



**PARTICIPANT HANDBOOK**  
**2004**



**UtahState**  
UNIVERSITY

ELEMENTARY CORE ACADEMY

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ISBN: 1-890563-88-9

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# Acknowledgements

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These materials have been produced by and for the teachers of the State of Utah. Appreciation is expressed to the numerous individuals who provided input and effort into the creation of this curriculum. Delivery of the Elementary CORE Academy, including the development and delivery of content, coordination of sessions, distribution of materials, and participant interaction, has been a collaborative effort of many educational groups across Utah. The following organizations, Utah teachers, and science leaders contributed ideas and activities as part of this professional development project:

**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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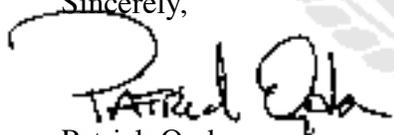
Dear CORE Academy Teachers:

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

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# ***Funding Sources***

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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

**School Funds:**

- 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

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## **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 no longer 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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***Fourth 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.

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.

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



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 Fourth 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.

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

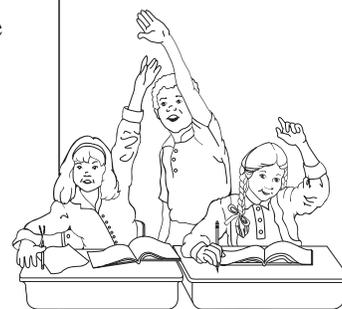
**1. Demonstrate a positive learning attitude toward mathematics.**

- 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.

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



**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.

# Fourth Grade Mathematics Core Curriculum

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

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

- Model, read, and write numerals from tenths to 100,000.
- 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  $70,000+6,000+500+30+9$ ).
- Identify the place and the value of a given digit in a five-digit numeral, including decimals to tenths.
- 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  $9 \times 4$ ).
- Identify *square numbers* using models.

*Objective 2:* Identify relationships among whole numbers and decimals.

- Identify the number that is 100 more, 100 less, 1,000 more, or 1,000 less than any *whole number* up to 10,000.
- Compare the relative size of numbers (e.g., 100 is small compared to a million, but large compared to 5).
- Compare whole numbers up to five digits using the symbols  $<$ ,  $>$ , and  $=$ .
- Identify a whole number that is between two given whole numbers.
- Order and compare whole numbers and decimals to tenths on a number line.

*Objective 3:* Model and illustrate meanings of the four operations and describe how they relate.

- 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*.
- Recognize that division by zero is not possible (e.g.,  $6 \div 0$  is undefined).

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



- 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.,  $3 \times 4 = 12$ ; thus,  $12 \div 4 = 3$  and  $12 \div 3 = 4$ ).
- f. Describe the effect of place value when multiplying whole numbers by 10 and 100.

*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 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 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.

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

*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 2:* Recognize, represent, and solve mathematical situations using patterns and symbols.

- a. Solve equations involving equivalent *expressions* (e.g.,  $6 \times 2 = \square \times 3$  or  $6 \times \square = 9 + 9$ ).
- b. Use the  $<$ ,  $>$ ,  $=$  symbols to compare two expressions involving addition, subtraction, multiplication, and division (e.g.,  $5 \times 49 \div 3$ ).
- c. Recognize that a given variable maintains the same value throughout an equation or expression (e.g.,  $\square + \square = 8$ ;  $\square = 4$ ).
- d. Demonstrate that changing the order of *factors* does not change the *product* (e.g.,  $2 \times 3 = 6$ ,  $3 \times 2 = 6$ ) and that the grouping of three or more factors does not change the product (e.g.,  $(2 \times 3) \times 1 = 6$ ;  $2 \times (3 \times 1) = 6$ ).
- e. Demonstrate the distribution of multiplication over addition using a rectangular *array* (e.g.,  $8 \times 14 = 8$  rows of 10 plus 8 rows of 4).

**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.

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

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

- a. Identify a *slide* (translation) or a *flip* (reflection) of a geometric shape using manipulatives.
- b. Relate *cubes*, *cylinders*, *cones*, and *rectangular prisms* to the *two-dimensional* shapes (*nets*) from which they were created.

**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. Describe the relationship among *metric* units of length (i.e., millimeter, centimeter, meter), between metric units of volume (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 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.

**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 use basic concepts of probability.**

*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 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.

# 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.

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.

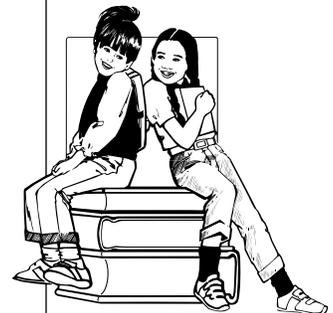
## Organization of the Elementary Science Core

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.

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



- 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.

## ***Eight Guidelines Were Used in Developing the Elementary Science Core***

### ***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**

### **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.

# Fourth Grade Science Core Curriculum

The theme for the fourth grade Science Core curriculum is **Utah natural history**. Students will learn about Utah environments including; weather, water cycle, rocks, fossils, soils, plants and animals. Understanding the concepts of **cycles** is an essential component of science literacy and is introduced at this grade level. Emphasis should be placed on skills to classify many things. Students should come to value and use science as a process of obtaining knowledge based on observable evidence, and their curiosity should be encouraged and sustained as they develop the abilities associated with inquiry in science.

Good science instruction requires that attention be paid to providing students with hands-on science investigations in which student inquiry is an important goal. Their curiosity should be encouraged and sustained. Teachers should provide opportunities for all students to experience many things. Fourth graders should feel the excitement of a rainstorm, hunt for fossils in rocks, observe the patterns in a spider web, and teach their parents to recognize the song of the lark. They should have many opportunities to observe and predict, to infer and to classify. They should come to enjoy science as a process of learning about their world.

Science 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. Technology issues and the nature of science are significant components of this Core. 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 fourth 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 fourth grade; the *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 fourth grade Science Core. These resources are all available on the Utah Science Home Page. <http://www.usoe.k12.ut.us/curr/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.**



**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 Fourth 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.**

By the end of Fourth 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.

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



**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.

# Fourth Grade Science Standards

## Science Benchmark

Matter on Earth cycles from one form to another. The cycling of matter on Earth requires energy. The cycling of water is an example of this process. The sun is the source of energy for the water cycle. Water changes state as it cycles between the atmosphere, land, and bodies of water on Earth.

## Standard I: Students will understand that water changes state as it moves through the water cycle.

*Objective 1:* Describe the relationship between heat energy, evaporation and condensation of water on Earth.

- a. Identify the relative amount and kind of water found in various locations on Earth (e.g., oceans have most of the water, glaciers and snowfields contain most fresh water).
- b. Identify the sun as the source of energy that evaporates water from the surface of Earth.
- c. Compare the processes of evaporation and condensation of water.
- d. Investigate and record temperature data to show the effects of heat energy on changing the states of water.

*Objective 2:* Describe the water cycle.

- a. Locate examples of evaporation and condensation in the water cycle (e.g., water evaporates when heated and clouds or dew forms when vapor is cooled).
- b. Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.
- c. Identify locations that hold water as it passes through the water cycle (e.g., oceans, atmosphere, fresh surface water, snow, ice, and ground water).
- d. Construct a model or diagram to show how water continuously moves through the water cycle over time.
- e. Describe how the water cycle relates to the water supply in your community.

## Science language students should use:

vapor, precipitation, evaporation, clouds, dew, condensation, temperature, water cycle

**Standard I:**  
Students will understand that water changes state as it moves through the water cycle.



**Standard II:**  
Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

**Science Benchmark**

Weather describes conditions in the atmosphere at a certain place and time. Water, energy from the sun, and wind create a cycle of changing weather. The sun's energy warms the oceans and lands at Earth's surface, creating changes in the atmosphere that cause the weather. The temperature and movement of air can be observed and measured to determine the effect on cloud formation and precipitation. Recording weather observations provides data that can be used to predict future weather conditions and establish patterns over time. Weather affects many aspects of people's lives.

**Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.**

*Objective 1:* Observe, measure, and record the basic elements of weather.

- a. Identify basic cloud types (i.e., cumulus, cirrus, stratus clouds).
- b. Observe, measure, and record data on the basic elements of weather over a period of time (i.e., precipitation, air temperature, wind speed and direction, and air pressure).
- c. Investigate evidence that air is a substance (e.g., takes up space, moves as wind, temperature can be measured).
- d. Compare the components of severe weather phenomena to normal weather conditions (e.g., thunderstorm with lightning and high winds compared to rainstorm with rain showers and breezes).

*Objective 2:* Interpret recorded weather data for simple patterns.

- a. Observe and record effects of air temperature on precipitation (e.g., below freezing results in snow, above freezing results in rain).
- b. Graph recorded data to show daily and seasonal patterns in weather.
- c. Infer relationships between wind and weather change (e.g., windy days often precede changes in the weather; south winds in Utah often precede a cold front coming from the north).

*Objective 3:* Evaluate weather predictions based upon observational data.

- a. Identify and use the tools of a meteorologist (e.g., measure rainfall using rain gauge, measure air pressure using barometer, measure temperature using a thermometer).
- b. Describe how weather and forecasts affect people's lives.
- c. Predict weather and justify prediction with observable evidence.
- d. Evaluate the accuracy of student and professional weather forecasts.
- e. Relate weather forecast accuracy to evidence or tools used to make the forecast (e.g., feels like rain vs. barometer is dropping).

**Science language students should use:**

atmosphere, meteorologist, freezing, cumulus, stratus, cirrus, air pressure, thermometer, air temperature, wind speed, forecast, severe, phenomena, precipitation, seasonal, accuracy, barometer, rain gauge, components

**Standard III:**  
Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

**Science Benchmark**

Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

**Standard III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.**

*Objective 1:* Identify basic properties of minerals and rocks.

- a. a. Describe the differences between minerals and rocks.
- b. Observe rocks using a magnifying glass and draw shapes and colors of the minerals.
- c. Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary—rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous—with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic—crystals/minerals, often in layers).
- d. Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and metamorphic (i.e., marble, gneiss, schist).

*Objective 2:* Explain how the processes of weathering and erosion change and move materials that become soil.

- a. a. Identify the processes of physical weathering that break down rocks at Earth's surface (i.e., water movement, freezing, plant growth, wind).
- b. Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).
- c. Model erosion of Earth materials and collection of these materials as part of the process that leads to soil (e.g., water moving sand in a playground area and depositing this sand in another area).
- d. Investigate layers of soil in the local area and predict the sources of the sand and rocks in the soil.

**Objective 3:** Observe the basic components of soil and relate the components to plant growth.

- a. Observe and list the components of soil (i.e., minerals, rocks, air, water, living and dead organisms) and distinguish between the living, nonliving, and once living components of soil.
- b. Diagram or model a soil profile showing topsoil, subsoil, and bedrock, and how the layers differ in composition.
- c. Relate the components of soils to the growth of plants in soil (e.g., mineral nutrients, water).
- d. Explain how plants may help control the erosion of soil.
- e. Research and investigate ways to provide mineral nutrients for plants to grow without soil (e.g., grow plants in wet towels, grow plants in wet gravel, grow plants in water).

**Science language students should use:**

mineral, weathering, erosion, sedimentary, igneous, metamorphic, topsoil, subsoil, bedrock, organism, freeze, thaw, profile, nonliving, structural support, nutrients

**Standard IV:**  
Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

**Science Benchmark**

Fossils are evidence of living organisms from the past and are usually preserved in sedimentary rocks. A fossil may be an impression left in sediments, the preserved remains of an organism, or a trace mark showing that an organism once existed. Fossils are usually made from the hard parts of an organism because soft parts decay quickly. Fossils provide clues to Earth's history. They provide evidence that can be used to make inferences about past environments. Fossils can be compared to one another, to living organisms, and to organisms that lived long ago.

**Standard IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.**

*Objective 1:* Describe Utah fossils and explain how they were formed.

- a. Identify features of fossils that can be used to compare them to living organisms that are familiar (e.g., shape, size and structure of skeleton, patterns of leaves).
- b. Describe three ways fossils are formed in sedimentary rock (i.e., preserved organisms, mineral replacement of organisms, impressions or tracks).
- c. Research locations where fossils are found in Utah and construct a simple fossil map.

*Objective 2:* Explain how fossils can be used to make inferences about past life, climate, geology, and environments.

- a. Explain why fossils are usually found in sedimentary rock.
- b. Based on the fossils found in various locations, infer how Utah environments have changed over time (e.g., trilobite fossils indicate that Millard County was once covered by a large shallow ocean; dinosaur fossils and coal indicate that Emery and Uintah County were once tropical and swampy).
- c. Research information on two scientific explanations for the extinction of dinosaurs and other prehistoric organisms.
- d. Formulate questions that can be answered using information gathered on the extinction of dinosaurs

**Science language students should use:**

infer, environments, climate, dinosaur, preserved, extinct, extinction, impression, fossil, prehistoric, mineral, organism, replacement, trilobite, sedimentary, tropical

**Science Benchmark**

Utah has diverse plant and animal life that is adapted to and interacts in areas that can be described as wetlands, forests, and deserts. The characteristics of the wetlands, forests, and deserts influence which plants and animals survive best there. Living and nonliving things in these areas are classified based on physical features.

**Standard V: Students will understand the physical characteristics of Utah’s wetlands, forests, and deserts and identify common organisms for each environment.**

*Objective 1:* Describe the physical characteristics of Utah’s wetlands, forests, and deserts.

- a. a. Compare the physical characteristics (e.g., precipitation, temperature, and surface terrain) of Utah’s wetlands, forests, and deserts.
- b. Describe Utah’s wetlands (e.g., river, lake, stream, and marsh areas where water is a major feature of the environment) forests (e.g., oak, pine, aspen, juniper areas where trees are a major feature of the environment), and deserts (e.g., areas where the lack of water provided an environment where plants needing little water are a major feature of the environment).
- c. Locate examples of areas that have characteristics of wetlands, forests, or deserts in Utah.
- d. Based upon information gathered, classify areas of Utah that are generally identified as wetlands, forests, or deserts.
- e. Create models of wetlands, forests, and deserts.

*Objective 2:* Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

- a. Identify common plants and animals that inhabit Utah’s forests, wetlands, and deserts.
- b. Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).
- c. Describe some of the interactions between animals and plants of a given environment (e.g., woodpecker eats insects that live on trees of a forest, brine shrimp of the Great Salt Lake eat algae and birds feed on brine shrimp).

**Standard V:  
Students will understand the physical characteristics of Utah’s wetlands, forests, and deserts and identify common organisms for each environment.**

- d. Identify the effect elevation has on types of plants and animals that live in a specific wetland, forest, or desert.
- e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them.

*Objective 3:* Use a simple scheme to classify Utah plants and animals.

- a. Explain how scientists use classification schemes.
- b. Use a simple classification system to classify unfamiliar Utah plants or animals (e.g., fish/amphibians/reptile/bird/mammal, invertebrate/vertebrate, tree/shrub/grass, deciduous/conifers).

*Objective 4:* Observe and record the behavior of Utah animals.

- a. Observe and record the behavior of birds (e.g., caring for young, obtaining food, surviving winter).
- b. Describe how the behavior and adaptations of Utah mammals help them survive winter (e.g., obtaining food, building homes, hibernation, migration).
- c. Research and report on the behavior of a species of Utah fish (e.g., feeding on the bottom or surface, time of year and movement of fish to spawn, types of food and how it is obtained).
- d. Compare the structure and behavior of Utah amphibians and reptiles.
- e. Use simple classification schemes to sort Utah's common insects and spiders.

**Science language students should use:**

wetland, forest, desert, adaptation, deciduous, coniferous, invertebrate, vertebrate, bird, amphibian, reptile, fish, mammal, insect, hibernation, migration

**Common plants:**

sagebrush, pinyon pine, Utah juniper, spruce, fir, oak brush, quaking aspen, cottonwood, cattail, bulrush, prickly pear cactus

**Common animals:**

jackrabbit, cottontail rabbit, red fox, coyote, mule deer, elk, moose, cougar, bobcat, deer mouse, kangaroo rat, muskrat, beaver, gopher snake, rattlesnake, lizard, tortoise, frog, salamander, red-tailed hawk, barn owl, lark, robin, pinyon jay, magpie, crow, trout, catfish, carp, grasshopper, ant, moth, butterfly, housefly, bee, wasp, pill bug, millipede

# K-6 Elementary Mathematics Core Curriculum in Table Format

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Standard I:</b> Students will understand simple number concepts and relationships.</p> <p><b>Objective 1:</b> <b>Identify and use whole numbers.</b></p> <ol style="list-style-type: none"> <li>Relate a <i>numeral</i> to the number of objects in a set (e.g., <math>\square \square \square = 3</math>).</li> <li>Construct models of numbers to 10 with physical objects or manipulatives.</li> <li>Make pictorial representations of numbers to 10 (e.g., draw four circles, draw six squares).</li> <li>Recognize and write numerals from 0 to 10.</li> <li>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).</li> </ol>	<p><b>Standard I:</b> Students will acquire number sense and perform simple operations with whole numbers.</p> <p><b>Objective 1:</b> <b>Represent whole numbers in a variety of ways.</b></p> <ol style="list-style-type: none"> <li>Relate number words to the <i>numerals</i> that represent the quantities 0 to 10.</li> <li>Sort objects into groups of tens and ones and write the numeral representing the set.</li> <li>Represent <i>whole numbers</i> up to 100 in groups of tens and ones using objects.</li> <li>Write a numeral when given the number of tens and ones.</li> <li>Write a numeral to 99 in <i>expanded form</i> (e.g., 39 is 3 tens and 9 ones or 30+9).</li> <li>Use zero to represent the number of elements in the empty set or as a placeholder in a two-digit numeral.</li> </ol>	<p><b>Standard I:</b> Students will acquire number sense and perform operations with whole numbers.</p> <p><b>Objective 1:</b> <b>Represent whole numbers in a variety of ways.</b></p> <ol style="list-style-type: none"> <li>Relate number words to the <i>numerals</i> that represent the quantities 0-100.</li> <li>Represent <i>whole numbers</i> up to 1,000 in groups of hundreds, tens, and ones using base ten models, and write the numeral representing the set.</li> <li>Read and write a three-digit numeral, relating it to a set of objects and a pictorial representation.</li> <li>Write a numeral to 999 in <i>expanded form</i> (e.g., 539 is 5 hundreds, 3 tens, 9 ones or 500+30+9).</li> <li>Identify the place and value of a given digit in a three-digit numeral (e.g., the two in 281 means 2 hundreds or 200).</li> <li>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).</li> </ol>	<p><b>Standard I:</b> Students will acquire number sense and perform operations with whole numbers, and simple fractions.</p> <p><b>Objective 1:</b> <b>Represent whole numbers in a variety of ways.</b></p> <ol style="list-style-type: none"> <li>Model, read, and write <i>whole numbers</i> up to 10,000 using base ten models, pictures, and symbols.</li> <li>Write a <i>numeral</i> when given the number of thousands, hundreds, tens, and ones.</li> <li>Write a number up to 9,999 in expanded form (e.g., 6,539 is 6 thousands, 5 hundreds, 3 tens, 9 ones or 70,000+6,000+500+30+9).</li> <li>Identify the place and value of a given digit in a five-digit numeral, including decimals to tenths.</li> <li>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).</li> <li>Identify <i>square numbers</i> using models.</li> </ol>	<p><b>Standard I:</b> Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.</p> <p><b>Objective 1:</b> <b>Represent whole numbers and decimals in a variety of ways.</b></p> <ol style="list-style-type: none"> <li>Model, read, and write numerals from hundredths to one millions.</li> <li>Write a <i>whole number</i> up to 99,999 in <i>expanded form</i> (e.g., 876,539 = 8 hundred-thousands, 7 ten-thousands, 5 hundreds, 3 tens, 9 ones or 70,000+6,000+500+30+9).</li> <li>Identify the place and value of a given digit in a five-digit numeral, including decimals to tenths.</li> <li>Demonstrate multiple ways to represent whole numbers by using models and symbolic representations (e.g., <math>108=2 \times 50+8</math>; <math>108=10^2 + 8</math>).</li> <li>Classify whole numbers from 2 to 20 as <i>prime</i> or <i>composite</i> and 0 and 1 as neither prime nor composite, using models.</li> <li>Represent repeated factors using <i>exponents</i> up to three (e.g., <math>8=2 \times 2 \times 2</math>).</li> </ol>	<p><b>Standard I:</b> Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.</p> <p><b>Objective 1:</b> <b>Represent whole numbers and decimals in a variety of ways.</b></p> <ol style="list-style-type: none"> <li>Change <i>whole numbers</i> with <i>exponents</i> to <i>standard form</i> (e.g., <math>2^4=16</math>) and recognize that <math>10^0 = 1</math>.</li> <li>Read and write <i>numerals</i> from thousandths to one billion.</li> <li>Write a whole number to 999,999 in <i>expanded form</i> using <i>exponents</i> (e.g., <math>876,539 = 8 \times 10^5 + 7 \times 10^4 + 6 \times 10^3 + 5 \times 10^2 + 3 \times 10^1 + 9 \times 10^0</math>).</li> <li>Express numbers in <i>scientific notation</i> using positive powers of ten.</li> <li>Classify whole numbers to 100 as <i>prime</i>, <i>composite</i>, or neither.</li> <li>Determine the <i>prime factorization</i> for a whole number up to 50.</li> </ol>	

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

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Objective 3:</b> Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.</p> <p>a. Demonstrate the joining and separating of sets of objects to solve problems.</p> <p>b. Describe the joining or separating of sets with informal language when using models.</p> <p>c. Record pictorially the results from the joining or separating of sets.</p>	<p><b>Objective 3:</b> Model and illustrate meanings of the operations of addition and subtraction and describe how they relate.</p> <p>a. Demonstrate the joining and separating of sets with twelve or fewer objects and record the results with pictures or symbols.</p> <p>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.</p> <p>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).</p> <p>d. Use zero in addition and subtraction sentences.</p>	<p><b>Objective 3:</b> Model and illustrate meanings of the operations of addition and subtraction, and describe how they relate.</p> <p>a. Demonstrate the joining and separating of sets with eighteen or fewer objects and record the results with pictures or symbols.</p> <p>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.</p> <p>c. Separate a given set of objects into two, three, five, or ten groups of equal size.</p> <p>d. Model addition and subtraction of two-digit whole numbers in a variety of ways.</p> <p>e. Select an addition or subtraction sentence to solve a problem involving joining or separating of sets with eighteen or fewer objects.</p> <p>f. Recognize that addition number sentences have related subtraction sentences (e.g., <math>8-5=3</math>, <math>3+5=8</math>).</p>	<p><b>Objective 3:</b> Model and illustrate meanings of the operations of addition, subtraction, and multiplication, and describe how they relate.</p> <p>a. Model addition and subtraction of two- and three-digit whole numbers in a variety of ways.</p> <p>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.</p> <p>c. Model division as sharing equally and as repeated subtraction using various methods (e.g., rectangular arrays, manipulatives, number lines, pictorial representations).</p> <p>d. Demonstrate, using objects, that multiplication and division are inverse operations (e.g., <math>3 \times 4 = 12</math>; thus, <math>12 \div 4 = 3</math> and <math>12 \div 3 = 4</math>).</p> <p>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.</p> <p>f. Demonstrate the effects of place value when multiplying whole numbers by 10.</p>	<p><b>Objective 3:</b> Model and illustrate meanings of the four operations and describe how they relate.</p> <p>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.</p> <p>b. Recognize that division by zero is not possible (e.g., <math>6 \div 0</math> is undefined).</p> <p>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.</p> <p>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.</p> <p>e. Demonstrate that multiplication and division are inverse operations (e.g., <math>3 \times 4 = 12</math>; thus, <math>12 \div 4 = 3</math> and <math>12 \div 3 = 4</math>).</p> <p>f. Describe the effect of place value when multiplying whole numbers by 10 and 100.</p>	<p><b>Objective 3:</b> Model and illustrate meanings of operations and describe how they relate.</p> <p>a. Identify the <i>dividend</i>, <i>divisor</i>, and <i>quotient</i> regardless of the division symbol used.</p> <p>b. Determine whether a whole number is divisible by 2, 3, 5, 9, and/or 10, using the <i>rules of divisibility</i>.</p> <p>c. Represent remainders as <i>whole numbers</i>, 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?).</p> <p>d. Model addition, subtraction, and multiplication of fractions and decimals in a variety of ways (e.g., using objects and a number line).</p> <p>e. Select or write the number sentences that can be used to solve a two-step problem.</p> <p>f. Model different strategies for whole number multiplication (e.g., partial product, lattice) and division (e.g., partial quotient).</p> <p>g. Describe the effect on place value when multiplying and dividing whole numbers and decimals by 10, 100, and 1,000.</p>	<p><b>Objective 3:</b> Model and illustrate meanings of operations and describe how they relate.</p> <p>a. Represent division of a multi-digit dividend by two-digit divisors, including decimals, using models, pictures, and symbols.</p> <p>b. Model addition, subtraction, and division of fractions and decimals in a variety of ways (e.g., objects, a number line).</p> <p>c. Apply <i>rules of divisibility</i>.</p> <p>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.</p>

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

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
	<p><b>Objective 5:</b> Solve whole number problems using addition and subtraction in horizontal and vertical notation.</p> <ol style="list-style-type: none"> <li>Compute addition and subtraction facts to twelve.</li> <li>Add three whole numbers with sums to twelve.</li> </ol>	<p><b>Objective 5:</b> Solve whole number problems using addition and subtraction in vertical and horizontal notation.</p> <ol style="list-style-type: none"> <li>Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator).</li> <li>Compute accurately with basic number combinations for addition and subtraction facts to eighteen.</li> <li>Add three <i>whole numbers</i> with <i>sums</i> to eighteen.</li> <li>Find the sum of two-digit whole numbers and describe the process used.</li> </ol>	<p><b>Objective 5:</b> Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.</p> <ol style="list-style-type: none"> <li>Use a variety of methods and tools to facilitate computation (e.g., estimation, mental math strategies, paper and pencil, calculator).</li> <li>Find the sum of any two <i>addends</i> with three or fewer digits, including monetary amounts, and describe the process used.</li> <li>Find the <i>difference</i> of two-digit <i>whole numbers</i> and describe the process used.</li> <li>Find the <i>product</i> for multiplication facts through ten times ten and describe the process used.</li> </ol>	<p><b>Objective 5:</b> Solve whole number problems using addition, subtraction, multiplication, and division in vertical and horizontal notation.</p> <ol style="list-style-type: none"> <li>Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator.</li> <li>Find the sum and difference of four-digit numbers, including monetary amounts, and describe the process used.</li> <li>Multiply two- and three-digit <i>factors</i> by a one-digit <i>factor</i> and describe the process used.</li> <li>Divide a two-digit <i>whole number dividend</i> by a one-digit <i>divisor</i>, with a <i>remainder</i> of zero and describe the process used.</li> </ol>	<p><b>Objective 5:</b> Solve problems using the four operations with whole numbers, decimals, and fractions.</p> <ol style="list-style-type: none"> <li>Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator.</li> <li>Use estimation strategies to determine whether results obtained using a calculator are reasonable.</li> <li>Multiply up to a three-digit <i>whole number</i> by a one- or two-digit whole number.</li> <li>Divide up to a three-digit whole number <i>dividend</i> by a one-digit <i>divisor</i>.</li> <li>Add and subtract decimals with digits to the hundredths place (e.g., <math>35.42+7.2</math>; <math>75.2-13.45</math>).</li> <li>Add, subtract, and multiply fractions.</li> <li>Simplify <i>expressions</i>, without <i>exponents</i>, using the <i>order of operations</i>.</li> </ol>	<p><b>Objective 5:</b> Solve problems using the four operations with whole numbers, decimals, and fractions.</p> <ol style="list-style-type: none"> <li>Determine when it is appropriate to use estimation, mental math strategies, paper and pencil, or a calculator.</li> <li>Use estimation strategies to determine whether results obtained using a calculator are reasonable.</li> <li>Multiply up to a three-digit <i>factor</i> by a one- or two-digit factor including decimals.</li> <li>Divide up to a three-digit <i>dividend</i> by a one- or two-digit <i>divisor</i> including decimals.</li> <li>Add and subtract decimals to the thousandths place (e.g., <math>34.567+3.45</math>; <math>65.3-5.987</math>).</li> <li>Add, subtract, multiply, and divide fractions and mixed numbers.</li> <li>Solve problems using ratios and proportions.</li> <li>Simplify <i>expressions</i>, with <i>exponents</i>, using the <i>order of operations</i>.</li> </ol>

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Standard II:</b> Students will identify and use patterns to represent mathematical situations.</p> <p><b>Objective 1:</b> Identify and sort objects according to common attributes.</p> <p>a. Sort objects into groups by color, shape, size, number, or other attributes.</p> <p>b. Identify which attribute was used to sort objects into a group.</p> <p>c. Find multiple ways to sort and classify a group of objects.</p>	<p><b>Standard II:</b> Students will identify and use patterns and relations to represent mathematical situations.</p> <p><b>Objective 1:</b> Recognize and represent patterns with one or two attributes.</p> <p>a. Sort and classify objects by one or two attributes.</p> <p>b. Identify, create, and label simple patterns using manipulatives, pictures, and symbolic notation (e.g., ABAB, . . . , <math>\square \bigcirc \square \bigcirc \triangle \dots</math>).</p> <p>c. Identify patterns in the environment.</p> <p>d. Identify horizontal and vertical patterns on hundreds charts.</p> <p>e. Use patterns to establish skip counting by twos to 20 and by fives and tens to 100.</p> <p>f. Count backward from 10 to 0 and identify the pattern.</p>	<p><b>Standard II:</b> Students will identify and use patterns and relations to represent mathematical situations.</p> <p><b>Objective 1:</b> Recognize and represent patterns having multiple attributes.</p> <p>a. Sort, classify, and label objects by three or more attributes.</p> <p>b. Identify and label repeating and growing patterns using objects, pictures, and symbolic notation (e.g., ABAABBAABB...).</p> <p>c. Identify repeating and growing patterns in the environment.</p> <p>d. Construct models and skip count by twos, threes, fives, and tens and relate to repeated addition.</p>	<p><b>Standard II:</b> Students will use patterns and relations to represent mathematical situations.</p> <p><b>Objective 1:</b> Recognize, describe, and use patterns and identify the attributes.</p> <p>a. Create and extend repeating and growing patterns using objects, numbers, and tables.</p> <p>b. Record results of patterns created using manipulatives, pictures, and numeric representations and describe how they are extended.</p>	<p><b>Standard II:</b> Students will use patterns and relations to represent and analyze mathematical situations using algebraic symbols.</p> <p><b>Objective 1:</b> Recognize, analyze, and use patterns and describe their attributes.</p> <p>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.</p> <p>b. Extend patterns and describe a rule for predicting the next element.</p>	<p><b>Objective 6:</b> Model and illustrate integers.</p> <p>a. Identify, read, and locate integers on a number line.</p> <p>b. Describe situations where integers are used in the students' environment.</p>	<p><b>Objective 6:</b> Model, illustrate, and perform the operations of addition and subtraction of integers.</p> <p>a. Recognize that the sum of an integer and its opposite is zero.</p> <p>b. Model addition and subtraction of integers using manipulatives and a number line.</p> <p>c. Add and subtract integers.</p>

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Objective 2:</b> Identify and use patterns to describe numbers or objects.</p> <p>a. Use patterns to count orally from 1 to 20 and backward from 10 to 0.</p> <p>b. Identify simple patterns in the environment.</p> <p>c. Predict what comes next in an established pattern and justify thinking.</p> <p>d. Duplicate, extend, and create simple patterns using objects and pictorial representations.</p>	<p><b>Objective 2:</b> Recognize and represent relations using mathematical symbols.</p> <p>a. Recognize that “=” indicates a relationship in which the quantities on each side of an equation are equal.</p> <p>b. Recognize that symbols such as <math>\square</math>, <math>\triangle</math>, or <math>\diamond</math> in an addition or subtraction equation represent a missing value that will make the statement true (e.g., <math>\square + 3 = 6</math>, <math>5 + 7 = \triangle</math>, <math>4 = 5 - \diamond</math>).</p> <p>c. Demonstrate that changing the order of addends does not change the sum (e.g., <math>3+2=5</math> and <math>2+3=5</math>).</p>	<p><b>Objective 2:</b> Recognize and represent mathematical patterns using symbols.</p> <p>a. Recognize that symbols such as <math>\square</math>, <math>\triangle</math>, or <math>\diamond</math> in an addition, subtraction, or multiplication equation, represent a value that will make the statement true (e.g., <math>5+7=\square</math>, <math>\square-3=6</math>, <math>\diamond=2\times4</math>).</p> <p>b. Solve equations involving equivalent expressions (e.g., <math>6+4 = \square+7</math>).</p> <p>c. Use the <math>&gt;</math>, <math>&lt;</math>, and <math>=</math> symbols to compare two expressions involving addition and subtraction (e.g., <math>4+6 \square 3+2</math>; <math>3+5 \diamond 16-9</math>).</p> <p>d. Demonstrate that grouping three or more addends does not change the sum (e.g., <math>(2+3)+7=12</math>, <math>2+(3+7)=12</math>).</p>	<p><b>Objective 2:</b> Recognize, represent, and solve mathematical patterns and symbols.</p> <p>a. Solve equations involving equivalent expressions (e.g., <math>6\times2 = \square \times 3</math> or <math>6 \square \square = 9+9</math>).</p> <p>b. Use the <math>&lt;</math>, <math>&gt;</math>, <math>=</math> symbols to compare two expressions involving addition, subtraction, multiplication, and division (e.g., <math>5 \times 4 \diamond 9 \div 3</math>).</p> <p>c. Recognize that a given variable maintains the same value throughout an equation or expression (e.g., <math>\square + \square = 8</math>; <math>\square = 4</math>).</p> <p>d. Demonstrate that changing the order of factors does not change the product (e.g., <math>2 \times 3 = 6</math>, <math>3 \times 2 = 6</math>) and that the grouping of three or more factors does not change the product (e.g., <math>(2 \times 3) \times 1 = 6</math>; <math>2 \times (3 \times 1) = 6</math>).</p> <p>e. Demonstrate the distributive property of multiplication over addition using a rectangular array (e.g., <math>8 \times 14 = 8</math> rows of 10 plus 8 rows of 4).</p>	<p><b>Objective 2:</b> Represent, solve, and analyze mathematical situations using algebraic symbols.</p> <p>a. Recognize a variety of symbols for multiplication and division including <math>\times</math>, <math>\div</math>, and <math>*</math> as symbols for multiplication and <math>\div</math>, <math>\overline{)</math>, and a fraction bar (<math>/</math> or <math>-</math>) as division symbols.</p> <p>b. Recognize that a variable (<math>\diamond</math>, <math>n</math>, <math>x</math>) represents an unknown quantity.</p> <p>c. Solve one-step equations involving whole numbers and a single variable (e.g., <math>n+7=3</math>).</p> <p>d. Recognize that the answer to a multiplication problem involving a factor of zero is equal to zero (e.g., <math>0 \times 45 = 0</math>).</p> <p>e. Use expressions or one-step equations to represent real-world situations.</p> <p>f. Use the associative, commutative, and distributive properties to compute with whole numbers.</p>	<p><b>Objective 2:</b> Represent, solve, and analyze mathematical situations using algebraic symbols.</p> <p>a. Recognize that a number in front of a variable indicates multiplication (e.g., <math>3y</math> means 3 times the quantity <math>y</math>).</p> <p>b. Solve two-step equations involving whole numbers and a single variable (e.g., <math>3x+4=19</math>).</p> <p>c. Recognize that “<math>\approx</math>” indicates a relationship in which the quantities on each side are approximately of equal value (e.g., <math>\pi \approx 3.14</math>).</p> <p>d. Recognize that an exponent can be represented in the following ways: <math>4^3</math> or <math>4 \wedge 3</math>.</p> <p>e. Evaluate expressions and formulas, substituting given values for the variables (e.g., <math>2x+4</math>; <math>x=2</math>; therefore, <math>2(2)+4=8</math>).</p> <p>f. Recognize that if the product is zero, then one or more factors equal zero (i.e., if <math>ab=0</math> then either <math>a=0</math> or <math>b=0</math> or <math>a</math> and <math>b=0</math>).</p>	

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Standard III:</b> Students will identify and create simple geometric shapes and describe spatial relationships.</p> <p><b>Objective 1:</b> Identify and create simple geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify circles, triangles, rectangles, and squares.</li> <li>Combine shapes to create <i>two-dimensional</i> objects.</li> <li>Draw circles, triangles, rectangles, and squares.</li> <li>Recognize circles, triangles, rectangles, and squares in the students' environment.</li> </ol>	<p><b>Standard III:</b> Students will describe, identify, and create and simple geometric shapes and describe spatial relationships.</p> <p><b>Objective 1:</b> Describe, identify, and create simple geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify, name, draw, create, and sort circles, triangles, rectangles, and squares.</li> <li>Identify circles, triangles, rectangles, and squares in the students' environment.</li> <li>Recognize that combining simple geometric shapes can create more complex geometric shapes.</li> </ol>	<p><b>Standard III:</b> Students will describe, identify, and create geometric shapes and describe spatial relationships.</p> <p><b>Objective 1:</b> Describe, identify, and create geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify, name, draw, sort, and compare circles, triangles, and <i>parallelograms</i>.</li> <li>Identify and name spheres, cones, and cylinders.</li> <li>Find and identify familiar geometric shapes in the students' environment.</li> <li>Determine whether a circle, triangle, square, or rectangle has a <i>line of symmetry</i>.</li> </ol>	<p><b>Standard III:</b> Students will use spatial reasoning to describe, identify, and create geometric shapes.</p> <p><b>Objective 1:</b> Describe, identify, and create geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify and draw <i>points, lines, line segments, and endpoints</i>.</li> <li>Identify and draw <i>lines of symmetry</i> on triangles, squares, circles, and rectangles.</li> <li>Determine whether an angle is <i>right, obtuse, or acute</i> by comparing the angle to the corner of a rectangle.</li> <li>Classify polygons (e.g., <i>quadrilaterals, pentagons, hexagons, octagons</i>) by the number of sides and corners.</li> <li>Identify, make, and describe cubes (e.g., a cube has 6 square <i>faces</i>, 8 <i>vertices</i>, and 12 <i>edges</i>).</li> </ol>	<p><b>Standard III:</b> Students will use spatial reasoning to recognize, describe, and identify geometric shapes.</p> <p><b>Objective 1:</b> Describe, identify, and analyze characteristics and properties of geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify and draw <i>parallel lines</i> and <i>intersecting lines</i>.</li> <li>Identify and draw lines of symmetry on a variety of <i>polygons</i>.</li> <li>Identify and describe <i>quadrilaterals</i> (i.e., rectangles, squares, <i>rhombuses, trapezoids, kites</i>).</li> <li>Identify <i>right, obtuse, and acute</i> angles.</li> <li>Compare two polygons to determine whether they are <i>congruent</i> or <i>similar</i>.</li> <li>Identify and describe <i>cylinders</i> and <i>rectangular prisms</i>.</li> </ol>	<p><b>Standard III:</b> Students will use spatial reasoning to recognize, describe, and identify geometric shapes and principles.</p> <p><b>Objective 1:</b> Describe, identify, and analyze characteristics and properties of geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify and draw <i>perpendicular lines</i>.</li> <li>Draw, label, and describe rays and describe an angle as two rays sharing a common endpoint.</li> <li>Label an angle as acute, <i>obtuse, right, or straight</i>.</li> <li>Identify and describe <i>equilateral, isosceles, scalene, right, acute, and obtuse</i> triangles.</li> <li>Identify the <i>vertex</i> of an angle or the <i>vertices</i> of a polygon.</li> <li>Compare <i>corresponding angles</i> of two triangles and determine whether the triangles are <i>similar</i>.</li> <li>Identify and describe <i>pyramids</i> and <i>prisms</i>.</li> </ol>	<p><b>Standard III:</b> Students will use spatial and logical reasoning to recognize, describe, and identify geometric shapes and principles.</p> <p><b>Objective 1:</b> Identify and analyze characteristics and properties of geometric shapes.</p> <ol style="list-style-type: none"> <li>Identify the <i>midpoint</i> of a <i>line segment</i>.</li> <li>Identify concave and <i>convex polygons</i>.</li> <li>Identify the center, <i>radius, diameter, and circumference</i> of a circle.</li> <li>Identify the number of <i>faces, edges, and vertices</i> of <i>pyramids</i> and <i>prisms</i>.</li> </ol>

