science Concepts and Principles

Content Connections:
Math IV-2

Science Standard V

Objective 1

Connections

Background Information

NASA's Observatorium, "Our Sun"

http://observe.arc.nasa.gov/nasa/exhibits/sun/sun_3.html

"The sun gives us heat, light, our food, and the air that we breathe. It powers the atmosphere to give us the winds and rain. Even the coal and oil that generate electricity for light and power come from plants and animals that lived hundreds of millions of years ago and depended on the Sun for life."

"The sun heats the land, oceans, and air. It evaporates water from lakes and oceans. When the water vapor cools, it drops as rain or snow giving us the moisture we need for drinking water and for plants and animals to grow."

"Green plants use the Sun's rays to turn carbon dioxide and water into carbohydrates. At the same time, they release oxygen that we use to breathe. This process of production of carbohydrates by green plants is called photosynthesis. The carbohydrates formed by plants are used by them to grow and we use plants for our food. Without the Sun, Earth would be a dark, cold, dead place."

The invitation to learn activity refers to the story of Thumbelina, which could be read previously during a reading period. The bottle activity demonstrates that energy from the sun can be collected and stored. White bottles reflect most of the sun's energy. Black bottles absorb the sun's energy better. As the black bottle absorbs energy, the air inside the bottle warms up and expands filling the balloon with air.

Making a Pizza Box Solar Oven is an engaging project for students because it shows that sunlight is a source of energy, and demonstrates the

use of insulation in trapping heat. This is combined with something students really enjoy: making something good to eat. Solar ovens can reach temperature of 200-275 degrees, hot enough to cook food. When cooking in a solar oven, get the food in early and don't worry about overcooking. The cooking time will be at least twice as long as conventional methods. Allow about 1/2 hour to preheat.

Recipes

Tacos

Ingredients: tortillas, shredded cheese, black beans, shredded lettuce, salsa

1. Lay a tortilla on the tray. Cover 1/2 with cheese and 1/2 with black beans.
2. When the cheese looks melted and the beans are warm, spoon on lettuce and salsa, fold over, and eat.

Mini-Pizzas

Ingredients: English muffins or pita bread, pizza sauce, shredded cheese, other toppings (sliced very thin), olives, mushrooms, or pepperoni

1. Split the muffin or pita pocket in half. Spread on a thin layer of pizza sauce.
2. Put on three pieces of topping and sprinkle a thin layer of cheese.
3. When the cheese looks melted, enjoy.

While the food is cooking in their solar ovens, use the *Solar Hot Air Balloon* to visually demonstrate the power of solar energy. Within a few minutes the black balloon will collect enough energy to heat up the air inside the balloon enabling it to float by itself. Caution: Handle the balloon carefully or it may get away and get caught in voltage power lines, etc. (The *Solar Hot Air Balloon* is smaller, 10' x 2', less expensive, and easier to manage with students than a Solar Bag 50' x 2'.)

Tips for improving your solar oven

1. Use a pizza box made from corrugated cardboard, as the trapped air in corrugated cardboard will help your solar oven heat up better than a thin cardboard pizza box.
2. Tape over any air leaks around the edges of the pizza box,

however make sure that the box can still be opened.

3. Use a dark metal pan or pizza tray inside your pizza box over the black paper. The dark metal absorbs solar energy and heats up hotter than black paper by itself.
4. Add a sheet of plastic to the top of the lid opening. This will create a layer of air as insulation between two sheets of plastic and will keep heat in the box. Be sure the plastic is tight and sealed.
5. Use foil covered cardboard to add extra flaps to increase the gain of your oven.

   Note: Arrange for parent helpers during the class period in which you are measuring and making your flaps to ensure that students with special needs have a successful experience.
6. Crumble 1 to 1 1/2 inches of newspaper and stuff it around the inside edges of the box for additional insulation.
7. Set the oven on blacktop, brick, or cement, close to the south side of a building. Keep it out of the wind. Tilt the oven a little to get rid of the shadows cast by the edges of the box.
8. Solar cooking takes time, and the sun will change position during cooking time. You may need to realign the solar oven now and then to keep the most sunlight entering the oven.

Invitation to Learn

Who's blowing up the balloons?

As an introduction to this unit, recall the story of Thumbelina. Why did the old mouse recommend that Thumbelina marry the mole? What were some of the reasons that Thumbelina was so unhappy in the mole's dark home? Why would you be happier in the warmth of the sun or than in a dark cold hole? People need the sun for many reasons. List them. Students will recommend, "Don't marry the mole!"

Materials

- ❑ Two plastic bottles, one painted white, I painted black
- ❑ Two balloons

You will need two plastic bottles, one painted black and one painted white. Place the open end of a small balloon over the mouth of each bottle. Make sure the balloon forms an air tight seal. Place both bottles with balloons in bright sunlight.

Discuss: What do you think is going to happen? Why?

Within a few minutes, you will notice the balloon on the black bottle will start to expand. The white balloon will remain limp.

Discuss: Why do you think the balloon on the black bottle expanded?

Touch the black bottle. Is it warm? Touch the white bottle. Is it cooler? Does a black object get warmer in the sunlight than a white object? What would be a good color to wear when playing tennis in the summer? What would be a good color to paint your car for staying cooler in summer?

Instructional Procedures

Materials

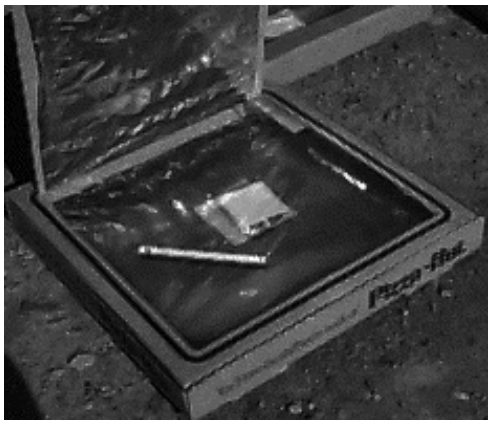
- ❑ Pizza box
- ❑ Black construction paper
- ❑ Aluminum foil
- ❑ Clear plastic sheet (clear plastic window covering)
- ❑ Non-toxic glue
- ❑ Tape
- ❑ Ruler
- ❑ Marker
- ❑ Scissors
- ❑ Pencil, or string
- ❑ Thermometer

Making a Pizza Box Solar Oven

Discuss: Can the sun cook our food?

Make pizza box solar ovens and try it.

1. Tape foil to the inside bottom of the pizza box, shiny side up. This will create a trap to hold heat that is radiated from food and air inside the box.
2. Cover the foil with black construction paper (you do not need to go up the sides of the box). This will help absorb the incoming sunlight.
3. Close the box. On the top, measure and mark 1 1/2 inches from the edge, in several places. Draw a line connecting your marks and outlining the flap. Decide where the hinge of the flap will be and write "Flap, Do Not Cut!"
4. Cut along the front and two sides to make the flap. (Work carefully especially around the corners. Remember not to cut along the line that will be the hinge for the flap. It may help to get adult help using an X-ACTO® knife instead of scissors.)
5. Place your ruler along the line that marks the hinge of the flap. Carefully pry the flap open. Make the fold for the hinge carefully. (It helps to do this with a partner.)
6. Cut a piece of foil the size of the flap. Glue it to the side of the flap that faces into the box, shiny side up. (Flatten out all wrinkles and be sure to wipe off any glue smears with a damp cloth.)
7. Put the box on the plastic. Draw an outline of the box on the plastic with a marker. Cut the plastic about 1/4 of an inch inside of the outline.
8. Open the box and tape the plastic to the inside of the top of the box. Tape one side and then the other. Try to make it tight and smooth. Seal it all around so that warm air cannot escape from the oven interior. Close the box and open the flap.



9. Your pizza box solar 0ven is ready to use. Make Nachos!

   Nachos

   Ingredients: corn chips, shredded cheese, salsa

   1. Put a single layer of chips on plastic wrap. Sprinkle on the cheese.
   2. When the cheese looks melted, dip nachos in salsa.

10. Aim the oven at the sun. Adjust the flap to reflect the most sunlight into the oven. You can tell the flap is adjusted correctly by looking at the sun's reflection inside of the oven. Use pencil, ruler, or string to hold the flap at the best angle. *Caution: Never look directly into the sun. You could damage your eyes.*
11. Place a thermometer inside the oven to measure the temperature.
12. Write in your science journal telling what you learned doing this project, what you liked about this project, and what you'd do differently if you were to make a new solar oven.

Materials

- ❏ Plastic wrap
- ❏ Corn chips
- ❏ Shredded cheese
- ❏ Salsa

Launching a Solar Hot Air Balloon

While the food is cooking in the solar ovens, launch the *Solar Hot Air Balloon*. The balloon will visually demonstrate the power of solar energy.

Materials

- ❏ *Solar Hot Air Balloon*
- ❏ *Solar Balloon* handout

1. Fill the balloon with air. Tie the balloon.
2. Add a long cord students have marked off in ten centimeter or one foot increments so that elevation can be measured.
3. As the black balloon is allowed to sit in the sun, it will heat up and begin to rise.
4. Start timing as soon as the balloon begins to rise. Record the elevation every minute. Use *Solar Balloon* handout (p. 7-11) to

graph your results. You could also calculate the rate of change in elevation.

Rate = Total Elevation divided by Time

Discussion questions: Why did the balloon begin to rise? Did it rise at a constant rate? What is the temperature of the air outside the bag? Bring the bag back down and lay a thermometer on the bag. What is the temperature of the outside of the bag?

Possible Extensions/Adaptations/Integration

Physical Education

Question: "What happens to molecules when they are heated?

Heat is a form of energy. As water, air, and other substances increase in temperature, their molecules start to get more energy. As those molecules move faster they bump into each other and take up more room.

Materials

- ❑ Masking tape

1. Use masking tape to create a circle (or make an outline of a cooking pot).
2. Tell students they are going to be playing the part of water molecules.
3. First, they will represent a frozen pot of water. Have students crowd into the pot and stand still. There should be room for all students to stand comfortably. You may choose to make a pot for each team.
4. Next, tell students you are going to turn the stove on and start heating up the pot of ice. They are to start moving slowly. Everyone should keep moving but they should not push or shove and they should stay within the circle.
5. Now the ice is all melted and the water is starting to warm up. The students should move a little faster. They should still avoid bumping into each other and try to stay within the circle.
6. Now the water is boiling, steam is starting to rise out of the pot. The students should move faster and faster until they can no longer stay within the lines of the pot. (Students could do various exercises that require more and more space, e.g., jumping up and down, jumping jacks, jumping side to side, etc.)
7. Discuss with students how this activity relates to the movement of molecules as they are heated, and the connection of sunlight as the energy source.

Language Arts

- Read folktales about the sun.
- Assign, edit, and publish student-written folktales about the sun.

Assessment Suggestions

- Edit and publish student folktales.
- Note student's measurements of the flap for the solar oven, assess and assist with mathematics measurement skills.
- Check student's chart and graph of solar balloon activity.
- Check student's Science Journals for understanding that the sun is the main source of heat and light for earth.

Additional Resources

Books

Amazing Sun Fun Activities, by Michael Daley (Learning Triangle Press); ISBN 0-07-015177-6

How Grandmother Spider Stole the Sun, Keepers of the Earth, by Michael J. Caduto and Joseph Bruchac; ISBN 1-55591-027-0

Crow Steals Some Daylight, Life in Polar Lands, by Monica Byles; ISBN 0-590-46130-3

Web sites

California Energy Commission, Science Projects, "Sun Jobs" http://www.energyquest.ca.gov/projects/sunjobs/html

Solar Now, Inc., "Make a Pizza Box Solar Oven!" http://www.solarnow.org/pizzabx.htm

"Make a Pizza Box Solar Oven" http://www,nmsea.org/Curriculim/4_6/pizza_box_oven/pizza_box_ovens.htm

Union Elementary School Home Page, "Solar Ovens Made from Pizza Boxes" http://www.reachoutmichigan.org/funexperiments/agesubject/lessons/other/solar.html

National Teacher Enhancement Project, "Solar Ovens" http://www.ed.final.gov/ntep/f98/projects/nrel_energy_2/solarovens.html

Educational Resources, "How to Build a Pizza Box Solar Oven" http://www.nrel.gov/education/solar_oven.html

Family Connections

- Make and use solar hot dog cookers made from foil-covered round oatmeal boxes cut in half lengthwise. Share your experience with the class.
- Students modify and enhance your solar ovens at home and get them ready for a class solar cook-off.

  Cook-off question: Which oven can produce the greatest water temperature increase in 60 minutes?

  1. Fill pie plates with two cups water at room temperature, place in solar ovens with a thermometer.
  2. Record temperatures every ten minutes for 60 minutes.
  3. Do you have a winner or is there a tie?
- Share your solar oven with your family by cooking a family treat in the oven. Share your recipe with your class.

Name _____

Solar Balloon

Time (minutes)	Elevation
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Sun or Shade?

Science Standard V

Objective 1

Connections

Science Standard V:
Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 1:
Provide evidence showing that the sun is the source of heat and light for Earth.