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

<p><b>Kindergarten</b></p> <p><b>Standard IV:</b> Students will understand and use simple measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify measurable attributes of objects and units of measurement.</p> <p>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.</p>	<p><b>1st Grade</b></p> <p><b>Standard IV:</b> Students will understand and use simple measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify measurable attributes of objects and units of measurement.</p> <p>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?).</p>	<p><b>2nd Grade</b></p> <p><b>Standard IV:</b> Students will understand and use measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify measurable attributes of objects and units of measurement.</p> <p>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.</p>	<p><b>3rd Grade</b></p> <p><b>Standard IV:</b> Students will understand and use measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify and describe measurable attributes of objects and units of measurement.</p> <p>a. Recognize the two systems of measurement: <i>metric</i> and <i>customary</i>. 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).</p> <p>d. Estimate length, capacity, and weight using metric and customary units.</p>	<p><b>4th Grade</b></p> <p><b>Standard IV:</b> Students will understand and use measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify and describe measurable attributes of objects and units of measurement.</p> <p>a. Describe the relationship among <i>metric</i> 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 <i>customary</i> units of length. c. Describe the relationship among customary units of <i>capacity</i> (i.e., cup, pint, quart, gallon). d. Estimate length, capacity, and weight using metric and customary units.</p>	<p><b>5th Grade</b></p> <p><b>Standard IV:</b> Students will understand and apply measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify and describe measurable attributes of objects and units of measurement.</p> <p>a. Describe the relationship among <i>metric</i> units of length (i.e., millimeter, centimeter, meter, kilometer). b. Describe the relationship among <i>customary</i> units of weight (i.e., ounce, pound). c. Identify the correct units of measurement for <i>volume</i>, <i>area</i>, and <i>perimeter</i> 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.</p>	<p><b>6th Grade</b></p> <p><b>Standard IV:</b> Students will understand and apply measurement tools and techniques.</p> <p><b>Objective 1:</b> Identify and describe measurable attributes of objects and units of measurement.</p> <p>a. Compare a meter to a yard, a liter to a quart, and a kilometer to a mile. b. Identify <i>pi</i> as the ratio of the <i>circumference</i> to <i>diameter</i> 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 <i>metric</i> and customary units.</p>

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

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Standard V:</b> Students will collect and draw conclusions from data and understand basic concepts of probability.</p> <p><b>Objective 1:</b> Collect, organize, and display simple data.</p> <ol style="list-style-type: none"> <li>Collect, organize, and record data using objects and pictures.</li> <li>Represent data in a variety of ways (e.g., graphs made from people, <i>pictographs</i>, bar graphs) and interpret the data (e.g., more people like red than blue).</li> </ol>	<p><b>Standard V:</b> Students will collect and draw conclusions from data and understand basic concepts of probability.</p> <p><b>Objective 1:</b> Collect, organize, and display simple data.</p> <ol style="list-style-type: none"> <li>Collect physical objects to use as data.</li> <li>Collect, represent, and interpret data using tables, tally marks, <i>pictographs</i>, and bar graphs.</li> </ol>	<p><b>Standard V:</b> Students will collect and organize data to make predictions and identify basic concepts of probability.</p> <p><b>Objective 1:</b> Collect, organize, and display data to make predictions.</p> <ol style="list-style-type: none"> <li>Collect, read, represent, and interpret data using tables, graphs, and charts, including keys (e.g., <i>pictographs</i>, bar graphs).</li> <li>Make predictions based on a data display.</li> </ol>	<p><b>Standard V:</b> Students will collect and organize data to make predictions and use basic concepts of probability.</p> <p><b>Objective 1:</b> Collect, organize, and display data to make predictions and answer questions.</p> <ol style="list-style-type: none"> <li>Identify a question that can be answered by collecting data.</li> <li>Collect, read, and interpret data from tables, graphs, charts, surveys, and observations.</li> <li>Represent data using tables, line plots, line graphs, and bar graphs.</li> <li>Identify and distinguish between <i>clusters</i> and <i>outliers</i> of a data set.</li> </ol>	<p><b>Standard V:</b> Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.</p> <p><b>Objective 1:</b> Formulate and answer questions using statistical methods to compare data.</p> <ol style="list-style-type: none"> <li>Formulate a question that can be answered by collecting data.</li> <li>Collect, compare, and display data using an appropriate format (i.e., <i>line plots</i>, bar graphs, <i>pictographs</i>, circle graphs, line graphs).</li> <li>Identify minimum and <i>maximum</i> values for a set of data.</li> <li>Identify or calculate the <i>mean</i>, <i>mode</i>, and <i>range</i>.</li> <li>Propose and justify inferences based on data.</li> </ol>	<p><b>Standard V:</b> Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.</p> <p><b>Objective 1:</b> Design investigations to reach conclusions using statistical methods to make inferences based on data.</p> <ol style="list-style-type: none"> <li>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).</li> <li>Collect, compare, and display data using an appropriate format (i.e., bar graphs, line graphs, <i>line plots</i>, circle graphs, scatter plots).</li> <li>Compare two similar sets of data on the same graph and compare two graphs representing the same set of data.</li> <li>Recognize that changing the scale influences the appearance of a display of data.</li> <li>Develop and evaluate inferences and predictions based on data.</li> </ol>	<p><b>Standard V:</b> Students will collect, analyze, and draw conclusions from data and apply basic concepts of probability.</p>

Kindergarten	1st Grade	2nd Grade	3rd Grade	4th Grade	5th Grade	6th Grade
<p><b>Objective 2:</b>  <b>Determine the likelihood of events.</b>                      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).</p>	<p><b>Objective 2:</b>  <b>Determine the likelihood of an event.</b>                      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).</p>	<p><b>Objective 2:</b>  <b>Determine the likelihood of an event.</b>                      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).</p>	<p><b>Objective 2:</b>  <b>Identify basic concepts of probability.</b>                      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?).</p>	<p><b>Objective 2:</b>  <b>Use basic concepts of probability.</b>                      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.</p>	<p><b>Objective 2:</b>  <b>Apply basic concepts of probability.</b>                      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.</p>	<p><b>Objective 2:</b>  <b>Apply basic concepts of probability.</b>                      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.</p>



# ***Facilitated Activities***



# Sinking and Floating Water

## Science

### 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

### Invitation to Learn

Introduce the concept of *density* by conducting a demonstration. Fill a large cup with water. Show it to the class. Ask the class to predict what they think will happen if you drop the following objects into the water: penny, rubber stopper, cork, wooden bead. Students will observe that some float and some sink. Tell the students that if an object floats in water the object is less dense than water. If an object sinks in water the object is more dense than water.

### Instructional Procedures

Tell the students that they are going to observe what happens when hot water is added to room temperature water without mixing the two.

1. Show the students how to attach a craft stick to a small vial with a rubber band.
2. Hold the stick by the end and gently lower the vial into a cup of clear room temperature water. **The water should not be stirred.** Tell the students that it is very important to hold the vial steady and upright as they lower it to the bottom of the cup.
3. With the vial on the bottom, demonstrate how to use a clothespin to clamp the stick to the side of the cup. Have students predict what will happen.
5. Distribute materials and have students perform the activity, filling the vial completely full with hot red water.
6. Have them observe the results. Discuss the observation of hot water. (Hot colored water floated on top of the cooler water.)
7. Leaving the large cup of water undisturbed, repeat the process with cold blue water. Reinforce that a change in temperature causes a change in the density of water.

*Ask:* Which water was denser than room temperature water? (Cold water is denser.) Which was less dense? (Hot water is less dense.)

### Materials

- One large cup (32 oz.)
- One set: bead, cork, stopper, penny
- One small vial (e.g., film canister)
- One craft stick
- One rubber band
- One clothespin
- Hot red water
- Cold blue water
- Room temperature water
- One thermometer (optional)

### ***Possible Extensions/Adaptations/Integration***

Help students connect by introducing the basic concept of molecules.

1. Have students stand in a unorganized group so close that they nearly touch each other.
2. Have them begin to jog in place. Help them notice that they must move apart.
3. Have students begin to run in place and then do jumping jacks. Help them notice that as they become more energetic they require greater space. Relate this to molecules of water. The greater the heat energy the more the volume of molecules must expand. Same mass of molecules requiring a greater volume of space establishes less density. That is why warmer water floats and cooler water sinks.

Help relate this to personal experience in pools or lakes where water near the surface is warmer than water at the bottom.

Facilitate the connection at the appropriate time to air molecules and weather. Varying density of air masses create wind conditions and weather.

# How Big is a Hand?

## Intended Learning Outcomes:

1. Demonstrate a positive learning attitude toward mathematics.
4. Communicate mathematically.

## Math

### Invitation to Learn

Introduce the concept of *volume* as “the space occupied by something.” Introduce the use of the syringe and graduated cylinder for measuring volume. Have students fill various containers to full capacity and practice measuring the volume of water held by each container.

### Instructional Procedures

Pose the question of how to measure the volume of an irregularly shaped solid. Lead students to suggesting that the displacement of water would allow them to determine the space occupied by an irregularly shaped solid (e.g., a rock).

1. Place the displacement chamber in the flood control basin with catch cup (the 16 oz. deli container) at the base of the spout.
2. Demonstrate how to fill a displacement chamber to “capacity and beyond.” Pour out the excess water from the catch cup. The chamber is now filled to capacity and a container is ready at the base of the spout to catch any displaced water.
3. Carefully lower the rock into the displacement chamber, being careful not to displace any water with your fingers. Help students concur that the volume of water in the catch cup equals the volume of the rock. “Would you agree that the water that was where the rock now is has been displaced and is equal to the amount of water in the catch cup?”
4. Measure the displaced water to determine the volume of the rock.
5. Have students repeat the process with various rocks or other objects.
6. Have students measure the volume of their hands.

### Materials

- One displacement chamber
- One rock
- One 16 oz. deli container
- One 50 ml syringe
- One 50 ml graduated cylinder
- One clothespin
- One liter of water in container
- Basin for flood control

### How to Make a Displacement Chamber

1. Measure up 16 centimeters from the base of a two-liter bottle.
2. Use scissors to cut the top off the two-liter bottle at the 16 cm mark.

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3. Make a spillway in the displacement chamber by making two 5 cm cuts at the top of the bottle that angle toward each other, starting 6 cm apart and ending 2 cm apart, forming a flap. Bend the flap down to form the spillway.

# What Shapes Can You Make?

**Math Standard III:**

Students will use spatial reasoning to recognize, describe, and identify geometric shapes.

**Objective 1:**

Describe, identify, and analyze characteristics and properties of geometric shapes.

## Math Standard III

### Objective 1

#### Connections

## Background Information

The rich potential of this activity challenges spatial sense, extends understanding of geometric shapes, enhances classification skills, and provides opportunity for group work and discussion. This activity also helps to develop vocabulary words such as *isosceles*, *right angles*, *rotation* (turn), *reflection* (flip), and *congruence*. Congruence may be explored as students try to determine if a shape is unique when the triangles within the congruent shapes are oriented differently. There are 14 distinct shapes that can be built with four isosceles triangles. They can easily be classified as *triangles*, *quadrilaterals*, *pentagons*, and *hexagons*.

## Instructional Procedures

1. Distribute the *Isosceles Triangle* handout (p. 2-9), scissors and tape to each student. Have the students carefully cut out the triangles. Students will work in groups of four during this activity.
2. Instruct the students to use four isosceles triangles and place all of them together along edges with no overlapping. The triangles need to touch side-to-side and not point-to-point. How many different figures can each group make?
3. Have each group classify the shapes in different ways (e.g., those having the same number of sides, those with right angles, or those having mirror symmetry). Attach shapes to a poster according to classification.

### Materials

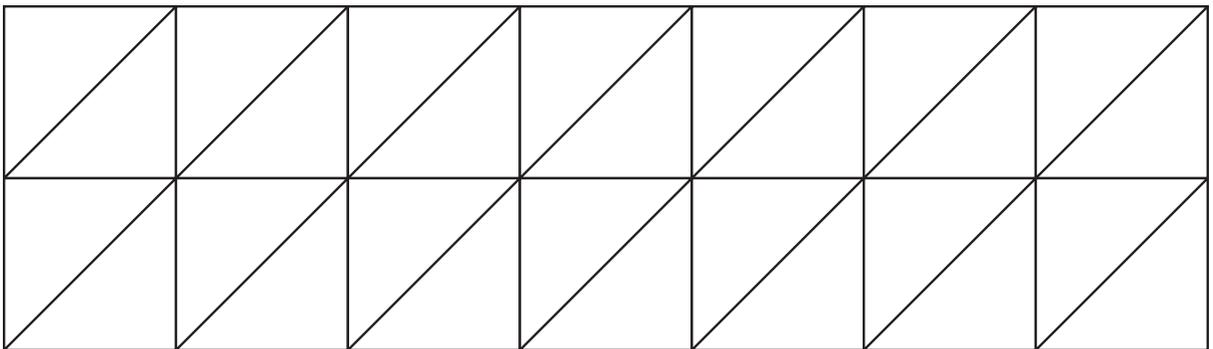
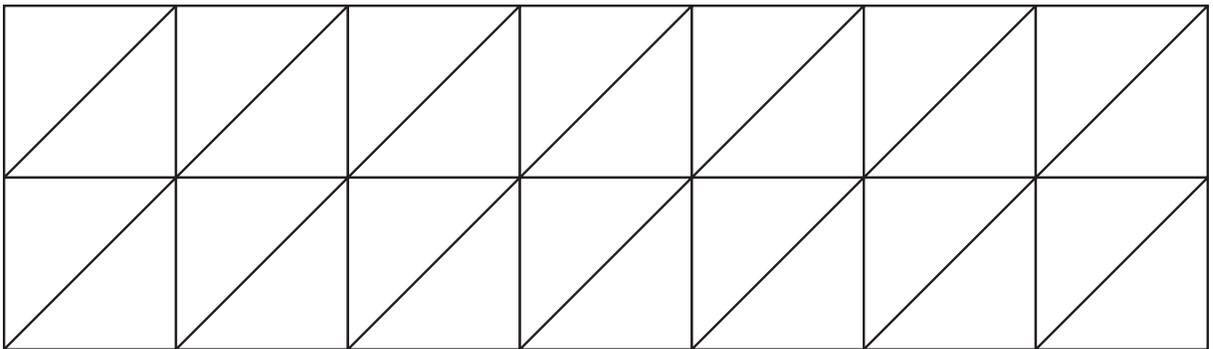
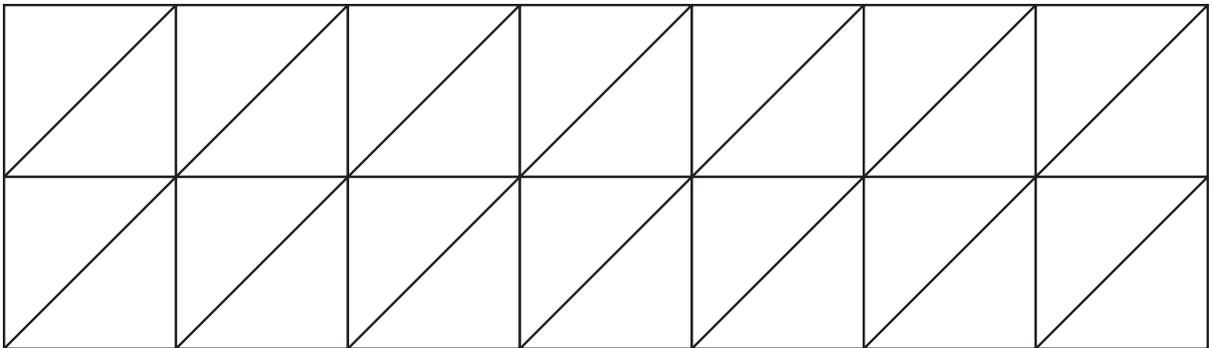
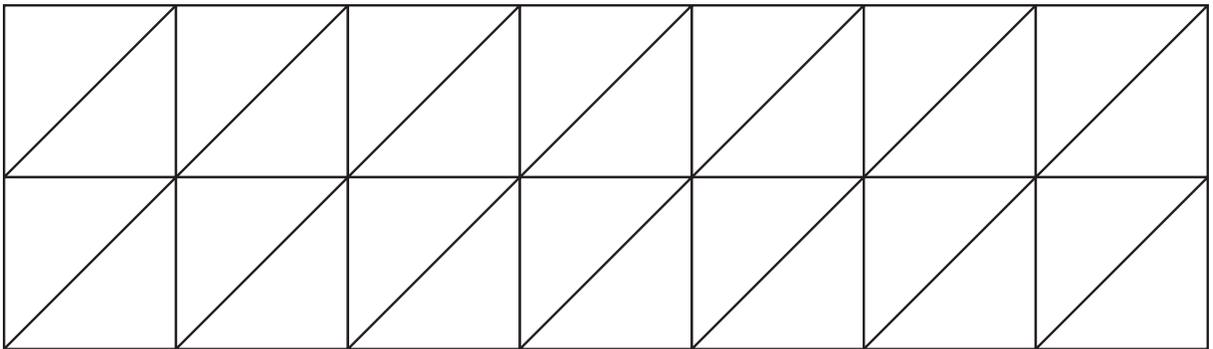
- Isosceles Triangles* handout
- Scissors
- Tape
- Poster paper (one for the class)

## Possible Extensions/Adaptations/Integration

Ask the students to predict, then investigate, to determine how many shapes would be possible with five isosceles triangles. Six triangles? Is there a pattern?



# Isosceles Triangles





# The Greedy Triangle

**Math Standard III:**

Students will use spatial reasoning to recognize, describe, and identify geometric shapes.

**Objective 1:**

Describe, identify, and analyze characteristics and properties of geometric shapes.

## Math Standard III

### Objective

1

### Connections

## Background Information

Children enjoy the experiences of investigating, playing and building with shapes. *The Greedy Triangle* introduces the names of polygons by exploring what happens to shapes as they get more sides and more angles. A polygon is a closed plane (flat) figure with three or more straight line segments. They are named by the number of sides they have:

3 sides = <i>triangle</i>	8 sides = <i>octagon</i>
4 sides = <i>quadrilateral</i>	9 sides = <i>nonagon</i>
5 sides = <i>pentagon</i>	10 sides = <i>decagon</i>
6 sides = <i>hexagon</i>	11 sides = <i>undecagon</i>
7 sides = <i>heptagon</i>	12 sides = <i>dodecagon</i>

## Instructional Procedures

1. Read the book *The Greedy Triangle*. Tell the students that they are going to become the “shape shifter” and turn the Greedy Triangle into the various shapes. First they will need the correct tools.
2. Divide students into groups of two. Distribute a hinged mirror and a blank sheet of 8 1/2” x 11” paper to each group. Instruct students to draw a 9 inch horizontal line in the middle of the paper, then place a large dot in the middle of the paper about 1 1/2” above the line.
3. Instruct students to place the vertex of the mirror on the dot in the middle of the paper above the line. Have the students discuss with their partners what they see as they open and close the mirror.
4. Have students create a three-sided polygon using the mirrors— this is the Greedy Triangle. Review the book and have the students create each polygon adding one more side. Have students identify the regular polygons that they see in the mirrors.

### Materials

- The Greedy Triangle*
- One per student:
- Reflect It* hinged mirrors
- 8 1/2” x 11” paper
- Ruler

Make sure that students understand that a regular polygon is a closed figure that has three or more equal sides and angles. (“Poly” means many and “gon” means angles.)

*Note:* When using the mirrors, all of the polygons are regular polygons. However, not all polygons are regular.

5. Ask the students to create any regular polygon with their mirrors and look for any other shape that appears in the mirror when the polygon is formed. Have the students share their findings. (The students should see that all of the polygons are composed of triangles.)

### ***Additional Resources***

*The Greedy Triangle*, by Marilyn Burns; ISBN 0-590-48992-5

Reflect It Hinged Mirrors (From ETA, M4-5035 \$7.95 ea., 800-445-5985)

# 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**

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

<p><b>Testing Adaptations:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Change essay questions to multiple choice.</li> <li><input type="checkbox"/> Reduce multiple choice to _____ choices.</li> <li><input type="checkbox"/> Avoid True or False questions.</li> <li><input type="checkbox"/> Avoid essay questions.</li> <li><input type="checkbox"/> Provide a word bank.</li> <li><input type="checkbox"/> Accept short answers.</li> <li><input type="checkbox"/> Give open book/notes tests.</li> <li><input type="checkbox"/> Allow student to record or dictate answers.</li> <li><input type="checkbox"/> Reduce spelling list for spelling tests.</li> <li><input type="checkbox"/> Extend time frame or shorten length of test.</li> <li><input type="checkbox"/> Avoid Scantron answer sheets.</li> <li><input type="checkbox"/> Read test to student.</li> <li><input type="checkbox"/> Provide study guide prior to test.</li> <li><input type="checkbox"/> Type tests and/or use large print.</li> <li><input type="checkbox"/> Test smaller units of material.</li> <li><input type="checkbox"/> Highlight key directions.</li> <li><input type="checkbox"/> Give test in an alternate site.</li> <li><input type="checkbox"/> Allow student to use calculator.</li> <li><input type="checkbox"/> Allow a test retake.</li> <li><input type="checkbox"/> Other: _____.</li> </ul>	<p><b>Presentation of Subject Matter:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Teach to the student's learning style: _____</li> <li><input type="checkbox"/> Read text aloud.</li> <li><input type="checkbox"/> Provide small group instruction.</li> <li><input type="checkbox"/> Provide an accurate copy of notes or key points written on the board or overhead.</li> <li><input type="checkbox"/> Model lesson being taught.</li> <li><input type="checkbox"/> Utilize manipulatives.</li> <li><input type="checkbox"/> Highlight critical information.</li> <li><input type="checkbox"/> Pre-teach the vocabulary.</li> <li><input type="checkbox"/> Do not call on the student to read aloud in class.</li> <li><input type="checkbox"/> Check student's understanding during the lesson.</li> <li><input type="checkbox"/> Provide study guides.</li> <li><input type="checkbox"/> Assign a study buddy.</li> <li><input type="checkbox"/> Allow time for student to process directions/information.</li> <li><input type="checkbox"/> Other: _____.</li> </ul>	<p><b>Assignment Accommodations:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Give directions in writing and verbally.</li> <li><input type="checkbox"/> Avoid penalizing for spelling errors, except on spelling tests/assignments.</li> <li><input type="checkbox"/> Show an example of what the completed assignment should look like.</li> <li><input type="checkbox"/> Reduce assignment.</li> <li><input type="checkbox"/> Read written work to student.</li> <li><input type="checkbox"/> Provide alternate assignment/strategy when demands of assignment conflict with student capabilities.</li> <li><input type="checkbox"/> Allow student to word process assignment.</li> <li><input type="checkbox"/> Avoid penalizing for poor penmanship.</li> <li><input type="checkbox"/> Allow student to use manuscript.</li> <li><input type="checkbox"/> Communicate homework expectations with parents.</li> <li><input type="checkbox"/> Check for student's understanding of the task.</li> <li><input type="checkbox"/> Chunk tasks.</li> <li><input type="checkbox"/> Allow a scribe or note taker.</li> <li><input type="checkbox"/> Other: _____.</li> </ul>
<p><b>Materials:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Taped textbooks or other class material.</li> <li><input type="checkbox"/> Highlighted textbooks.</li> <li><input type="checkbox"/> Special equipment: calculator, computer, word processor/spell checker, other _____</li> <li><input type="checkbox"/> Large print books.</li> <li><input type="checkbox"/> Special paper (wide-lined, graph, etc.)</li> <li><input type="checkbox"/> Two sets of books; second one for home.</li> <li><input type="checkbox"/> Assignment sheet or planner.</li> <li><input type="checkbox"/> Behavior monitoring sheet.</li> <li><input type="checkbox"/> Other: _____</li> </ul>	<p><b>Grading:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Use pass/fail grading system.</li> <li><input type="checkbox"/> Use a modified scale.</li> <li><input type="checkbox"/> Give credit for partial completion.</li> <li><input type="checkbox"/> Consider effort in assigning grade.</li> <li><input type="checkbox"/> Give credit for participation.</li> <li><input type="checkbox"/> Give copies of midterms to parents.</li> <li><input type="checkbox"/> Notify special education teacher when grades drop below a C-.</li> <li><input type="checkbox"/> Other: _____</li> </ul>	<p><b>Miscellaneous:</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Avoid timed activities.</li> <li><input type="checkbox"/> Implement preferential seating.</li> <li><input type="checkbox"/> Provide cues for staying on task.</li> <li><input type="checkbox"/> Provide a quiet place to work.</li> <li><input type="checkbox"/> Allow short breaks during assignments.</li> <li><input type="checkbox"/> Seat student next to a good role model.</li> <li><input type="checkbox"/> Provide daily check-in time with teacher.</li> <li><input type="checkbox"/> Consider Assistive Technology and Services.</li> <li><input type="checkbox"/> Other: _____.</li> </ul>

<b>Why Do Some Students Struggle in Your Classroom?</b>	
<b>In explaining deficits in learning, there are weaknesses in cognitive processes that should be ruled in or ruled out through formalized assessment.</b>	
<b>Cognitive Processes:</b>	<b>What it looks like in the classroom:</b>
<b>Auditory Processing</b> —Perception, analysis, and synthesis of auditory stimuli.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Confuses words and phrases that sound alike (e.g., “blue” with “blow” or “ball” with “bell”).</li> <li><input type="checkbox"/> Finds it hard to pick out an auditory figure from its background and it may seem that they are not listening or paying attention.</li> <li><input type="checkbox"/> Processes sound slowly and cannot keep up with the flow of conversation, inside or outside the classroom.</li> <li><input type="checkbox"/> Difficulty with phonics (decoding), spelling, and reading fluency.</li> </ul>
<b>Visual Perception</b> —Recognizing the position and shape of what is seen (The “Mind’s Eye”).	<ul style="list-style-type: none"> <li><input type="checkbox"/> Reverses/rotates letters, jumps over words, reads the same line twice, or skip lines.</li> <li><input type="checkbox"/> Difficulty distinguishing a significant form from its background.</li> </ul>
<b>Short-Term Memory</b> —Ability to hold information in immediate awareness and use it within a few seconds.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Difficulty learning from lecture, listening and following directions.</li> <li><input type="checkbox"/> Cannot remember information long enough to process for comprehension and retrieval.</li> </ul>
<b>Long-Term Retrieval</b> —Ability to store information and retrieve it later over extended time periods.	<ul style="list-style-type: none"> <li><input type="checkbox"/> “I know it but I can’t think of it” phenomena.</li> <li><input type="checkbox"/> Demonstrate mastery of information one day and unable to recall it on test day (poor test performance/inconsistent grades).</li> </ul>
<b>Comprehension-Knowledge</b> —Breadth and depth of acquired cultural knowledge and experience.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Low vocabulary and reading comprehension.</li> <li><input type="checkbox"/> Difficulty in listening comprehension and in answering factual questions.</li> </ul>
<b>Processing Speed</b> —Fluent performance of cognitive tasks automatically when under pressure to maintain attention.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Can’t process symbols fast enough to enhance decoding or comprehension.</li> <li><input type="checkbox"/> Does poorly on timed tasks.</li> </ul>
<b>Visual-Spatial Thinking</b> —Perception, analysis, synthesis, and manipulation of visual stimuli.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Weakness: rapid sound/symbol associations, copying tasks, and recognizing whole words.</li> </ul>
<b>Fluid Reasoning</b> —Involves inductive and deductive reasoning, identifying relations, and drawing inferences.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Difficulty in transfer and generalization.</li> <li><input type="checkbox"/> Poor flexibility in thinking.</li> <li><input type="checkbox"/> Low abstract problem solving.</li> </ul>
<b>Attention/Concentration</b> —Ability to filter and prioritize external/internal stimuli to attend.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Poor task/work completion.</li> <li><input type="checkbox"/> Assignments are partially completed, often items are skipped.</li> <li><input type="checkbox"/> Seems disorganized during instruction and practice.</li> </ul>
<b>Working Memory</b> —Ability to temporarily store and perform a cognitive operation on a set of information.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Problems with sequencing.</li> <li><input type="checkbox"/> Not flexible in use of strategies to solve problem/task.</li> <li><input type="checkbox"/> Attempts task but only understands a part of it.</li> <li><input type="checkbox"/> Seems unmotivated.</li> </ul>
<b>Cognitive Academic Language Proficiency</b> —Proficiency in academic situations and those aspects of language that emerge from formal schooling.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Understands more than can express.</li> <li><input type="checkbox"/> Difficulty in receptive and expressive language.</li> <li><input type="checkbox"/> Language “different” rather than language “disability”.</li> <li><input type="checkbox"/> Poor vocabulary knowledge.</li> </ul>

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](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](http://www.ldonline.org/ld_indepth/reading/reading-2.html)



***Science***  
***Standards I and II***  
***Activities***



# How Do You Dew?

**Science Standard I:**

Students will understand that water changes state as it moves through the water cycle.

**Objective 1:**

Describe the relationship between heat energy, evaporation and condensation of water on Earth.

**Intended Learning Outcomes:**

3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

**Content Connections:**

Math IV-2; Writing VIII-6; Art IV-3

## Science Standard I

### Objective 1

#### Connections

## Background Information

The purpose of this activity is to provide students with a hands-on experience of seeing how the processes of *condensation* and *evaporation* occur.

Water is made up of molecules that are always moving. It can be found in different states: solid, liquid, or gas. Adding or taking away heat causes the molecules to speed up or slow down.

*Condensation* is when water changes from a gas to a liquid. The opposite of this is evaporation. *Evaporation* is when water changes from a liquid to a gas. When water is in the state of a gas it is called water vapor. We cannot see it because the molecules are too far apart. As the molecules collect together during condensation, we can see evidence that this process takes place.

A common misconception is that when we see water droplets on the grass early in the morning, that we are seeing condensation. What we are really seeing is the result of condensation called dew. Dew is made up of small drops of water that form from the night air and collect on the ground or another surface. The *dew point* is the temperature at which condensation occurs.

Temperature, humidity, and wind are factors that cause these processes to occur.

Increasing the amount of thermal energy causes water to change states from a solid to a liquid and from a liquid to a gas. At sea level, water heated to 100° C (212° F) boils. Water freezes at 0° C (32° F). In Utah, water boils at about 96° C. This is why it takes longer to cook food at higher elevations.

## Invitation to Learn

Have you ever gotten out of the shower and tried to look in the mirror to comb your hair and the mirror was all covered with water? You probably rubbed off the water with your hand or a towel so that you could see yourself, but did you ever wonder how it happened?

## Instructional Procedures

### Materials

- Pint-size canning jar with lid
- Ice
- Hair dryer
- Food coloring
- Vanilla extract
- Spoon
- Small bowl
- Thermometer
- Water
- Magnifying glass
- Journal
- White napkins
- Crayons

1. Discuss evaporation and condensation.

Have students give examples of the processes of evaporation and condensation that they may have seen (e.g., water boiling, rain puddles shrinking, water vapor from our breath condensing on the windows, looking like clouds of smoke on a cold winter day, etc.).

Discuss how heat is involved in these processes. For example, if you heat water to 100° C (at sea level), it turns into water vapor. As it cools, the molecules slow down and return to a liquid state. Remind students that the sun is the main source of heat that causes these processes to occur.

2. Have students sit in groups of three or four and take turns completing the steps in the activity.
3. Have one student pour a half-spoonful of vanilla into a small bowl and place it in the center of the group. Instruct the group to lean their heads over the bowl and see if they can smell the vanilla.
4. Have an inquiry session. Ask them how it was possible for them to smell the scent of the liquid vanilla? (The molecules float through the air into our nose.)

Compare how the vanilla evaporates and the molecules travel through the air in the same way that water vapor does.

Ask: What would happen if heat and wind were applied to the vanilla?

The teacher can demonstrate using a hair dryer to provide heat and wind, making the vanilla evaporate quickly.

Compare this process to the way the sun creates heat and wind to causing water to evaporate.

- \*\*\*This is a good point to explain how to measure with a thermometer and record data in a journal.

5. Give each group an empty jar and tell them to measure and record the temperature inside of it.

Ask each group to fill the jar half-full of cold water. Then measure and record the temperature again.

Next, add ice until the jar is almost full. Have students measure and record the temperature one more time. Add food coloring or punch powder.

*Option:* To help students see how water molecules are always moving, add food coloring one drop at a time. Add the drops in this order: red, blue, yellow. Watch each drop spread out into the water before adding one drop of the next color.

Ask someone to screw the lid onto the jar to prevent the water inside from escaping.

6. Ask each student to illustrate the experiment in his/her journal. Then take turns using a magnifying glass to see if there is any water forming on the outside surface of the closed jar. Explain that the temperature of the water inside when the first droplets appear is the dew point, or the temperature at which condensation has occurred. Also discuss where the water came from and what this process is called (condensation). Students can blow softly toward the jar to help provide water vapor. The results will vary depending on the humidity in the classroom.

\*\*\*This is a good point to discuss the misconception of condensation. We don't see condensation on the jar. What we see are droplets of water. Condensation is the process that caused the water to appear.

Have students draw a second picture of the jar, showing droplets of water on it.

7. Demonstrate how a hair dryer can be used to blow hot air on the outside of the jar until the water disappears. Discuss where the water went and what this process is called (evaporation).
8. Have the students draw a third picture of the jar with the droplets missing. Include the hair dryer or the sun as the source of heat. Include labels for all of the objects in the pictures (e.g., jar, water, ice, droplets, hair dryer or the sun).

### ***Possible Extensions/Adaptations/Integration***

- See if breathing slowly on the jar causes droplets to appear faster.
- Check to see if the water on the outside of the jar is the same color as the colored water in the jar. Use a napkin to wipe off the outside of the jar, then unscrew the lid and carefully dip another napkin into the colored water. Compare the color of the napkins.

- Try adding some drops of perfume to a spoonful of water instead of using vanilla.
- Students with special needs can be paired with a partner who can help with the drawings and following the directions.

### ***Assessment Suggestions***

- The drawing learners complete during the experiment may be assessed.
- Students may describe or draw what they learned in a science journal.

### ***Additional Resources***

#### **Books**

*The Search for the Water Cycle*, available through the Living Planet Aquarium, 522 S. 400 W. Suite 200, Salt Lake City, UT 84101, 801-320-9951.

*The Comprehensive Water Education Book* (1994 edition) and additional experiments and information on water is available through Utah State University in Logan, Utah 84322 or 1-800-922-4693.

#### **Web sites**

The USOE science Web site has Internet links for lesson plans and ideas

<http://www.usoe.k12.ut.us>

*USU Water Quality Extension*

[http://extension.usu.edu/waterquality/kids\\_page.htm](http://extension.usu.edu/waterquality/kids_page.htm)

Water Science for Schools

<http://ga.water.usgs.gov/edu/>

### ***Family Connections***

- Take an early morning walk through a grassy park or field. Observe how the dew has formed on the grass and how it gets your shoes wet.
- Try using a hair dryer on the mirror in the bathroom after taking a steamy shower to see if you can make the water evaporate.
- Discuss with your family why you can “see your breath” when you exhale on a cold winter day.
- Students may display their experiments at a school science fair.

# Hottest, Coldest, Highest, Deepest

**Science Standard II:**

Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

**Objective 2:**

Interpret recorded weather data for simple patterns.

**Intended Learning Outcomes:**

3. Understand Science Concepts and Principles
4. Communicate Effectively Using Science Language and Reasoning

**Content Connections:**

Math; Science; Social Studies; Reading

## Science Standard II

### Objective 2

#### Connections

## Background Information

The state of Utah is unique in the type of landforms that people come from all over the world to see. There are the mountain regions in the north, the breathtaking canyons in the south, the deserts in the west, and the plateau regions to the east. Utah's position on Earth (where we are relative to the ocean and equator) combine with the landscape to provide a variety of weather and climate patterns.

Our climate also varies extremely throughout the state on any given day. One person may be golfing in sunny St. George while another person is skiing at Park City on the same day.

It is important to be able to compare the temperature, rainfall, and other data of different locations throughout the state. Discuss why these variations exist.

Information can be found through reference books and the Internet to make comparisons of weather data in Utah and other places in the world.

## Invitation to Learn

What do you think are the coldest and hottest places in Utah? What is the coldest or hottest place in the world? How cold or hot do you think it gets?

## Instructional Procedures

1. Students make a K-W-L chart in their journal.
2. Have students list the highest, coldest, hottest, rainiest, and driest places in the world that they know of in the "K" section.
3. Ask them to write some questions they would like answered in the "W" section that relate to Utah (e.g., What is the coldest place in Utah?).