Intended Learning Outcomes:
1: Use Science Process and Thinking Skills
3: Understand Science Concepts and Principles

Content Connections:
Math IV-1, 2

Background Information

When a temperature is reported on the news it is an official reading taken at a weather observing station. At these stations, thermometers are shielded from sunshine inside specially constructed shelters that allow air in but not direct sunlight. This is necessary if you want to measure the temperature of air. If a thermometer sits out in the sun the thermometer itself, the glass, and the liquid inside will absorb sunlight and heat up. You wouldn't be measuring the temperature of the air anymore but rather the temperature of a heated thermometer. On a sunny day that could be about 30 degrees higher than the actual air temperature. So the next time you hear a temperature of 80 degrees and your backyard thermometer reads 110 you'll know the reason for the difference.

Students should receive instruction on reading and using thermometers as part of a math lesson before doing this activity.

The plant experiment shows differences in plant growth with differences in light. Plant size and the amount of water are variables that should be kept the same in this experiment. The two most important climatic factors for ecosystems are sunlight and water. Light from the sun gives plants the energy they need to grow.

Invitation to Learn

Materials

- ❑ White construction paper
- ❑ Pencil
- ❑ Crayons
- ❑ Markers

What jobs can the sun do?

What jobs does the sun do? Discuss this question with students. Divide class into groups of two or three and assign each group to make and illustrate a page for a class book of the sun's jobs. Following is an example of how pages may look.

Instructional Procedures

Temperature Measurements

Discuss: On a hot sunny day, we often go into the shade to get cool. Is the air really cooler in the shade? How could we find out?

1. Using the *Sun or Shade?* handout (p. 7-16), and working with a partner, go outside with your class and take measurements of the air temperature around the school in five different locations. Hang the thermometer in a sunny spot for five minutes. Record the temperature. Hang the thermometer in a shady spot for five minutes. Record the temperature. Try four other shady or sunny locations.
2. Compare the temperature in different locations. Why is there a difference in temperature? Is the air really warmer in the sun? Why does it feel like it is warmer in the sun? Is the sun's energy hitting your skin?
3. Complete a bar graph showing the temperatures you have recorded using the *Temperatures in the Sun and Shade* chart (p. 7-17) or computer graphing software.
4. Write a paragraph in your science journal explaining what you have learned.

Materials

- ❑ Student thermometers
- ❑ String
- ❑ *Sun or Shade?* handout
- ❑ *Temperatures in the Sun and Shade* chart

Plant and Light Experiment

1. Plant three similar tomato plants in containers. (If you use Styrofoam cups, poke small holes in the bottom for water drainage.)
2. Number the plant containers 1, 2, and 3. Allow each plant to have the following amounts of sunlight per day: #1—no light, #2—six hours, #3—continuous light.
3. Measure and record the growth of each plant for ten days. Give the plants equal amounts of water regularly. (Keep the soil moist but not saturated.) Use the *Plant Growth* chart (p. 7-18).
4. Write a paragraph in your science journal summarizing what happened and why you think it happened.

Materials

- ❑ 3 small tomato plants about the same size
- ❑ 3 large Styrofoam cups or clay pots
- ❑ Potting Soil
- ❑ Florescent light and sunlight if available
- ❑ *Plant Growth* chart

Follow-up discussion questions: Which tomato plant grew the most? (The one receiving continuous light.) Which plant grew least? (The one receiving no light.) How does sunlight affect plant growth? Are there ways that a location on earth would receive less sunlight? (Volcanoes could blow dust high into the atmosphere, decreasing sunlight reaching the ground.) How would less sunlight affect an ecosystem? (Some plants may grow less if they need a lot of sunlight, some may grow more if they are shade tolerant; flowering patterns of plants may change; cooler air temperatures.)

Possible Extensions/Adaptations/Integration

Materials

- ❑ Two thermometers
- ❑ Two cups filled with water

- *Question:* Is a paper cup of water cooler when it is not left in sunlight? Place a thermometer in each paper cup filled with water. Put one cup in direct sunlight and the other in the shade. Record the temperatures, at the beginning and each hour for three hours. Tell students to feel the water in each cup. What happened? Is water hotter in the sun than in the shade?

- **Art—Sun Pictures**

  Students observe that energy from heat and light can cause changes.

  1. Cut out several shapes (squares, triangles, free form, etc.) from lightweight cardboard.
  2. Secure the shapes to an 8 x 10 piece of construction paper with double faced tape. (The shapes will be removed later. The tape should keep the shapes from slipping during the experiment.)
  3. Tape the construction paper to a window where the sun will shine on it.
  4. After a week, take down the construction paper and remove the shapes.

Discuss: What happened? What caused the change?

Materials

- ❑ Two small plants (beans)
- ❑ Cardboard box to cover plants
- ❑ Scissors
- ❑ Masking tape
- ❑ Sunny indoor place

- *Question:* Do plants grow toward the sun? Cut the top off of the box, turn it upside down, and cut a two inch square in one side of the box. Place the plants near a sunny window and put the box over the top of one plant. Adjust the box so that sunlight enters through the small hole. Do not uncover the boxed plant except to water it for about two weeks. Compare the growth of the two plants.

- Study pet needs in different weather conditions. Why does your dog need shade in the summer? What kind of shelter is best for winter?

Assessment Suggestions

- Check student's temperature charts, graphs and science journals after completing the sunny and shady temperature project.
- Check student's charts and science journals after completing the tomato plant activity.

Additional Resources

Book

Amazing Sun Fun Activities, by Michael Daley (Learning Triangle Press); ISBN 0-07-015177-6

Web sites

Natural Resources, The Environment, and Ecosystems, "Ecosystems and Climate," http://www.urdanext.uiuc.edu/ecosystems/teacherguide1.html

Solar Energy Experiment, by Beatrice Ortiz, Ann Parish Elem., NM http://www.col-ed.org/cur/sci/sci106.txt

Franklin Fact Archive, Official Temperatures in the Shade," http://www.whyy.org/tv12/franklinfacts/JUL1800ff.html

NASA's Observatorium, "Our Sun" http://observe.arc.nasa.gov/nasa/exhibits/sun/sun_3.html

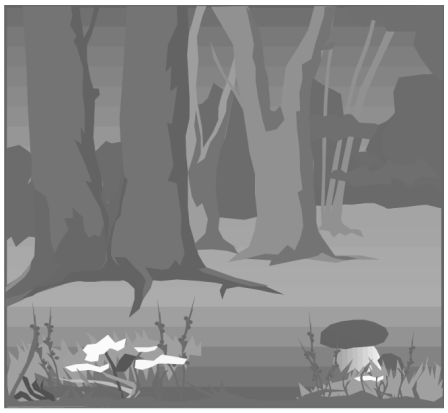
Science NetLinks, "The Warmth of the Sun" http://www.sciencenetlinks.com/lessonds.cfm?DocID=329

Family Connections

- Assign students to survey parent's feelings about, and use of, sunscreen in their families. As a group, discuss the value of sunscreen, problems with sunburn, etc.
- Survey students and assign them to survey their parents about UV sensitive T-shirt designs, thread, or nail polish. Share with the class.
- Assign students to check temperatures of different rooms in their homes. Are rooms with larger windows and more sunlight warmer? Do students have sun blocking materials added to their windows? Have students noticed furniture or drapes that have faded in the sun? Share finding with the class.

Name _____

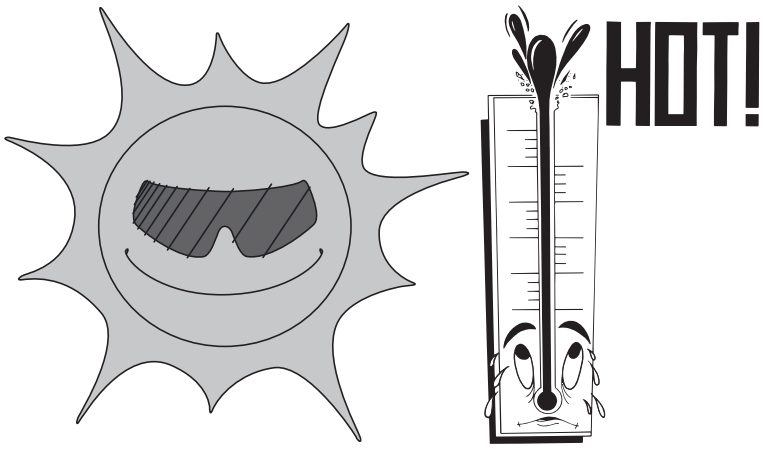
Sun or Shade?



Location	Temperature	Notes

Name _____

Temperatures in the Sun and Shade



120°										
115°										
110°										
105°										
100°										
95°										
90°										
85°										
80°										
75°										
70°										
65°										
60°										
55°										
50°										
Location										

Name _____

Plant Growth

Record growth in inches and centimeters.

Plants	#1 No Light	#2 6 Hours Light	#3 Continuous Light
Day 1			
Day 2			
Day 3			
Day 4			
Day 5			
Day 6			
Day 7			
Day 8			
Day 9			
Day 10			

Things Are Heating Up!

Science Standard V:
Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Objective 2:
Demonstrate that mechanical and electrical machines produce heat and sometimes light.

Objective 3:
Demonstrate that heat may be produced when objects are rubbed against one another.

Intended Learning Outcomes:
1: Use Science Process and Thinking Skills
2: Manifest Scientific Attitudes and Interests
3: Understand Science Concepts and Principles

Content Connections:
Math IV-1, 2

Science Standard V

Objectives 2 & 3

Connections

Background Information

In this activity students will learn that heat is produced from mechanical and electrical machines and human activities. Students can look for, and note, things that give off heat—lights, flash lights, pencil sharpeners, radios, televisions, running motors, the sun, polishing surfaces, sawing wood, animals, people, etc.

Students may also have some misconceptions. Some things that keep us warm such as blankets, sweaters, or gloves and mittens may be thought of as sources of heat. Clothes do not produce heat. Other things like metal may be thought of as cold. Ice cubes do not give off cold.

Use materials that can be easily found in the classroom. Mechanical machines may include: scissors, stapler, flag pole, mechanical pencil sharpener, a skate board, etc. Electrical machines may include: electric pencil sharpener, projector, television, laminator, overhead projector, copier, computer, etc.. Electrical machines that also produce light may include a flashlight, television, etc.

When you rub your hands together you feel resistance. When you rub your hands together you are doing work. The result of this work is the heat produced. Many things rub against each other creating heat. Breaks on a bike create heat as they apply force to the wheels. Have you ever had a rope burn? Sliding your hands along a rope can cause burns as the rope rubs against the palms of your hands. Have you ever had a carpet or rug burn when you accidentally slid across the carpet on your knees?

Invitation to Learn

Hand Boiler

Materials
- ❑ "Hand Boiler" toy
- ❑ Ice cubes

Show students a hand boiler and have someone hold it. The liquid will go to the top, not because the student squeezed the boiler, but because the heat from their hands warms the gas that pushes the liquid into the top chamber.

Challenge students to get the liquid back to the bottom without turning it over. What happens if you put your hand on the top of the hand boiler? What happens if you rub your hands together before touching the bottom of the hand boiler? What happens if you hold an ice cube before you hold the hand boiler?

Instructional Procedures

Melting an Ice Cube

Materials
- ❑ Ice cubes in Ziploc bags

1. Hold an ice cube melting contest between cooperative learning groups in your class.
2. First, have students estimate how many minutes it will take them to melt their ice cube.
3. Give each group an ice cube in a Ziploc bag.
4. When the group's ice cube is melted, have them record how many minutes it took to melt.
5. What did the group do to get the ice cube to melt? (Did students rub the ice cube?)
6. Students write what they learned from this activity in science journals. What should be done differently next time?

Producing Heat

Materials
- ❑ Thermometer
- ❑ Penny
- ❑ Piece of paper
- ❑ Small piece of wool
- ❑ Rubber band
- ❑ Lotion

1. Students hold their hands together, palms touching. Do they feel cold, warm, damp, or sticky? Record observations.
2. Make a hypothesis. What will happen if hands are rubbed together?
3. Students rub their hands together very fast for ten seconds. What happened? (The movement or force caused heat. The amount of heat will vary depending on how dry the hands are.)

4. Students place their hands on their cheeks. Feel how warm they are. Try rubbing hands. Now check their hands on their cheeks for warmth. Students then rub their hands together faster and place their hands on their cheeks. Do they feel the heat? Ask, "In what kinds of situations would you rub your hands together? Is it useful or helpful?"
5. For about ten seconds, try rubbing a penny with wool, or a penny with paper. Touch the penny, touch the paper, and touch the wool. What happened?
6. Students place a thermometer between their hands. What is the temperature reading? Try rubbing their hands together for about 30 seconds and then place the thermometer between them. Now how hot are their hands? Apply some lotion to their hands. Then try rubbing them together for 30 seconds. Check the heat with a thermometer. What happened? (The lotion provided a lubricant, reducing the friction, and now their hands do not heat up as much.)
7. Ask students to think of examples where lubricants reduce heat. (Oil in engines, oil on door hinges, etc.)
8. Have each student take a pencil and quickly scribble for 30 seconds. Then quickly touch the tip of the pencil to his/her other hand and note the temperature. Is it hot? What two objects were rubbed against each other? Was heat created?
9. Each student touchs a rubber band to his/her forehead, then stretches the rubber band and touch it to their forehead. Does it get hot? Ask students to think of examples in their own lives where rubbing things together creates heat. (Skidding on a bike, etc.)
10. Students should write the answer to the question, "What happens when two objects are rubbed against one another?" listing examples in their science journals.