**Materials**

- Hottest, Coldest, Highest, Deepest*
- Weather extremes data
- A science journal

4. Read the book *Hottest, Coldest, Highest, Deepest* aloud.
5. Have students list what they learned in the “L” section of the chart.
6. Share data about weather records for the state of Utah (see *Records for Utah Weather Extremes* p. 3-10). Additional information is available in reference books or the Internet. List records of temperature, wind speed, precipitation, etc.
7. Have them fill in the “L” section with what they learned about Utah’s weather in general and their area in particular.

### ***Possible Extensions/Adaptations/Integration***

- Students may also look up information about another state or country (such as Japan) to see what weather extremes they experience.
- Have students write and illustrate their own book about extremes in weather, landforms, elevation, etc. from what they learn about another location.
- Have students record the temperature each day for a week to see what the highest and lowest temperatures are at the school.
- It may be necessary to have students sit up close to see the pictures in the book.
- Students can work in groups to complete the K-W-L activity sheet.

### ***Assessment Suggestions***

- Use the K-W-L chart for assessment purposes.
- Assign the learners to create their own illustrated book.
- Give a written quiz with multiple choice or fill-ins where students list the hottest, coldest, etc., places.

### ***Additional Resources***

Students can access web sites on weather

<http://www.brainpop.com>

<http://www.ksl.com>

<http://weather.gov/om/reachout/kidspage.html>

<http://www.wrh.noaa.gov/saltlake>

There are videos available on weather through district media centers.

DK Vision has a video called *Eyewitness Weather* that is good

(<http://www.dk.com>).

## **Books**

*Hottest, Coldest, Highest, Deepest*, by Steve Jenkins;  
ISBN 0395899990

*Utah's Weather Guide*, by Dan Pope and Clayton Brough. 1997  
News4Utah

*Can It Rain Cats and Dogs?*, by Melvin and Gilda Berger  
(Scholastic); ISBN 0-439-08573-X

*The Wind Blew*, by Pat Hutchins (Scholastic); ISBN 0-590-46632-1

*Looking At Clouds*, by Susan Ring (Newbridge);  
ISBN 1-58273-027-X

*Cloudy With a Chance of Meatballs*, by Judith Barrett (Scholastic);  
ISBN 0-590-30384-8

*Magic School Bus-Inside A Hurricane*, by Joana Cole (Scholastic);  
ISBN 0-590-44687-8

*Weather Words*, by Gail Gibbons (Scholastic); ISBN 0-590-44408-5

*Weather*, by Valerie Wyatt (Kids Can Press); ISBN 1-55074-815-7

*The Tornado Desk*, by Jacalyn S. Leavitt (Talon Printing)

## ***Family Connections***

- Keep track of the weather elements at home for several weeks. Record the highest, lowest temperatures, rainfall, etc.
- Share the book *Hottest, Coldest, Highest, Deepest* and the K-W-L chart with family members.
- Watch the local weather forecast on television or find it in the newspaper. Look for the highest and lowest temperatures for the state and country.

## **Utah Weather Extremes**

### **Temperature**

HIGHEST	117 F (JUL 5 1985)	ST. GEORGE
LOWEST	-69 F (FEB 1 1985)	PETER SINK

### **Precipitation (inches)**

GREATEST IN 5 MINS	1.03 (AUG 11 1975)	BRYCE CANYON
GREATEST IN 10 MINS	1.03 (AUG 11 1975)	BRYCE CANYON
GREATEST IN 15 MINS	1.53 (SEP 3 1983)	WEST VALLEY
GREATEST IN 30 MINS	2.10 (AUG 8 1941)	OGDEN CANYON
GREATEST IN 1 HOUR	5.00 (AUG 16 1958)	MORGAN
GREATEST IN 3 HRS	5.00 (AUG 16 1958)	MORGAN
GREATEST IN 6 HRS	5.50 (SEP 7 1991)	NORTH OGDEN
GREATEST IN 12 HRS	6.00 (SEP 5 1970)	BUG POINT
GREATEST IN 24 HRS	8.40 (SEP 7-8 1991)	NORTH OGDEN
GREATEST WATER YR	98.37 (OCT 1983-SEP 1984)	ALTA
GREATEST WATER MONTH	25.45 (DEC 1983)	ALTA
DRIEST WATER YEAR	0.71 (OCT 1952-SEP 1953)	CALLAO

### **Snow (inches)**

GREATEST IN 24-HOURS	55.5 (JAN 5-6 1994)	ALTA (MOUNTAINS)
	34.0 (FEB 9 1953)	KANOSH (VALLEYS)
GREATEST STORM	105.0 (JAN 24-30 1965)	ALTA
GREATEST MONTH	244.5 (DEC 1983)	ALTA
GREATEST SEASON	743.5 (NOV 1983-APR 1984)	ALTA
GREATEST YEAR	808.5 (SEP 1983-JUN 1984)	ALTA

### **Barometric Pressure/Sea Level (inches)**

HIGHEST	31.13 (DEC 9 1956)	MILFORD
LOWEST	29.00 (APR 15 2002)	SALT LAKE CITY

**Wind (peak gust)**

HIGH-ELEVATION (MOUNTAIN) LOCATION (ABOVE 8,000')

124 MPH

SNOWBIRD RESORT HIDDEN PEAK 11,000' NOVEMBER 8, 1986

MID-ELEVATION (BENCH) LOCATION (5,000-8,000')

120 MPH

BOUNTIFUL BENCH 5,004' NOVEMBER 11, 1978

LOW-ELEVATION (VALLEY) LOCATION (BELOW 5,000')

113 MPH

BRIGHAM CITY AIRPORT 4226' APRIL 23, 1999

UPDATED 8/7/02

Webmaster

National Weather Service

2242 West North Temple

Salt Lake City, Utah 84116

Telephone: (801)524-5133

Last Update: March 19, 2004

# Water World Story

## Science Standard I

## Objective 2

### Connections

**Science Standard I:**

Students will understand that water changes state as it moves through the water cycle.

**Objective 2:**

Describe the water cycle.

**Intended Learning Outcomes:**

2. Manifest Scientific Attitudes and Interests
4. Communicate Effectively Using Science Language and Reasoning

**Content Connections:**

Technology; Math; Social Studies; Writing

## Background Information

The purpose of this activity is to help students discover the actual locations that hold water as it passes through the water cycle. The whole process begins with the sun. It is the sun's heat that causes evaporation to occur. Water changes from its liquid state, like an ocean, and becomes an invisible vapor that rises. As the water condenses, we see it as clouds in the atmosphere. Depending on the temperature, humidity and other factors, the water can form different types of precipitation such as rain, snow, or hail. This water then collects in streams, rivers, lakes, and oceans. Some water also seeps into the ground and collects there. Water is also found in its solid state in the form of glaciers, near the polar regions of Earth and in snowpack conditions of high elevations for portions of the year.

## Invitation to Learn

*Ask:* Have you ever taken a cold drink of water and wondered where it came from? Where do you think it came from? How did it get to our school?

## Instructional Procedures

1. Read a sample narrative story about a droplet of water (e.g., *The Drop of Water*, by Donald R. Daugs in *The Comprehensive Water Education Book*).
2. Distribute maps of Utah.
3. Discuss major lakes, rivers, and mountain ranges found close to the school.

4. Distribute journals or writing paper.
5. Have the students write a story about how a drop of water may have traveled to arrive at the school. The story should include specific names of mountains, lakes, and rivers it could have been held in.
6. Use their science journal pages to design a six-frame template for a presentation on the water cycle.
7. Assign the students to write in the following titles for each frame: Title, The Sun, Evaporation, Condensation, Precipitation, Collection.
8. Have the students illustrate each frame. This can be done with any media available.

### **Materials**

- Map of Utah
- Map of Japan (optional)
- Map of China (optional)
- Journal or writing paper
- Narrative story (e.g. *The Drop of Water*)
- Use a science journal to make a six-frame outline
- Crayons, colored pencils, or markers

### **Possible Extensions/Adaptations/Integration**

- Students could do another water story with a setting in another part of the world, such as Japan or China.
- A water story could be prepared in advance with blanks for students to fill in the names of the mountains, oceans, rivers, etc.
- Students with computer access could design a multimedia presentation of the water cycle or their water story.

### **Assessment Suggestions**

- The stories that the students write can be collected and evaluated.
- The six-frame presentation design can be assessed.

### **Additional Resources**

#### **Reference Books**

*The Search for the Water Cycle*, available through the Living Planet Aquarium, 522 S. 400 W. Suite 200, Salt Lake City, UT 84101, 801-320-9951.

*The Comprehensive Water Education Book* (1994 edition), available through Utah State University in Logan, Utah 84322 or 1-800-922-4693.

### **Children's Literature**

*A Drop Around The World*, by Barbara Shaw McKinney (1998);  
ISBN 1883220726

*The Magic School Bus: At the Waterworks*, by Joanna Cole (1988);  
ISBN 0590403605

### **Web sites**

<http://www.uen.org> Look for lessons: *All Washed Up* and *Miniature Water Cycles*

<http://www.usoe.k12.ut.us> Look up activities under the science core for 4th grade.

The Sci-ber Site lessons have good information and activities.

<http://www.epa.gov> This site has a lesson on the water cycle.

<http://www.kimballmedia.com/Drippy> This site has an online story plus videos, etc.

<http://www.brainpop.com> Watch the video and take the quiz.

<http://ga.water.usgs.gov/edu/>

### **Agency Contacts**

Central Utah Water Conservancy District  
355 West University Parkway  
Orem, Utah 84058  
Phone: 801-226-7100

## ***Family Connections***

- Use a digital or 35 mm camera to take pictures of the sun (use caution when viewing the sun), clouds, mountains, lakes, rivers, etc. These can be assembled in a water cycle poster or made into a multimedia presentation.
- Find out ways that you can help conserve water in your community and at home.
- Take a family fieldtrip to the local water treatment plant or water storage facilities.

# Everyone Knows It's Windy

**Science Standard II:**

Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

**Objective 1:**

Observe, measure, and record the basic elements of weather.

**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:**

Art IV-3; Writing VIII-6

## Science Standard II

### Objective 1

#### Connections

## Background Information

*Wind* is one of the elements of weather. It is the movement of air that can be felt against our faces and bodies. We can see the effect of wind by the movement of objects. The direction, temperature, and speed of wind can help us predict changes in the weather.

Wind is the result of pressure differences in the atmosphere. This is why the weather people on TV care so much about high and low pressure systems.

A *wind vane* is an instrument that tells the direction the wind is moving.

Along with wind direction, meteorologists measure wind speed. *Wind speed* is a measure of how fast the air is moving. It is measured using an instrument called an anemometer. As the spinning cups of an anemometer turn, the speed of the wind is determined. Knowing wind speed and air pressure helps meteorologists forecast when an approaching storm will arrive or how long the weather in an area will remain.

## Invitation to Learn

Read a riddle or a poem about the wind. (Example: This was the second riddle that Gollum asked Bilbo Baggins in *The Hobbit*. “Voiceless it cries, Wingless flutters, Toothless bites, Mouthless mutters.” If he doesn’t know the answer Gollum will eat him. The answer is “the wind.”)

## Instructional Procedures

### Materials

- Five 3 ounce paper Dixie cups
- Two straight plastic soda straws
- Pin
- Scissors
- Paper punch
- Small stapler
- Sharp pencil with an eraser

1. Using the paper punch, punch one hole in each of four Dixie cups, about a half inch below the rim.
2. Take the fifth cup. Punch four equally spaced holes about a quarter inch below the rim. Then punch a hole in the center of the bottom of the cup.
3. Push a soda straw through the hole of one cup. Fold the end of the straw, and staple it to the side of the cup across from the hole. Repeat this procedure for another one-hole cup and the second straw.
4. Now slide one cup and straw assembly through two opposite holes in the cup with four holes. Push another one-hole cup onto the end of the straw just pushed through the four-hole cup. Bend the straw and staple it to the one-hole cup, making certain that the cup faces in the opposite direction from the first cup. Repeat this procedure using the other cup and straw assembly and the remaining one-hole cup.
5. Align the four cups so that their open ends face in the same direction (clockwise or counterclockwise) around the center cup. Push the straight pin through the two straws where they intersect. Push the eraser end of the pencil through the bottom hole in the center cup. Push the pin into the end of the pencil eraser as far as it will go. Mark one of the four cups with an "X" so you can count how many times it goes around in one minute. Your anemometer is ready to use.

Your anemometer is useful because it rotates with the wind. Try taking it somewhere that is windy so you can watch it spin. A fan can be used indoors if it is not windy enough outside to see if it works. Count how many revolutions it makes in one minute. Record your observations in your science journal. Include a description of how an anemometer works and is used by weather forecasters.



## ***Possible Extensions/Adaptations/Integration***

- Assist students with limitations in the construction of their anemometers.
- Research the effects of severe windstorms on people and property.

## ***Assessment Suggestion***

- Check to see if the anemometer works when placed in a windy location.
- Check journal entry describing how an anemometer works and is used by weather forecasters.
- Compare the rate the anemometer revolves with the daily change in weather over a period of time.

## ***Additional Resources***

Students can bring in newspapers with daily weather maps and forecasts. They can also check weather Web sites for current wind readings and forecasts.

Check school and local libraries for books on weather.

Check district media centers for videos about weather. There are also commercial weather videos available.

*Utah's Weather Guide*, by Dan Pope and Clayton Brough (1997  
News4Utah)

*USU Water Quality Extension*  
[http://extension.usu.edu/waterquality/kids\\_page.htm](http://extension.usu.edu/waterquality/kids_page.htm)

Water Science for Schools  
<http://ga.water.usgs.gov/edu/>

## ***Family Connections***

Students with Internet connections at home can be asked to visit weather Web sites. They can also be assigned to watch the evening weather forecast on one of the television news channels. They could demonstrate information about wind as part of a school science fair. Some families may want to purchase an anemometer for home use.



***Math***  
***Standards I and V***  
***Activities***



# Getting A Grip On Graphs

**Math Standard V:**

Students will collect and organize data to make predictions and use basic concepts of probability.

**Objective 1:**

Collect, organize, and display data to make predictions and answer questions.

**Intended Learning Outcomes:**

4. Communicate mathematically.
5. Make mathematical connections.
6. Represent mathematical situations.

**Math Standard**
**V**
**Objective**
**1**
**Connections**

## Background Information

Displaying data clearly can help you prove a point. It can also help you to discover patterns/trends in your data. Clear displays can help you see trends, make predictions, and compare ideas. *Graphs* help you to see the “big picture” hidden in your data.

A big part of showing data clearly is choosing *which kind of graph to use*. You might use a Venn Diagram to show how the students’ family pet data are related to each other. You might choose a line graph to show how a baby tiger gains weight as it grows. To compare the number of games your favorite team has won, you might select a bar graph. Only introduce one graph per day.

The most effective way to introduce young children to the concept of gathering data and transferring that data onto a graph is to start with a pictograph, and then gradually explore the many and varied kinds of graphs as new and different data are gathered. Keeping a math journal as you go is also very important to help children see their progress and review concepts.

## Invitation to Learn

Read *Tiger Math*. Teachers should only read aloud one page per day.

*Guiding questions:* What are the different kinds of graphs that were used to show the tiger’s growth? How do graphs show “the big picture?”

## Instructional Procedures

### Materials

- Tiger Math*
- Post-it® notes
- Poster board
- Clipboard
- Tally sheet
- Pencil
- Tips on Building Great Graphs*
- Graph Illustrations*
- Grid paper
- Colored markers
- Large clay flower pot
- Lengths of yarn for each student in the class
- Paper
- Circle patterns
- Rulers
- Overhead projector and transparencies of bar graph, circle graph, and other samples
- Math journal

1. Draw a graph on poster board. On the x-axis, list several fast food restaurants in your area. On the y-axis, list numbers 1-15. Name your graph *Favorite Fast Food Restaurants*.
2. Give each student a Post-it® note. Have him/her write his/her name and favorite fast food restaurant on it. Each student will stick his/her Post-it® on the correct location on the graph to show a “representation” graph. This is a quick and simple method to introduce graphing.
3. Use the *Tips On Building Great Graphs* chart (p. 4-7) to discuss.
4. One person takes a survey: “What is your favorite kind of potato dish?”  
Convert tally sheet into a frequency table.
5. Have the students make a *real* bar graph in the classroom. Ask them to arrange themselves in a bar graph form to illustrate data (e.g., “What is your favorite flavor of ice cream?...chocolate, vanilla, or strawberry?”).
6. Create a bar graph from the data using a different colored bar for each item.  
Use overhead projector to illustrate; each person makes his/her own bar graph.
7. Using flower pot and twine, show how you can use people to make a circle graph. Lay the flower pot upside down. The pieces of yarn should be equivalent to the number of students. Tie one end of pieces of yarn together and insert through the hole. Students will transform the bar graph into a circle graph.
8. Using this data, create a circle graph, using same colors as on the bar graph.  
Use overhead projector to illustrate; each person makes his/her own circle graph.
9. Place graphs in a math journal.

### Possible Extensions/Adaptations/Integration

- *Make a Graph From the Internet* (p. 4-7).
- Make entries in your daily math journal.

- Examples of graphing data from 4th grade curriculum:  
“What is your favorite kind of rock?”  
“What is your favorite kind of weather?”  
“What is your favorite place to visit in Utah?”  
“What country in Asia would you like to visit?”

## ***Assessment Suggestions***

- Give each student a clipboard and tally sheet; ask him/her to make up his/her own question and transfer the resulting data into various kinds of graphs.
- Reading graphs: Ask questions, verbally or written, to test students’ ability to interpret data on various kinds of graphs. (Example: During which month of the year did Utah have the greatest and least amounts of precipitation?)
- On a different day, ask students to use the same data as gathered previously to create a different kind of graph. Plan to graph at least twice a month, and add these graphs to their math journals. This will provide the teacher with student work showing progress, indicating graphing content needing clarification.

## ***Additional Resources***

### **Books**

*Tiger Math*, by Ann Whitehead Nagda; ISBN 0805062483

*Math At Hand*, by Great Source Education Group Staff;  
ISBN 0-669-46922-X

*Creative Graphing Book*

*Hands-On Statistics, Probability, and Graphing*, Grades 3-8, by Scott Purdy; ISBN 0927723114

*Lemonade For Sale*, by Stuart J. Murphy; ISBN 0-06-446715-5

“Graphs Bulletin Board Set” (Nasco catalog) TBI8290(X)TB

## ***Family Connections***

- Assign students to take a survey at home and make one or more graphs showing the data resulting from the survey.
- Using the previously mentioned graph(s), write three questions to show correct interpretation of the data.

## Graphing Ideas

### What is a Graph?

A graph is a visual tool that makes it easier for us to see and analyze information. A graph uses pictures, objects, circles, bars, and lines to show and compare information. Graphs help students to become better problem solvers as they see things in patterns and arranged in different ways.

### Kinds of Graphs – Fourth Grade

1. *Pictograph*—uses pictures or symbols to show data
2. *Real Graph*—use actual objects or models
3. *Circle Graph* (or “pie” graph)—used to show how parts make up a whole
4. *Bar Graph* (vertical or horizontal; single or double bars)—used to compare data
5. *Line Graph*—shows change over time
6. *Venn Diagrams*—show how data can belong in more than one group. It uses circles that may overlap or intersect.
7. *Line Plot*—a graph showing frequency of data on a number line

### Ideas For Gathering Data

1. What is your favorite season of the year?
2. What is your favorite flavor of ice cream?
3. What is your favorite color?
4. What is your favorite kind of potato dish? (mashed, baked, french fries, au gratin, potato chips, hash browns)
5. How many letters are in your first name? Last name?
6. What is the month of your birthday?
7. How many people are in your family?
8. What is your favorite fast-food restaurant?
9. How do you like to eat eggs? (scrambled, hard-boiled, fried, poached, none)
10. What color is your hair?
11. Which holiday do you like best?
12. How many televisions are there in your house?
13. How many pencils do you have in your desk?
14. How many teeth have you lost?
15. What is your favorite pizza topping? (Must choose just one)
16. What is your favorite candy bar?
17. What is your favorite animal to have for a pet?

### **Tips on Building Great Graphs**

1. Choose a **question** to answer; give your graph a **title**.
2. **Gather data** with a survey question; use tally marks on a question sheet.
3. Use the tally sheet results to count the tallies and determine the number of times each item occurs.
4. Choose the **type of graph** applicable to your data. (Problem Solving Strategy)
  - a. If using a **pictograph**, or graphs that **compare** (such as a double bar graph), showing the symbols or colors and their values in a **key**.
  - b. If using a **bar graph**, make the bars the same width and put equal space between them.
  - c. Use the correct number scale
5. **Analyze** and **discuss** recorded data, using logical reasoning.
6. Enter your findings in a **math journal** page:
  - a. Date
  - b. Problem Solving Strategy: Graphing
  - c. Use logical reasoning
  - d. Cut out & glue graph sample on the page

### **Make a Graph From the Internet**

1. Log in
2. Go to “start”
3. Go to Internet Explorer
4. Granite School District website
5. Click on “favorites”
6. Click on “create a graph”
7. Select a type of graph
8. Go to “click here to create a bar graph”
9. Type title of graph
10. Title of X axis (favorite pie, etc.)
11. Title of Y axis (number of students)
12. Bar 1 (apple) Value (3) Color (red)
13. Bar 2 (pumpkin) Value (5) Color (orange)
14. Bar 3 (berry) Value (4) Color (blue)
15. Bar 4 (minced meat) Value (0) Color (default)
16. Bar 5 (other) Value (8) Color (purple)
17. Graph direction (horizontal)
18. Click “create a printable graph”
19. To save your graph, right click on the graph
20. Click on “copy”
21. Go to “Start Menu”
22. Go to “Microsoft Word”
23. Open to a new document
24. Right click; go to “paste”
25. Double click below the box
26. Type any information you would like to add to your graph
27. Go to “file”
28. Save on “My Documents” (Create a new folder if you don’t have one) and save your graph on the A drive
29. Take your disc to computer one to print in Microsoft Word

# Practice with Probability

## Math Standard

V

## Objective

2

Connections

### Math Standard V:

Students will collect and organize data to make predictions and use basic concepts of probability.

### Objective 2:

Use basic concepts of probability.

### Intended Learning Outcomes:

3. Reason mathematically.
5. Make mathematical connections.

## Background Information

It is helpful to know if something is *likely* or *unlikely* to happen. It's more useful if you can use a number to describe that likelihood. Probability will help you decide how often something is likely to happen. However, it usually won't help you to know exactly when that event will happen.

An *event* is something that may happen. The *probability* of an event can be any number from zero through one. It can be written as a *fraction*, a *decimal*, or a *percent*. If the probability of an event is zero, it is *impossible*. If an event is *certain*, it has a probability of one. The more unlikely an event is, the closer its probability is to zero. The more likely an event is, the closer its probability is to one.

When you flip a penny, two things can happen. These two things are called *outcomes*. When using a spinner with eight equal sections, there are eight *possible outcomes*. When three of those eight sections are red, and other colors have less than three sections, there are three *favorable outcomes*. When you do an experiment to get an idea about probability, you are *sampling*, but you may not get exactly the same number as finding the ratio of favorable to possible outcomes, and sampling can fool you.

## Invitation to Learn

Read *Probably Pistachio*.

*Guiding questions:* What are the boy's chances of choosing a bag of popcorn from the coach's basket? What are some examples of probability in our own lives?

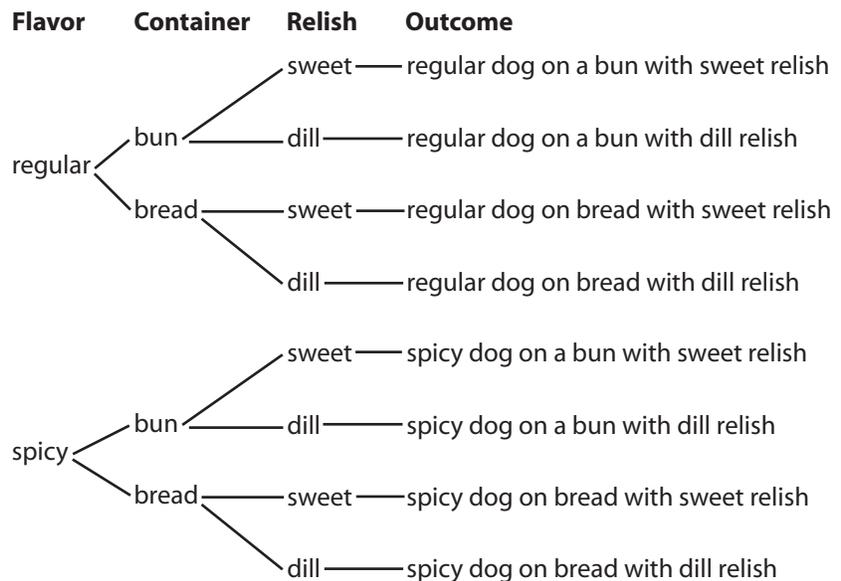


- Distribute 1-6 number cubes; students experiment with how many combinations of cube throws to complete the chart. Notice a pattern (e.g., How many different ways can you throw the cube to get a total of seven?).

### **Possible Extensions/Adaptations/Integration**

- When teaching about Native American tribes of Utah, teach the Native American Stick Game as part of the unit.
- What is the probability that a given county in Utah was named after a mineral? State this as a fraction.
- Tree diagrams** are used to find all possible outcomes in a sample space by drawing a diagram or making an organized list.

Example:



### **Assessment Suggestions**

#### **Problem Solving**

- What is the probability that a number between one and 50 contains the digit four in it? State this as a fraction.
- What is the probability that a person was born in a summer month? State this as a fraction.

## ***Additional Resources***

### **Books**

*Probably Pistachio*, by Stuart J. Murphy; ISBN 0-06-446734-1

*Data, Chance, and Probability* (Grades 4-6) (Learning Resources, Incorporated); ISBN 1-56-911997-X

*Math At Hand*, by Great Source Education Group Staff;  
ISBN 0-669-46922-X

### **Game**

*Yahtzee* (Dice game involving probability)

## ***Family Connections***

- Assign students to choose four of their shirts and four pairs of pants. Draw pictures to show how many different combinations of outfits they could wear to school (outcomes) using those items of clothing.
- Election outcome: Six people are running for class president; the person with the most votes will be president. The person who comes in second will be vice president. How many different pairs of president and vice president combinations (outcome) are possible?

# A Stick Game

Long ago, Native Americans played games with sticks. Have fun playing this stick game.

First write Utah’s regions on one side of three craft sticks in the following manner:

Stick 1—one Utah region

Stick 2—another Utah region

Stick 3—a third Utah region

To play the game, you will be throwing the sticks in the air and seeing which side lands facing up. Before you begin, write in the table at the right all the different ways the sticks might land. You may use the first letter of each word. Example: **p** for plain, **d** for desert, **w** for wetland, **f** for forest.

Stick 1	Stick 2	Stick 3
p	d	w
p	d	f

Write the combination you think will occur most often. \_\_\_\_\_

Now throw the sticks ten times and record how they land.

	Stick 1	Stick 2	Stick 3
<b>1</b>			
<b>2</b>			
<b>3</b>			
<b>4</b>			
<b>5</b>			

	Stick 1	Stick 2	Stick 3
<b>6</b>			
<b>7</b>			
<b>8</b>			
<b>9</b>			
<b>10</b>			

What were your results? \_\_\_\_\_

\_\_\_\_\_

Name \_\_\_\_\_

# Probability Data Chart

	Red 1	Red 2	Red 3	Red 4	Red 5	Red 6
Green 1						
Green 2						
Green 3						
Green 4						
Green 5						
Green 6						

# The Long and Short of It

## Math Standard

### I

## Objective

### 1

## Connections

#### Math Standard I:

Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.

#### Objective 1:

Represent whole numbers and decimals in a variety of ways.

#### Intended Learning Outcomes:

5. Make mathematical connections.
6. Represent mathematical situations.

## Background Information

The number system we use for everyday life is based on **tens**. We use ten symbols, called *digits*. Add punctuation (comma, decimal point, etc.) and you can write numbers for any situation. With just a handful of symbols, you can write quantities larger than the number of shells in the sea and smaller than the width of one hair on your head.

*Whole numbers* are 0, 1, 2, 3, 4, 5, 6, and so on. If a number has a *decimal* part, a part that is a *fraction*, or a *negative sign*, it is not a whole number.

Our number system is based on a simple pattern of tens. Each place has ten times the value of the place to its right. *Place value* tells you how much each digit stands for: *ones, tens, hundreds, thousands*, etc.

We arrange numbers into groups of three places called *periods*. The places within the periods repeat (hundreds, tens, ones; hundreds, tens, ones; etc.) In the U.S., we usually use commas to separate the periods.

*Decimal numbers* are numbers that are written using place value. We use a *decimal point* to separate the whole-number places from the places less than one. Comparing decimals is like comparing whole numbers. If you know how to compare two decimals (line up the decimals in a vertical line and compare the values of the digits) you also know how to put a group of decimals in order.

## Invitation to Learn

Let students write a number on a paper. Digits should not exceed the ten thousands place. Invite four students to come to the front and form a line. Challenge the class to put the numbers (students holding cards) in order from least to greatest; only one switch allowed at a time (e.g., “John trade places with Sarah.”). Continue this procedure until each set of four students has been placed in the correct order to form the line.

Do the same procedure with decimal number cards. Decimals should only contain the tenths place.

## ***Instructional Procedures***

### **Lesson 1**

1. Distribute *Spinners* (p. 4-17), large paper clips, pencils, and *Data Recording Sheets* (p. 4-18). Explain game rules and allow time for pairs to play the game. Partner A spins, then partner B. Write the number from each on the *Data Recording Sheet*. Discuss how this helps to teach periods and place value.
2. Demonstrate use of “plastic canvas” with an overhead projector to model place value. These can be used to model both whole numbers and decimal numbers.
3. Distribute *Expanded Notation Cards* (p. 4-20) for the *Long and Short of It!* game (p. 4-19). Explain game rules. Allow time for pairs to play the game.
4. Create a poster as a class using *Expanded Notation Cards*.

### **Lesson 2**

1. Demonstrate the comparison of whole numbers and decimals by using money models on an overhead projector. Model correct terminology (e.g., “twenty-three and forty-nine hundredths”). Emphasize the use of “ths” when verbalizing decimals.
2. Distribute sets of plastic money. Ask students to show whole numbers and decimals by using money models.
3. Ask students to point to decimal amounts on their number lines.
4. Use whole number/decimal number cards to show how, when comparing decimal numbers or when adding or subtracting decimal numbers, the decimals *must* be lined up to give the correct sum or difference.

## ***Possible Extensions/Adaptations/Integration***

- Compare the populations of various counties in Utah. Put them in order of largest to smallest, or smallest to largest. Do the same with area in square miles of the counties.
- Give each letter of the alphabet a money value (e.g., A = \$0.01, B = \$0.02, etc.). Challenge students to add the money value of their first and last name.

### **Materials**

- Whole number cards and decimal cards to be put in order

One per student:

- Spinners*
- Large paper clips and pencils
- Recording sheet for spinner game
- “Plastic canvas” pieces cut into thousands, hundreds, tens, and ones

One set per pair of students:

- Long and Short of It!* game sheet
- Expanded Notation Cards*
- Plastic money set
- Laminated number lines (whole numbers and decimals included)

One per class:

- Poster board and glue
- Overhead models of money: \$1.00, \$.50, \$.25, \$.10, \$.05, \$.01

## ***Assessment Suggestions***

- Read numbers aloud (up to 100,000 place value). Using worksheets divided into periods and place values, have students write the numbers and compare their results.

*Alternate method:* Ask students to write on erasable cards divided into periods and place values, and hold them up for you to check.

- When students have been taught lessons in decimals, follow the same procedure as above using decimal numbers.
- Give the students addition and subtraction problems with money, emphasizing the importance of lining up the decimals. Have them model the problems with plastic money.

## ***Additional Resources***

### **Books**

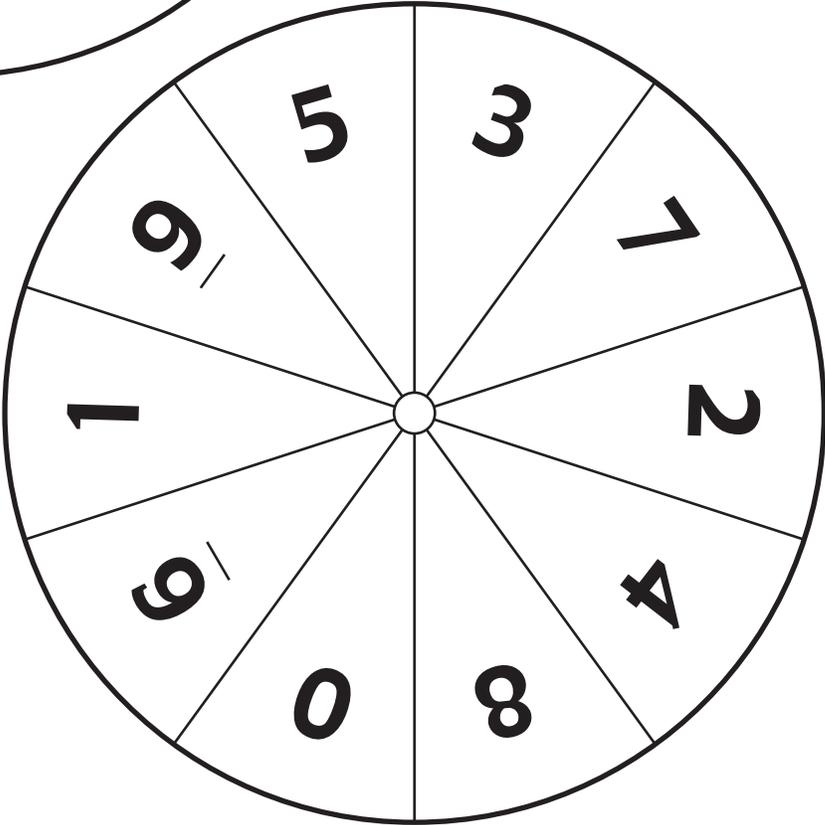
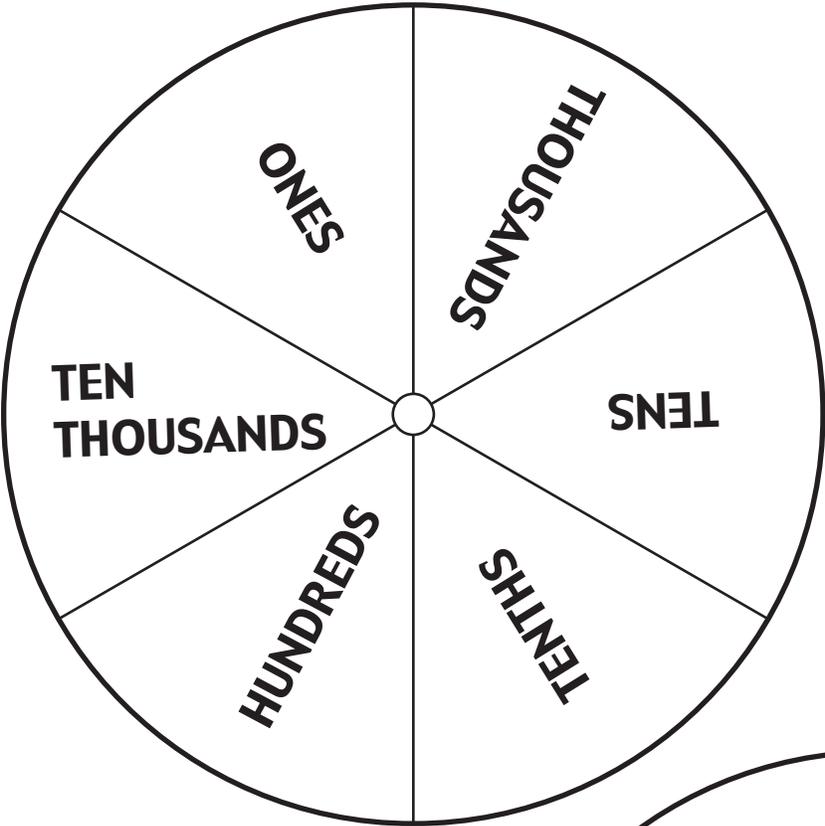
*The \$1.00 Word Riddle Book*, by Marilyn Burns;  
ISBN 0-941355-02-0

*How Much Is A Million?*, by David M. Schwartz;  
ISBN 0-688099-335-02-0

## ***Family Connections***

- Assign students to choose ten items from the grocery store (can use ten items from a cash register receipt); list the items and add them together. Show how the decimals must be lined up to add correctly.
- List the grocery items (from the activity above) from greatest to least in price.
- Using a bathroom scale at home, weigh ten items that are more than five pounds. List them from heaviest to lightest, or lightest to heaviest.

# Spinners



**Data Recording Sheet**

<b>Ten Thousands</b>						
<b>Thousands</b>						
<b>Hundreds</b>						
<b>Tens</b>						
<b>Ones</b>						
<b>Tenths</b>						

Name \_\_\_\_\_

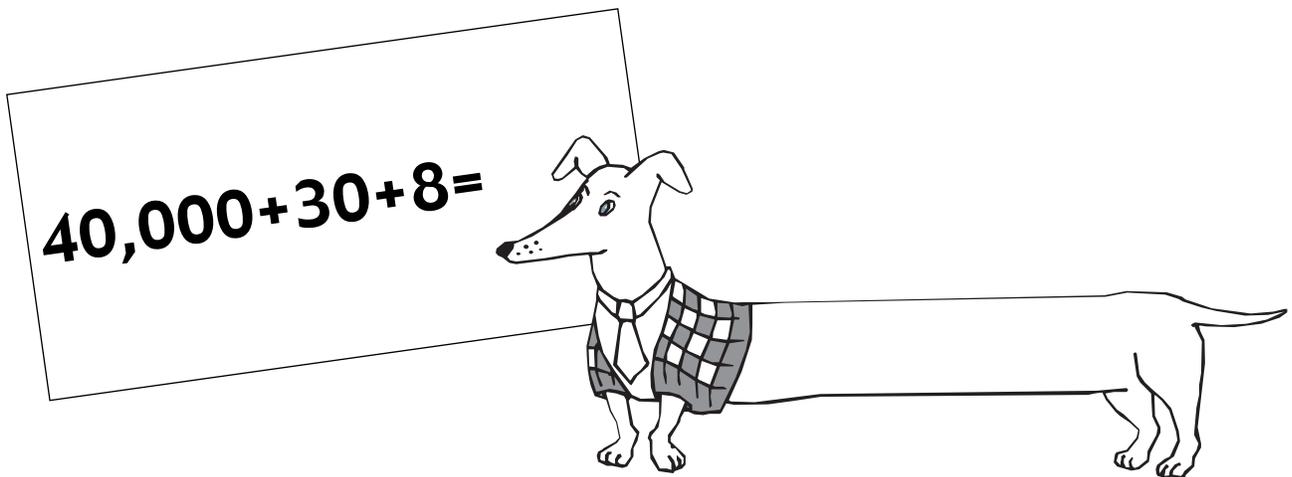
## The Long and The Short of It!