Heat Scavenger Hunt

1. Have students either jog in place, stomp their feet, or wave their arms again and again. After a few minutes, have students stop their activity and discuss their reactions. Do we produce heat when we are physically active?
2. *Discuss:* Do people need heat? What are some sources of heat? What kinds of machines produce heat?
3. Introduce students to the radiometer. The vanes are delicately pivoted and will rotate when exposed to light radiating from the sun or a light bulb.

Materials

- ❑ Radiometer
- ❑ *Things Are Heating Up* handout
- ❑ Electrical machines (hair dryer, space heater, etc.)
- ❑ Mechanical machines (blender, pencil sharpener, etc.)

4. Using the *Things Are Heating Up* handout (p. 7-24) , take your class on a "Heat Scavenger Hunt" of your school. Look for mechanical and electrical machines that produce heat or light. *Note:* Blender may be filled with water. Measure temperature. Run blender for several minutes. Take temperature again.

Possible Extensions/Adaptations/Integration

- Students could collect pictures from old magazines of mechanical and electrical machines and arrange these on a poster or collage to share and display in the classroom.
- Assign students to draw a cartoon with conversation bubbles explaining an activity just completed.
- Sand and paint a small wooden key holder for a Mother's Day or Father's Day gift (demonstrating the heat created with sand paper).

Question: Is a glove or mitten warmer, colder, or the same as the air?

1. Take the temperature of the air.
2. Take the temperature inside of a glove or mitten.
3. Next, do some exercises with your gloves or mittens on for a few minutes. Now take the temperature inside of the glove or mitten.
4. Discuss what students have learned.

Assessment Suggestion

- Check science journals and check for student understanding.

Additional Resources

Books

Science For Fun-Experiments (*Friction*, pp. 70-71 and *Get A Grip,* pp. 72-73), by Gary Gibson (Copper Beech Books); ISBN 0-7613-0517-3

The Magic School Bus Plays Ball: A Book About Forces and Friction, by Joanna Cole; ISBN 0-590-92240-8

Hands-on Physical Science Activities (*What Happens When You Rub Your Hands Together?*" p. 188 and *Friction pp.* 189-193), by Marvin N. Tolman (Parker Publishing Co.); ISBN 0-13-230178-4

Web sites

Science Net Links: ”When things Start Heating up,”
http://www.sciencenetlinks.com/lessons_printable.cfmDocID=330

Exploratorium: science Snacks: Hand-Held Heat Engine
http://www.exploratorium.edu/snacks/hand_held/index.html

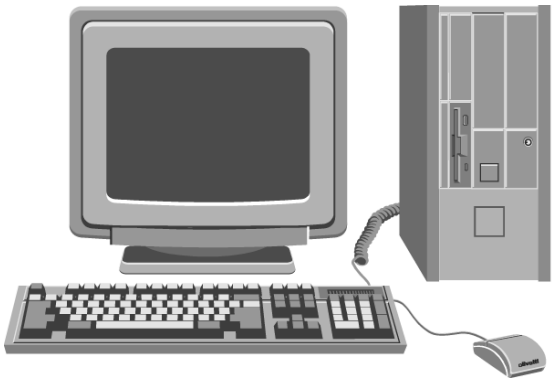
What is Friction?—Summary
http://wings.avkids.com/Curriculums/Forces_Motion/what_is_friction_summary.html

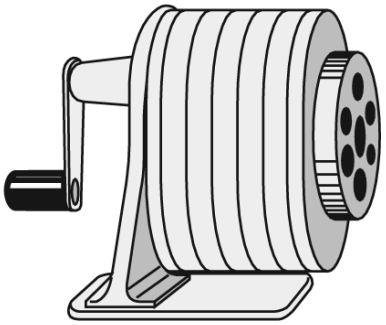
Family Connections

- Assign students to check around their homes with help from their parents and list as many mechanical and electrical machines as they can that produce heat. Bring your list to school and share with the class.
- Students try rubbing their hands together as they did in this activity at home with family. Check the temperature. Then put their hands in water and try rubbing their wet hands together. How do they feel? Check the temperature. Now try it with other substances, like cooking oil, etc.
- Hold a “Keep-a-Cube” contest. Each student will build a container at home out of trash and other readily available materials. Hold your contest to see which container can keep an ice cube from melting longest.

Name _____

Things Are Heating Up!





Mechanical Machine	Electrical Machine	Produce Heat	Produce Light	How Hot Is It?
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5

Math
Standard III
Activities

Slides, Flips, and Turns

Math Standard III:
Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 3:
Visualize and identify geometric shapes after applying transformations.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics
2. Become mathematical problem solvers
3. Reason mathematically

Content Connections:
Math III-2

Math Standard III

Objective 3

Connections

Background information

A *slide* (translation) is the movement of a shape right, left, up, or down without changing sides or rotating. A *flip* (reflection) is the movement of a shape from front to back, top to bottom, or bottom to top without turning. A *turn* (rotation) is the movement of a shape by turning without flipping.

Invitation to Learn

How many of you have gone down a slippery slide? Who has ever seen someone do a back flip? Who would like to show the class how you turn around?

Instructional Procedures

Today we are going to learn how things slide, turn, and flip in geometry.

Slides (Translation)

Have the children lie on the floor (on their backs or stomachs) and ask them to show you a move by sliding.

"How would you show a slide? If your feet are pointing toward me to start, where are they pointing after a slide?" (same way)

Flips (Reflection)

Have the students lie on the floor and show you a flip. Students move from their backs to their stomachs, their stomachs to their backs, or feet to head. Suggest that they flip on their left side, flip on their right side.

Is a summersault a flip? (two flips)

Materials

- ❑ 3" x 5" cards (two per student)
- ❑ Crayons or colored pencils
- ❑ Pattern blocks, pentominoes, or tangrams

If your head is pointing to me when you start, where is it pointing after a flip?

- Right or left—the head and feet point in the same direction as before, but what is now right was left and vice-versa
- Head or feet flip—the head will be pointing the opposite direction

Turns (Rotation)

How could you show a turn?

If moving from your back to stomach is a flip and not a turn, what does a turn look like? Are your bodies pointing in the same direction before and after a turn? (no, the direction is different for all turns except a complete turn)

Give each student two 3 x 5 cards. Have them draw a picture of themselves lying face up on one side and face down on the other side. Then repeat the drawings on the other card. Each student should have two cards.

Now use your cards to show a slide. Tell how all slides are alike. (you point the same direction: you stay on your back or stomach)

Hint: Use one card for the beginning position and use the other card to show the movement.

Now use your cards to show a flip. Tell how all flips are alike. (You move from stomach to back or back to stomach, but may not always point the same direction.)

Now use your cards to show a turn. Tell how all turns are alike. (You stay either on your back or stomach. You usually point in a different direction.)

Use cards to show one to five moves. Example: If you start on your stomach, would you be on your back or stomach after two flips. (on stomach)

How would you be lying after a slide, a flip, and a slide if you start on your stomach. (back)

Possible Extensions/Adaptations/Integration

- Use the card activity with specific directions to access understanding.
- Use pentominoes, or pattern blocks pieces, or shapes cut from graph paper.
    1. Trace a shape.
    2. Trace and label a slide with the same shape.
    3. Trace and label a flip with the same shape.
    4. Trace and label a turn with the same shape.

Covering Spaces

Math Standard III:
Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 3:
Visualize and identify geometric shapes after applying transformations.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics
2. Become mathematical problem solvers
3. Reason mathematically

Content Connections:
Language Arts I-1, VI-1

Math Standard III

Objective 3

Connections

Background Information

Hexagon—a six-sided plane figure

Trapezoid—a quadrilateral with exactly one pair of parallel sides

Parallelogram—a quadrilateral with two pairs of same-length sides and two pairs of parallel sides

Square—a quadrilateral with two pairs of parallel sides, four right angles (90 degrees, four sides of equal length)

Invitation to Learn

Can you make shapes with a rope? Use a 12 ft. rope with knots tied at one foot intervals and have students create a square, triangle, right triangle, and hexagon.

How many of you like to play games? Today you will create designs with pattern blocks and then play a game with your partner.

Instructional Procedures

Pass out pattern blocks and the *Let's Try It!* handout (p. 8-7). Have students work with a partner.

Have students keep track of the number of each shape they use in each of the three ways. Challenge the students to use the correct name of each shape before placing it on the paper.

Materials

For each pair of students:

- ❑ *Let's Try It!* handout
- ❑ *Beat Dino Hex* handout
- ❑ *Making Figures with Squares* handout
- ❑ Pattern blocks
- ❑ Crayons
- ❑ Centimeter grid paper

Possible Extensions/Adaptations/Integration

Beat Dino Hex (p. 8-8)

1. Use only yellow, green, and blue pattern blocks.

2. Take turns adding one block at a time to the game board.
3. Blocks must fit inside the lines.
4. The player who places the last block loses the game.
5. Reverse play by having players take turns removing the blocks.
6. The player who takes away the last block wins!

Making Figures with Squares (p. 8-9)

1. Color red rectangles made of three squares.
2. Color blue shapes as indicated on the sheet.
3. Follow the directions and fill the shapes using red, blue, or red and blue shapes.

Assessment Suggestions

- Allow students to share their strategies for each activity. Use an overhead copy of each activity and have students share their way to solve that activity.
- Have student pairs share, with another pair, their way of covering the areas.
- Use the coloring activity to assess the *Making Figures with Squares* handout.

Additional Resources

Books

The Fly on the Ceiling, a Math Myth, by Dr. Julie Glass; ISBN 0-679-88607-9

Not Enough Room, by Joanne Rocklin; ISBN 0-590-39962-4

The Greedy Triangle, by Marilyn Burns; ISBN 0-590-48992-5

Grandfather Tang's Story, by Ann Tompert; ISBN 0-517-88558-1

Changes, Changes, by Pat Hutchins; ISBN 0-689-71137-9

Pigs on the Ball, by Amy Axelrod; ISBN 0-689-83537-X

Shape Up! Fun with Triangles and Other Polygons, by Nancy Tobin; ISBN 0-8234-1638-0

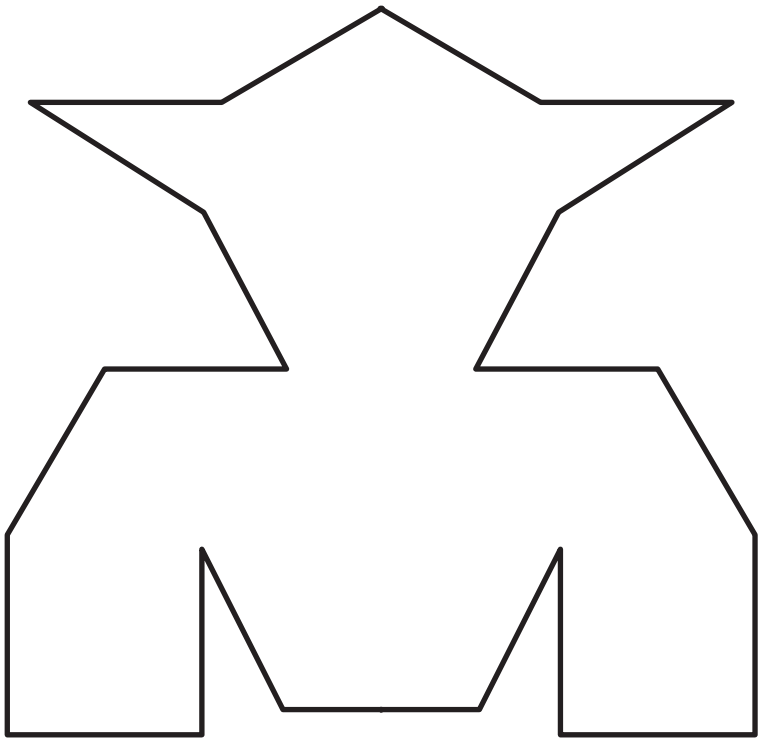
Web site

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

Name _____

Let's Try It!

Cover with blocks in 3 different ways. Use the *most* blocks for the 3rd way.



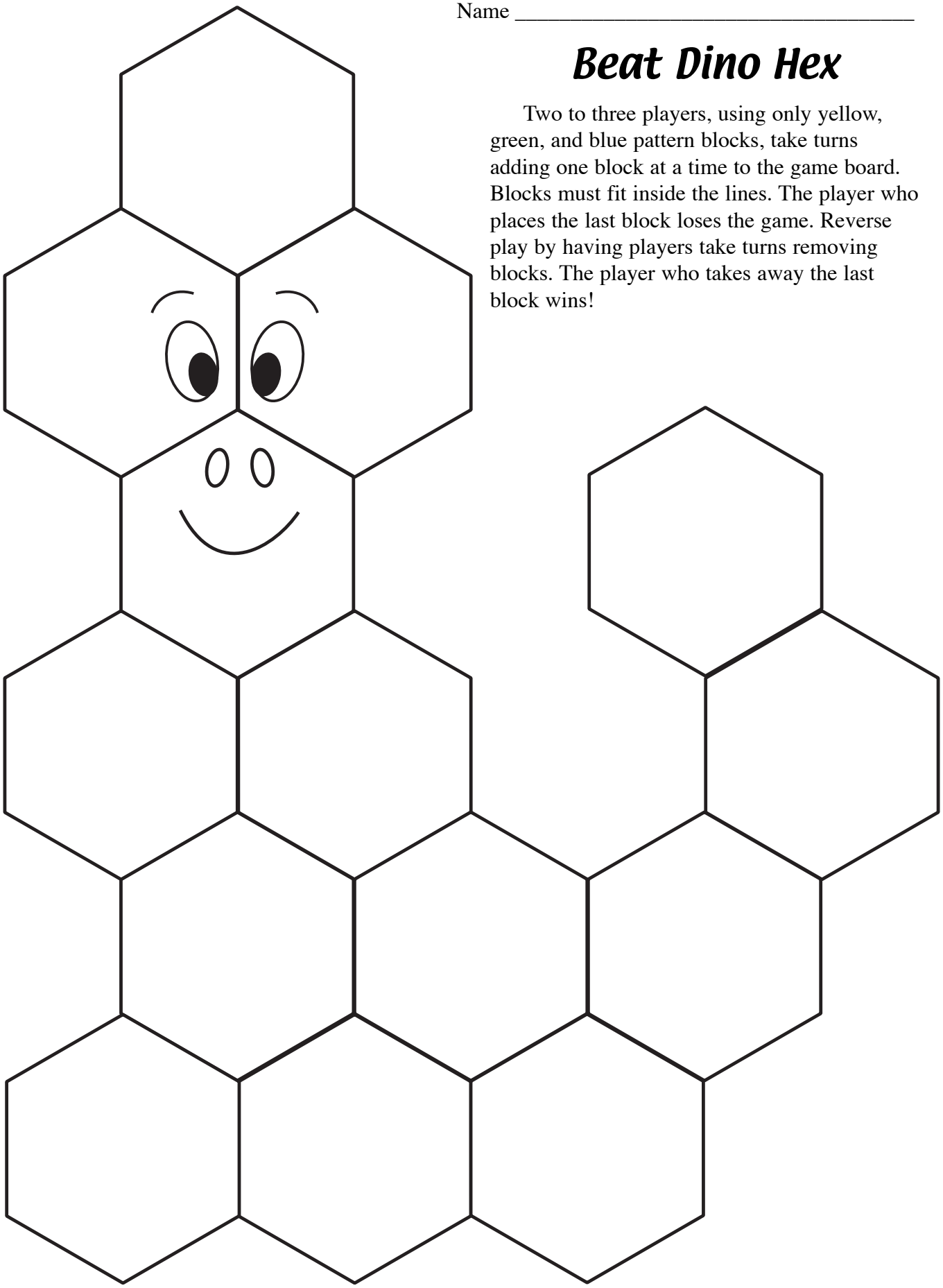
How many did you use?

1st Way	2nd Way	3rd Way
___ yellow	___ yellow	___ yellow
___ red	___ red	___ red
___ blue	___ blue	___ blue
___ orange	___ orange	___ orange
___ green	___ green	___ green
___ tan	___ tan	___ tan
___ all together	___ all together	___ all together

Name _____

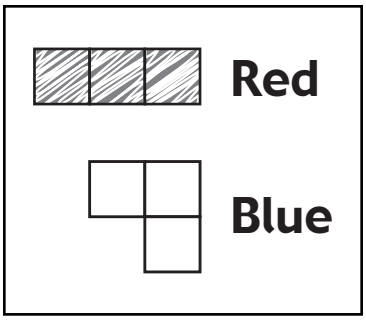
Beat Dino Hex

Two to three players, using only yellow, green, and blue pattern blocks, take turns adding one block at a time to the game board. Blocks must fit inside the lines. The player who places the last block loses the game. Reverse play by having players take turns removing blocks. The player who takes away the last block wins!

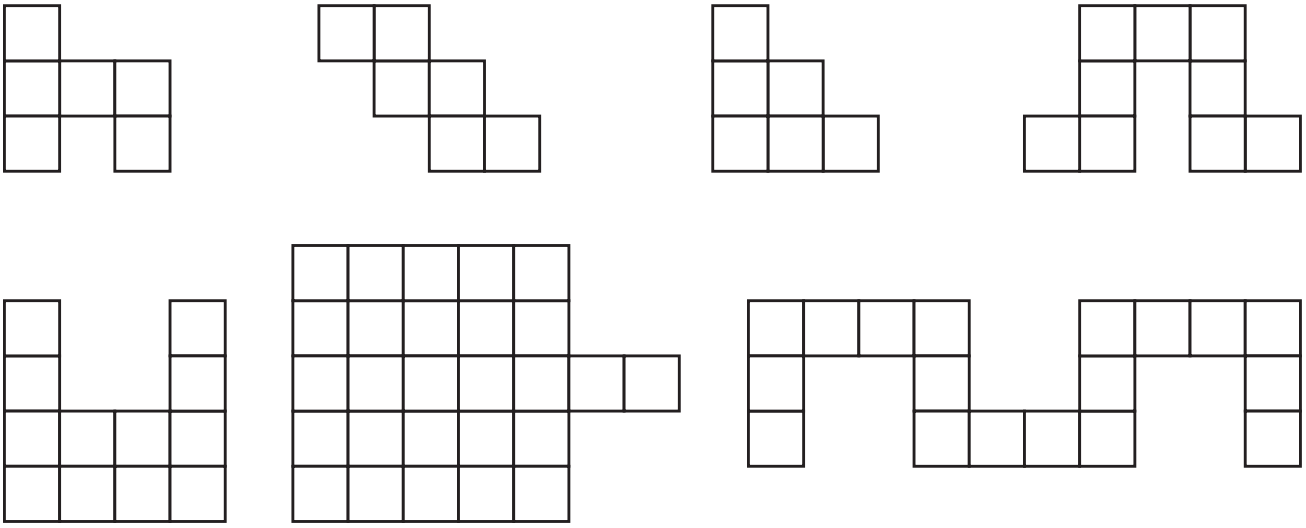


Name _____

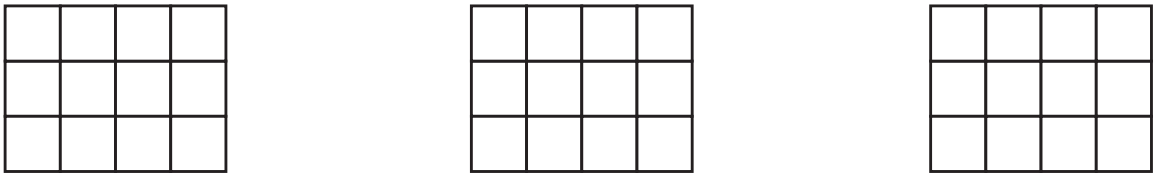
Making Figures with Squares



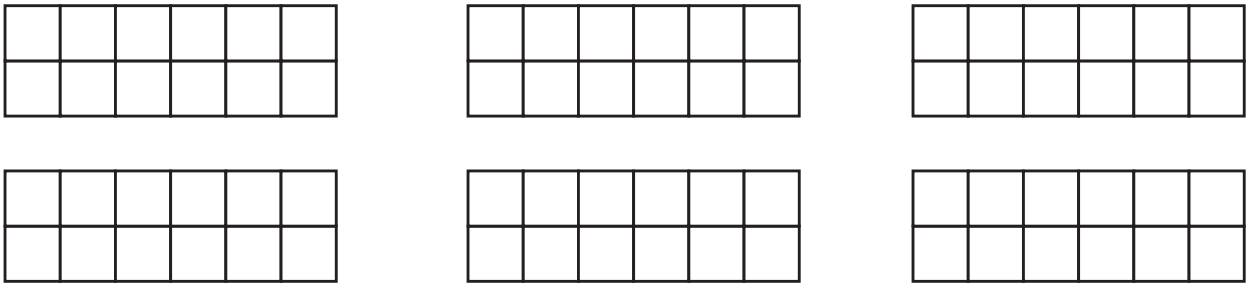
1. Make multiple copies of the figures in the box and color them red and blue.
2. Each figure below can be made from red figures, blue figures, or both red and blue figures.
3. Use red and blue pieces to show how to cover each figure.



Cover the three rectangles in different ways.

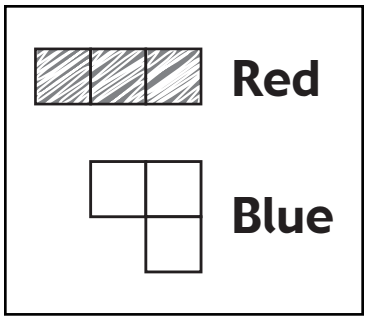


Find as many ways as you can to make the rectangle from red and blue pieces.



Name _____

Making Figures with Squares



Make multiple copies of the figures in the box and color them red and blue.

Making Tangram Pieces by Folding Paper

Math Standard III:
Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 1:
Describe, identify, and create geometric shapes.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics.
2. Become mathematical problem solvers.
3. Reason mathematically.
4. Communicate mathematically.

Content Connections:
Math II-1

Math Standard III

Objective 1

Connections

Background Information

Geometry Definitions

Acute—an angle that is smaller than a right angle (i.e., measures less than 90 degrees)

Congruent—figures, segments, or angles that have the same size and shape

Obtuse—an angle that is greater than a right angle (i.e., measures more than 90 degrees)

Parallel—lines that do not intersect

Parallelogram—a quadrilateral with two pairs of parallel sides

Trapezoid—a quadrilateral with exactly one pair of parallel sides

Invitation to Learn

Tell or read *Grandfather Tang's Story.*

Instructional Procedures

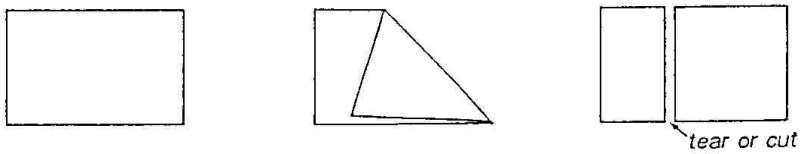
Use the following step-by-step directions (word for word if you choose) to direct this activity. *[In brackets are discussion suggestions that emphasize geometric concepts.]* At each step along the way, it's helpful if you fold and tear a large piece of paper as a demonstration.

By the way, instead of cutting, fold back and forth, then lick, fold, and tear! It works!

Materials

- ❑ One sheet of construction paper per student
- ❑ Scissors

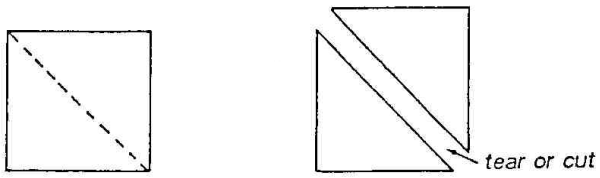
1. First we need to make a square piece of paper. Fold your sheet so that a shorter side coincides with a longer side. Tear (or cut) off the excess strip of paper. Unfold the remaining paper.



[Discuss the original shape (rectangle), and the shape you now have (square).]

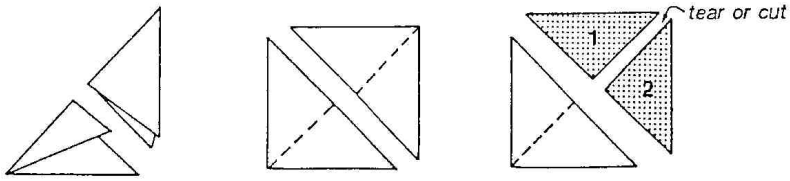
Note: After each of the following steps, have students reassemble the torn pieces into a square before going on.

2. Fold along the diagonal in the square. Tear along the fold.



[Discuss the two shapes. The two triangles are alike or congruent; each has one square corner called a right angle.]

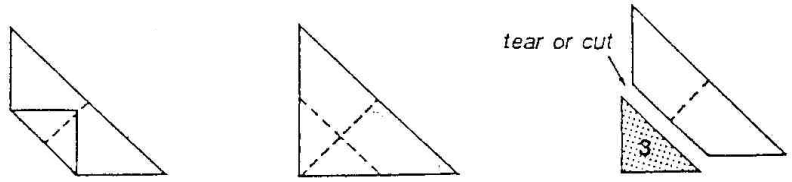
3. Fold each triangle in half. Unfold each. Tear *one* triangle along the fold to make the first two tangram pieces. Set them aside.