**Players:** two to four

**Materials:** 20 Standard Numeral Cards  
20 Expanded Numeral Cards

**Procedure:**

Shuffle both stacks of cards. Deal one type of card to the players, five cards per player. Place the other type of card face down in the center of the table. The first player draws a card from the center and checks to see if it matches a card in his/her hand. If a match is made, the player lays down the match and it is the next player's turn. If a match is not made, the player adds the draw card to his/her hand for later use. The first player out of cards is the winner.



## Expanded Notation Cards

$$400+70+9=$$

$$300+90+6=$$

479

396

$$900+20+5=$$

$$900+90+9=$$

925

999

$$100+4=$$

104

$3000+200+7=$	$8000+80+4=$
3,207	8,084
$5000+600+40+1=$	$7000+100+20+3=$
5,641	7,123
$6000+500+40+2=$	6,542



***Science***  
***Standards III and IV***  
***Activities***



# Fossil Footsteps

**Science Standard IV:**

Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

**Objective 1:**

Describe Utah fossils and explain how they were formed.

**Intended Learning Outcomes:**

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning.

**Content Connections:**

Social Studies VI-1

## Science Standard IV

### Objective 1

#### Connections

## Background Information

Fossils of ancient living organisms are found throughout Utah. They tell the story of Utah’s past. Almost all fossils are found in sedimentary rocks. Since sedimentary rock is deposited in layers, the oldest rocks are at the bottom of a sequence, and the youngest are on the top. Fossils in the lower layers tell us about what life was like long ago. There are three ways in which fossils are formed in sedimentary rock:

1. preserved organisms,
2. mineral replacement of organisms, and
3. impressions or tracks.

Tracks belong to that category of fossils known as trace fossils. Trace fossils are different from body fossils, which represent the actual remains of an animal. Trace fossils are such things as tracks, burrows, and droppings, and represent traces the animal left as it moved around in its environment. Tracks can tell us much about where dinosaurs lived and how they moved. Dinosaur tracks have been found in many places throughout Utah. They have even been found in coal deposits near Price. Typically they are found in shale or other sedimentary rocks.

## Invitation to Learn

What inferences can be made from sets of dinosaur tracks? What kind of animals might have made these tracks?

## Instructional Procedures

1. Divide students into small learning groups.
2. Give each group a large ball of Model Magic or clay.
3. Have them flatten the model magic into a “mud flat.”

**Materials**

- Model Magic or clay
- Paper clips, pencils or Lego pieces
- Paper for writing
- Plaster of paris (optional)

4. Have them create a scenario of what type of dinosaurs might have lived near this mud flat. What might their activities have been? Create a story with each person in the group representing a different animal.
5. Using small instruments (e.g., paper clips, pencils, fingers, Lego pieces, etc.), make footprints in the clay representing an animal and its movement. Make sure there are interactions with other animals.
6. Students create a story represented by the clay model and write it in a journal.
7. Trade mudflats with another group. Ask if the other group can come up with a reasonable explanation for what has happened. Have students think about how different dinosaurs created different tracks. Prepared dinosaur track sheets can be handed out and interpreted.

### ***Possible Extensions/Adaptations/Integration***

- Students may wish to make casts of the footprints using plaster of paris. Students can also consider other fossils. What would it take to preserve a bone? What happens to animals when they die?

### ***Assessment Suggestion***

- There is no “right nor wrong” answer in this activity. The importance is placed on whether the student contributes to the story and if the tracks they have made in the mudflat correspond to the described activity their animal was engaged in. The most important goals are the thinking skills used and the ability to communicate effectively with other group members.

### ***Family Connections***

- Encourage students to take a sheet of dinosaur tracks home for the family to interpret. A copy of the story written by the group may be taken home and illustrated by family members using the information in the story. Parents can be encouraged to stop and see dinosaur tracks while traveling through Utah.

## ***Additional Resources***

Fossil Kits (The Bug House 435-864-2402, 350 E. 300 S.,  
Delta, UT 84624)

Pictures of dinosaur tracks found in Utah  
<http://www.stadiumweb.com/reprints/reprints.html>

<http://www.umnh.utah.edu/museum/exhibits/dinotales/index.html>

<http://www.ugs.state.ut.us/utahgeo/dinofossil/dinotracks.htm>

# Weathering and Erosion Splashdown

## Science Standard III

## Objectives 2 & 3

## Connections

### Science Standard III:

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

### Objective 2:

Explain how the processes weathering and erosion change and move materials that become soil.

### Objective 3:

Observe the basic components of soil and relate the components to plant growth.

### Intended Learning Outcomes:

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning.

## Background Information

Rocks and other materials on Earth's surface are constantly subjected to the powerful forces of weathering, erosion, transport, and deposition. *Weathering* is the breakdown of rock and other materials into smaller pieces. *Erosion* is the removal of those smaller pieces of rock and soil. *Transport* moves these pieces, and *deposition* is the dropping off or depositing of those materials in a new location.

Rocks can be broken down by physical or chemical weathering. *Physical weathering* is the cracking, breaking up, and grinding down of rocks into smaller pieces while maintaining the same mineral composition. This type of weathering is caused by a number of different factors. Changing temperatures cause rocks to crack and flake, ice splits rocks open, living things dig or pry open rocks, gravity causes rocks to fall and shatter, and abrasion breaks down rocks with solid particles like sand.

*Chemical weathering* is the breakdown of rocks as a result of a change in their mineral composition. In this type of weathering, minerals can either be added to or removed from rocks. Water and acids are the major destructive agents of chemical weathering because they can dissolve minerals that hold rocks together by chemically changing the rock and causing it to crumble. Acid rain, plant acids, carbonation, and oxidation can cause chemical weathering. Erosion, the transportation of weathered materials, and deposition, the deposit of these materials in a new location, are processes that often occur together. Erosion and deposition can be caused by various factors. Gravity pulls rocks down slopes, wind and running water pick up and carry loose materials, waves fragment the shoreline, and glaciers erode and carve away land as they move.

Weathering and erosion are two of the most important concepts in geology. They affect the landscape that we live on and are important in the formation of soil.

Over time, humans have learned techniques to minimize the effects of these three forces of nature to preserve land formations and soil, which is a valuable resource. Soil erosion can be slowed down by plant growth covering bare soil. This is accomplished in two ways: 1) the roots hold the soil in place, and 2) the vegetation absorbs the impact of the water hitting the ground, lowering the velocity with which the water enters the soil.

## ***Invitation to Learn***

*Ask:* What is soil erosion? How does soil move? What can be done to help keep it where it is needed?

## ***Instructional Procedures***

1. Divide the students into small learning groups (four to five students) and distribute the materials.
2. Instruct the students to place the soil in the center of their *Splashdown Target* (p. 5-10).
3. One student in each group should fill a pipette with water. Holding the pipette approximately two to three centimeters above the soil, drop ten droplets of water onto the soil.
4. Count the number of droplets that have splashed into outlying zones on the target. Record this number on a tally sheet.
5. Pass the pipette to another student in the group. The new student will hold the pipette approximately five to six centimeters above the soil (or twice the height as before) and drop ten droplets of water onto the soil.
6. Observe and record the number of splashes on a tally sheet.
7. Pass the pipette to the next student, who drops water from twice the height of the previous drop. Record the results.
8. Once again, pass the pipette to the remaining one or two students in the group, holding the pipette twice as high as the previous student. Drop ten droplets of water on the soil. Observe and record the results.
9. Ask each group to answer the following questions in a journal:
  - a. What did you observe happening?
  - b. What color are the droplets of water and why are they that color?

### ***Materials***

- Splashdown Target*
- Soil
- Pipettes
- Cups for water
- Tally sheet
- Ruler
- Grass plugs

- c. What results were observed as the pipette was raised?
  - d. Write a hypothesis about what they believe will happen if the pipette is raised even higher.
  - e. Write a hypothesis about what they think happens when a raindrop falls onto the soil.
10. Wash the *Splashdown Targets* and place a grass plug in the center of the target.
  11. Repeat steps #3 to 9.
  12. Discuss with the class the following information:
    - None of the water splashed off the dry soil when the first water droplets were dropped.
    - The soil needed to become saturated before any splashes occurred. When the soil became saturated and could hold no more water, the droplets started to splash onto the target.
    - The drops were brown because some of the soil was being carried away with the water. This is erosion.
    - As the water was dropped from a higher point, the splashes became more prolific, covering a larger area. This is because of the increased velocity of the water droplets. Raindrops hit with a great velocity because of the speed they are able to obtain as they fall through the atmosphere.
    - The grass plug helped slow the process of erosion in two ways:
      1. the roots helped hold the soil in place, and
      2. the blades of grass absorbed the force of the falling water droplet, allowing the water to trickle into the soil instead of blasting it.

### ***Possible Extensions/Adaptations/Integration***

#### **Math**

Measure the splashes to the nearest centimeter. Make a graph showing the results of the number of splashes in each zone at each height.

#### **Social Studies**

Identify local areas that are prone to soil erosion.

## **Assessment Suggestions**

- Each student should have completed a journal answering the five questions in procedure #9 for the soil water drop and the grass plug water drop. S/he should be able to communicate two ways in which plants help slow the process of erosion.

## **Family Connections**

- Encourage students to survey their yards and surrounding neighborhoods for signs of soil erosion. Have them discuss with family members ways in which vulnerable areas could be protected.

## **Additional Resources**

### **Video**

*Erosion and Rocks and Soil*, by Bill Nye

### **Web sites**

*Dirtmeister's Science Reporters: Erosion*

<http://teacher.scholastic.com/dirtrep/erosion/index.htm>

What better place to learn about erosion, soil, and “Dirt” than with The “Dirtmeister” himself! On this Dirtmeister’s Science Reporters page, children investigate one way that erosion shapes your neighborhood and report on it. As always, there is an informative background section on the causes and impacts of erosion, and a Teacher’s Guide to make lesson planning a breeze!

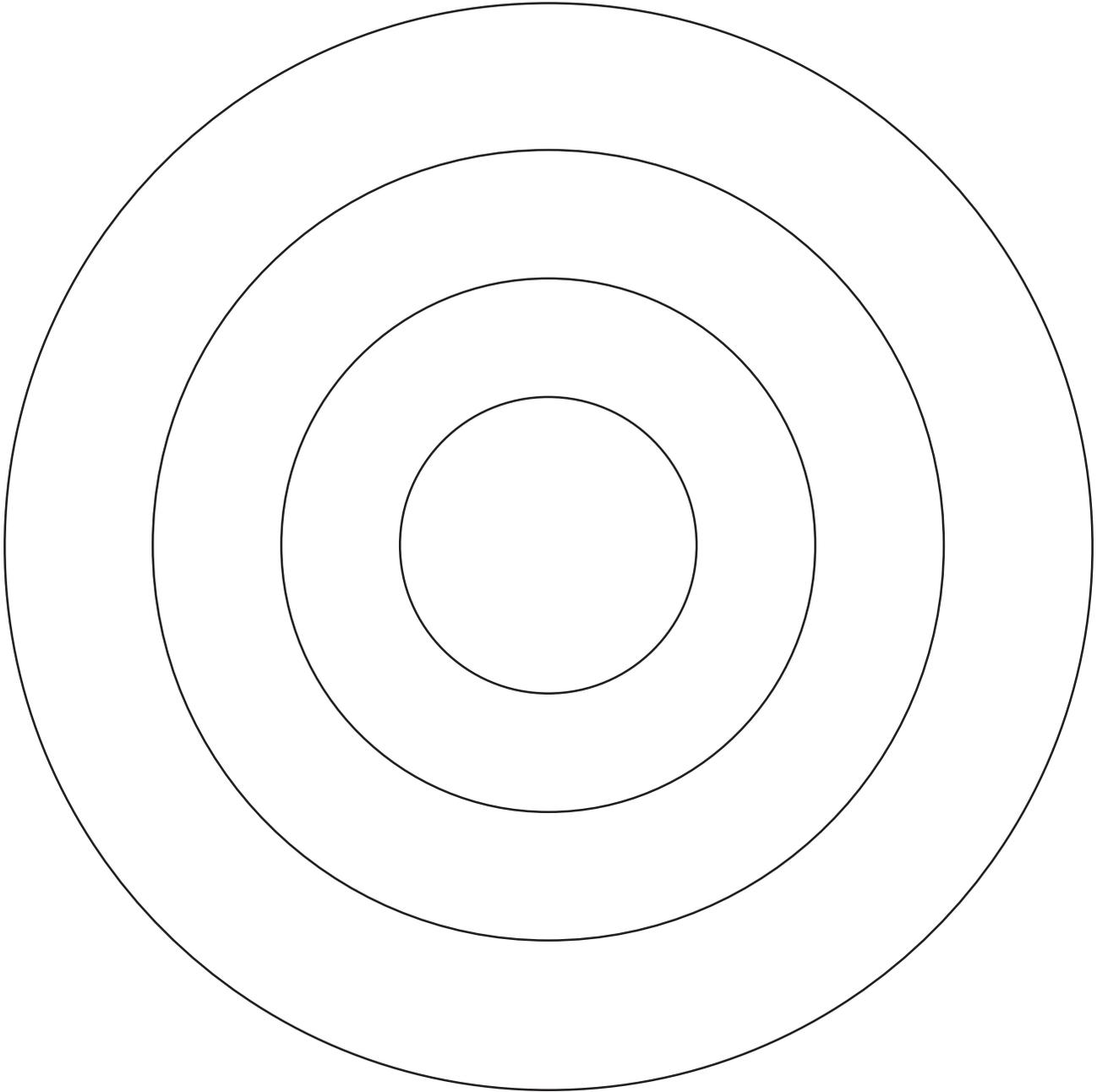
*The Start of Utah and Its National Parks*

<http://www.scs.wsu.edu/~mschoenm/Utah/back.html>

If you’re looking for the effects of long-term erosion, then this is a great place to start! While the state of Utah may not have the Grand Canyon, it has three truly great places that display some rather spectacular erosional topography. From this introductory page, you can zoom into Zion, Bryce Canyon, and Arches National Parks, and learn about how they developed and what forces are still at work today. Your students can discover for themselves how “hoodoos” form and what makes a “natural bridge.” By comparing the features at the different parks, students can develop a good understanding of how the forces of erosion shape Earth!

Name \_\_\_\_\_

# ***Splashdown Target***



# Mineral Magic

**Science Standard III:**

Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

**Objective 1:**

Identify basic properties of minerals and rocks.

**Intended Learning Outcomes:**

1. Use Science Process and Thinking Skills
3. Understand Science Concepts and Principles

**Content Connections:**

Social Studies VI-1, VII-2

## Science Standard III

### Objective 1

#### Connections

## Background Information

A *mineral* is a naturally occurring inorganic chemical substance having a definite chemical composition and a characteristic crystal structure. Minerals are the building blocks of rocks. A *rock*, therefore, is a naturally occurring solid material composed of one or more minerals.

There are three types of rock: *igneous*, *sedimentary*, and *metamorphic*. They are classified into one of these categories because of the way in which they were formed.

*Igneous* rocks are those that solidify from a molten or partially molten state. They include such rocks as basalt, granite, pumice and obsidian.

*Sedimentary* rocks are formed from erosion and deposition. Wind, water, ice, and chemicals break down existing rock into sediment that is then transported and deposited by wind, water, and glaciers. As sediment accumulates with time (thousands of years), it becomes compacted and cemented, eventually forming rock. Over a period spanning hundreds of millions of years, oceans, rivers, and great deserts covered Utah and deposited the sediment that has formed into the sedimentary rocks we see today. Some common sedimentary rocks are shale, sandstone, limestone, and conglomerate.

*Metamorphic* rocks are any rock type that has been altered by heat, pressure, and/or the chemical action of fluids and gases. Metamorphic rocks are classified by their structure and their dominant minerals.

## Invitation to Learn

Show students a set of rocks and minerals. Ask them to look at what may be similar between each one. What are some of the differences they observe? Ask if they might be able to put them in groups according to

what they look like, how they feel and any other characteristic they observe.

## ***Instructional Procedures***

### **Day 1**

#### **Materials**

- A group of assorted school supplies (e.g., pencil, marker, paper clip, ruler, scissors, etc.)
- Pasta in assorted shapes
- Rock and mineral samples
- Hand lenses

1. Ask questions to the students as to what they like, what they don't like, statistics about their family, themselves, etc. Point out that they are certainly different; that no two students answered the questions the very same. Ask them how they are alike. Discuss with the class the reasons why they are members of the same class.
2. Show the students a collection of school supplies. Ask how the supplies are the same and how they are different.
3. Classify the school supplies and record them on a simple chart on the board.
4. Divide the students into small learning groups of three to four students each.
5. Distribute a plastic bag filled with pasta to each group. Ask the students to look at each kind of pasta. What similarities and differences do they observe? Have them place the pasta into two groups.
6. Working with the entire class, discuss how the pasta can be classified into groups. Have each group create a classification sheet, classifying each piece of pasta.

### **Day 2**

1. Give each group a bag of rocks and minerals and a hand lens.
2. Have students look at the rocks and minerals, noting any characteristics they observe. Have them share their findings with the rest of the group.
3. Using group input, what characteristics did they come up with? Guide students to discovering the characteristics they might use.
4. Ask the students to put the rocks and minerals into groups according to what they see and feel, putting those of similar characteristics in the same group. (These groups of rocks and minerals will be quite varied.)
5. Ask each group to classify their rocks and minerals according to their individual characteristics.
6. Have them share their charts with other groups. Can the new group follow the previous group's classification chart?

## ***Possible Extensions/Adaptations/Integration***

- Ask the students to identify the rocks from the minerals in their collection. Knowing the characteristics of igneous, sedimentary and metamorphic rocks, have the students place the rocks in their respective groups.

## ***Assessment Suggestion***

- Students should be able to communicate the characteristics they observe in rock and mineral samples using correct scientific language. They should be able to make a simple classification outline using a minimum of five objects.

## ***Family Connections***

- Have the family start a rock collection. Classify objects around the house. Visit the national parks in southern Utah and look at the rock formations.

## ***Additional Resources***

### **Video**

*Rocks and Soil*, by Bill Nye

### **Web sites**

Utah Geological Survey web site:

<http://www.ugs.state.ut.us/surveynotes/gladasked/gladrocks.htm>

SURWEB [www.surweb.org](http://www.surweb.org)

### **Other Resources**

Rock and Mineral Kits (The Bug House 435-864-2402,  
350 E. 300 S., Delta, UT 84624)

# How Big is a Dinosaur?

## Science Standard IV

### Objective 1

#### Connections

**Science Standard IV:**

Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

**Objective 1:**

Describe Utah fossils and explain how they were formed.

**Intended Learning Outcomes:**

1. Use Science Process and Thinking Skills
2. Manifest Science Interests and Attitudes
3. Understand Science Concepts and Principles

**Content Connections:**

Math III-2

## Background Information

Dinosaurs are a group of animals descended from reptiles and the ancestors of birds. They were different from their reptile ancestors in that they have an S shaped neck and feet held directly beneath their bodies, as well as several other features. They lived on land, grew both big and small, and died out 65 million years ago.

We know of over 300 kinds of dinosaurs, half of those from a single tooth or bone. A reliably new kind of dinosaur is found every seven weeks on average. There were probably thousands of kinds of dinosaurs, but most haven't been found yet. We don't get a great sample because fossils are usually only made in lowland areas where bones get covered over by mud, even though dinosaurs lived all over. And we only find fossils where rock from dinosaur times is now near the surface, and when the bones were preserved—many bones are weathered soon after the animal dies. Many places have dinosaurs but they are deep in the ground; in other places the weather wasn't right to turn dinosaurs into fossils.

More species of plant-eating dinosaurs (herbivores) have been found than carnivores, because there are always more herbivores than carnivores in any animal population. One such plant eater was the stegosaurus. The stegosaurus was a dinosaur that lived in Utah and surrounding states. It weighed three tons, was nine feet tall and 15 feet long. It had plates that it used for protection as well as to control body temperature. The stegosaurus had a curved beak and very small teeth. These teeth were too weak to chew food, so the plants were torn off by the beak, swallowed in large pieces, and digested in the stomach.

## **Invitation to Learn**

*Ask:* How big were dinosaurs that lived in Utah? Could we enlarge a picture to represent the size of a dinosaur?

## **Instructional Procedures**

1. Mark a grid on the wall using string. The grid should be seven squares long by four squares high. Each square in the grid should be one square foot.
2. Give each child a *Stegosaurus Grid* (p. 5-18).
3. Using coordinates, assign each child one of the squares on the grid in which there is a part of the stegosaurus outline.
4. Give each child a one foot square piece of paper. Using a marker, have him/her transfer the lines from his/her assigned square of the stegosaurus onto the large sheet of paper.
5. Have each child locate and mount his/her paper in the correct spot on the wall grid to form an outline of a stegosaurus.
6. Add blank paper to the wall grid to fill in the stegosaurus.

### **Materials**

- String
- 12 x12 inch paper
- Stegosaurus Grid*
- Markers

## **Possible Extensions/Adaptations/Integration**

### **Math**

Using coordinates, find the correct region on a grid.

### **Art**

Interpret and apply visual arts in relation to history and all learning.

## **Assessment Suggestions**

- Each student should have successfully placed his/her drawing in the correct location on the wall grid. The drawing should be enlarged to replicate the original drawing.

## **Family Connections**

- Encourage students to share information on dinosaurs with family members. Ask students to research information on a dinosaur that lived in Utah. If possible, have students and their families visit a dinosaur museum or quarry close to their home.

## ***Additional Resources***

### **Video**

*Dinosaurs*, by Bill Nye

### **Web sites**

Utah Dinosaur Facts

<http://www.enchantedlearning.com/usa/states/utah/>

Utah Dinosaur Tracks

<http://scienceviews.com/dinosaurs/dinotracks.html>

Dinosaur Math Activity

<http://www.enchantedlearning.com/subjects/dinosaurs/activities/math/size>

Utah Museum of Natural History

<http://www.umnh.utah.edu/museum/departments/paleontology>

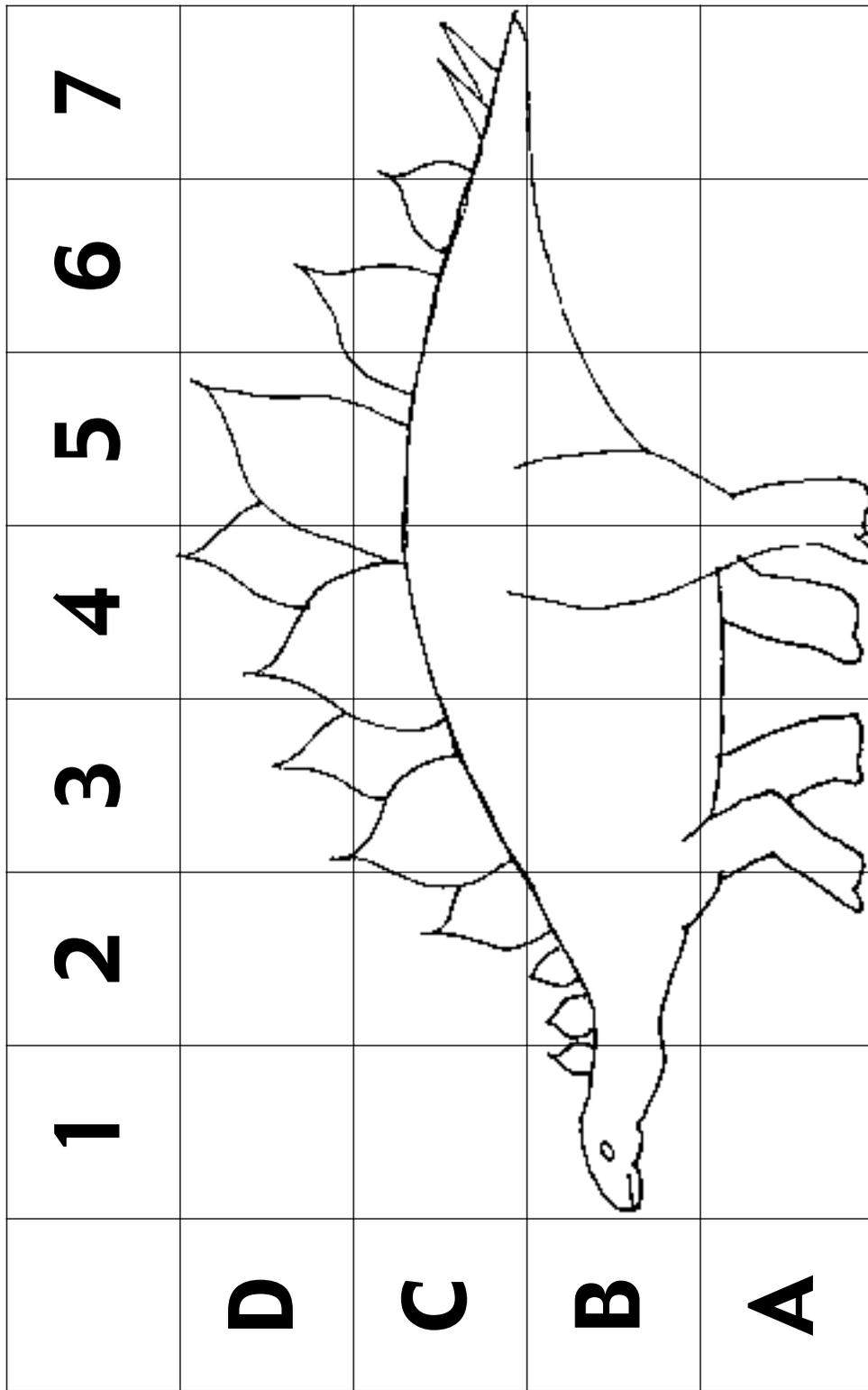
Dinosaurs and Fossils, Utah Geological Survey

<http://www.ugs.state.ut.us/utahgeo/dinofossil/index.htm>

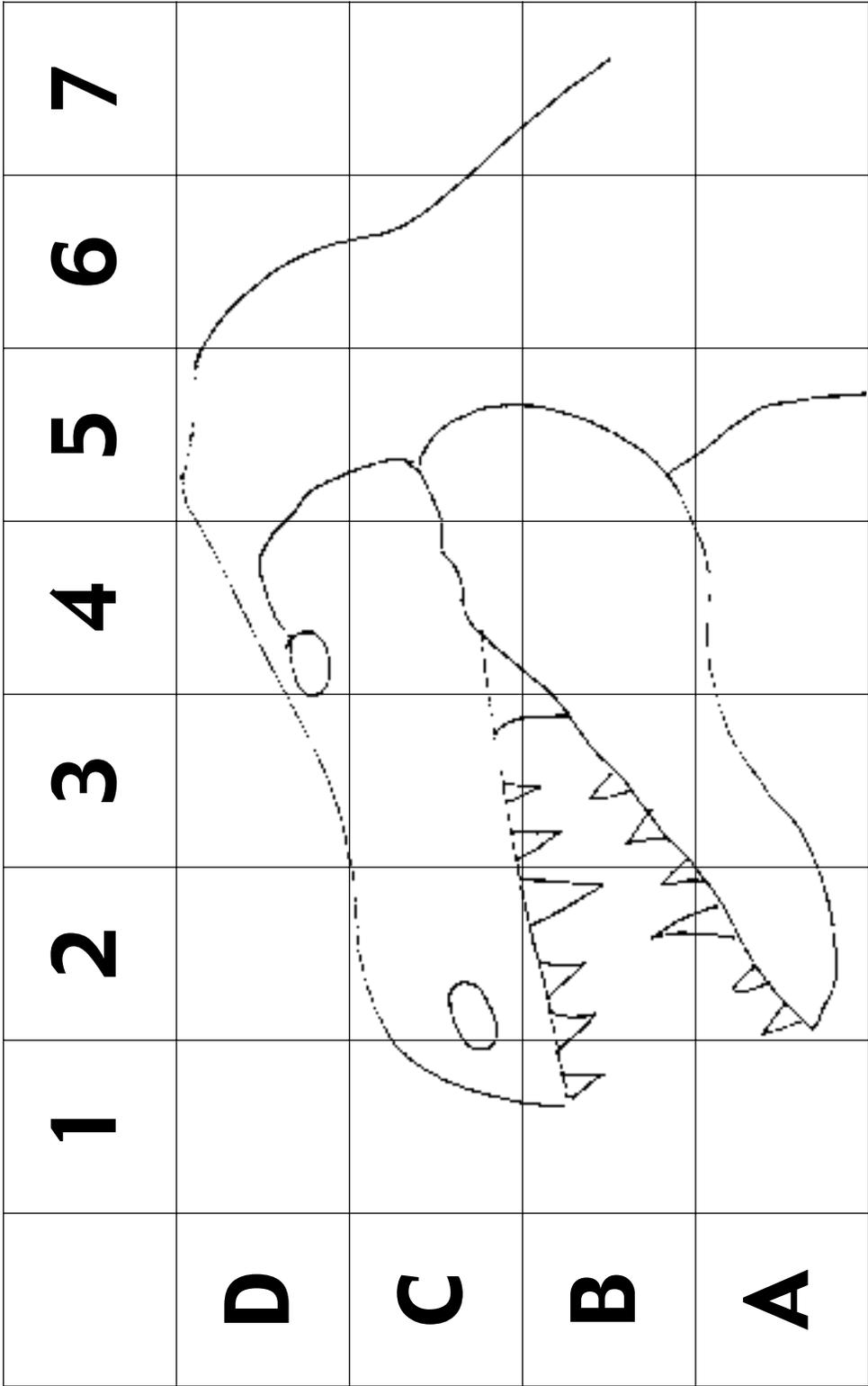
*Grid Paper*

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>					
<b>D</b>												
<b>C</b>												
<b>B</b>												
<b>A</b>												

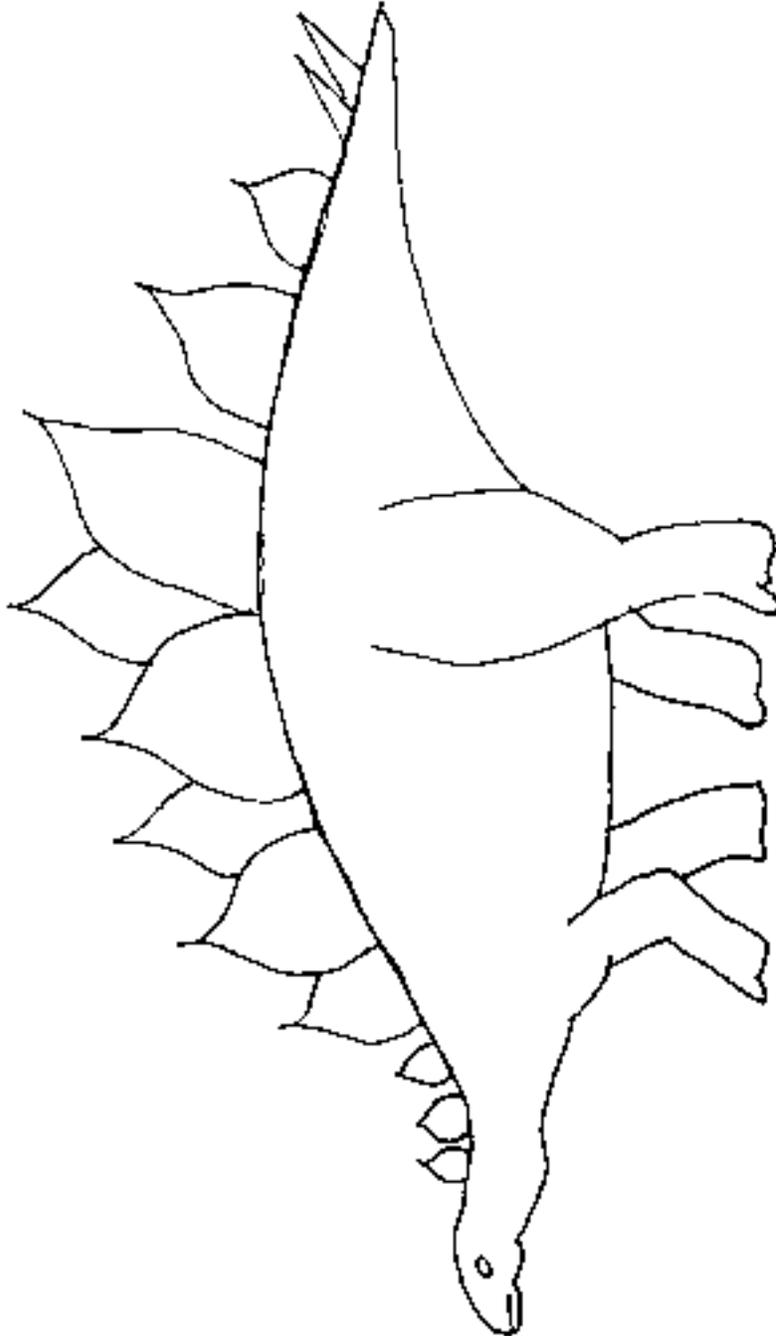
# Stegosaurus Grid



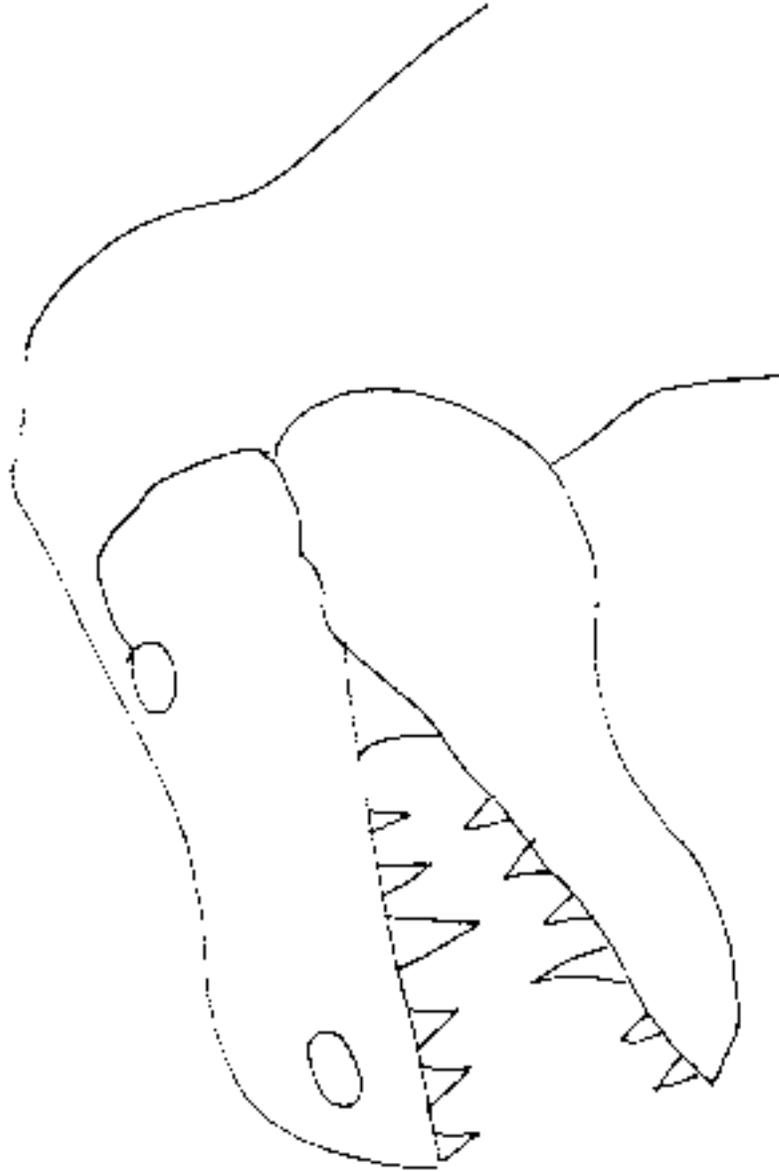
***Tyrannosaurus Rex Grid***



# ***Stegosaurus Outline***



# ***Tyrannosaurus Rex Outline***





***Math  
Standard II  
Activities***



# Making Patterns—Create, Analyze, and Predict

**Math Standard II:**

Students will use patterns and relations to represent mathematical situations.

**Objective 1:**

Recognize, describe, and use patterns and identify the attributes.

**Intended Learning Outcomes:**

3. Reason mathematically
6. Represent mathematical situations.

**Content Connections:**

Fine Arts I-1, 2

## Math Standard II

### Objective 1

#### Connections

## Background Information

Many people think that math is the science of patterns. As we teach almost any math skill there is some sort of patterning incorporated into it. Place value, multiplication, even long division—the nemesis of so many fourth graders—are all based on patterns.

Helping our students develop a stronger pattern sense also helps them develop a deeper and more thorough understanding of how numbers and mathematical processes work. Giving students this knowledge makes math more accessible and allows students to think their way through a problem rather than relying on memorization or random guessing. This higher level thinking better prepares children for the demands of today’s society and the careers of the future.

Students should have had previous experience in making patterns using Unifix cubes and pattern blocks.

## Invitation to Learn

Detectives solve mysteries by being able to analyze clues and predict the solutions. Today we will be “pattern detectives” and solve the mysteries of the patterns we look at and create. We will also look for patterns in nature, art, and music.

Show students various patterns using real life objects (e.g., fabrics, wallpaper, etc.), and have them describe the patterns either verbally or in writing.

## Instructional Procedures

1. Give each child a *Hundreds Chart* (p. 6-8), a set of Unifix cubes, a sheet of graph paper, and a set of colored pencils.
2. Have each student use two to five cubes to create a core pattern and display it on his/her *Hundreds Chart*.