[Discuss the shapes. All are right triangles; the two small triangles are alike or congruent; the small triangles are the same shape or similar to the large triangle.]

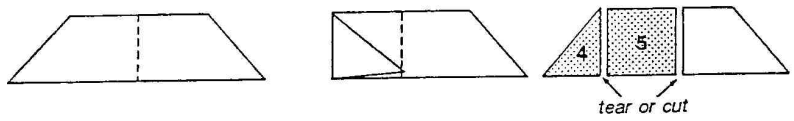
4. Take the large triangle and fold its square corner (right angle) to the middle of the opposite side (hypotenuse). Tear along the new fold to make the third piece.

   Set this triangle aside.



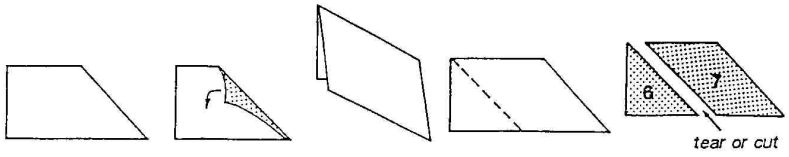
   [Discuss the resulting shapes and angles. A trapezoid is a four-sided figure with one pair of opposite sides parallel; in this case, the triangle has a right angle but the trapezoid does not; two angles in the triangle are congruent to two angles in the trapezoid.]

5. Hold the figure (trapezoid) with the longest side toward you. Notice the fold line down the middle. Fold the lower left corner (acute angle) to the middle of the bottom side. Unfold it. Tear along the two fold lines to make the fourth and fifth pieces (triangle and square).



   [Discuss the shapes. The triangle is similar but not congruent to the other triangles; the square is similar but not congruent to the original square; the trapezoid has two right angles.]

6. Hold the figure (trapezoid) with the longest side toward you and right angles to the left. Fold the top right corner (obtuse angle) to the opposite corner (right angle) so that the top side now coincides with the left side. Unfold it. Tear along the fold to make the sixth and seventh pieces.



[Discuss these last two shapes. The triangle is congruent to the other small triangles; the parallelogram, a four-sided figure with opposite side parallel, has two angles congruent to the smaller angles in the triangles.]

Possible Extensions/Adaptations/Integration

- *Tangram-graphing Grid* activity (p. 8-15).
- Rearrange tangram pieces to make something other than a square (e.g., a sail boat, a bird, etc.)
- *Geometry Triangle Puzzle* (p. 8-16).

Additional Resources

Book

Grandfather Tang's Story, by Ann Tompert; ISBN 0517885581

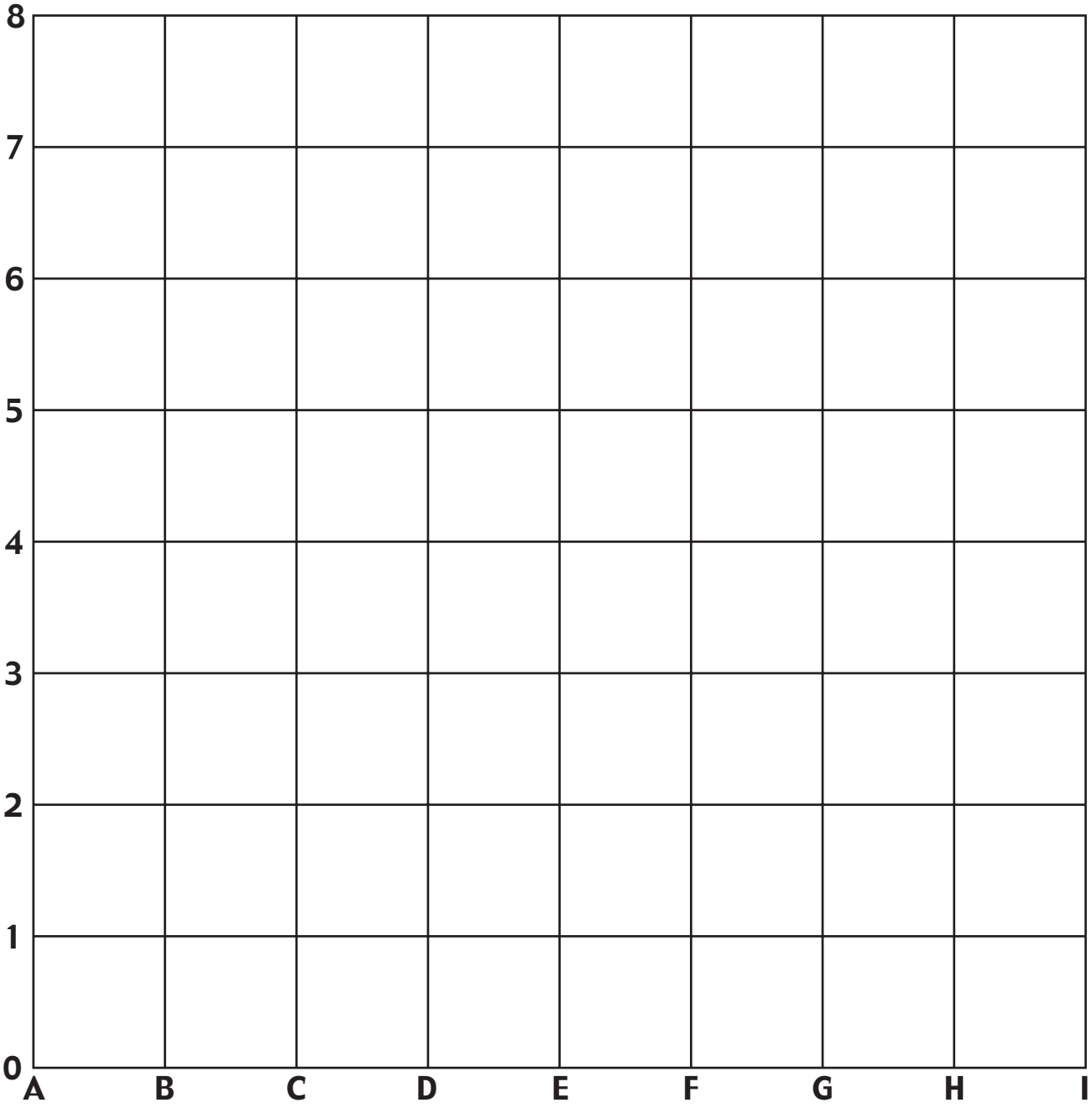
Web site

http://www.matti.usu.edu (National Library of Virtual Manipulatives)

Name _____

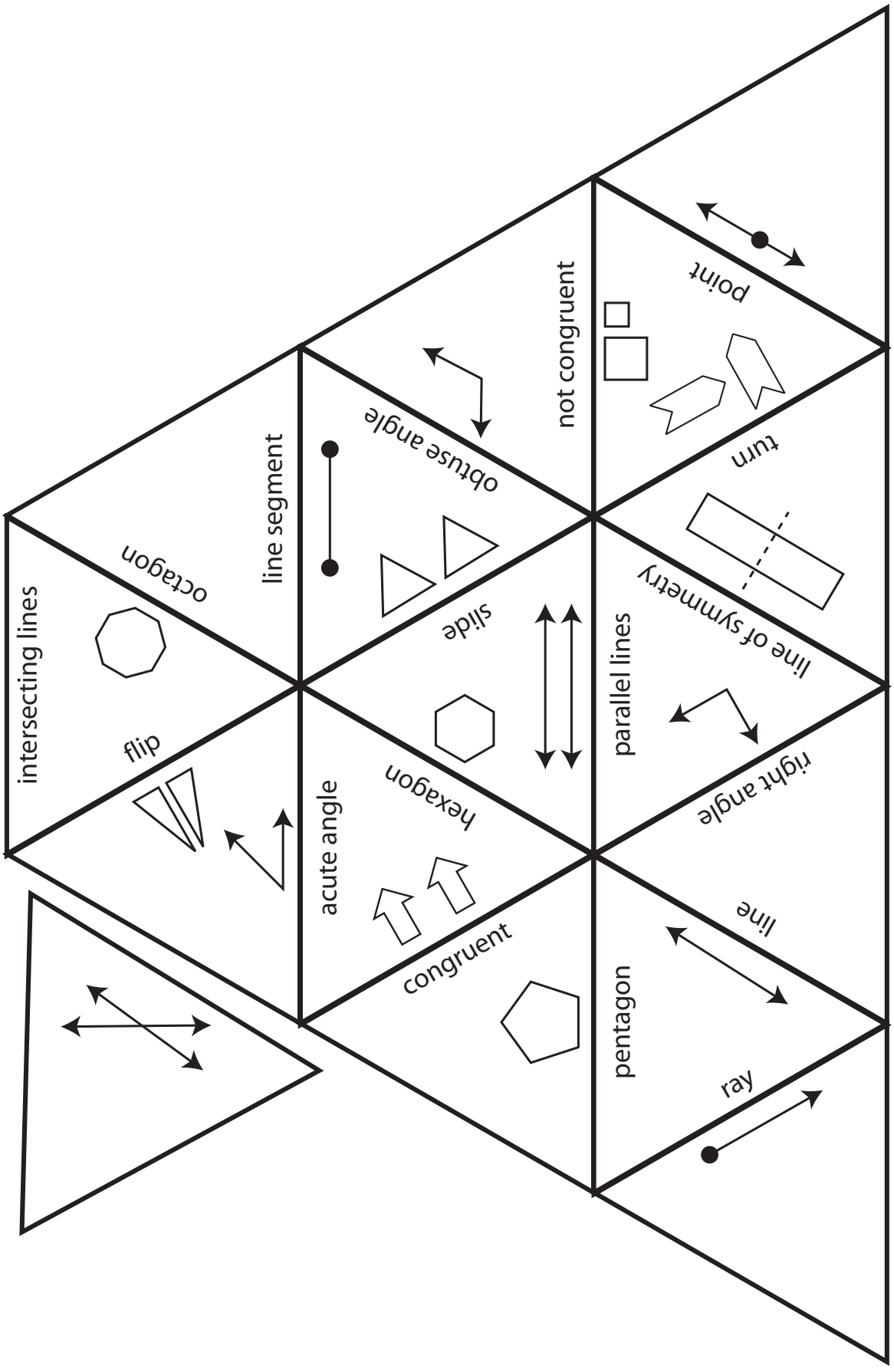
Tangram-graphing Grid

Form the tangram by connecting the coordinates.



1. Connect (I, 0) and (A, 8). Lift pencil.
2. Connect (E, 0) and (A, 4). Lift pencil.
3. Connect (C, 2) and (I, 8). Lift pencil.
4. Connect (C, 2) and (C, 6). Lift pencil.
5. Connect (E, 0) and (G, 2). Lift pencil.

Geometry Triangle Puzzle



Nets

Math Standard III:
Students will use spatial reasoning to describe, identify, and create geometric shapes.

Objective 1:
Describe, identify, and create geometric shapes.

Objective 3:
Visualize and identify geometric shapes after applying transformations.

Intended Learning Outcomes:
1. Demonstrate a positive learning attitude toward mathematics
2. Become mathematical problems solvers.
3. Reason mathematically.
4. Communicate mathematically.

Content Connections:
Language Arts I-1

Math Standard III

Objectives 1 & 3

Connections

Background Information

Geometry Definitions

Cube—a space figure that has six squares and no other faces

Edge—a segment where two faces are joined together

Face—one of the plane figures making up a space figure

Vertex (Pl: vertices)—the common point where three or more edges meet

Invitation to Learn

Today you are going to be mechanical engineers designing boxes to fit the cube exactly. You will work with a partner, your task is to find as many ways as possible to make patterns for boxes. The team that finds the most patterns wins the contract (prize).

Instructional Procedures

Task 1

Materials
- ❑ Tiles or squares from pattern blocks
- ❑ *Dot Grid*

Pass out tiles and *Dot Grid* (p. 8-21) and discover the various patterns for omino, domino, triomino, tetraomino, pentomino, and hexomino shapes. Discuss repeats of slides, turns, or flips do not count as different shapes. Each segment must touch a complete segment of an adjoining square.

Task 2

Materials
- ❑ 1" cube
- ❑ *1" Grid*
- ❑ Scissors
- ❑ Tape

1. Find patterns for boxes that will fit one cube. Each pattern must follow three rules:
   - It must be made from a single piece of paper
   - It can be folded only along the edges of the squares
   - No sides can overlap

   Hint: If your pattern doesn't work, how can you change it to make it work?
2. When you find one that works, draw it on *1" Grid* (p. 8-20) and cut it out in one piece.
3. Allow students to discuss the strategies they used to devise their patterns.
4. Have the students show their patterns on an overhead or on the chalkboard.
5. For each pattern posted, ask if the class agrees that it works. When there is disagreement, students should justify their beliefs.
6. Sometimes students will post duplicate patterns. Discuss which patterns are flips or turns.

Possible Extensions/Adaptations/Integration

Repeat the activity for creating nets to build a triangular prism or boxes to fit two cubes.

Assessment Suggestions

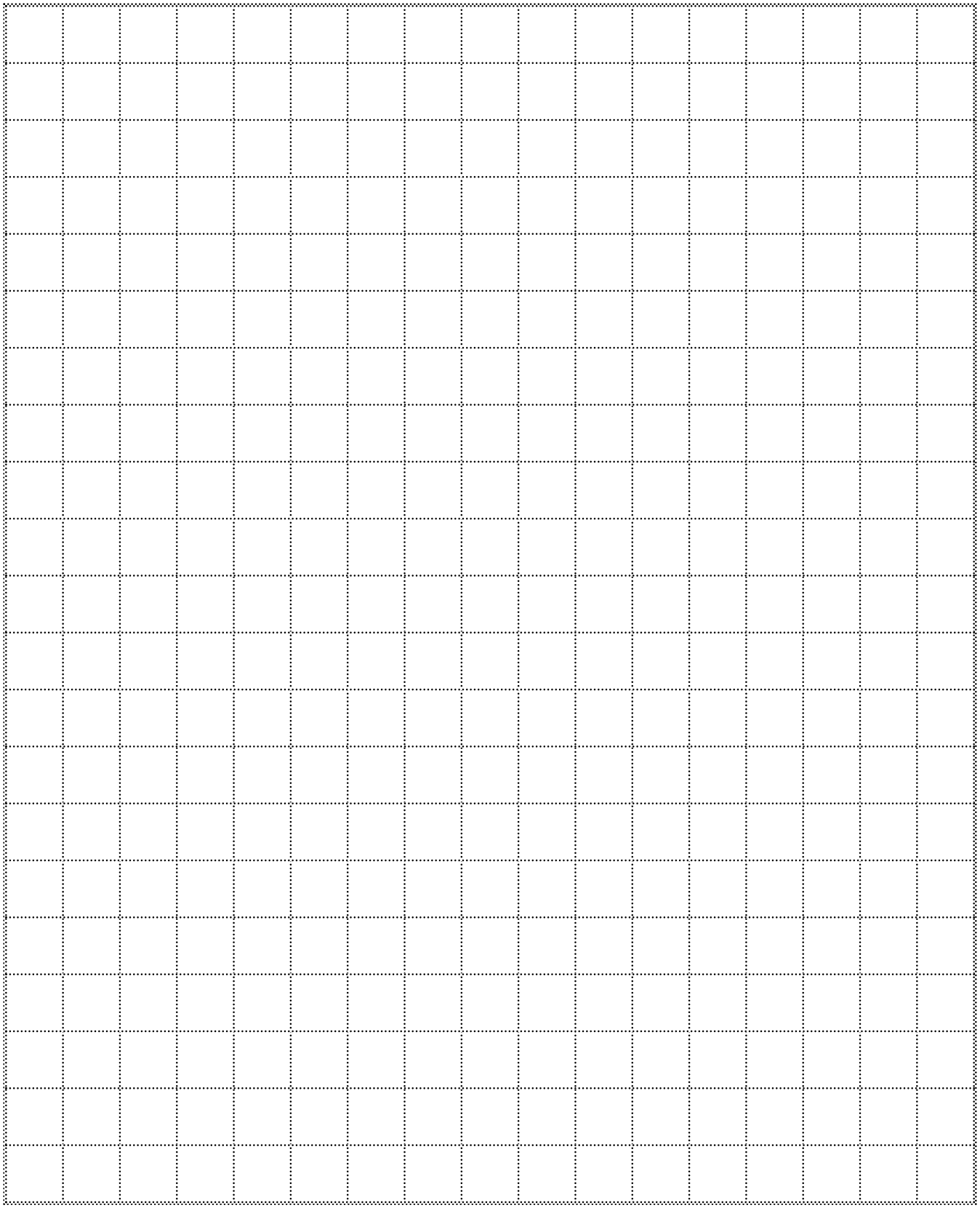
- Were the students able to create at least one net?
- Provide examples and non-examples of nets for cubes. Can the students identify the correct choices?
- Use *Family Connections* as an assignment.

Family Connections

- Find a box at home. Draw a net that you think will fit the box exactly. Cut it out and try it. Did it work? If not, what could you change to make it work? Try it.
- If possible, cut the box on the edges so that it opens flat to create a net. Is it different than the net you created?