### **Materials**

- Hundreds Chart
- Unifix cubes or pattern blocks
- Graph paper
- Colored pencils

3. Ask students to visualize how the grid will look when the pattern is repeated. Help them predict and analyze the patterns by asking questions such as: “How many squares are in your pattern unit? How many times can you repeat your pattern in one row? What happens if you make your pattern one cube shorter? Or longer? What color will the \_\_\_\_ cube be?” Some students will like the option of using graph paper and colored pencils to help them determine these patterns.
4. Pair students up to play the “Secret Patterns” game. Have them place their desks facing each other. They will need a folder to put up between them so they can hide their patterns from each other.
5. Instruct Partner #1 to create a secret pattern using a specified number of cubes.
6. Instruct Partner #2 to try to guess and recreate their partner’s secret pattern by asking yes/no questions.  
*Example:* Partner one creates a pattern of three red, one blue, two green. Partner two might ask: “Did you use more than two colors? Did you use three colors? Are there two cubes of the same color next to each other?” Model good questioning techniques to help students think their way through the activity rather than just randomly guessing.
7. When partner two has successfully recreated the pattern, have the partners switch roles and repeat the activity.

## **Additional Activities with Unifix Cubes**

### **Towers**

1. Give each student two different colors of Unifix cubes, at least 20 of each color.
2. Challenge them to make as many different patterns as possible making towers that are four cubes high.
3. Have them try to group their towers into pairs by matching up opposite towers.

*Example:* Tower 1—blue, white, white, blue would match with  
Tower 2—white, blue, blue, white.

### **Ice Cream Cones**

1. Put students into pairs or small groups.
2. Give each group six Unifix cubes—one of each color.
3. Tell them each cube represents a flavor of ice cream and

challenge them to create as many different cones as possible. You can change criteria by requiring all six flavors to be used or by allowing them to use a minimum number of flavors per cone.

## ***Possible Extensions/Adaptations/Integration***

### **Fine Arts Music I-1, 2**

Pass any playground and you will hear the age-old sounds of young hands clapping and snapping in perfect rhythm to sing-song chants, either borrowed from previous generations or brand new inventions of their own. Jump rope rhymes, hopscotch, foursquare—children use patterns in all these games—and the possibilities of the patterns they create are endless. Babies will follow the pattern of clapping in *Patty Cake*, and older children love the patterns involved in playing rhythm or doing hand jives. Counting songs such as the *Five Speckled Frogs*, *Five Little Ducks*, and *Three Little Monkeys* develop number pattern sense. Children have no thought other than having fun while participating in these activities, but they are actually using and developing math skills through their play. Music is a series of mathematically based patterns. The beat and melody of songs are developed through patterns. Combining music and movement helps children “see” the patterns in music. The rondo is a perfect form to show patterns in music through movement.

### **Rondo**

*Rondo for Percussion* (p. 6-9).

### **Visual Arts I-1, II-1, 2**

Visual arts are full of patterns and perhaps the best example is the work of the artist MC Escher. His fantastic tessellations fascinate people of all ages and children love them. Give students the opportunity to make their own tessellations.

1. Show and discuss prints of Escher’s work.
2. Use pattern blocks to create simple geometric tessellations.
3. Students create their own tessellation patterns using instructions on the *Tessellations* handout (p. 6-9).

#### **Materials**

- Music with rondo form (*Axel F* or other song)
- Rondo for Percussion* handout

#### **Materials**

- MC Escher prints
- Oaktag squares 2” x 2”
- 12 x 18 art paper
- Colored pencils or crayons
- Scissors
- Tape
- Pattern block sets
- Tessellations* handout

## ***Assessment Suggestions***

- Informal assessment techniques with the teacher observing and interacting with the students as they create, predict, and try to guess the patterns would work well with this activity.
- Use performance task assessment of finished products, such as the tessellations.
- Performance tasks should include repeating/growing pattern understandings, rather than whether or not students can create a tessellation.

## ***Additional Resources***

### **Books**

Many picture books involve patterning. You could read these to your class and have students look for the patterns.

*The Hungry Caterpillar*, by Eric Carle; ISBN 024119081

*Exploring Patterns*, by Betty Franco (Scholastic 1999),  
ISBN 0590644405X

*Math All Around Me—Patterns in the Park*, by Lisa Bruce (Raintree 2003); ISBN 1410906604

*MC Escher Coloring Book*, by Abrams (Target.direct);  
ASIN 0810926350

### **Web sites**

There are a number of Web sites that have interactive patterning activities that students could do in the computer lab. Many of them can also be adapted to use with manipulatives or pencil/paper activities in the classroom. Do a search for “Math patterns” and you will find a wealth of activities.

<http://www.nctm.org>

<http://www.funbrain.com>

eThemes Math Patterns

<http://emints.more.net/ethemes/resources/S00000622.shtml>

### **CDs**

*Multiplication Unplugged*, Sara Jordan Publishing;  
ISBN 1-895523-75-3

*Skip Counting, Intelli-Tunes*, by Ron Brown (Joyful Noise Publications, [www.joyful-noise.com](http://www.joyful-noise.com)); Item TTM-103

## ***Family Connections***

- Assign students to find an example of a pattern in their home (e.g., fabric, wallpaper, door and window arrangements, etc.). Students then recreate the pattern on paper and return it to school.
- Nature is full of patterns. Assign students to find an animal, plant, landform, etc., with a pattern and bring a sketch or picture of it to school.

Name \_\_\_\_\_

## *Hundreds Chart*

<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>10</b>
<b>11</b>	<b>12</b>	<b>13</b>	<b>14</b>	<b>15</b>	<b>16</b>	<b>17</b>	<b>18</b>	<b>19</b>	<b>20</b>
<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>
<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>	<b>39</b>	<b>40</b>
<b>41</b>	<b>42</b>	<b>43</b>	<b>44</b>	<b>45</b>	<b>46</b>	<b>47</b>	<b>48</b>	<b>49</b>	<b>50</b>
<b>51</b>	<b>52</b>	<b>53</b>	<b>54</b>	<b>55</b>	<b>56</b>	<b>57</b>	<b>58</b>	<b>59</b>	<b>60</b>
<b>61</b>	<b>62</b>	<b>63</b>	<b>64</b>	<b>65</b>	<b>66</b>	<b>67</b>	<b>68</b>	<b>69</b>	<b>70</b>
<b>71</b>	<b>72</b>	<b>73</b>	<b>74</b>	<b>75</b>	<b>76</b>	<b>77</b>	<b>78</b>	<b>79</b>	<b>80</b>
<b>81</b>	<b>82</b>	<b>83</b>	<b>84</b>	<b>85</b>	<b>86</b>	<b>87</b>	<b>88</b>	<b>89</b>	<b>90</b>
<b>91</b>	<b>92</b>	<b>93</b>	<b>94</b>	<b>95</b>	<b>96</b>	<b>97</b>	<b>98</b>	<b>99</b>	<b>100</b>



# Number Games

## Math Standard II

### Objective 1

#### Connections

#### Math Standard II:

Students will use patterns and relations to represent mathematical situations.

#### Objective 1:

Recognize, describe, and use patterns and identify the attributes.

#### Intended Learning Outcome:

3. Reason mathematically.

## Background Information

Mathematics is especially useful for predictions. Multiples and other number patterns are all about prediction. Working with number patterns helps students develop their concept of functions in mathematics.

The very youngest children start simply by counting. Then they start counting in multiples—twos, fives, tens, etc. These number patterns give students a natural strategy to understand addition and multiplication. Students start by using patterns to find sums:  $2 + 2 = 4$ . As students get older they start using their knowledge of patterns to find products. When asked what  $5 \times 9$  is, they will count by fives nine times. High school students can use their knowledge of number patterns to start to understand functions and other algebraic concepts.

## Invitation to Learn

Play a skip counting song from the math songs CD. Let children discuss and demonstrate their favorite examples of skip counting.

## Instructional Procedures

Ask students how learning the skip counting songs could help them learn their multiplication tables. Introduce the concept of multiples and explain that it is the same as skip counting. Reinforce their understanding of the connection between multiples and multiplication facts.

### Calculator/Skip Counting Activity

1. Pass out hundreds chart (p. 6-8) and calculator for each student.
2. Use your overhead calculator to demonstrate.
3. Review how to skip count on a calculator (e.g.,  $5 + 5 = = =$ , the calculator will count by multiples).

### Materials

- CDs—Math songs that teach skip counting and multiplication tables
- Calculators (Overhead projector and overhead calculator if available)
- Birthdate Game* handout
- I Spy* handout
- Hundreds charts

4. Do familiar multiples such as twos, fives, tens where they will be able to easily recognize the patterns

Ask questions as students work with the calculators, such as “What pattern do you see when\_\_\_\_\_?”

.....you skip count by 2s and start with 2? Why????

.....you skip count by 2s and start with 1?

.....you skip count by 5s and start with 3?

Skip-counting by what numbers will include 100 in the pattern?

*Note:* Always ask “why” to give the students a chance to understand and verbalize their understanding of what is happening on the calculator.

Explain that many people enjoy riddles, games, and other activities that require the recognition of number patterns to solve.

### ***Birthdate Game***

Play using *The Birthdate Game* handout (p. 6-13).

### ***I Spy***

Play using the *I Spy* handout (p. 6-14).

## ***Possible Extensions/Adaptations/Integration***

### **Literature**

Introduce students to stories/books about detectives and mysteries. *Two Minute Mysteries* and *Encyclopedia Brown* books by Donald Sobol work well for fourth graders.

### **Music**

Use the Math Songs CDs and have children learn and sing the skip counting and multiplication table songs.

## ***Assessment Suggestions***

- Use informal quick response activities to assess students' understanding of multiples. For example, call out a number pattern and then call on a student to give you the next number.
- Formal assessments such as the 100 basic multiplication and 90 basic division facts tests are one way to show progress toward mastery of these skills. Students should be given adequate time to complete fact test with greater emphasis on accuracy versus speed. You can also assess student understanding of skip counting and multiples by assigning them to write sets of multiples (e.g., write the multiples of three from 3 to 36, etc.).

## ***Additional Resources***

### **Web site**

Interactive version of the calculator activity at  
[standards.nctm.org/document/eexamples](http://standards.nctm.org/document/eexamples) 4.5.2

### **CDs**

*Multiplication Unplugged*, Sara Jordan; ISBN 1-895523-75-3

*Skip Counting, Intelli-Tunes*, by Ron Brown (Joyful Noise Publications, [www.joyful-noise.com](http://www.joyful-noise.com)); Item TTM-103

## ***Family Connections***

- Give students copies of the *Birthdate Games* and *I Spy* handouts to take them home and share with their families.

Name \_\_\_\_\_

## The Birthdate Game

Enlarge the A-B-C-D cards from below. Display them on the board and let the students study them. Have them identify which cards have their birthdate on them (the date on which they were born, e.g., 10th, 30th, etc.).

Tell them you can magically identify which of those numbers is their birthdate.

After a few tries, tell them you know they know you are not magic, so there must be some logical way to figure out how you know all their birthdates. Remind them to look for patterns and use number sense to solve the mystery.

Here's the secret:

Add the first numbers of the cards they said their birthdate was on.

For example: If they said their birthdate was on Cards A and B, then you would add 1 (the first number on Card A), and 2 (the first number on B)—showing that their birthdate is the 3rd.

<b>Card A</b>	<b>Card B</b>	<b>Card C</b>	<b>Card D</b>	<b>Card E</b>
<b>1 17</b>	<b>2 18</b>	<b>4 20</b>	<b>8 24</b>	<b>16 24</b>
<b>3 19</b>	<b>3 19</b>	<b>5 21</b>	<b>9 25</b>	<b>17 25</b>
<b>5 21</b>	<b>6 22</b>	<b>6 22</b>	<b>10 26</b>	<b>18 26</b>
<b>7 23</b>	<b>7 23</b>	<b>7 23</b>	<b>11 27</b>	<b>19 27</b>
<b>9 25</b>	<b>10 26</b>	<b>12 28</b>	<b>12 28</b>	<b>20 28</b>
<b>11 27</b>	<b>11 27</b>	<b>13 29</b>	<b>13 29</b>	<b>21 29</b>
<b>13 29</b>	<b>14 30</b>	<b>14 30</b>	<b>14 30</b>	<b>22 30</b>
<b>15 31</b>	<b>15 31</b>	<b>15 31</b>	<b>15 31</b>	<b>23 31</b>

## *I Spy*

*I Spy* is a game you can play as a whole class or you can pair students up and let them play in partners. Be sure to play it a few times all together to help students develop the ability to look for patterns and use number sense rather than just wild guessing.

The Codemaker makes a secret number by choosing a three digit number that does not repeat any digits.

The Number Spy uses logical reasoning, patterns, and number sense to find the secret number.

The Codemaker writes the number down where the Number Spy or Spies cannot see it.

On each turn, the Number Spy guesses a three digit number. The Codemaker compares the guess with the secret number and gives a clue that tells:

- how many of the digits are in the secret number, and
- how many of the digits are in the correct position.

Make a chart to help keep track of the guesses. A sample is given below—you can do the reasoning orally and not write it down each time.

<b>Number Spy's Guess</b>	<b>Codemaker's Digits Correct</b>	<b>Clues Places Correct</b>	<b>Number Spy's Reasoning</b>
<b>375</b>	<b>1</b>	<b>0</b>	<b>There is a 3, 7, or 5 in the number</b>
<b>786</b>	<b>0</b>	<b>0</b>	<b>There is no 7, 8, or 6. There might be a 3 or 5.</b>
<b>123</b>	<b>1</b>	<b>0</b>	<b>There could be a 1, 2, or 3.</b>
<b>125</b>	<b>0</b>	<b>0</b>	<b>The 3 is correct. There is no 1, 2, or 5. I can try 0, 4, and 9.</b>
<b>349</b>	<b>3</b>	<b>1</b>	<b>I was right about all the digits. Now I need to change the places.</b>
<b>394</b>	<b>3</b>	<b>1</b>	<b>The 3 can't be first.</b>
<b>493</b>	<b>3</b>	<b>1</b>	<b>Almost—I'll try switching the last two numbers.</b>
<b>439</b>	<b>3</b>	<b>3</b>	<b>I guessed it!</b>

# That's Not Fair

**Math Standard II:**

Students will use patterns and relations to represent mathematical situations.

**Objective 2:**

Recognize, represent, and solve mathematical situations using patterns and symbols.

**Intended Learning Outcomes:**

2. Become mathematical problem solvers.
3. Reason mathematically.

## Math Standard II

### Objective 2

#### Connections

## Background Knowledge

Many students and adults are programmed to look for “the answer” at the end of the problem when doing math. They have difficulty understanding that math problems can be written in different forms. One of the most difficult forms for students, and often their parents, to understand is the equation. Students must be taught the concept of equal values. They must also understand that an equation is a number sentence that shows relationships, not just an operation. To become competent with equations requires a lot of practice and review throughout the year.

## Invitation to Learn

Pass out small candies to the students. Give different amounts to each student, some one, some two, some five, some none. Ask students if they were treated fairly. Why or why not? They should come up with the idea that they did not get the same (equal) amount. Explain that you will be working on math problems that require them to understand the concept of equal value and making sure that all parts are worth the same amounts. Pass out more candies so that each student gets five pieces. Tell them that they will be allowed to eat them when they have shown you they understand the math concept for the day.

## Instructional Procedures

1. Invite two students to come up to the front of the class. Give one student five candies in one hand and four candies in the other hand. Give the other student four candies in one hand and none in the other. Ask the class if you treated the two students fairly. Why or why not?
2. Ask students to figure out what you would need to do to make the second student's candies equal to the first student's candies. They should figure out that the second student needs five candies in his/her other hand.

### **Materials**

- M&Ms or other small candies
- Balance scale
- Unifix cubes
- Equations Review* worksheet
- Math Equations Match-Up Level 2*

3. Write the equation on the board to represent the candies.  
 $5 + 4 = 4 + \underline{\hspace{2cm}}$
4. Review what the equal sign means and point out that the number sentences on each side of the equal sign must have equal values.
5. If students are still having difficulty grasping the concept of “equal value,” try using a simple balance scale to visually show “equal.”

*Example:* Put six cubes on one side and two on the other. Ask how many cubes you need to add to make the scale balance. Explain that when the scale balances, the weights (values) are equal.

6. Do a number of equations on the board or overhead to help the students grasp the concept of different types of equations. Use the operations they are familiar with. At the beginning of the year use addition and subtraction, then as the year progresses you can add multiplication, division, fractions, and decimals.
7. Assign students to complete the *Equations Review* worksheet (p. 6-18) independently. Some students will struggle to understand these. Let them work with a partner or form skill groups to work with you.
8. When students have had several experiences working with equations you can assign equations as warm-ups/seat work. Give students a challenge such as: “How many equations can you make where one side is ten?” Give them a few minutes to work. Allow time for them to share their favorite equation—the discussion among the children about whether the equations are true helps them develop their understanding of equations and other math concepts.
9. Use the *Math Equations Match-Up Level 2* to provide students with more practice. They can work on them independently, in partners, or in small groups.

### **Possible Extensions/Adaptations/Integration**

- Write problems that need to be solved using an equation by using facts from your science or social studies curriculum.

## Assessment Suggestions

- Use ongoing assessments throughout the year by correcting the students' assignments and evaluating the types of mistakes they are making. Reteach the difficult types of equations and continue working on them on a regular basis.
- Teacher observation and interaction with students while they are writing their lists of equations will provide the teacher with information about how the students' skills are developing and provide opportunity for reteaching/correcting.

## Additional Resources

### Books

*Thinking Mathematically—Integrating Arithmetic and Algebra in Elementary School*, by Thomas P. Carpenter, Megan Loef Franke, and Linda Levi; ISBN 0-325-00565-6

*In the Balance—Algebra Logic Puzzles Grades 4-6*, by Lou Kroner (McGraw-Hill); ISBN 0-7622-0551-2

### CDs

*Equate The Equation Thinking Game*,  
<http://www.lakeshorelearning.com>; Item ZE511

*Math Equation Match-Ups*,  
<http://www.lakeshorelearning.com>; Item GG269

### Other Resources

You can quite easily make your own worksheets for your students to practice this skill.

## Family Connections

- Send an *Equations Review* worksheet home and assign your students to teach this concept to their parents. Ask their parents to reply with a comment on how hard they thought it was to understand this concept.

## Equations Review

1.  $6 \times 9 = 4 + \underline{\quad}$

14.  $(8 \times 2) \times 2 = (2 \times 2) \times \underline{\quad}$

2.  $(3 \times 2) \times 4 = (4 \times \underline{\quad}) \times 3$

15.  $100 \div \underline{\quad} = 10 \times 10$

3.  $45 \div 9 = 1 \times \underline{\quad}$

16.  $3,765 + 333 = 333 + \underline{\quad}$

4.  $7 \times 8 = \underline{\quad} \times 7$

17.  $81 \div 9 = 4 + \underline{\quad}$

5.  $9 \times \underline{\quad} = 12 \times 3$

18.  $(6 \times 9) + 6 = 6 + (\underline{\quad} \times 9)$

6.  $1/2 = 1/4 + \underline{\quad}$

19.  $\underline{\quad} \times 9 = 9 \times 3$

7.  $49 \div \underline{\quad} = 56 \div 8$

20.  $90 = (9 \times 9) + \underline{\quad}$

8.  $(10 + 10) \div 2 = 10 \times \underline{\quad}$

21.  $\underline{\quad} = 7 \times 9$

9.  $5 \times \underline{\quad} = (10 + 10) + 5$

22.  $27 \times 35 = 35 \times \underline{\quad}$

10.  $\underline{\quad} \times 3 = 21$

23.  $7 + 7 + 7 + 7 = 4 \times \underline{\quad}$

11.  $(\underline{\quad} \times \underline{\quad}) + 1 = 37$

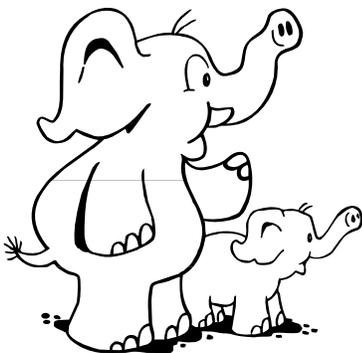
24.  $54 = 6 \times \underline{\quad}$

12.  $2 \times 3 = (3 \times \underline{\quad}) \times 1$

25.  $345 \div 1 = \underline{\quad} \times 1$

13.  $25 + \underline{\quad} = 40 - 5$

### Extra!



Hogle Zoo has 2 elephant pens with 6 elephants in each one. The elephants are too crowded so they are building 2 new pens. How many elephants will they put in each pen when the new ones are finished? (Equal number in each pen.) Write an equation to solve this problem.

$$\underline{\quad} \times \underline{\quad} = \underline{\quad} \times \underline{\quad}$$

***Science  
Standard V  
and  
Math  
Standard IV  
Activities***



# Tree Cookie Combat

This activity helps students understand what trees need to live and grow in the environment. They will also realize that trees sometimes interact or compete with other organisms as well as each other.

## Instructional Procedures

1. Give each student a round circle of paper approximately ten inches in diameter (e.g., paper plates). Have each student imagine that this is a cross section of his/her life as a tree. On this circle, draw rings to represent his/her own life's years. The rings should vary in size: the years of much growth should have wider rings than years of less growth.
2. Students should position themselves around the room. Placing their cross section on the floor, they need to stand with one foot on their "tree of life."
3. Distribute the colored squares randomly on the floor around the students so the squares are about one or two feet apart. Each colored square represents the requirements of a tree for survival: blue is water, yellow is sunlight, and green is nutrients.
4. Play *Tree Cookie Combat*. The game is played by having each "tree" gather as many squares as they can when the signal is given. On the signal, trees must reach with their roots and branches (arms and legs) to gather their requirements. One foot, (the tap root!), must remain planted on their cross section at all times and there is NO SLIDING!!
5. Questions to ask:
  - Were you successful in gathering your needs?
  - Did any tree fail to get its requirements?
  - What would happen if you were really a tree without these requirements?
  - Is there such a thing as too much water? sun? nutrients?

### Materials

- Paper plates
- Two squares of blue, yellow and green paper for each student. These are mixed together.
- Colored markers or pens

### ***Possible Extensions/Adaptations/Integration***

- The size of growth rings on a tree is based on the kinds of years that tree experiences. Look at the size of your growth rings. Based on the rings drawn, create a fraction of the good years in your life. Do the same for difficult years. Are they tied to nutrition? sunlight? water? Are there other things that affect a tree? What conclusions can you draw?
- Graph the information from the classroom experiences.
- Extend this to family trees. Have students create their own family trees to represent their family. This is another “tree of life.”

### **Resources**

*Project Learning Tree*, Activity Book, Activity 27 “Every Tree For Itself.”

Educational Insights Discover and Activity Kit: Tree Rings (Hands On Nature Kit) 1991.

# Plant Puzzlers

<p><b>Science Standard V:</b> Students will understand the physical characteristics of Utah’s wetlands, forests, and deserts and identify common organisms for each environment.</p> <hr/> <p><b>Objective 2:</b> Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.</p> <hr/> <p><b>Intended Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Use Sciecne Process and Thinking Skills</li> <li>3. Understand Science Concepts and Principles</li> </ol> <hr/> <p><b>Content Connections:</b> Math IV-2; Language Arts VII-6; Art</p>
--

Science  
Standard  
V

Objective  
2

Connections

## Background Information

This activity requires students to sort data about plants of Utah. Fourth grade students are to learn about plants that live in deserts, wetlands, and forests. Those listed in the *Science Words to Know* section of the standard include:

cottonwood	Utah juniper	quaking aspen	pinyon pine
bulrushes	cattails	sagebrush	prickly pear

*Some other common Utah plants:*

Douglas pine	sego lily	Blue spruce	fir
Gamble’s oak			

Playing this game requires students to make inferences about why plants might live in a particular environment and how physical characteristics influence survival in these areas. A great resource to help students find answers, or for teacher information, is the 4th grade science Web page listed under *Resources* in the science section of the USOE Web site.

## Invitation to Learn

Start a clapping rhythm such as knees, clap, snap fingers, clap, and keep it going while you say,

*Plants, plants, everywhere*

*Let’s name parts that plants all share.*

Continue the clapping rhythm and call on a student who will then recite a plant part that they know. This should all be to the rhythm.

*Example:*

Plants, plants, everywhere

Let's name parts that plants all share.

Knees, clap, snap, clap (call student name)

Knees, clap, snap, clap—FLOWERS

Continue until students run out of parts (e.g., branches, leaves, roots, seeds, etc.).

If you have studied plant adaptations, try this rhythm with them changing the second line to "Name adaptations plants can share" (e.g., color, thorns, waxy coating, etc.). This leads into the following activity.

## **Instructional Procedures**

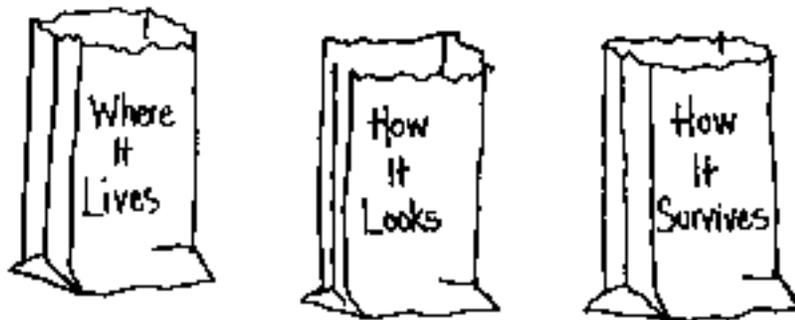
### **Materials**

For each pair of students:

- Three lunch bags
- Plant Puzzler Cards*
- Plant Puzzlers Student Worksheet*
- Plant Puzzler Journal*

1. Prepare materials for the activity. Each pair of students should label their sacks (Where It Lives, How it Looks, and How it Survives) and cut up the *Plant Puzzler Cards* (p. 7-9). Decide which sack the cards will go in.

This is a place where students will need to sort the data and make decisions about where to put it. Some pairs might put different cards in different places. For example, "furry leaves" is a physical characteristic, but it can also be a means of survival for some plants. Students will need to be able to explain their decisions if questioned.



2. Make sure the students understand all the words on the *Plant Puzzler Cards*. Tell them they will be looking at data about plants and then determining which plant might fit the characteristics.
3. One team member will take a card from each bag. The other student will write the words on different squares in the correct column of the *Plant Puzzlers Student Worksheet* (p. 7-10).
4. The next team member takes a turn. Continue until each member has filled in two rows across.

5. As a team, look at the rows of words. Through research, determine a plant that can fulfill all the descriptors. For example, if a row lists desert, attracts pollinators, and spiny skin, students might determine that the name of the plant is the prickly pear cactus. Have the team draw an illustration of their plants in the space on the chart and label, or draw larger illustrations on another paper.
6. As students research each group, they might discover one that isn't solvable (e.g., wetland, spiny skin, loses leaves, etc.). If this happens, they might want to pick another card from the appropriate bag.
7. Students will present their findings to the class. They should be prepared to explain how the plant is suited for the environment it lives in.

## ***Possible Extensions/Adaptations/Integration***

### **Art Target**

Arrange subjects in a piece of art so some of them touch or extend out of its edges.

### *Journal Activity*

The journal cover is made with leaf rubbings or leaf printing in two colors. Students will see that creating interesting combinations can require them to go off the page, or work “beyond the box.”

The *Plant Puzzler Journal* (p. 7-11) can be any size, but using half of a 9” x 12” sheet of art paper (4 1/2” x 12”) works well for the cover.

- Fold the paper like a “wallet” (1). The approximate size is 5” x 5” with a foldover piece of two inches.
- The inside pages can be made using one half of an 8 1/2” x 11” paper, folded (2).
- You will also need to cut graph paper to the size of the inside pages for your perimeter leaf drawings (3).
- Fold these in half and “tuck” into the book.
- Punch a hole with a hole punch on the fold close to the top and bottom of the pages (4).
- Insert the toothpick or skewer into the holes to create the book binding (5).
- Secure the foldover by cutting a small slit in the front cover and tucking the piece into the slit.

*Suggested activities for the journal contents:*

- Find some leaves with simple contour lines and trace them on the graph pages. Find the perimeter of the squares for simple leaves.
- Use the journal to record any data students collect about plants and their physical characteristics.
- Record and answer any questions students might have about the plants they investigate during the activity.

### ***Possible Extensions/Adaptations/Integration***

- *Create a New Plant* (p. 7-12).
- Use *Environmental Tree Page* (p. 7-14) to extend the activity further. Pick an environment. Choose an unusual or uncommon plant from Utah. In the branches provided, list physical characteristics of these organisms.

### ***Assessment Suggestions***

- *Plant Puzzlers Student Worksheet* with plants identified correctly is a good assessment tool.
- Using the *Create a New Plant Rubric* (p. 7-13) will help determine if students have grasped the intended learning outcomes for this lesson.
- The *Plant Puzzler Journal* can also be used if it includes entries where students have recorded information about the physical characteristics of plants.

### ***Additional Resources***

*Plants of the Rocky Mountains*, by Linda J. Kershaw;  
ISBN 1-55105-088-7

*Rocky Mountain Tree Finder*, by Tom Watts (1972, Nature Study Guild, Berkeley); ISBN 0912550058

*Rocky Mountain Plants and Animals Coloring Book*, by Dot Barlowe (Dover Publications); ISBN 0486430456

### ***Family Connections***

- List different environments (forests, wetlands, deserts) in three columns on a page. Keep a tally of plants your family sees over the weekend, either at home, on television, in books, newspapers, etc. Which is most common?

## Plant Puzzler Cards

Cut this page into squares along the lines. Put the squares into the correct bag.

<b>forest</b>	<b>desert</b>	<b>wetland</b>	<b>woody stems</b>
<b>spiny skin</b>	<b>lives near water</b>	<b>loses leaves in Autumn</b>	<b>waxy coating</b>
<b>furry leaves</b>	<b>light color</b>	<b>leaves go dormant</b>	<b>seeds float and flutter</b>
<b>two-sided needles</b>	<b>looks dead in dry spells</b>	<b>grows acorns which are food for rodents, birds, or deer</b>	<b>long slender green stalks with brown growth on top</b>
<b>yellow flowers</b>	<b>roots are shallow</b>	<b>broad leaves</b>	<b>tall stalks with triangular stems</b>
<b>attracts pollinators</b>	<b>desert</b>	<b>forest</b>	<b>wetland</b>

# Plant Puzzlers Student Worksheet

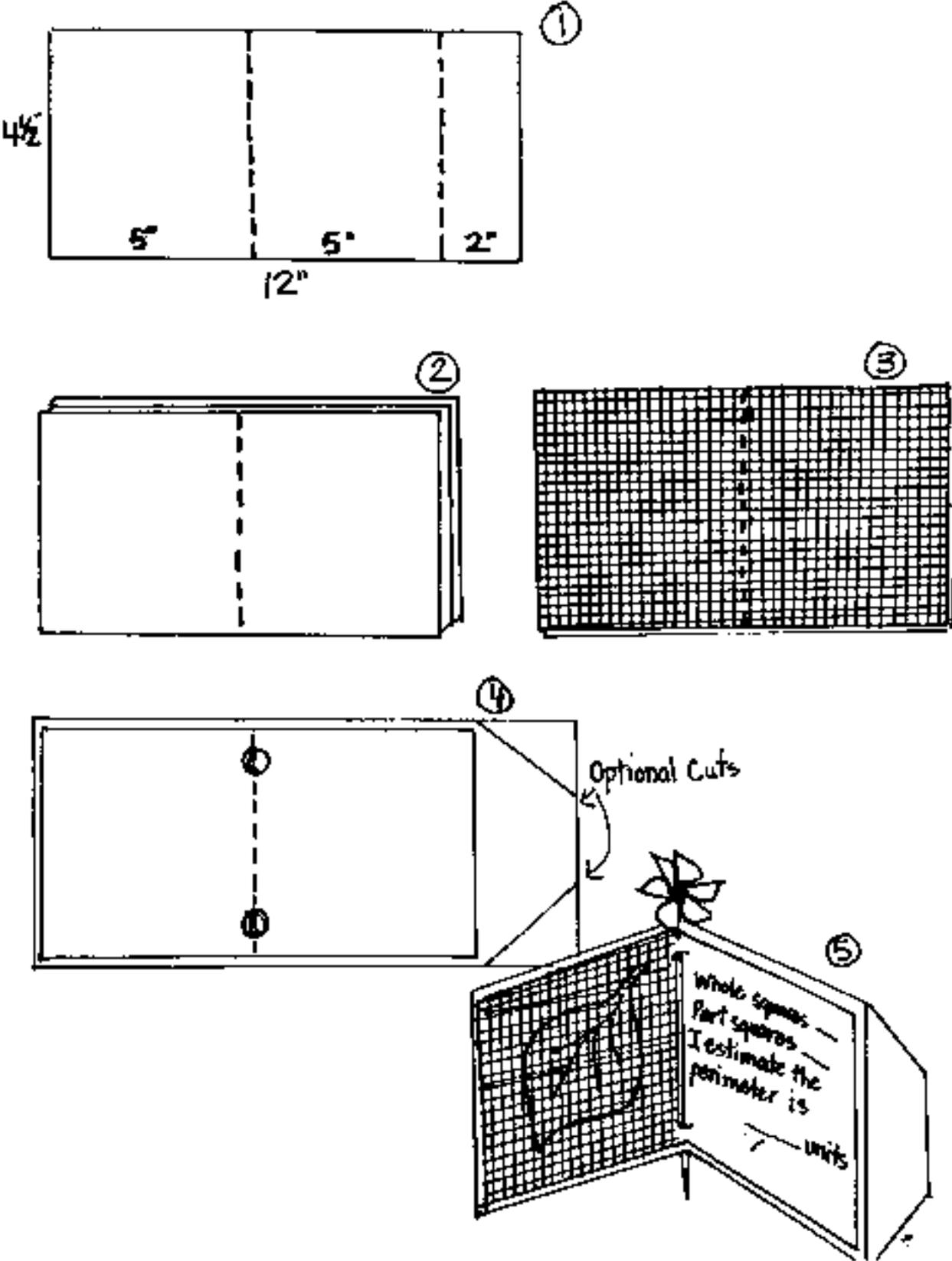
**Directions:**

One team member will take a square from each bag. The other will write the words on different squares in the correct column of this activity page. Take turns.

Continue until each member has filled in two rows across.

<b>Where it Lives</b>	<b>How it Looks</b>	<b>How it Survives</b>	<b>Name of Plant</b>

# Plant Puzzler Journal



# Create A New Plant

## Directions:

Pretend you are a scientist who has just discovered a completely new species of plant life in Utah. Using the description below, create this plant. Take the information you have put together and write a report to explain it to others.

## *New Plant Species Description*

On a recent expedition in \_\_\_\_\_ of Utah, I discovered a new species of plant that I call \_\_\_\_\_ . This plant appears to live in \_\_\_\_\_ . It resembles a/an \_\_\_\_\_, but also has \_\_\_\_\_ and \_\_\_\_\_.

There are many dangers that \_\_\_\_\_ must protect itself against in \_\_\_\_\_ . \_\_\_\_\_ threatens it the most, but this plant has adapted by \_\_\_\_\_ . In addition, it has the ability to \_\_\_\_\_ when \_\_\_\_\_ . During certain times of the (year/month/day) I observed \_\_\_\_\_ which caused the \_\_\_\_\_ to \_\_\_\_\_.

After studying this new organism for some time, I discovered some unique behavior patterns. The \_\_\_\_\_ lives (in groups of \_\_\_\_\_ or alone.) The main source of food for this plant is \_\_\_\_\_ which it gets through/by \_\_\_\_\_.

(Add any other interesting facts on the back of this sheet.)

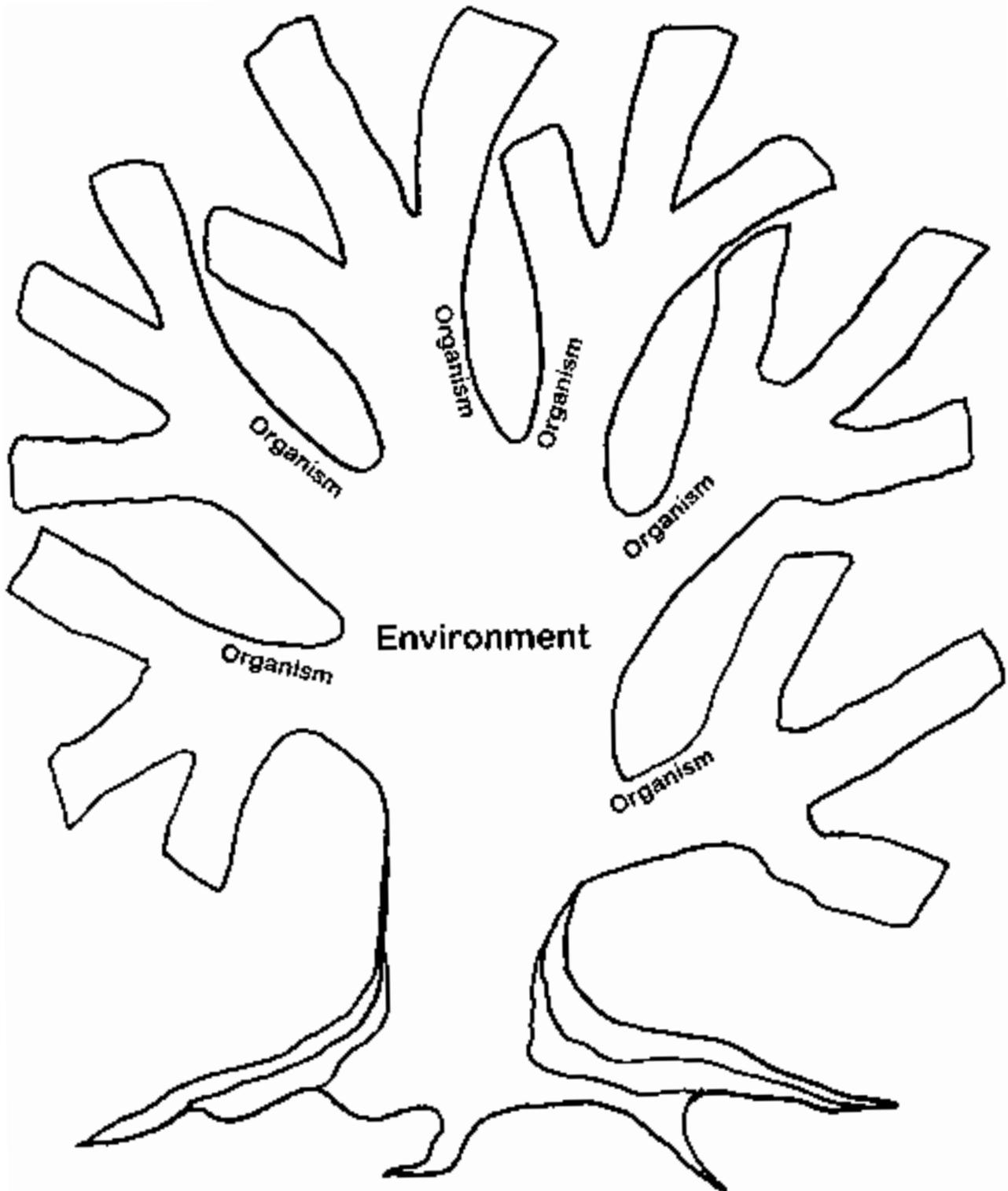
Name \_\_\_\_\_

## ***Creative Plant Rubric***

	<ul style="list-style-type: none"> <li>• The written profile follows the structure given: name as title, describes habitat, identifies conditions, explains three adaptations, closes with an interesting fact.</li> <li>• The plant models or shows the information in the written profile.</li> <li>• The project is neat, well organized and completed on time</li> </ul>
	<ul style="list-style-type: none"> <li>• Written profile is complete but sections are out of order.</li> <li>• Plant may or may not be accurate to the written description.</li> <li>• Project is clearly organized, but could improve on neatness or was late</li> </ul>
	<ul style="list-style-type: none"> <li>• Written profile is out of order or is missing one or two sections.</li> <li>• Plant does not match its written profile.</li> <li>• Project lacks organization and neatness.</li> </ul>
	<ul style="list-style-type: none"> <li>• Written profile does not describe plant’s adaptation to its habitat.</li> <li>• Plant does not match its written profile.</li> <li>• Project appears rushed and messy.</li> </ul>

**Comments:**

# Environment Tree Page



Pick an environment. Choose common plants and animals (organisms) that live there. In the branches of the tree list three physical characteristics of these organisms.