1" Grid

Dot Grid

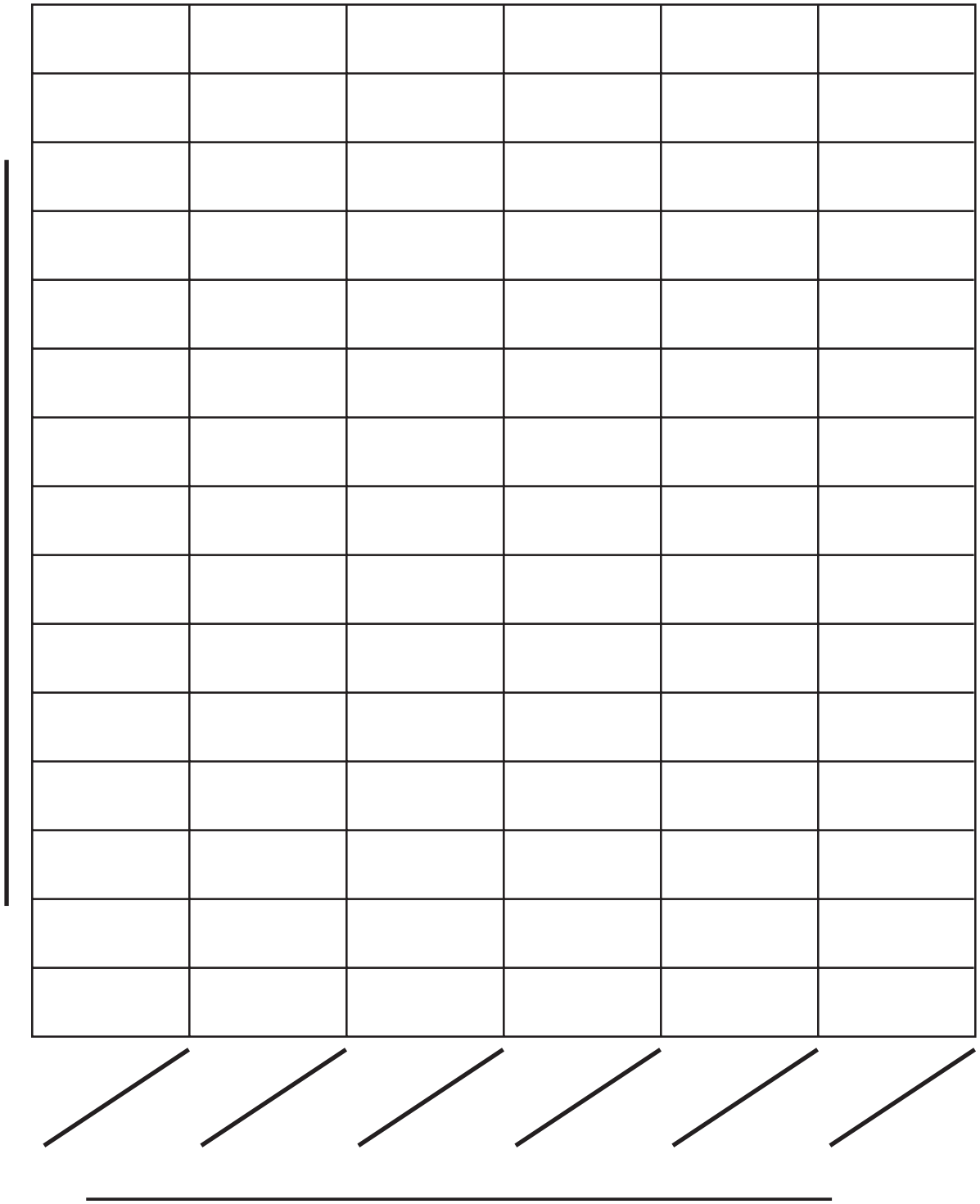


Appendix

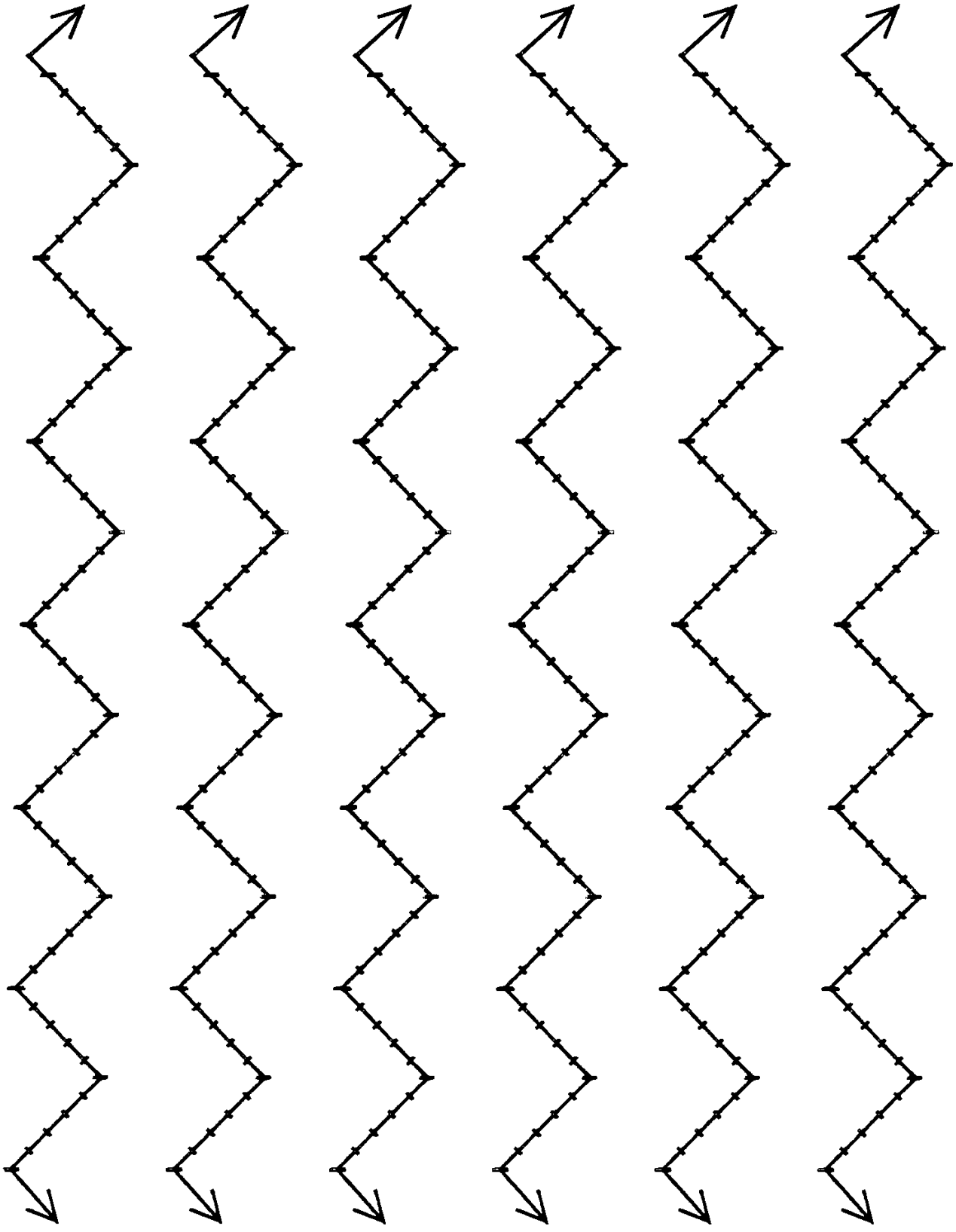
Name _____

My Favorite Candy Bar Pictograph

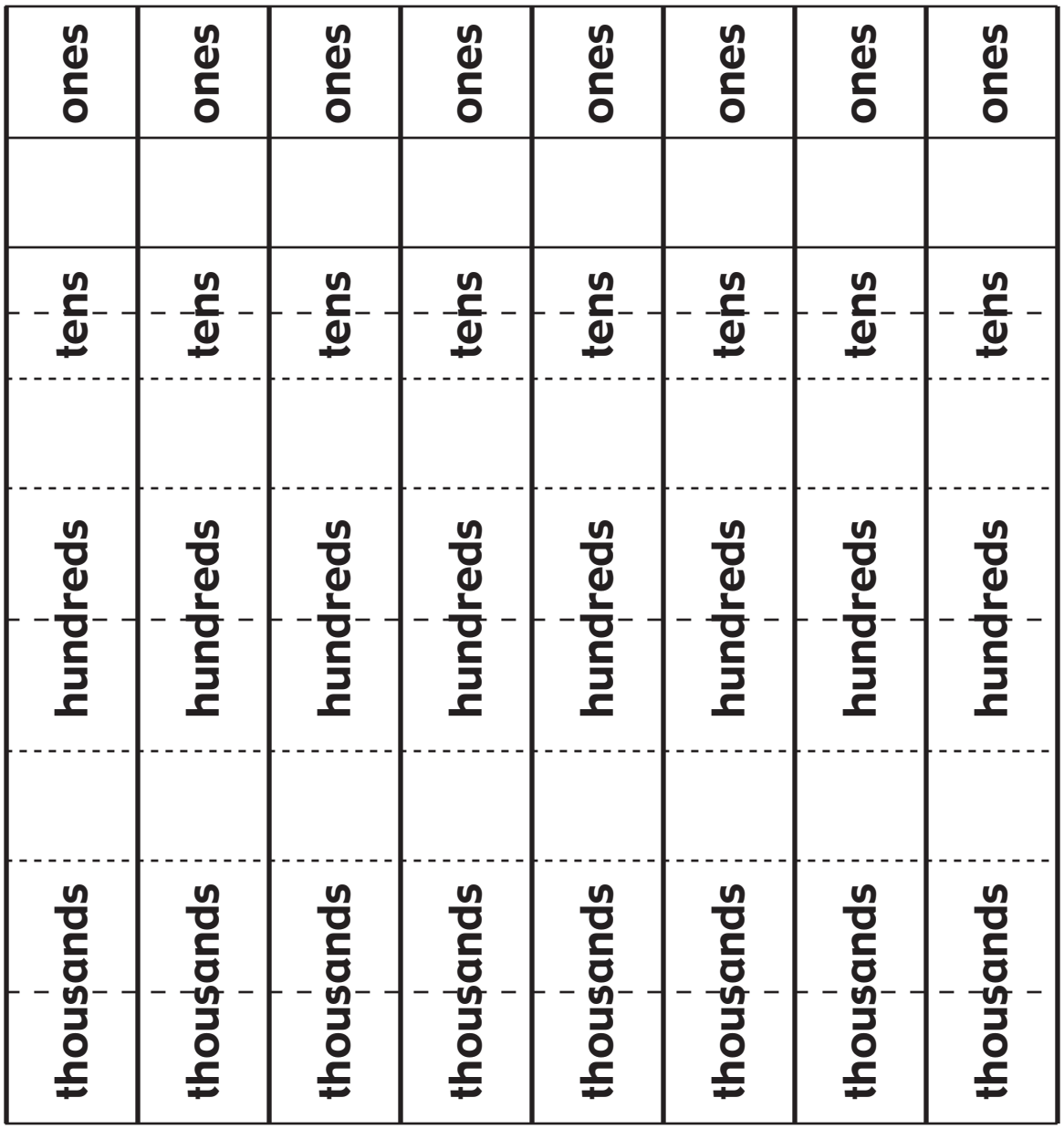
Using the data collected, complete the pictograph. Include title, label the vertical axis and horizontal axis, and write the scale on the lines.



Rounding Mountains



Place Value Strips



Name _____

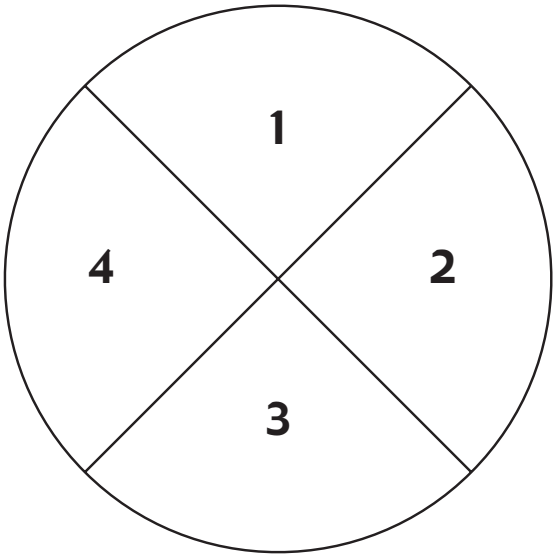
Odds and Evens

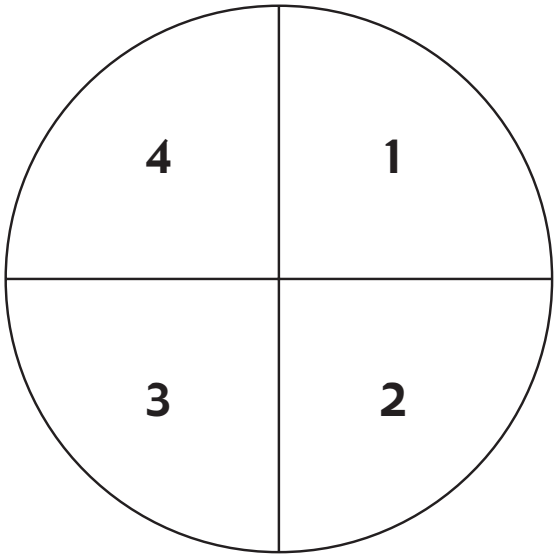
Players

two players

Directions

- Players determine who will be *even* or *odd*.
- Spin both spinners and add the numbers together. If the sum is even, the even player gets a point. If the sum is odd, the odd player gets a point.
- The player with the most points at the end is the winner.





Spin the spinner for three minutes. Tally the points on the lines provided. Determine who the winner is.

Odds	Evens
_____	_____
_____	_____
_____	_____

1. Was the game fair? Explain your thinking of why it was or was not fair.

_____

_____

_____

_____

2. If the game is not fair, what can be done to make it fair?

_____

_____

_____

_____

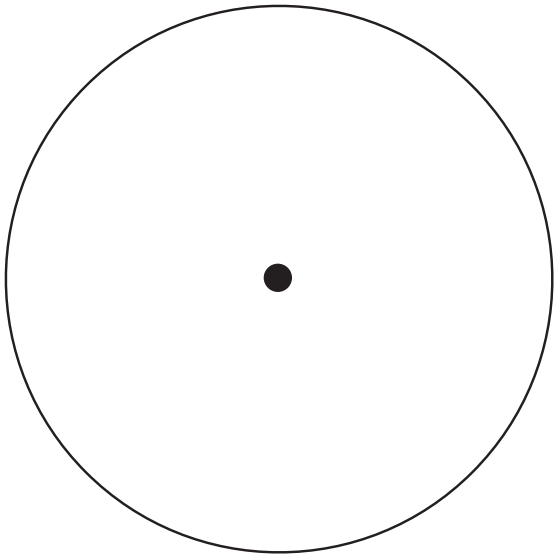
3. Design a new game that is fair. Explain how you know it is a fair game.

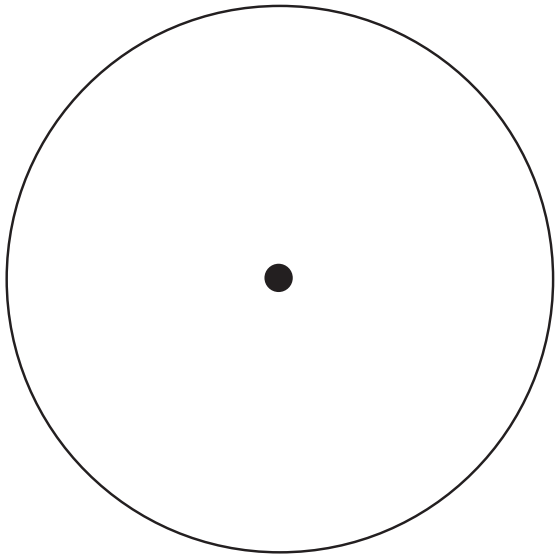
_____

_____

_____

_____





NAME_____

Uphill - Inclined Plane

	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
Straight Up ----------g											
5 Books ----------g											
3 Books ----------g											
1 Book ----------g											

NAME_____

Uphill - Inclined Plane

	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
Straight Up ----------g											
5 Books ----------g											
3 Books ----------g											
1 Book ----------g											

NAME_____

It's a Weighty Matter

	0g	50g	100g	150g	200g	250g	300g	350g	400g	450g	500g
----------g											
----------g											
----------g											
----------g											

NAME_____

It's an Up Uphill Battle

A: **Starting Point**	B: **How far up the other side the marble traveled**	**Difference** **A-B=____**
24 Inches		
18 Inches		
12 Inches		
6 Inches		

Pattern Connect Four Game Board

R Bl R Bl	R Y Y R	O R R O	Br O O Br	Y Y Bl Bl
Br G Br G	R R G R	Br Br G G	O Bl O Bl	R Br R Br
Br Bl Bl O	R Bl R Bl	Y Br Br R	O G O R	G Y G G
O Bl O O	R Bl R Bl	R R G G	Y R Y R	G Br Br Br

Walk the Dog

Day Number	Pay for That Day	Total Pay
1	$.01	$.01
2	$.02	$.03
3	$.04	$.07
4	$.08	$.15
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		

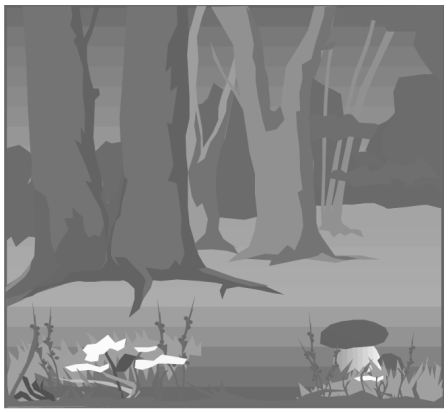
Name _____

Solar Balloon

Time (minutes)	Elevation
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Name _____

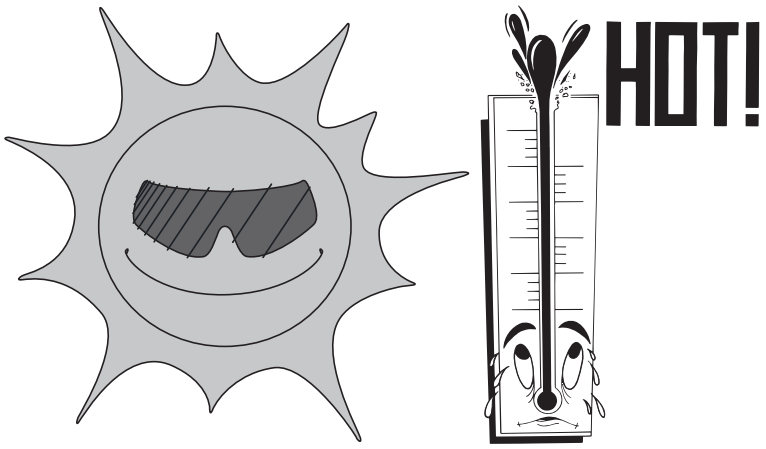
Sun or Shade?



Location	Temperature	Notes

Name _____

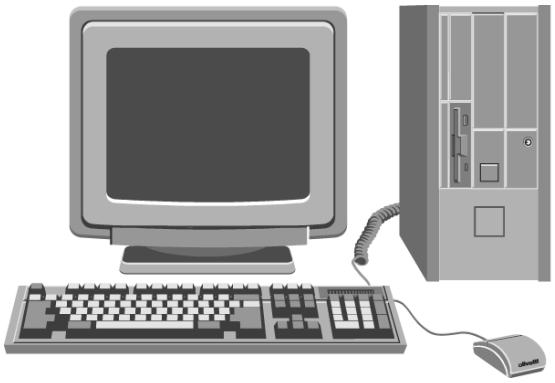
Temperatures in the Sun and Shade

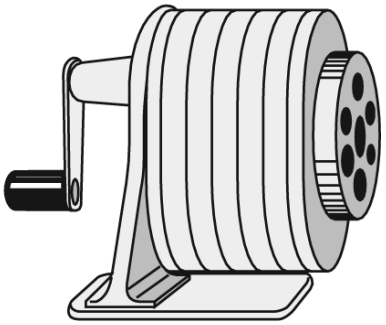


120°										
115°										
110°										
105°										
100°										
95°										
90°										
85°										
80°										
75°										
70°										
65°										
60°										
55°										
50°										
Location										

Name _____

Things Are Heating Up!