# Mapping It Out

<p><b>Science Standard V:</b> Students will understand the physical characteristics of Utah’s wetlands, forests, and deserts and identify common organisms for each environment.</p>
<p><b>Objective 2:</b> Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.</p>
<p><b>Intended Learning Outcomes:</b></p> <ol style="list-style-type: none"> <li>1. Use Science Process and Thinking Skills</li> <li>2. Manifest Scientific Attitudes and Interests</li> </ol>
<p><b>Content Connections:</b> Math III-2, IV-2; Social Studies VI-1</p>

Science  
Standard  
V

Objective  
2

Connections

## Background Information

Fourth grade students not only need to learn about Utah’s environments, temperature, elevation and rainfall, they also need to create relationships between these concepts. This activity requires students to use map reading skills and to make connections between elevation, climate, and temperature. They will then communicate this information to classmates. Not only will students be discussing science concepts, but also math skills of reading temperature and rainfall figures that are applied in practical ways.

This activity uses the jigsaw model. Each group or team will take a set of questions, become the expert in that area, and then present their findings to the rest of the class. In this manner, all students learn information, but each group has different questions to answer. The maps used for the activity contain the following information:

Map A: Temperature

Map B: Elevation

Map C: Rainfall (Precipitation)

Map D: Environment

Many questions can be discussed with students. Consider how different factors might affect the development of different environments (e.g., more rainfall supports more plant and animal life). Would climate also affect where particular animals and plants can live? (Yes, animals depend on food sources that are specific to certain climate conditions.) Students should begin to see relationships between temperature, rainfall, environments, and elevations. They will also see trends that develop because most of Utah is a high basin desert, which creates conditions for specific trends in these areas.

## **Invitation to Learn**

Ask students to solve the following riddle:

I can be as long as 450 miles or fit in the palm of your hand.

I can be blue, green, white, or sometimes bright pink.

I can be detailed and fascinating to some, or very boring to others.

I can be confusing or keep someone from getting lost.

What am I?

A map of Utah!

## **Instructional Procedures**

### **Materials**

For each group:

- Utah Maps* pages
- Utah Question Cards*
- Overhead transparencies of the maps of Utah

1. Review the maps of Utah (p. 7-21). Tell students this activity will help them practice applying some of the information they have learned about Utah, and make decisions from reading a variety of Utah maps. *Utah Question Cards* (p. 7-19) should already be cut.
2. Organize groups of three to four students. Have each group select one of the *Utah Question Cards*. Tell students they are going to use the jigsaw model and study the relationships between climate, elevation, temperature, and environments. Each group will study their questions and determine answers from the information found on the maps of Utah.
3. Have each group study and organize their information to present to the whole class.
4. After each group has had an opportunity to investigate, take turns sharing their discoveries with the class. Allow groups to present their findings. (You may find it useful to have overhead copies of the larger maps available for students to use.)
5. Have students write a paragraph about the four maps in their science journals. Use questions such as the following for structure:
  - What is the relationship between elevation and temperature in Utah?
  - What is the relationship between rainfall and environments in Utah?
  - Do these characteristics affect the plants and animals in the environments?
  - Write two conclusions you can draw from your investigation.

## ***Possible Extensions/Adaptations/Integration***

A social studies connection to this activity is one that helps students practice using grids on maps. It also ties into Mathematics Standard III, Objective 2: Specify locations and describe spatial relationships using grids and maps.

After a discussion of how a grid can help you find places on a map, or if you are learning about grids during math, transfer the skill to the Utah map. Show students a grid on an overhead, and then place the grid over the Utah map (also on an overhead). Have students practice identifying and pointing to grid locations. They can also locate the grid square of specific Utah locations and tell what part of the state it is located in. Practice with cities, as well as counties or landforms. They should state the specific locations and then tell the compass rose directions.

Place the grid over one of the maps from the preceding activity. Ask:

- Which grid squares contain wetlands? Forests?
- Which grid squares are only desert?
- What is the average temperature in C5? D1?
- What is the typical rainfall in A3?

## ***Assessment Suggestions***

- Participation in the map discussion is a good assessment.
- Students should answer the questions on the *Utah Question Cards* correctly and respond appropriately in their science journals.

## ***Additional Resources***

### **Book**

*Atlas of Utah*, editor, Wayne L. Wahlquist, (Weber State College, BYU Press); ISBN 0-852-1831-1.

This is an older book found in the reference sections of libraries, but it has excellent maps with a variety of Utah information.

### **Web sites**

*Map activities about Salt Lake City*,

<http://www.usgs.gov/education/index.html>

Utah Climate Center, <http://climate.usu.edu/>

Western Regional Climate Center, <http://www.wrcc.dri.edu/>

National Geographic Web site for kids has lots of great map activities.

## ***Family Connections***

- The next time your family takes a trip anywhere in the state, practice using a map to plan out the trip. Perhaps the student can be the co-pilot for the family driver and use skills learned in school to help with travel.
- Notice maps used in a variety of places in the coming months. Newspapers, weather people on television, bus routes, and the Trax route all have maps.
- Create a treasure map for family members to follow to locate a special place or treat.

# Utah Question Cards

## **1. Study maps A, B, and D.**

- **What is the relationship between elevation and temperature in Utah?**
- **Do you think this relationship occurs in all environments?**
- **What connections can you make?**

## **2. Study maps B and C.**

- **What is the relationship between elevation and rainfall in Utah?**
- **What makes you say this?**
- **Give a specific example of the relationship.**

## **3. Study maps A and C.**

- **What is the relationship between temperature and rainfall?**
- **What might cause this relationship?**
- **What connections can you make between the two kinds of maps?**

#### **4. Study maps C and B.**

- **Find regions with most rainfall?**
- **Are these areas at high, medium or low elevation?**
- **Name animals that need plenty of rainfall.**
- **Name plants that can survive without lots of rain.**

#### **5. Study maps C and D.**

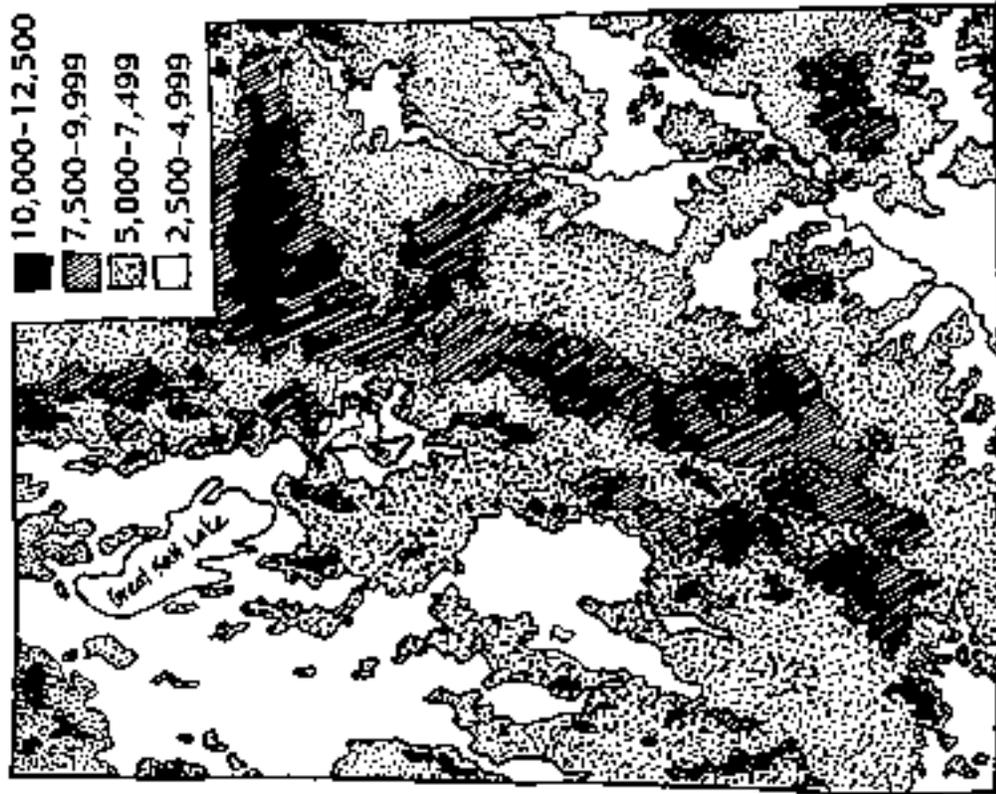
- **Find the region with the least rainfall. Is the temperature higher/lower than other regions?**
- **What are some animals that can survive in an area that receives little rainfall?**
- **How do they adapt to these conditions?**

#### **6. Study maps B and D.**

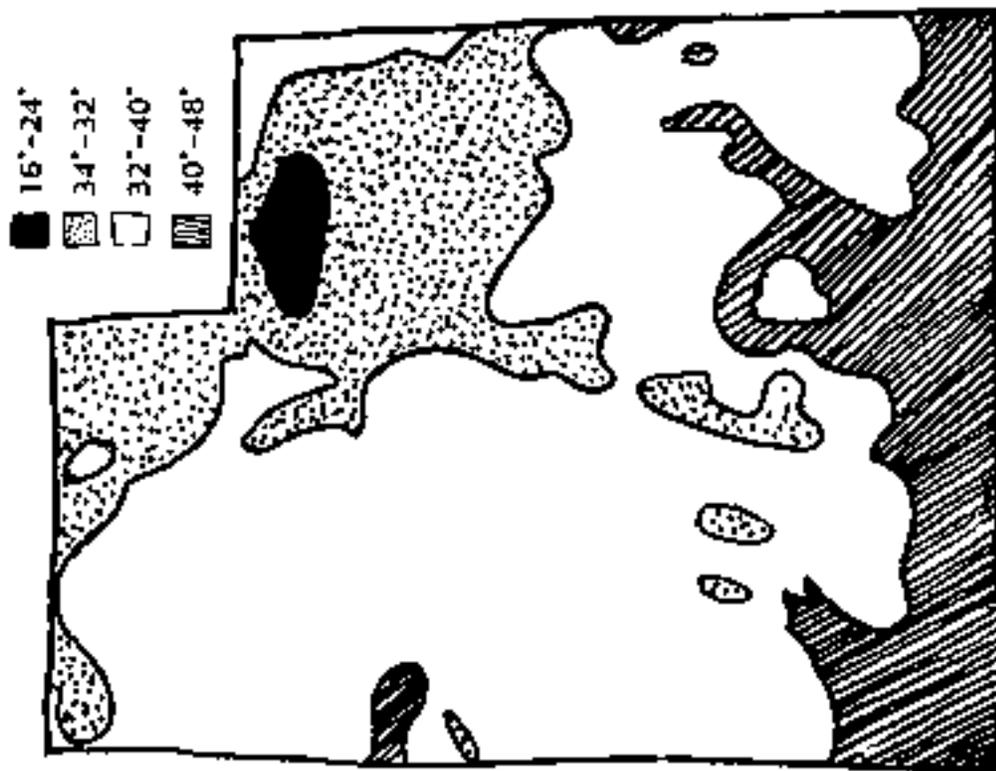
- **What kinds of plants and animals would live in the region with high elevation? What about lowest?**
- **What elevations are wetland environments located in?**
- **Can you name the environment that is most common in Utah? What would the fractional part be?**

# Utah Maps

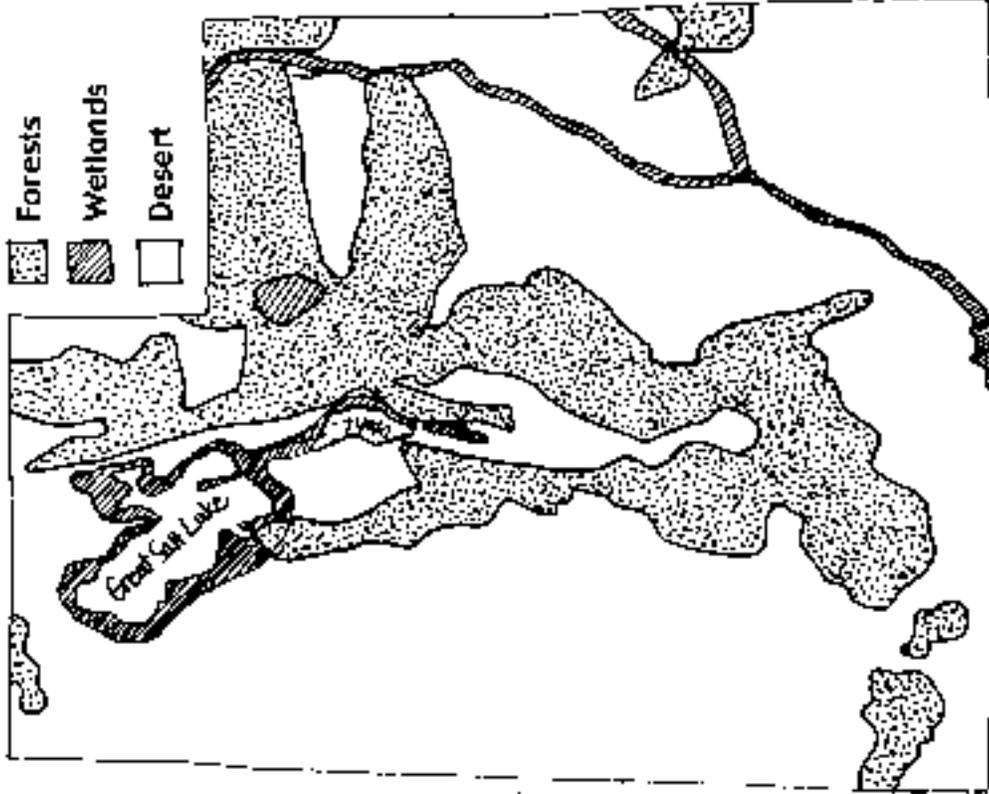
**B. Elevation**



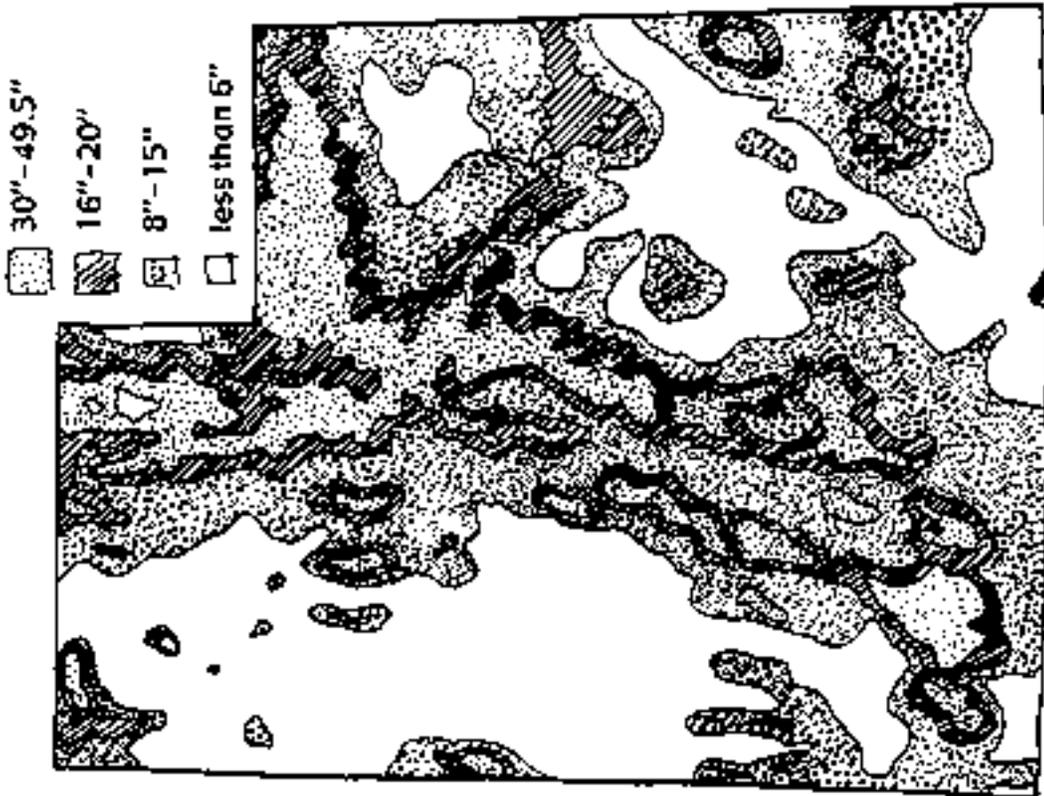
**A. Temperature (January)**



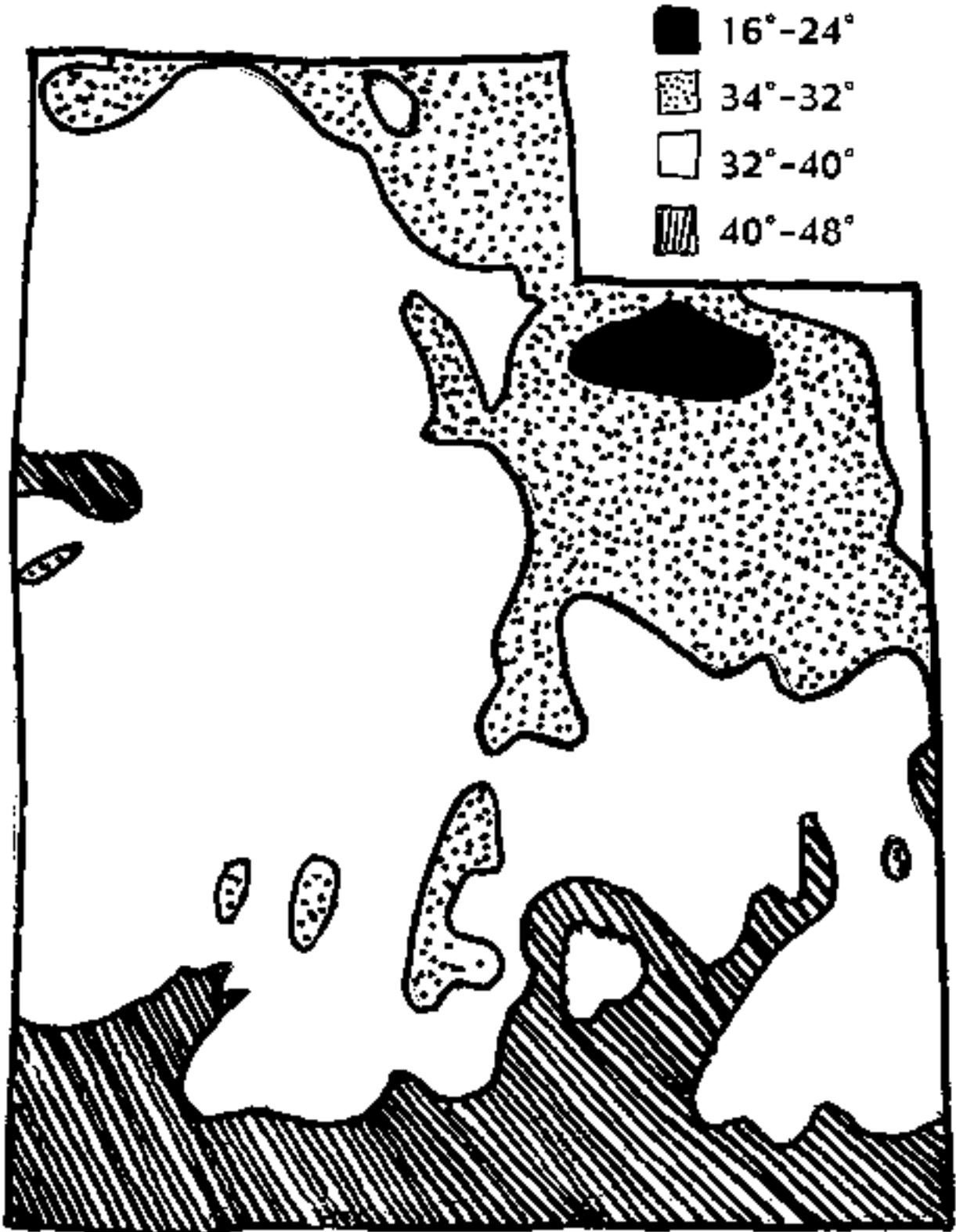
### D. Utah Environments



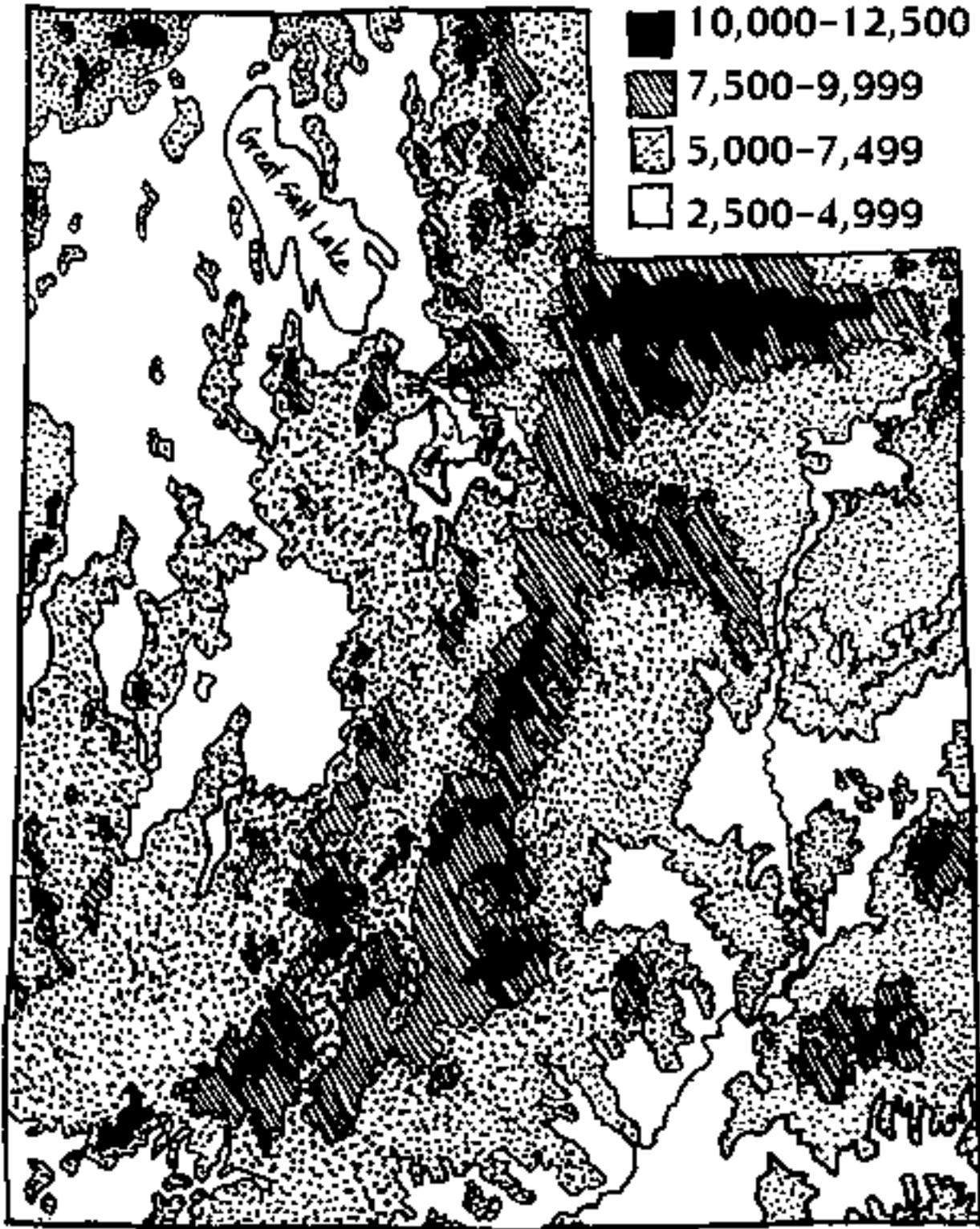
### C. Annual Normal Precipitation



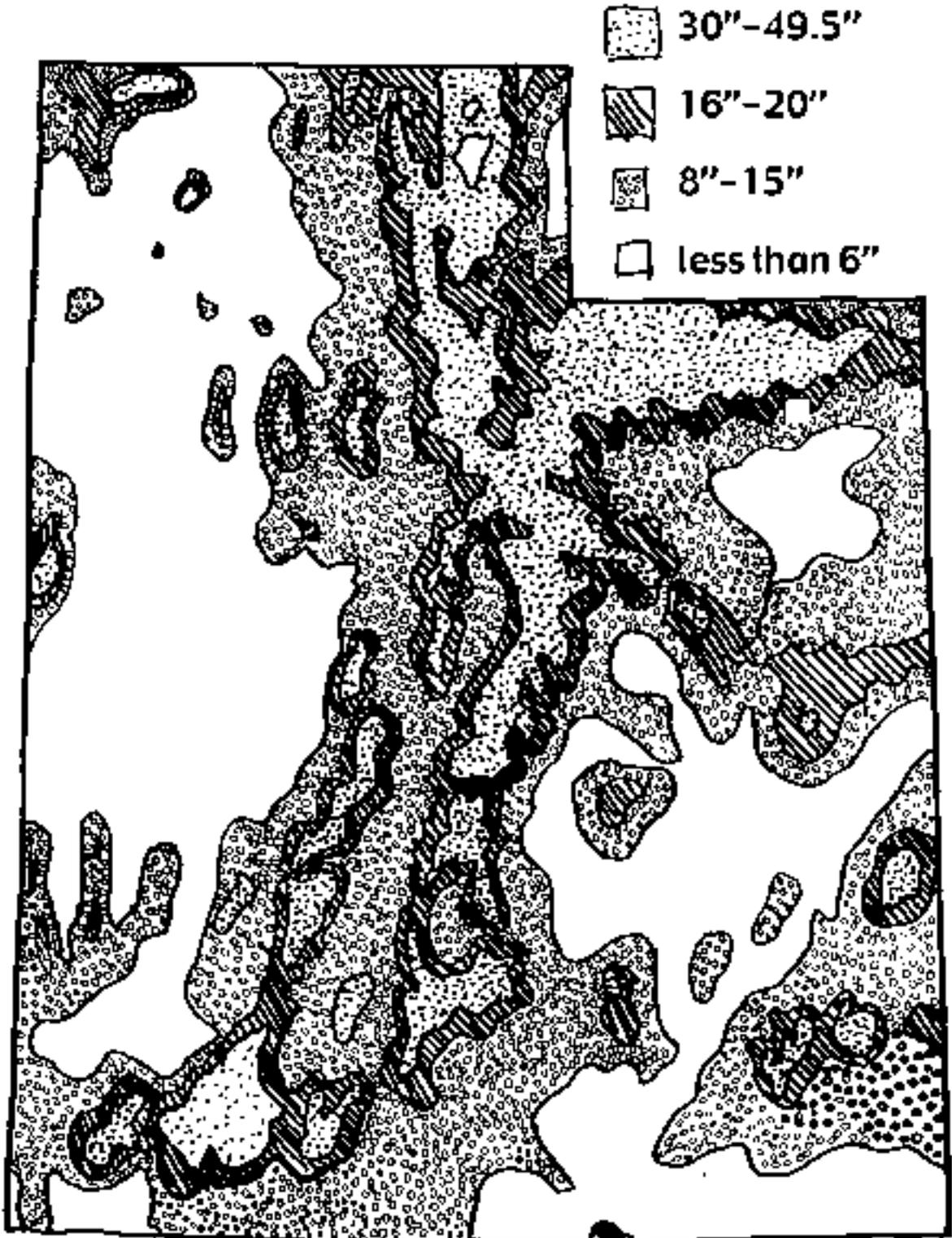
## Temperature (January)



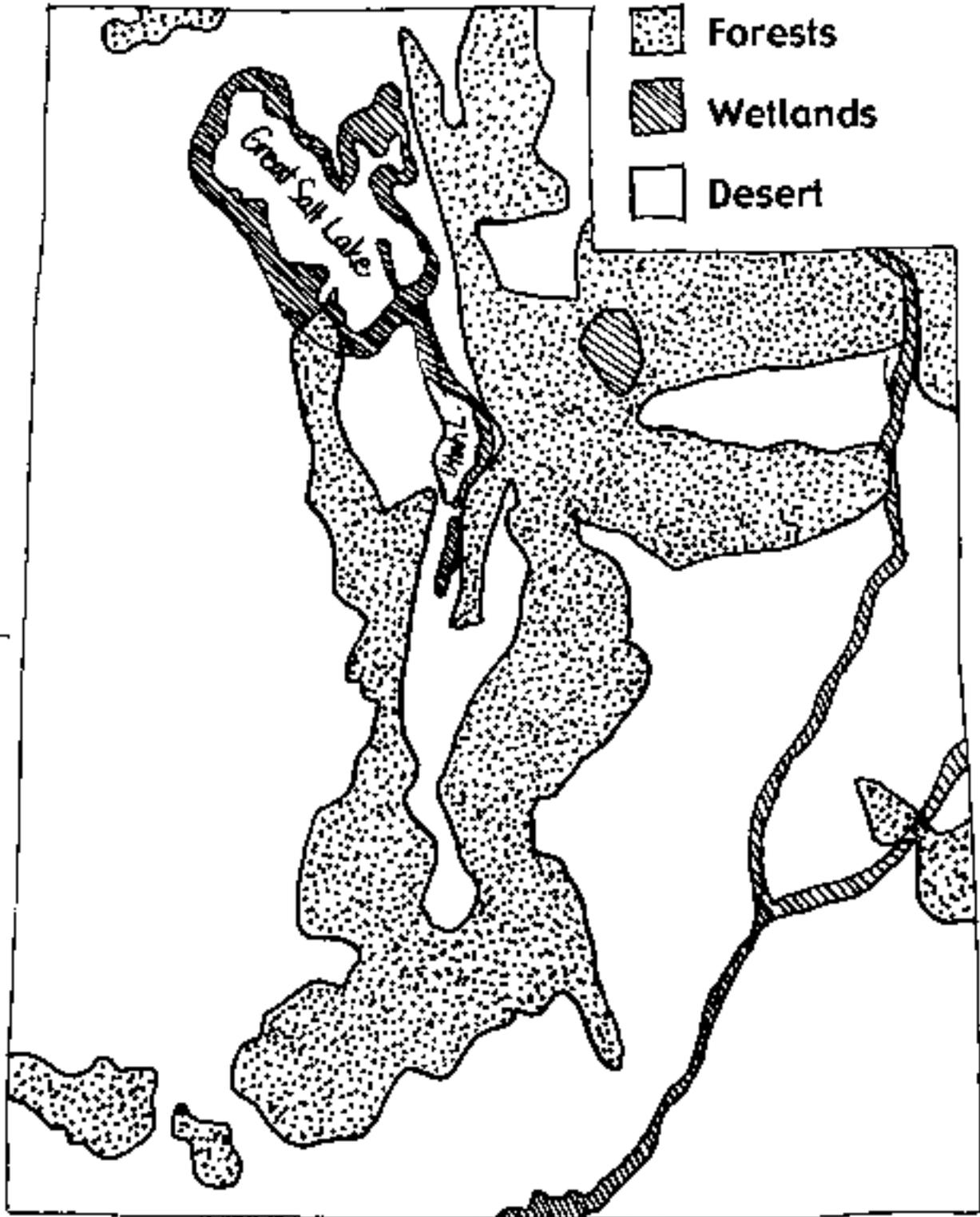
# Elevation



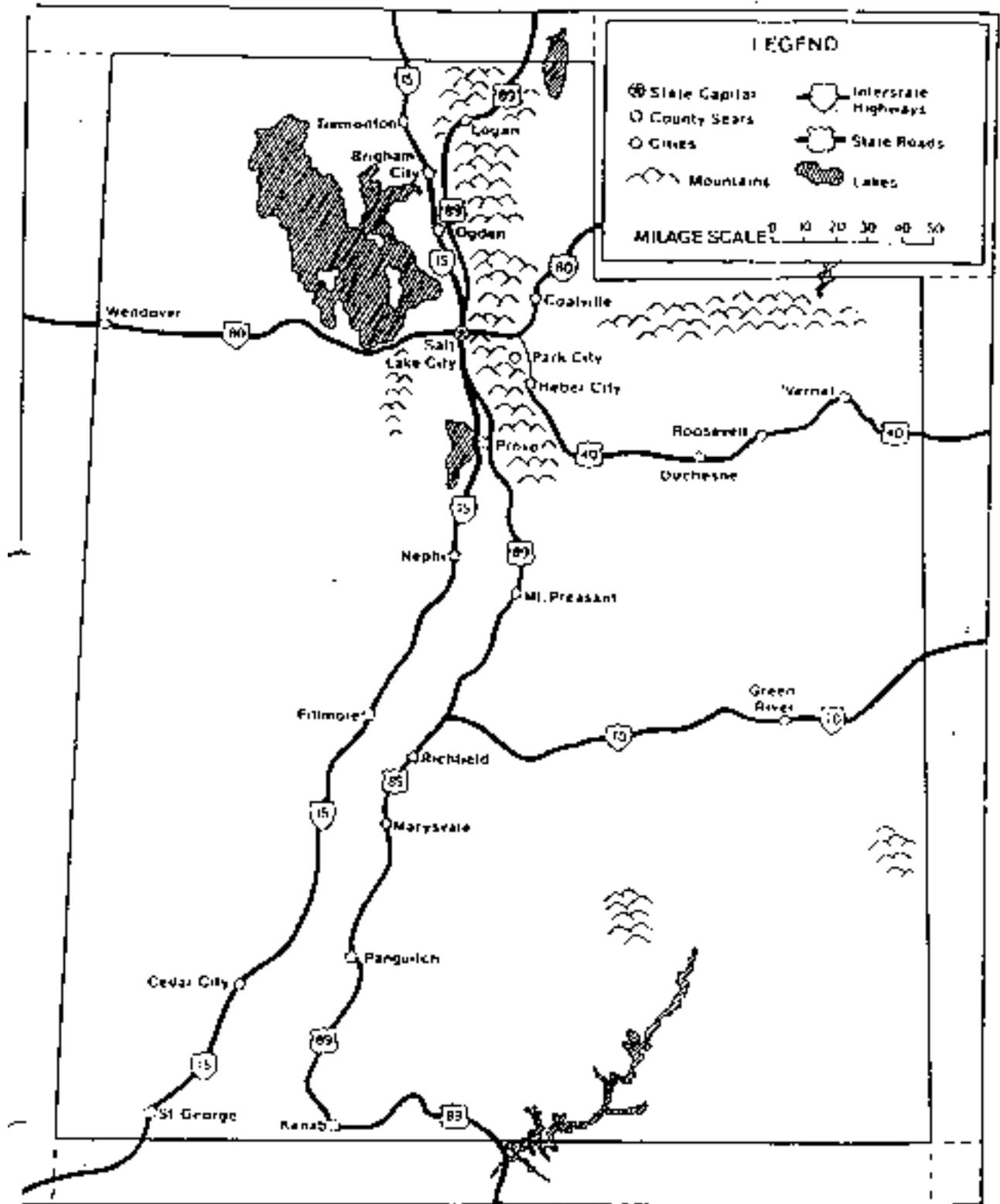
## Annual Normal Precipitation



# Utah Environments



### MAP OF UTAH WITH LEGEND



Name \_\_\_\_\_

# Overlay Grid for Utah

<b>8</b>							
<b>7</b>							
<b>6</b>							
<b>5</b>							
<b>4</b>							
<b>3</b>							
<b>2</b>							
<b>1</b>							
	<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>	<b>E</b>	<b>F</b>	

# I Spy Environments

**Science Standard V:**

Students will understand the physical characteristics of Utah’s wetlands, forests, and deserts and identify common organisms for each environment.

**Objective 1:**

Describe the physical characteristics of Utah’s wetlands, forests, and deserts.

**Intended Learning Outcomes:**

1. Use Science Process and Thinking Skills
4. Communicate Effectively Using Science Language and Reasoning

**Content Connections:**

Math III; Social Studies VI-1

Science  
Standard  
V

Objective  
1

Connections

## Background Information

This activity is an opportunity for students to use their knowledge of environments in an activity that will also allow them to explore fine art paintings from the Springville Art Museum. In small groups, students will investigate a variety of paintings of places in Utah in different seasons and different environments using different mediums. They will then decide on physical characteristics of these using a graphic organizer.

You will need photos of the postcards that contain paintings of landscapes from the museum. These can be easily downloaded from the museum’s Web site. Directions for *Creating Your Own Postcards* are included on p. 7-35. You can also obtain sets of postcards from the museum and use only the ones containing landscapes. Many of the pictures are also available from your school library in the Utah art prints.

## Invitation to Learn

Several days ahead of time, hang a variety of the Springville Art Museum art posters around the classroom. Use posters that show landscapes, specifically of deserts, wetlands, or forests from Utah. As you begin this lesson, mentally choose one of the landscapes. Then play a game of 20 questions where students may only ask questions with yes/no answers. For example, you might choose the painting, *Moonrise in the Canyon Moab*, by Birger Sandzen. Students might ask, “Does the painting have lots of trees? (No) “Are there mountains in the painting?” (Yes) When the teacher’s painting has been guessed, let a few students try it. Then respond, “Some of the observations that identify physical characteristics of environments are the same things that were in the questions you asked. You have good eyes!”

## Instructional Procedures

### Materials

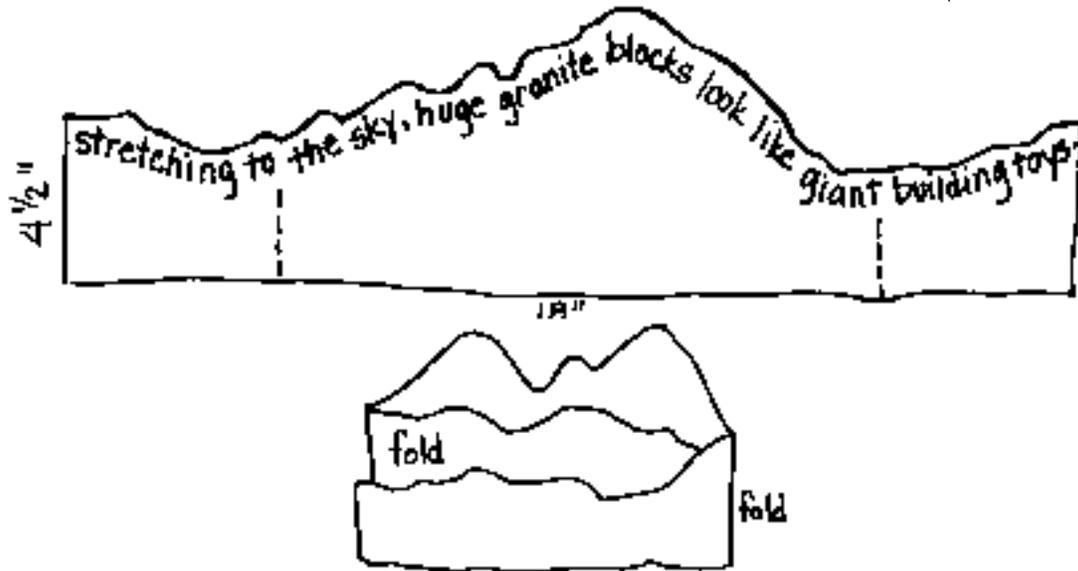
- Four to six postcards for each group of four to six students (see *Additional Resources*)
- Utah Art Graphic Organizer*
- Suggestions for Adjectives List*
- Art posters from Springville Art Museum
- Brown construction paper
- Chalk (optional)
- Literature books to model information about environments written in poetic language

1. Distribute postcards to the groups and have the students talk with each other about the artwork. Post a list of suggested questions that they can discuss among the group.
  - What environment, or environments, do you see?
  - What time of year is it?
  - What might the temperature be?
  - Is there any evidence of precipitation?
  - Do any of the paintings have common characteristics?
  - What clues (inferences) were used to decide any information?
  - Can you see any geometric shapes in the paintings? Name them.
2. As a class, share discoveries about the paintings. If you are able to display the reprint posters from the Springville Art Museum, use these to help students discover additional information located on the back (e.g., artist name, location, media used, etc.).
3. Have students take one specific painting and fill out the *Utah Art Graphic Organizer* (p. 7-34) to record information that will help classify the painting for a specific environment. The graphic organizer asks students to identify shapes, common lines, and colors in their paintings. This will use some of their math skills to find parallel and perpendicular lines, as well as geometric shapes. Have them list the common colors they see in the paintings.  
(The next steps can be another lesson or a continuation for this one.)
4. If you live in an area where there are mountains, forests, or deserts, take the class outside and have them look around and quickly sketch what they see. Observe the colors and common lines and shapes. If there are mountains, be sure they observe the line where Earth meets the sky.
5. Brainstorm a list of adjectives students would use to describe what they see and tell someone else how the painting, or the outside observations, made them feel. Use the list of *Suggestions for Adjectives List* (p. 7-36) as a resource for the mountain writing activity.
6. Create a *Mountain Journal* (p. 7-31).

## Possible Extensions/Adaptations/Integration

### Language Arts

#### Mountain Journals



Students need a piece of paper that is long and skinny—the size can vary. It can be as simple as brown construction paper cut to 4 1/2" x 18".

1. Fold the paper into thirds so the ends of the sheet overlap each other. (Each student can decide how much of an overlap s/he wants to have.) Unfold back to a long skinny line.
2. Sketch ideas for a mountain silhouette on scratch paper. This is the line where land meets sky. Choose one for the journal.
3. Lightly draw the silhouette of mountains on the top of the paper. Remind students that they can always cut more off if they need to, but they can't put paper back on. This can also be done as a "torn" paper activity, giving a nice texture to the top of the book.
4. After cutting out the silhouette, students can check the shapes and make any adjustments needed.
5. An option that adds a nice touch to the book is to use chalk to add highlights or details to the mountains.
6. The book can either be a science journal with data collected about physical characteristics of mountains or a poem that describes these characteristics.
7. If descriptive or narrative poetry is done, encourage students to use the *Suggestions for Adjectives List* to enhance their writing.

### **Art Connections**

If possible, allow students to choose the medium they want to use. If necessary, review some of the art principles about space such as:

- Objects get smaller as they recede into the distance.
  - Objects are higher in a picture as they get further away.
  - Objects lose detail as they get farther away.
  - Objects get bluer or grayer as they get farther away.
  - Objects in front overlap objects that are behind them.
1. Have students create a landscape that shows an environment from Utah and try to use some of the physical characteristics they have identified.
  2. Display and discuss the paintings while evaluating not only art targets for fourth grade but the science concepts studied.

### ***Possible Extensions/Adaptations/Integration***

- Place an overhead on top of the pictures and outline the geometric shapes in the paintings. Any parallel or intersecting lines? Any quadrilaterals? Cylinders? Rectangular prisms? What about angles? What about flips or slides?
- Find the painting locations on a map of Utah. Do the locations validate their inferences?
- Trip to the Springville Art Museum, or another exhibit near your school that will help students practice learned skills.
- Springville Art Museum visit to school.
- Create another folded book with a shape that represents another environment.

## **Assessment Suggestions**

- Share the mountain books with another class.
- Conduct “tours” of the art posters for younger students to explain the physical characteristics of the painting they study. Then share the mountain books in small readers’ circles. Observe students dialogue to assess comprehension and application of information.
- If students create their own landscape paintings, do the activity above with their original art. Have students evaluate their landscapes and find ways in which they are similar to the artists’ paintings. Do they use color blends, lightening and darkening colors, shades and tones?

## **Additional Resources**

Springville Art Museum will visit schools throughout the state and conduct day-long art presentations for the whole school, as well as provide teachers with sets of artist postcards for classroom use. Contact names: Amanda and Jessica 1-801-489-2727.

### **Books**

Examples of environmental pictures and models for narrative language:

*Mountain Dance*, by Thomas Locker; ISBN 0-15-202622-3

“Mountains rise through the clouds in a slow dance that goes on and on...”

*Mountain Alphabet*, by Andrew Kiss; ISBN 0-88776-384- “Avalanche slopes are aglow with aspen in autumn.”

*Earthshake: Poems from the Ground Up*, by Lisa Westberg Peters; ISBN 0-06-029265-2 “Melt a chunk of continent...”

## **Family Connections**

- During a week (include a weekend) have students, along with family members, keep a tally of how many different environments the family observes. Discuss together the physical characteristics, or clues, they observed and used to classify them.

# Utah Art Graphic Organizer

**Name of Painting**  
\_\_\_\_\_

**Artist**  
\_\_\_\_\_

**we think...**

<b>Rainfall</b> _____ _____	<b>Temperature</b> _____ _____
<b>Clues</b> _____ _____	<b>Clues</b> _____ _____

**Elevation Observations**  
\_\_\_\_\_

<b>LANDFORMS</b>	<b>PLANTS</b>	<b>ANIMALS</b>
<b>Name</b> _____	<b>Name</b> _____	<b>Name</b> _____
<b>Shapes, colors, Common lines</b> _____ _____	<b>Shapes, colors, Common lines</b> _____ _____	<b>Shapes, colors, Common lines</b> _____ _____
_____ _____	_____ _____	_____ _____
_____ _____	_____ _____	_____ _____

Name \_\_\_\_\_

## Creating Your Own Postcards

You may want to supplement the Postcard Set with additional images. You can purchase images at museums or from catalogues, or cut out pictures of posters from art poster catalogs and paste them on cardstock. However, one of the best ways to get these images is to download and print them from the Internet. The postcard activities include suggestions to help you choose supplemental images. Art history textbooks may be helpful. They can give you ideas of artists or styles that relate to your lesson materials.

To create postcards from images you have found on the Internet, open a word processing program like Word Perfect or Microsoft Word. Next, open Netscape or Internet Explorer and use a search engine to find an image you want to use as a postcard. Another way to search is to go to art sites, such as [artcyclopedia.com](http://artcyclopedia.com) and the Springville Museum's web site [www.sma.nebo.edu](http://www.sma.nebo.edu), and search their databases.

Once you have found a desired image, move your cursor to anywhere on the image. This will select the image. If you are using an IBM type computer, then click and hold the right mouse button until a pop-up menu is displayed. Move the cursor to select the menu choice "save image as." A new menu will appear that will allow you to name and save the file in any directory you choose on your hard drive or floppy disk. Now go back to your word processor and select "insert" from the menu bar, and a new pop-up menu will appear. From the insert pop-up menu, select "graphics," and then a new pop-up menu will appear. Choose the option "from file." This will allow you to insert the image you saved as a file from Netscape or Microsoft Internet Explorer.

Once the image is inserted in your document, you may increase the size of the image by moving your cursor over one of the dots at the corners until a double arrow appears at the corner. Now, hold and click on the left mouse button and at the same time, hold the control key down. This will allow you to increase or decrease the size of the image without distorting the proportions. A good size for a postcard is four by six inches.

Next, space down the page two or three lines and type the information for the label. The label should contain the following information:

- The name of the artist, the year the artist was born, and the year the artist died.
- The title of the artwork and the year the artwork was created.
- The size and media of the artwork.
- Who owns the artwork.

Include a short biographical sketch and some background information about the artwork if desired.

If possible, print this document using a color printer. Cut and crop both the image and text to fit the 4" x 6" format. Glue the paper with the label and additional information on the back of the image, using a small amount of glue from a glue stick. Now run both through a laminator, if possible, and trim the edges. It is most economical to run several postcards at a time through the laminator.

## ***Suggestions for Adjectives List***

(The best list is always student generated!)

big	huge	large
beautiful	nice	tall
wide	chunky	rambling
giant	towering	rocky
crumbled	sloping	grey
blue	white	green
dirty	wonderful	dangerous
treacherous	majestic	wasatch
purple	snowy	rugged
mysterious	volcanic	vertical
spacious	ancient	fierce
elevated	time-worn	misty
imposing	craggy	dangerous
venerable	stunning	

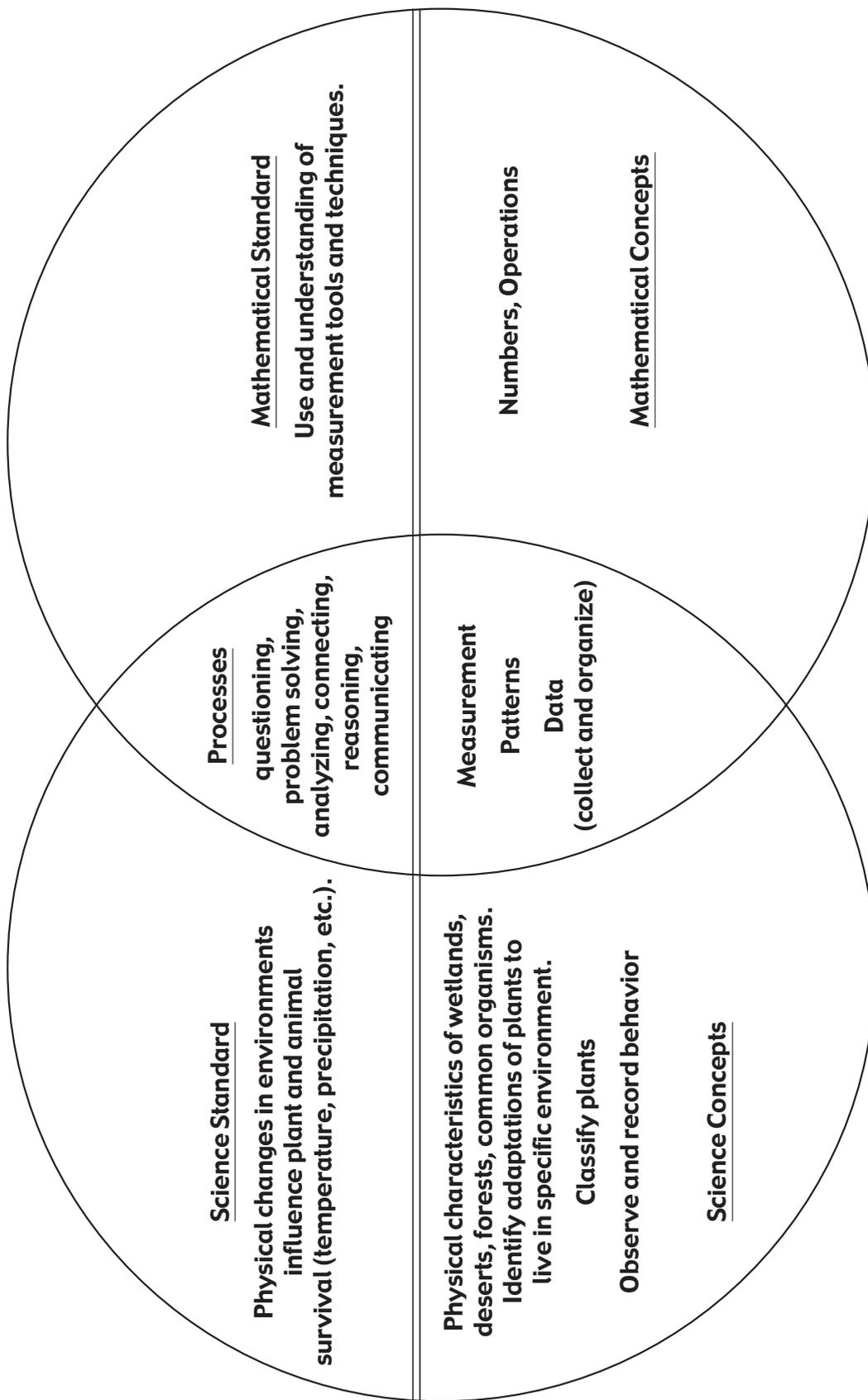
Sometimes student will begin to list nouns instead of adjectives. Create a new list of these words for reference in the writing. (Just make sure they know these are nouns!)

cliffs	hiking	gullies
wildflowers	animals	range
faults	folds	mudslides
rivers	altitude	

# Theme: Utah Natural History

## Science Literacy: Cycles

“Obtain knowledge based on observable evidence.”





***Math***  
***Standard III***  
***Activities***



# Mosaics

**Math Standard III:**

Students will use spatial reasoning to recognize, describe, and identify geometric shapes.

**Objective 1:**

Describe, identify, and analyze characteristics and properties of 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 Standard III

### Objective 1

#### Connections

## Background Information

“The most important connections for early mathematics development is between the intuitive, informal mathematics that students have learned through their own experiences and the mathematics they are learning in school. All other connections...are supported by the link between the students’ informal experiences and more formal mathematics.”

(*Principals and Standards for School Mathematics*, NCTM, p. 132).

The following activity is taken from *Developing Geometric Thinking Through Activities That Begin with Play*, by Pierre M. van Hiele, *Teaching Children Mathematics*, NCTM, February, 1999, pp. 310-316.

This activity can enrich the students’ store of visual structures. It will help develop a knowledge of shapes and their properties. Throughout this activity the teacher directs students’ attention to geometric shapes and terminology, and engages students in problem solving discussions using these terms. Remember, geometry begins with play.

## Invitation to Learn

Provide each student with a *Seven Piece Mosaic Puzzle* (p. 8-6). Begin by asking, “What can we do with these pieces?” As students begin to explore, have them share and talk about what they have built. They may use all the pieces or only a few. “*Children need ample time to explore and share their creations. Such play gives teachers a chance to observe how children use the pieces and to assess informally how they think and talk about pieces.*” (Van Hiele, p. 312)

## Instructional Procedures

### Materials

For each student:

- Seven Piece Mosaic Puzzle* for each student
- Parallelogram*
- Envelopes
- Paper

1. Ask students to sort geometric shapes from the *Seven Piece Mosaic Puzzle* (p. 8-6) and discuss how they sorted them.
2. Have them explore all the possible ways to make the *Parallelogram* (p. 8-6).

The students may slide, flip, turn (rotate) their pieces.

What two-piece combinations are possible?

Ask the students which pieces were not used?

3. Have students choose any two pieces, set the others to one side, and see how many different shapes can be made by joining them at the sides that match. Try pieces five and six.
4. Ask what pieces can be made from two others? Which ones cannot?  
*Challenge:* Find the one piece that can be made from three others. Solutions can be recorded by tracing around the larger pieces and then draw how the larger shape was made with the other pieces.
5. Can students make the *Parallelogram* with three pieces?
6. Have students make a short house and trace around it. Can they make the shape with two other pieces? Three pieces? Four pieces? Can they create a tall house with two pieces? Three pieces? (Remember: Touching edges have to be the same length.)
7. Each student creates his/her own puzzle using two, three, or four pieces; trace around the shape. Can students make this shape with other pieces? Write his/her name and a title for the shape.

## Assessment

- Observe students as they create their puzzles. What strategies do they use?
- Provide opportunities for students to share their strategies for solving puzzles.
- Have students record their findings in a journal.
- After students trace the shape they made, have them go back and draw the two or three shapes they used to make the shape.

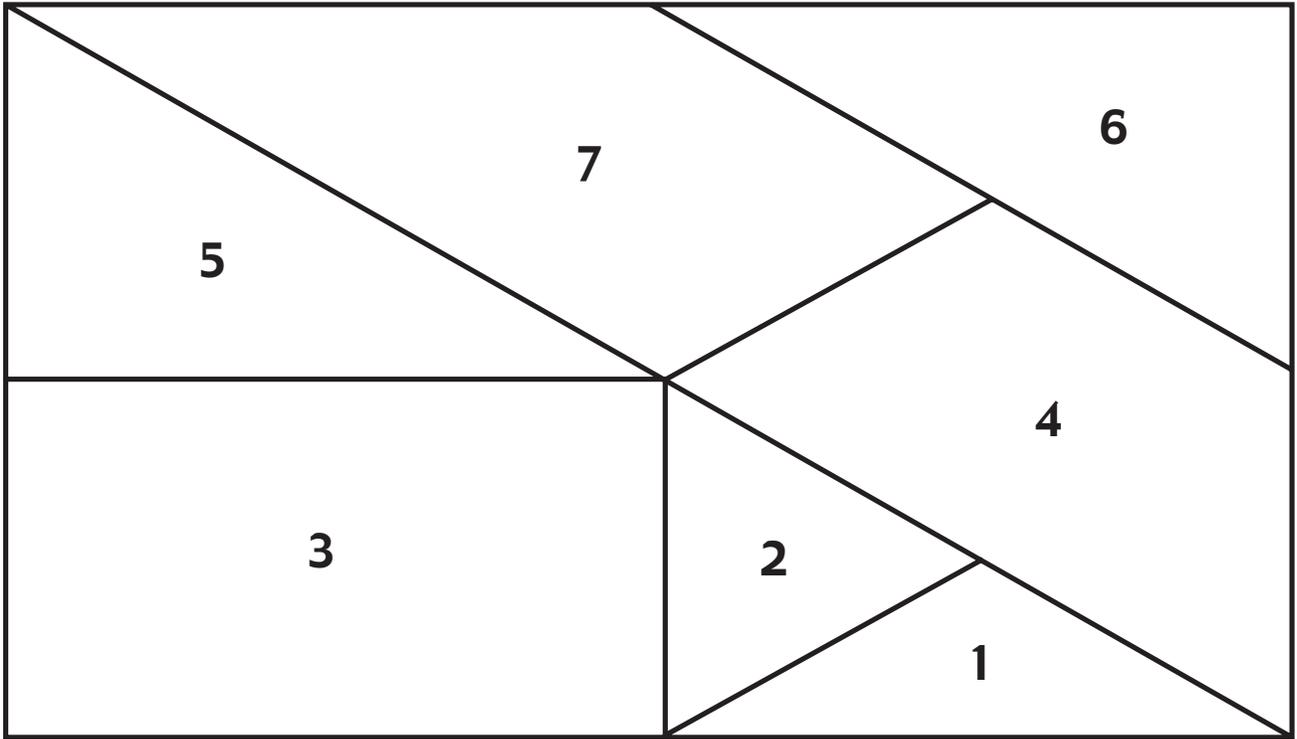
## ***Additional Resources***

*Developing Geometric Thinking Through Activities That Begin with Play*, by Piere M. van Hiele, *Teaching Children Mathematics*, NCTM, February, 1999, pp. 310-316.

## ***Family Connections***

- Have family members try to cover the parallelogram, houses, and new puzzle pieces created by the student with the geometric shapes from the *Seven Piece Mosaic Puzzle* used in class. They may also create new shapes for the student to try to cover in a variety of ways.

### Seven Piece Mosaic Puzzle



### Parallelogram



# Quadrilaterals

**Math Standard III:**

Students will use spatial reasoning to recognize, describe, and identify geometric shapes.

**Objective 1:**

Describe, identify, and analyze characteristics and properties of geometric shapes.

**Intended Learning Outcomes:**

1. Demonstrate a positive learning attitude toward mathematics.
3. Reason mathematically.
4. Communicate mathematically.
5. Make mathematical connections.

## Math Standard III

### Objective 1

#### Connections

## Background Information

A common activity involving geometry is for students to recognize and name various polygons. Their experiences with four-sided polygons may lack depth or may have some misconceptions. For example, students are often taught to categorize rectangles and squares separately. Typically, a polygon with four equal sides and four equal angles is referred to as a square; whereas, a polygon with four equal angles but one pair of long sides and one pair of short sides is referred to as a rectangle. We hear students refer to rectangles as being “long” or “tall.” Their system for differentiating between squares and rectangles is based on narrow experiences with a few specific examples.

These constructions may cause confusion later as students learn that squares also fit the description of rectangles. This new information does not fit logically to what they have already learned, and it does not allow for growth in understanding that a square is a more specific classification of a rectangle; just as a rectangle is a more specific classification of a parallelogram; and that a parallelogram is a specific classification of a quadrilateral. These shapes all fit in the quadrilateral “family.”

To aid understanding, teach quadrilaterals as a whole. Define quadrilaterals as a four-sided figure and give students the opportunity to create a variety of quadrilaterals. They look for similarities and differences and sort them into several different categories according to their attributes. The sorting activity offers insight into the mathematical hierarchy used in classifying quadrilaterals. It will become clear that every quadrilateral falls into three categories:

1. those with two pairs of parallel sides,
2. those with only one pair of parallel sides, and
3. those with no parallel sides.

This activity will set the stage for students to understand that many types of quadrilaterals exist and that these shapes have some elements in common.

## ***Invitation to Learn***

Provide each student with a geoboard and geoband. Ask them to create several four-sided polygons, then choose their most unique quadrilateral to share with their group.

## ***Instructional Procedures***

### ***Materials***

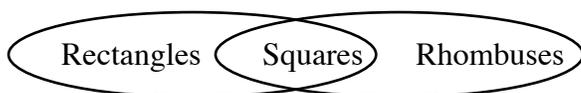
- Geoboards and geobands
- Geodot Paper*
- Various quadrilateral shapes
- Quadrilateral Family Tree*
- Quadrilateral Pieces*
- Quadrilateral Venn Diagram*
- Yarn or string

1. Ask the students to compare their quadrilateral with those made by other members in their group. Are all quadrilaterals different? If not, agree on how to make them look different. Record quadrilateral on *Geodot Paper* (p. 8-11) and cut shape out for display.
2. Invite each group to post their quadrilaterals in one of three columns:
  - a. those with one pair of parallel sides,
  - b. those with two pairs of parallel sides, and
  - c. those with no parallel sides.

Give students time to determine if all the quadrilaterals are in their appropriate columns. Discuss congruent and similar shapes and remove any duplicates.

3. Identify the columns with the appropriate headings: *trapezoids* (one pair of parallel sides), *parallelograms* (two pair of parallel sides), and *trapeziums* (no parallel sides).
4. Use the *Quadrilateral Family Tree* handout (p. 8-12) to discuss the properties, attributes, and characteristics, as well as the interconnective and hierarchical commonalities and differences, between and among quadrilateral shapes.
  - a. Have the students look at the relationship between squares and rectangles. What are the characteristics of each? Is a square a rectangle? (Yes, it has four equal angles.) Are all rectangles squares? (No, many rectangles do not have four equal angles **and** four equal sides.)
  - b. Have the students look at the relationship between squares and rhombuses. What are the characteristics of each? Is a square a rhombus? (Yes, it has four equal sides.) Are all rhombuses squares? (No, many rhombuses do not have four equal sides **and** four equal angles.)

- c. A Venn Diagram is a good visual aid to illustrate that a square is both a rectangle and a rhombus.



5. Further explore the relationships between quadrilaterals by having the students work with roping quadrilaterals. Provide each pair of students a set *Quadrilateral Pieces* (p. 8-14) and two or three pieces of string to make a *Quadrilateral Venn Diagram* (p. 8-16). Ask them to place the appropriate quadrilateral pieces in each ring according to the following labels:

Ring 1 (Left side): At least one pair of parallel sides

Ring 2 (Right side) No sides parallel

Ask students to justify their placement of different pieces. What do all the shapes in one ring have in common? How might the shapes in one ring be different? (Some shapes in Ring 1 are trapezoids, and some are parallelograms.) What different label would eliminate one or more of the shapes from a ring? (Only one pair of parallel sides.) If we drew a giant circle around everything, including any shapes that are outside the rings, what might the label for this new ring be? (Quadrilaterals) Try further explorations using the following labels:

Ring 1 (Inner ring): All sides of equal length

Ring 2 (Outer ring): At least one pair of parallel sides

Ring 1 (Left side): At least one right angle

Ring 2 (Right side): No right angles

Ring 1 (Left side): All sides the same length

Ring 2 (Right side): At least one acute angle

Ring 1 (Left side): At least one set of parallel sides

Ring 2 (Right side): At least one obtuse angle

### ***Possible Extensions/Adaptations/Integration***

- Have students make their own labels and then challenge a partner to use them to create quadrilateral rings.
- Have students make “mystery rings” for their partner to solve. Simply sort quadrilaterals into the Venn Diagram rings according to some characteristic and have a partner try to decide how the quadrilateral pieces have been sorted.

### ***Assessment Suggestions***

- Have students justify the placement of quadrilaterals in the Venn Diagram. Journal reflections explaining the placement of quadrilaterals are useful for checking students’ understanding.
- Have students explain the relationship among the rectangle, rhombus, and square.

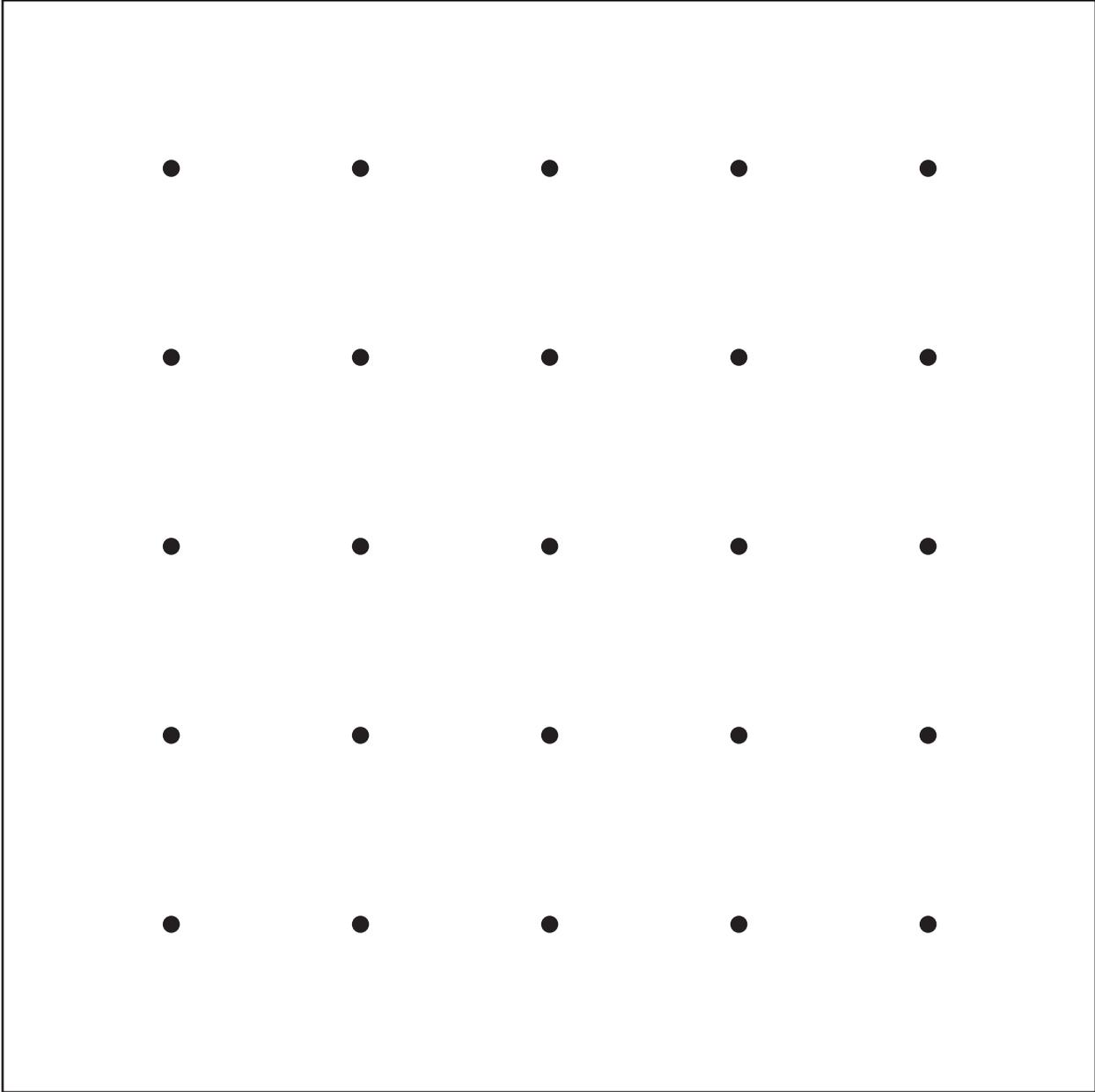
### ***Additional Resources***

*Navigating Through Geometry in Grades 3-5*, edited by M. Katherine Gavin and Gilbert J. Cuevas (NCTM Publication); ISBN 0-87353-512-X

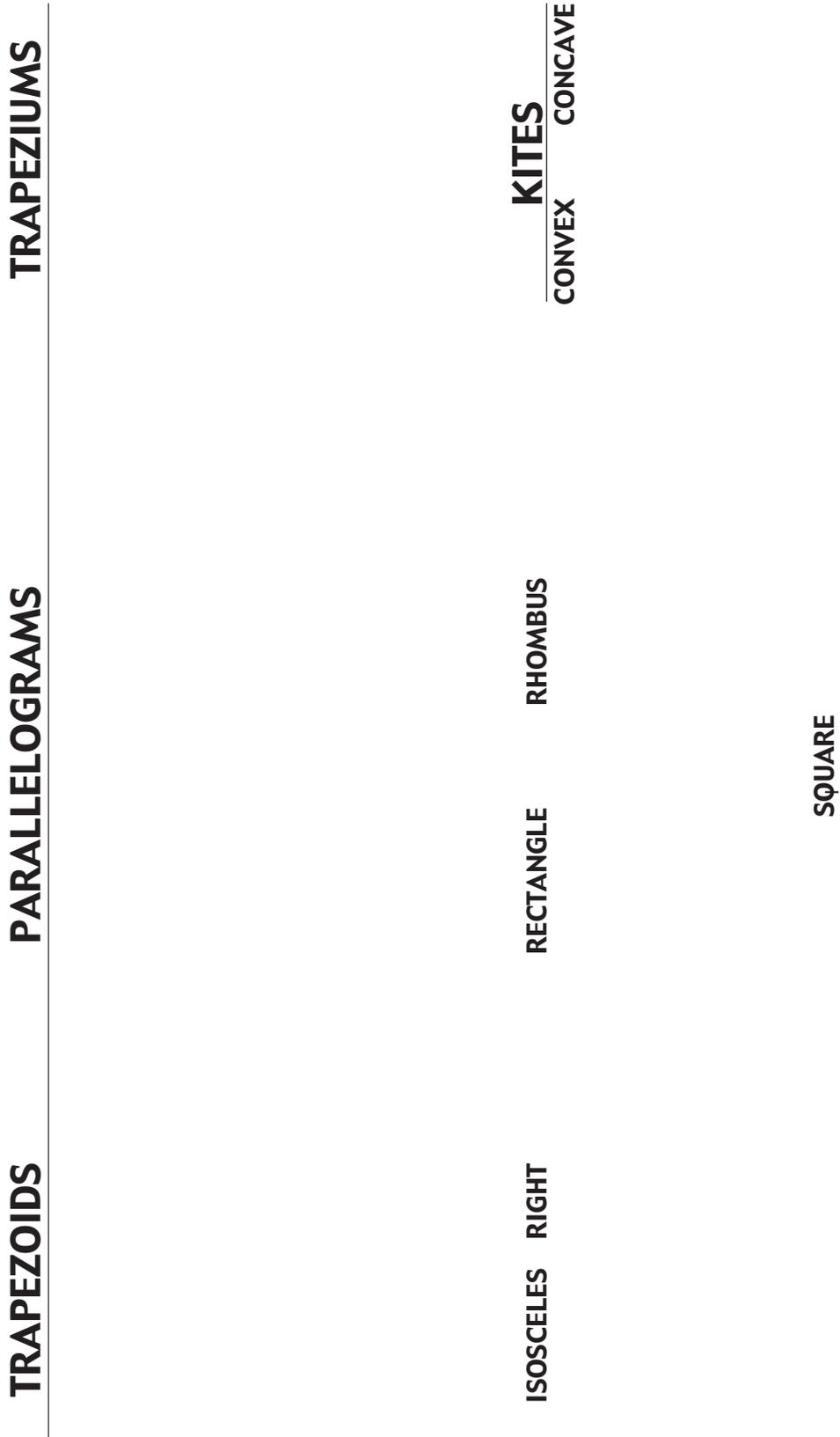
### ***Family Connections***

- Have students take home the quadrilateral pieces to share with their family. Show them how to sort the pieces in each ring according to the labels given. They may need to overlap some rings to form intersections. Make “mystery rings” for family members to solve.