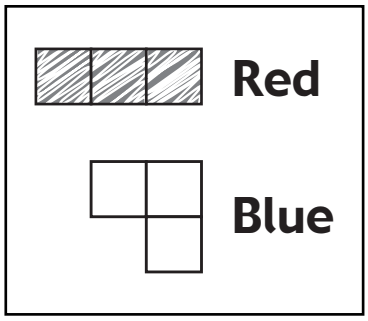




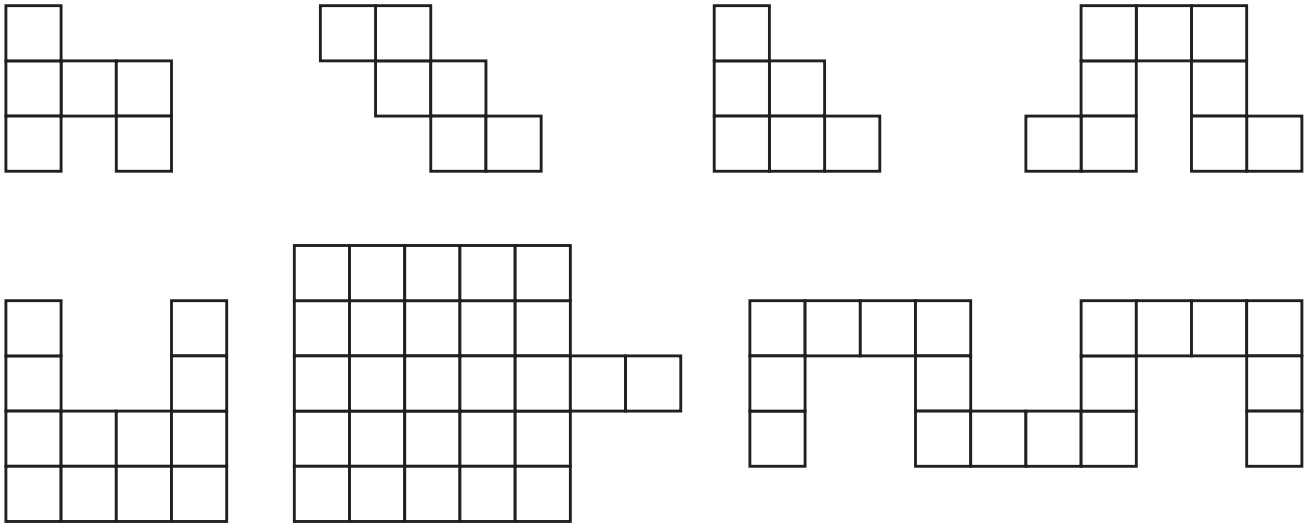
Mechanical Machine	Electrical Machine	Produce Heat	Produce Light	How Hot Is It?
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5
				1 2 3 4 5

Name _____

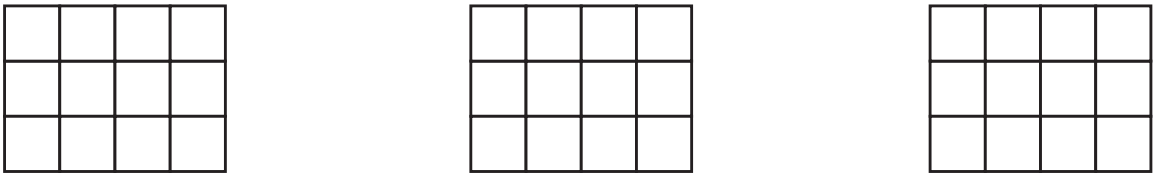
Making Figures with Squares



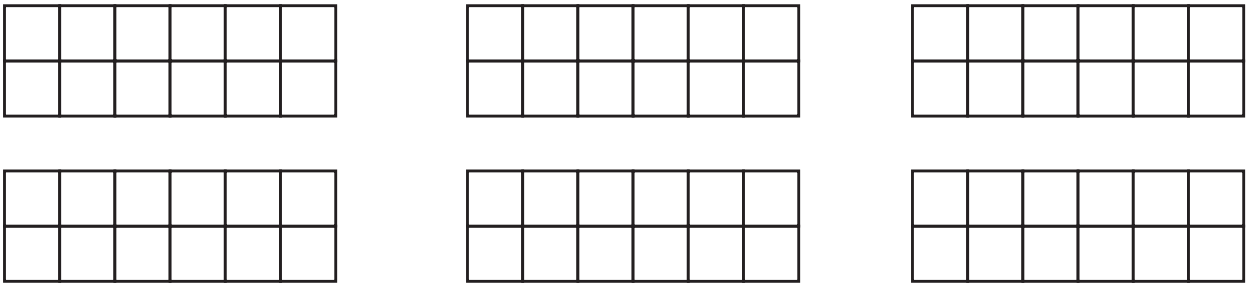
1. Make multiple copies of the figures in the box and color them red and blue.
2. Each figure below can be made from red figures, blue figures, or both red and blue figures.
3. Use red and blue pieces to show how to cover each figure.



Cover the three rectangles in different ways.

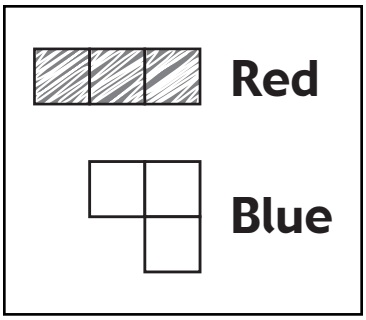


Find as many ways as you can to make the rectangle from red and blue pieces.



Name _____

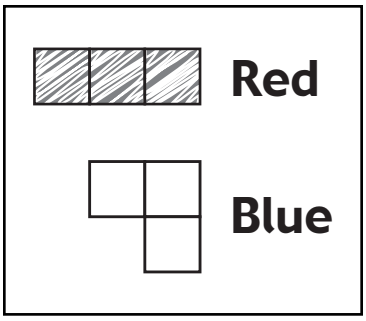
Making Figures with Squares



Make multiple copies of the figures in the box and color them red and blue.

Name _____

Making Figures with Squares

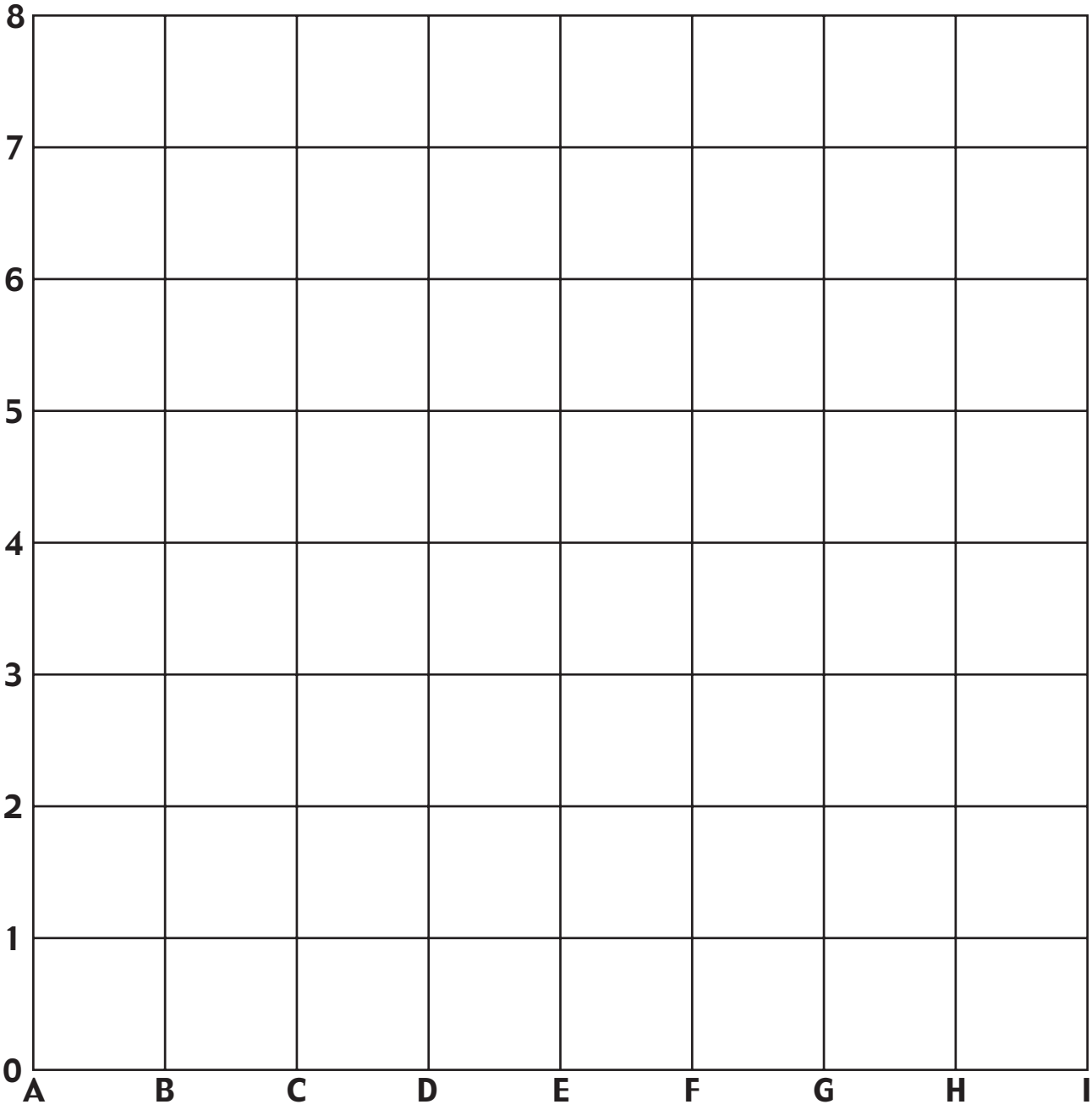


Make multiple copies of the figures in the box and color them red and blue.

Name _____

Tangram-graphing Grid

Form the tangram by connecting the coordinates.

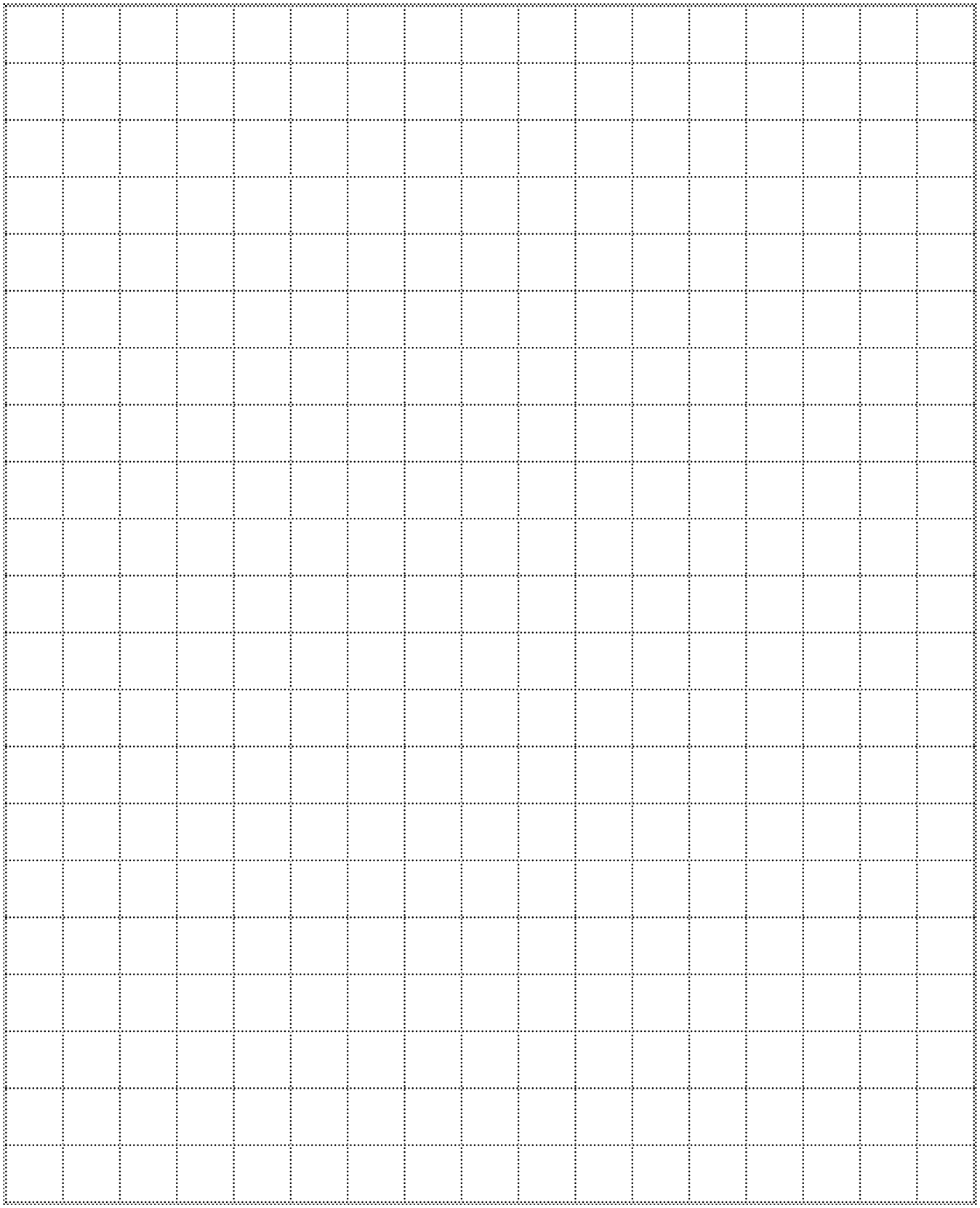


1. Connect (H, 0) and B, 8). Lift pencil.
2. Connect (D, 0) and (0, 4). Lift pencil.
3. Connect (B, 2) and (H, 8). Lift pencil.
4. Connect (B, 2) and (B, 6). Lift pencil.
5. Connect (D, 0) and (F, 2). Lift pencil.

1" Grid

1” Grid

Dot Grid



Dot Grid