# Geodot Paper



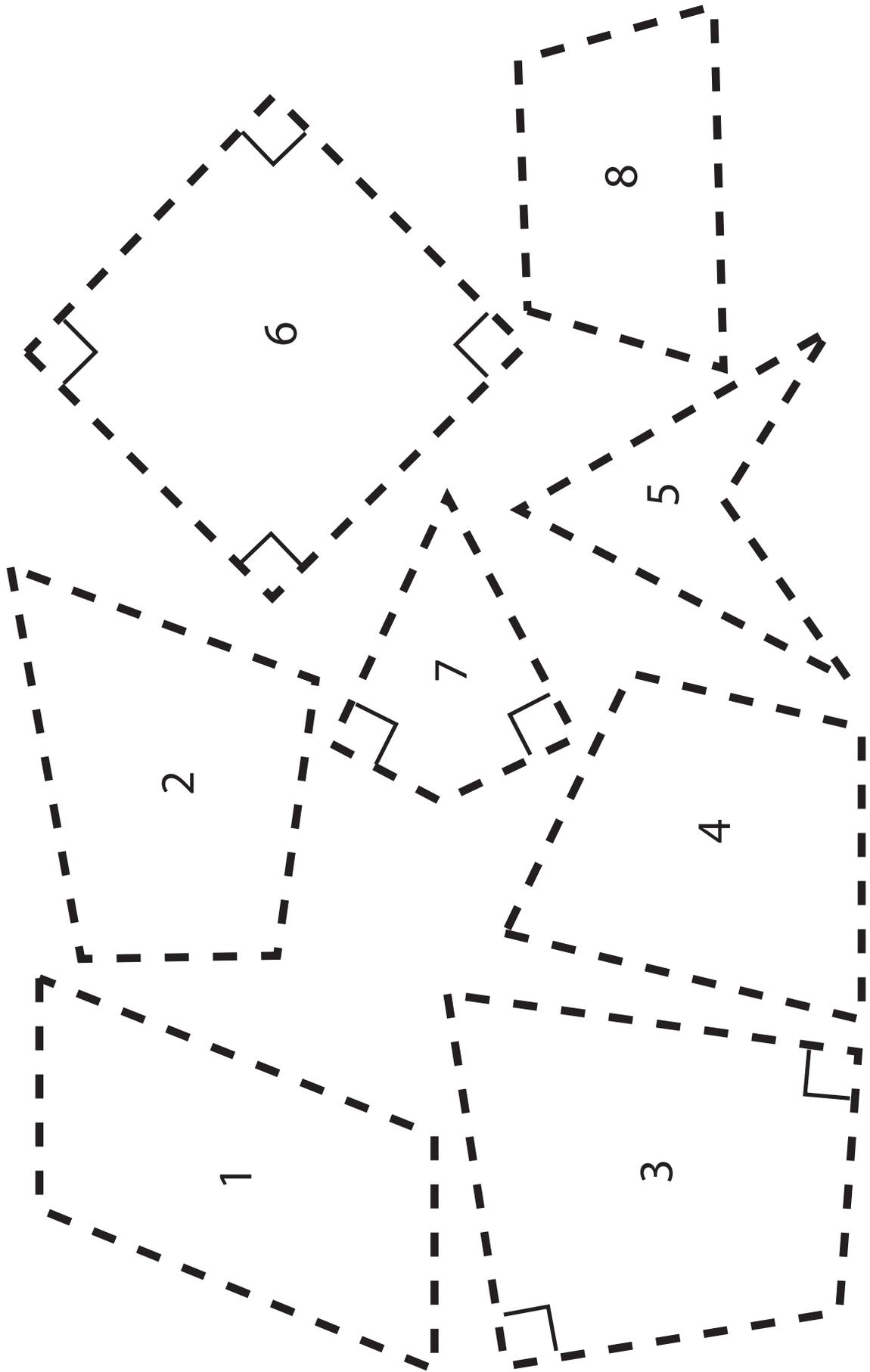
# *Quadrilateral Family Tree*



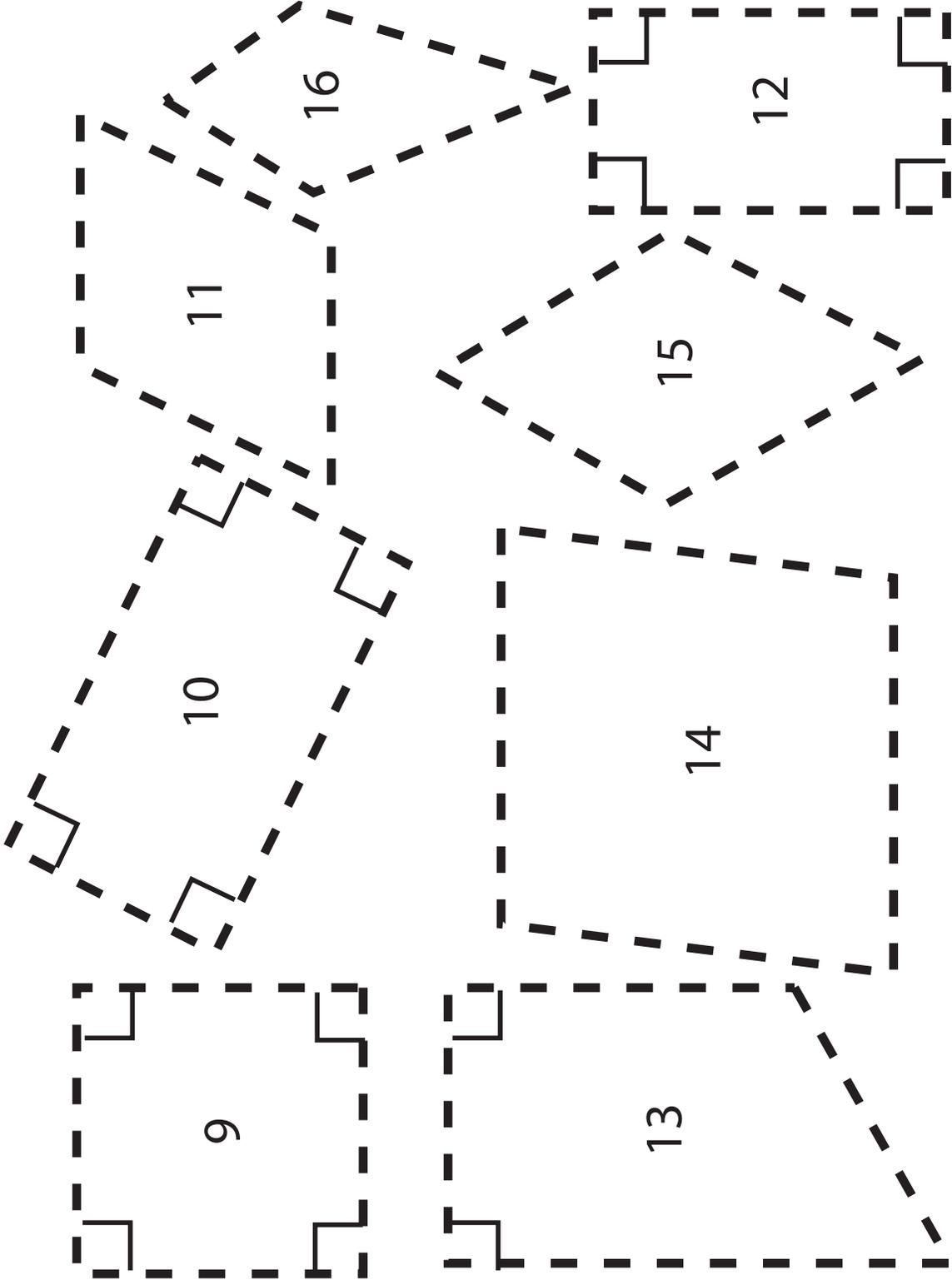
# Quadrilateral Family Tree

TRAPEZOIDS	PARALLELOGRAMS	TRAPEZIUMS
a quadrilateral with exactly <b>1 pair</b> of parallel sides	a quadrilateral with <b>2 pairs</b> of parallel sides	a quadrilateral with <b>no</b> parallel sides
<b>ISOSCELES</b> <b>RIGHT</b>	<b>RECTANGLE</b> <b>RHOMBUS</b>	<b>KITES</b>
	a parallelogram with a parallelogram with <b>4 equal angles</b> <b>4 equal sides</b>	<b>CONVEX</b> <b>CONCAVE</b>
	<b>SQUARE</b>	a quadrilateral with 2 pairs of different but equal adjacent (neighboring) sides
	a parallelogram with 4 equal sides <b>and</b> 4 equal angles	

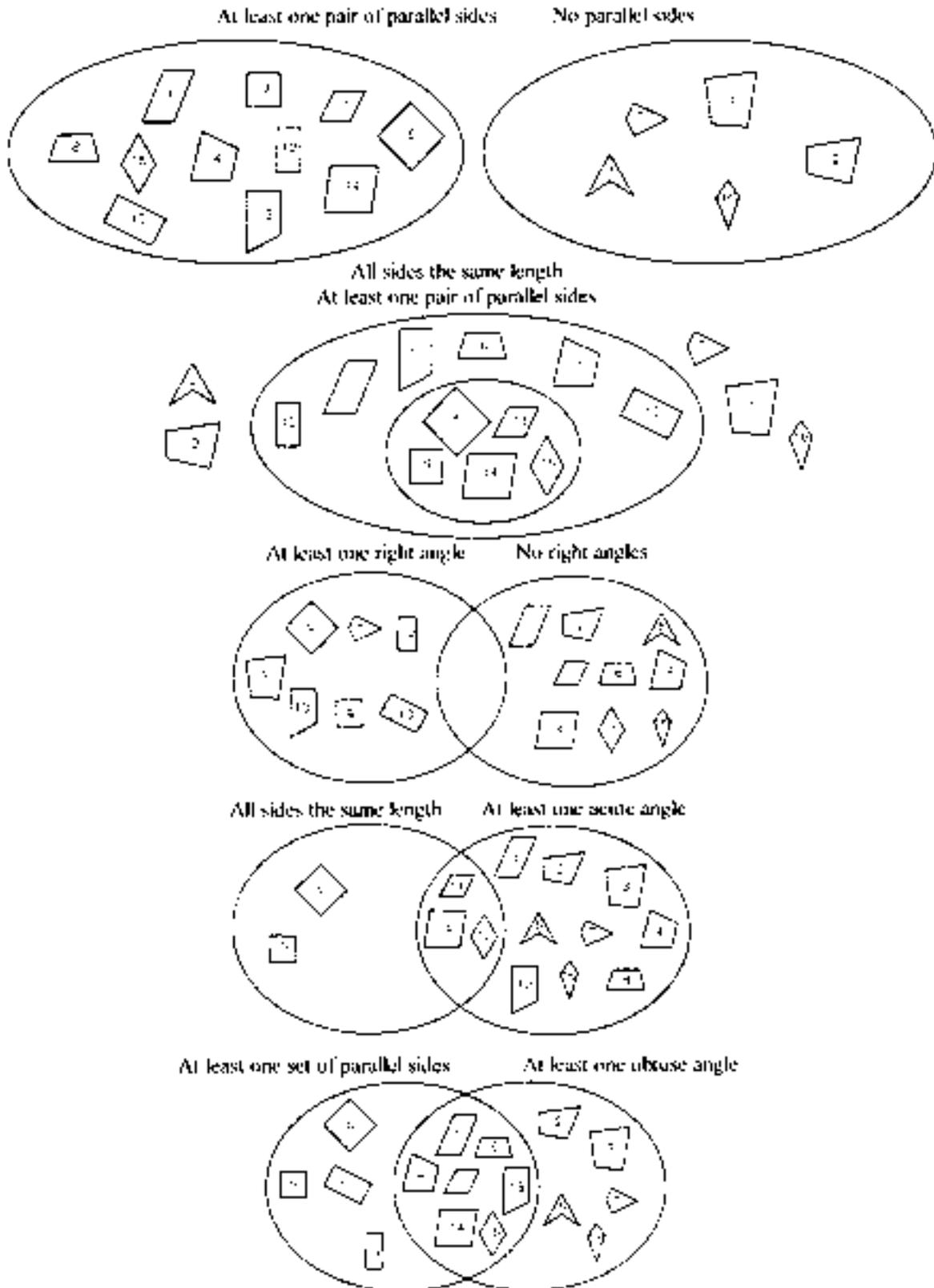
*Quadrilateral Pieces (page 1)*



*Quadrilateral Pieces (page 2)*



# Quadrilateral Venn Diagram



# Fly on the Ceiling

**Math Standard III:**

Students will use spatial reasoning to recognize, describe, and identify geometric shapes.

**Objective 2:**

Specify locations and describe spatial relationships using grids and maps.

**Intended Learning Outcomes:**

1. Demonstrate a positive learning attitude toward mathematics.
5. Make mathematical connections.

**Content Connections:**

Social Studies VI-1

## Math Standard III

### Objective 2

#### Connections

## Background Information

Identifying points on a coordinate grid is important in understanding how the coordinate system works and in constructing simple line graphs to display data or to plot points. These skills can be used to examine algebraic functions and relationships. The skills developed in this lesson can be applied to interpreting latitude and longitude in map reading in social studies and to plotting points to represent data collected during science experiments. Students can use the coordinate plane when exploring the ideas related to symmetry, reflection, and spatial sense.

## Invitation to Learn

Read *The Fly on the Ceiling*

## Instructional Procedures

1. Play the game *Fly Tic-Tac-Toe*.

Players: two

How to play:

- a. Points are marked at intersections of a grid. The size of the grid is 4 x 4 with corners at (0,0), (0,4), (4,4), and (4,0).
- b. One player plays X, the other plays O
- c. Players must locate a point by using an ordered pair of numbers to describe it, (e.g., (2,3)). The first number tells how far to go *across*, the second number tells how far to go *up* on this grid. The points **must** be named by their ordered pair and marked on the *Fly Tic-Tac-Toe* recording sheet (p. 8-20).

### Materials

- The Fly on the Ceiling*
- Tic-Tac-Toe* gameboard (one per partner)
- Swat the Flies* gameboard for each student (Laminated)
- Vis-à-Vis® markers (red, blue, green)

- d. If the player states the wrong coordinates, the turn ends.
  - e. To win, a player must get four coordinate points in an uninterrupted straight line—horizontally, vertically, or diagonally.
2. Play *Swat the Flies*.

Players: two

This game is similar to *Battleship*. The goal of this game is to be the first person to “swat” the other person’s flies by calling out the coordinates that locate the “fly families.” Each player has five fly families: one family of two, two families of three, and two families of four. To win, a player must locate and “swat” all of the families.

- a. Provide each player with a laminated *Swat the Flies* gameboard (p. 8-21), which contains two 10 x 10 grids. Have them draw their fly families on the left grid using a water based Vis-à-Vis® marker. They can be drawn vertically or horizontally. The right grid is used to mark the locations the player calls out to his/her opponent. This recording helps to prevent calling out the same location twice during a game.
- b. Players can roll a die or flip a coin to determine who goes first.
- c. On a turn, a player calls out the location of a point, (e.g. (3,2)). The student marks the point on his/her right grid, as the opponent calls out “hit” if the point is located at one of his/her fly families. The opponent will also mark a “hit” on his/her grid so s/he will know when all members of the fly family have been hit. When a player has hit all flies in a fly family, the opponent calls out “swatted” to signal all flies in a family have been hit.
- d. Play proceeds until one of the players has “swatted” all his/her opponent’s fly families. The first player to do so wins the game.

### ***Possible Extensions/Adaptations/Integration***

- Use a board that includes all four quadrants, so that some of the points will include negative numbers.
- Plot coordinate points, then connect the points to make a mystery picture. *Grid and Bear It* is an excellent choice for this type of practice.

- Have students create a picture on a grid, going through coordinate points. List the points that need to be plotted to complete the mystery picture on a separate sheet of paper. Have a partner try to recreate the mystery picture following the coordinates given.

## ***Assessment Suggestions***

- While students are playing each game, the teacher may walk around and observe the students' understanding of coordinates. Are they identifying the coordinate using the correct ordered pairs?
- The coordinate pictures created by each student can also help to determine understanding.

## ***Additional Resources***

### **Books**

*The Fly on the Ceiling*, by Julie Glass; ISBN 0679886079

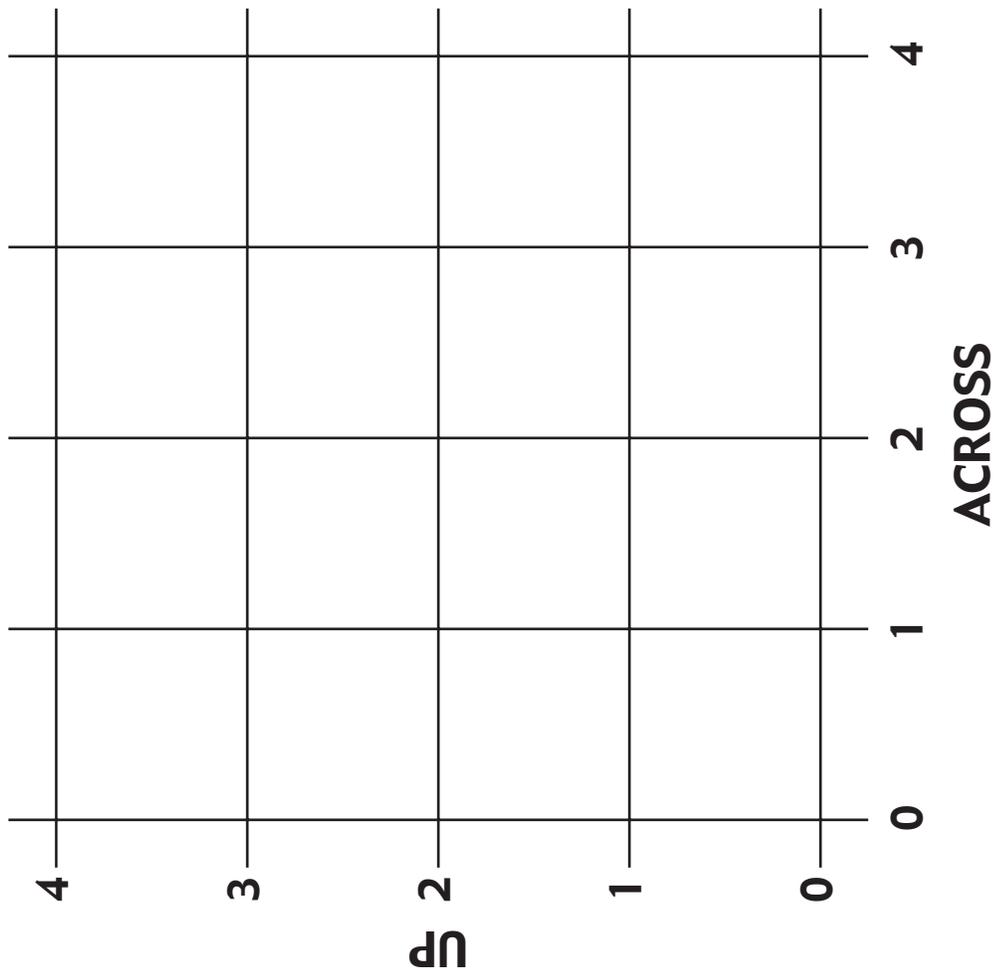
*Grid and Bear It*, by Will C. Howell (Fearon Teacher Aids);  
ISBN 0-8224-3510-1

*Grid and Graph It*, by Will C. Howell (Fearon Teacher Aids);  
ISBN 0-8224-3511-X

## ***Family Connections***

- Have students play *Fly Tic-Tac-Toe* with a family member.
- Have students play *Swat the Flies* with a family member at home.
- Have students create a picture on a grid and have a family member try to recreate the picture following the coordinates given.

# Fly Tic-Tac-Toe



**Fly  
Tic-Tac-Toe  
Player 2  
Recording Sheet**

**FLY COORDINATES**

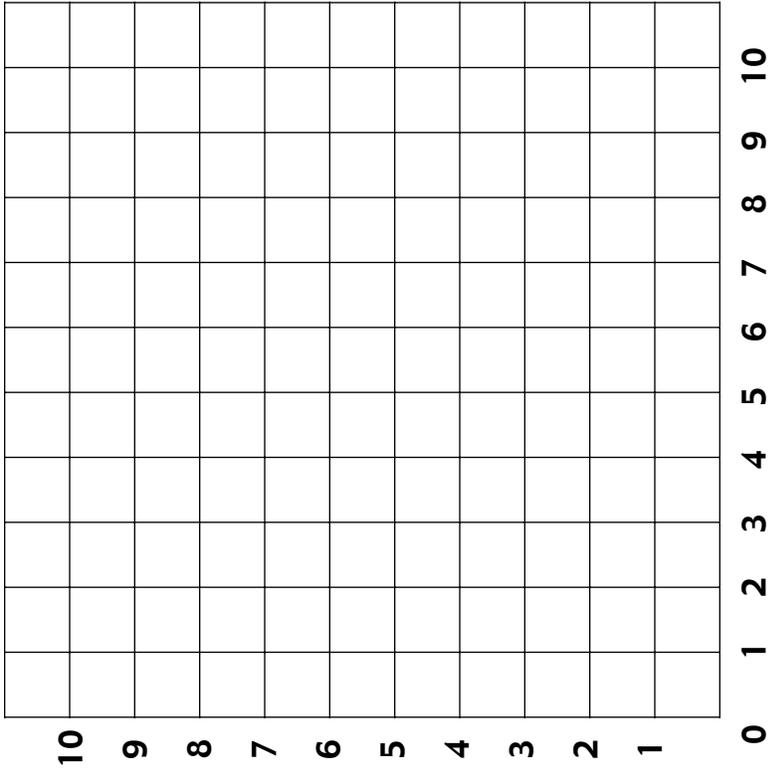
Across	Up
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
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**Fly  
Tic-Tac-Toe  
Player 1  
Recording Sheet**

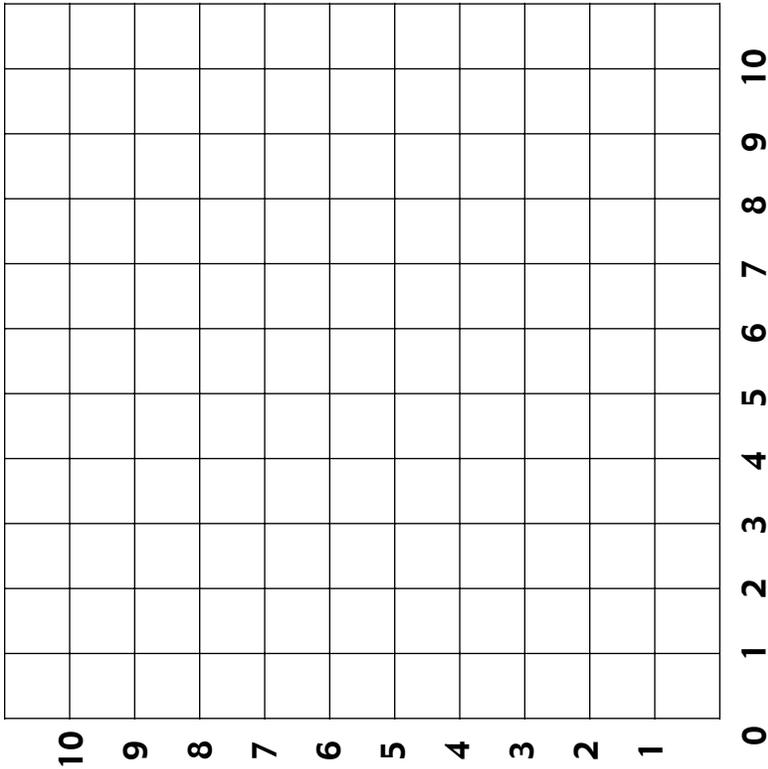
**FLY COORDINATES**

Across	Up
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
(    )	(    )
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# Swat the Flies



# Swat the Flies

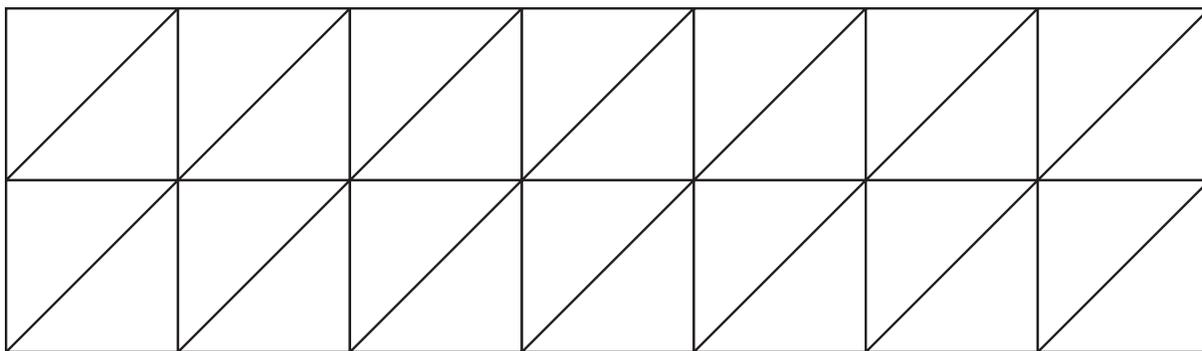
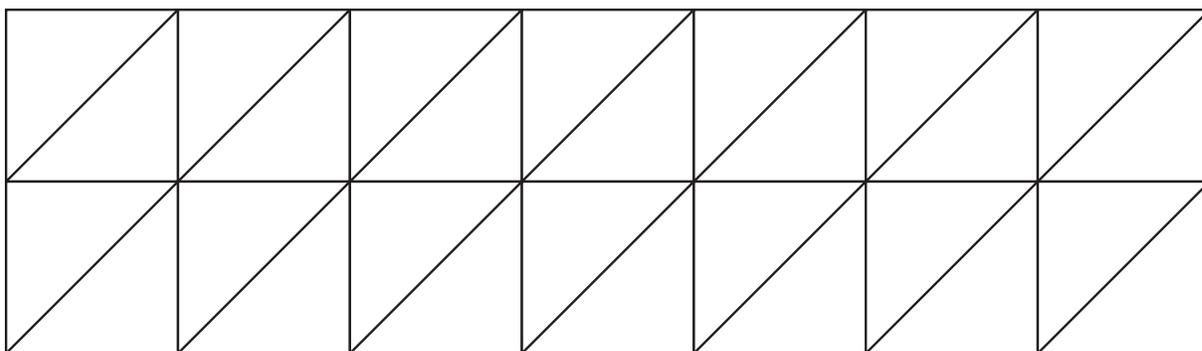
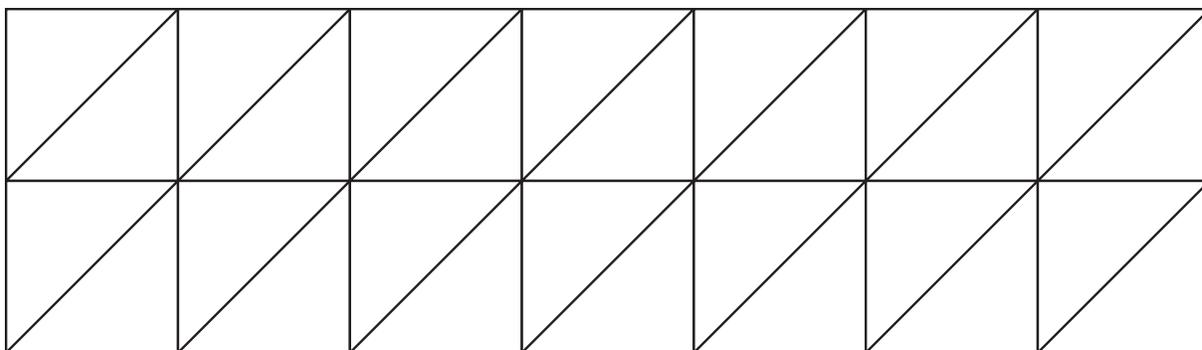
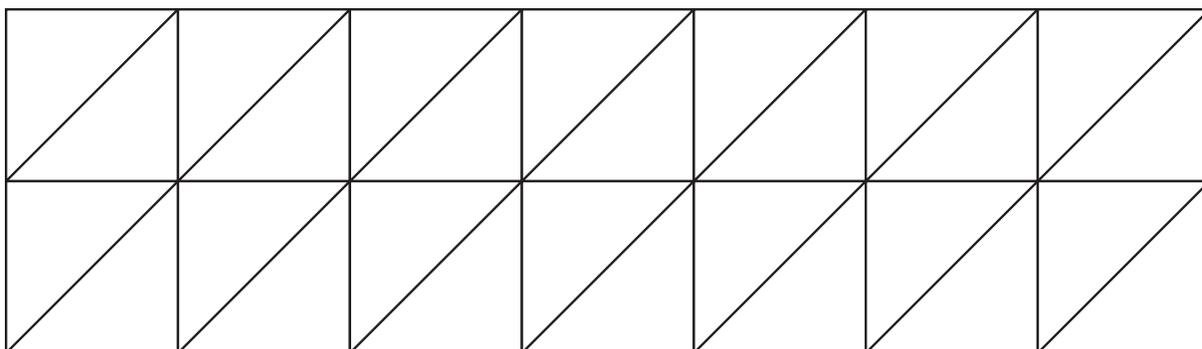




# ***Appendix***



# ***Isosceles Triangles***





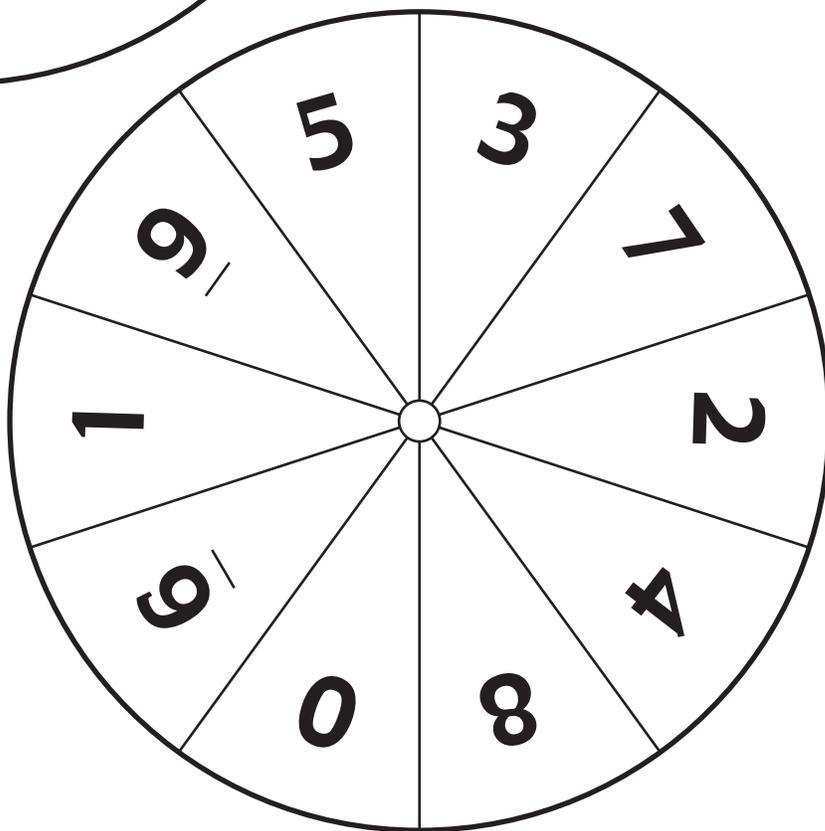
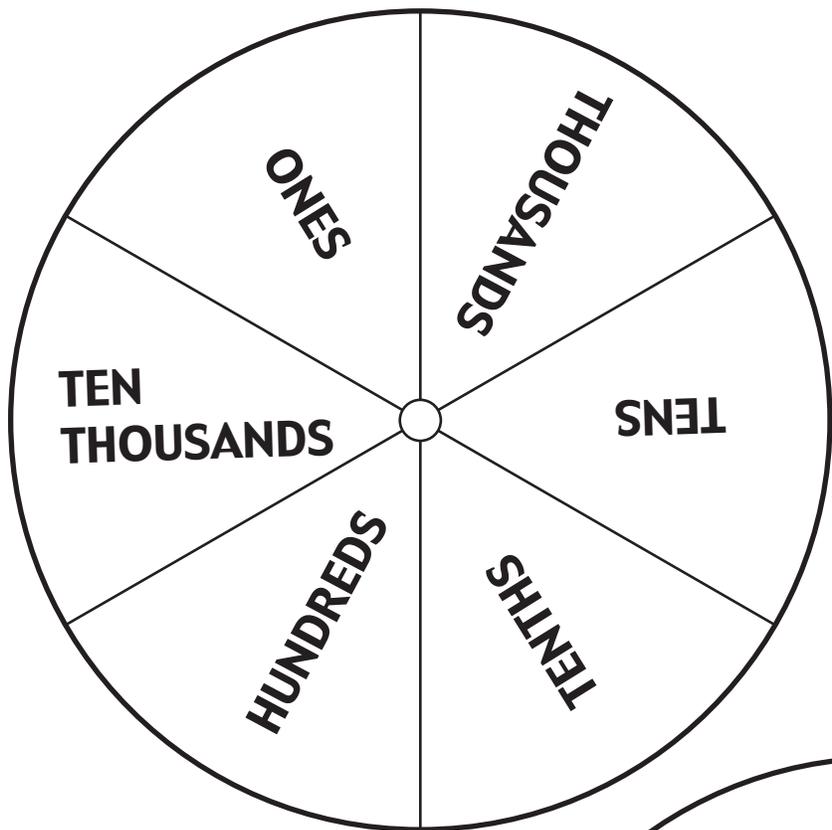
Name \_\_\_\_\_

## ***Probability Data Chart***

	<b>Red 1</b>	<b>Red 2</b>	<b>Red 3</b>	<b>Red 4</b>	<b>Red 5</b>	<b>Red 6</b>
<b>Green 1</b>						
<b>Green 2</b>						
<b>Green 3</b>						
<b>Green 4</b>						
<b>Green 5</b>						
<b>Green 6</b>						



# Spinners





## ***Plant Puzzler Cards***

Cut this page into squares along the lines. Put the squares into the correct bag.

<b>forest</b>	<b>desert</b>	<b>wetland</b>	<b>woody stems</b>
<b>spiny skin</b>	<b>lives near water</b>	<b>loses leaves in Autumn</b>	<b>waxy coating</b>
<b>furry leaves</b>	<b>light color</b>	<b>leaves go dormant</b>	<b>seeds float and flutter</b>
<b>two-sided needles</b>	<b>looks dead in dry spells</b>	<b>grows acorns which are food for rodents, birds, or deer</b>	<b>long slender green stalks with brown growth on top</b>
<b>yellow flowers</b>	<b>roots are shallow</b>	<b>broad leaves</b>	<b>tall stalks with triangular stems</b>
<b>attracts pollinators</b>	<b>desert</b>	<b>forest</b>	<b>wetland</b>



Name \_\_\_\_\_

## ***Plant Puzzlers Student Worksheet***

**Directions:**

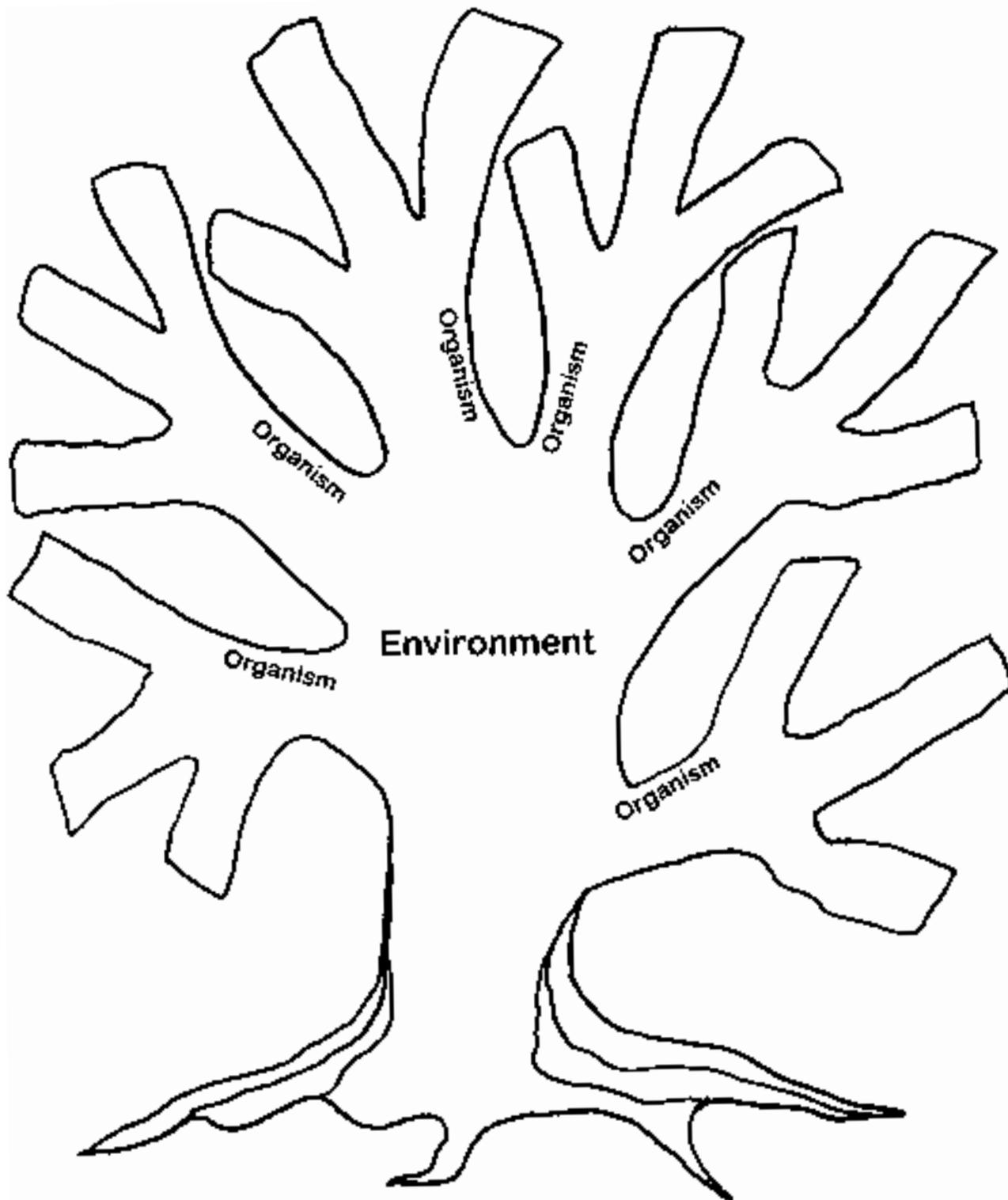
One team member will take a square from each bag. The other will write the words on different squares in the correct column of this activity page. Take turns.

Continue until each member has filled in two rows across.

<b>Where it Lives</b>	<b>How it Looks</b>	<b>How it Survives</b>	<b>Name of Plant</b>



## Environmental Tree Page

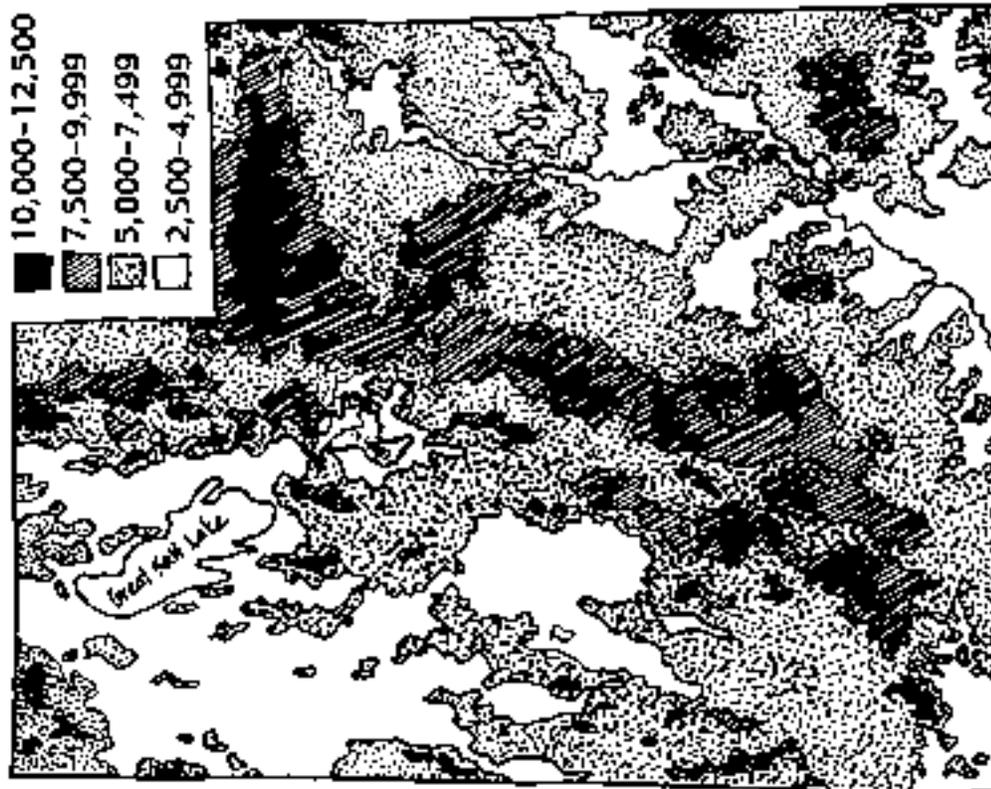


Pick an environment. Choose common plants and animals (organisms) that live there. In the branches of the tree list three physical characteristics of these organisms.

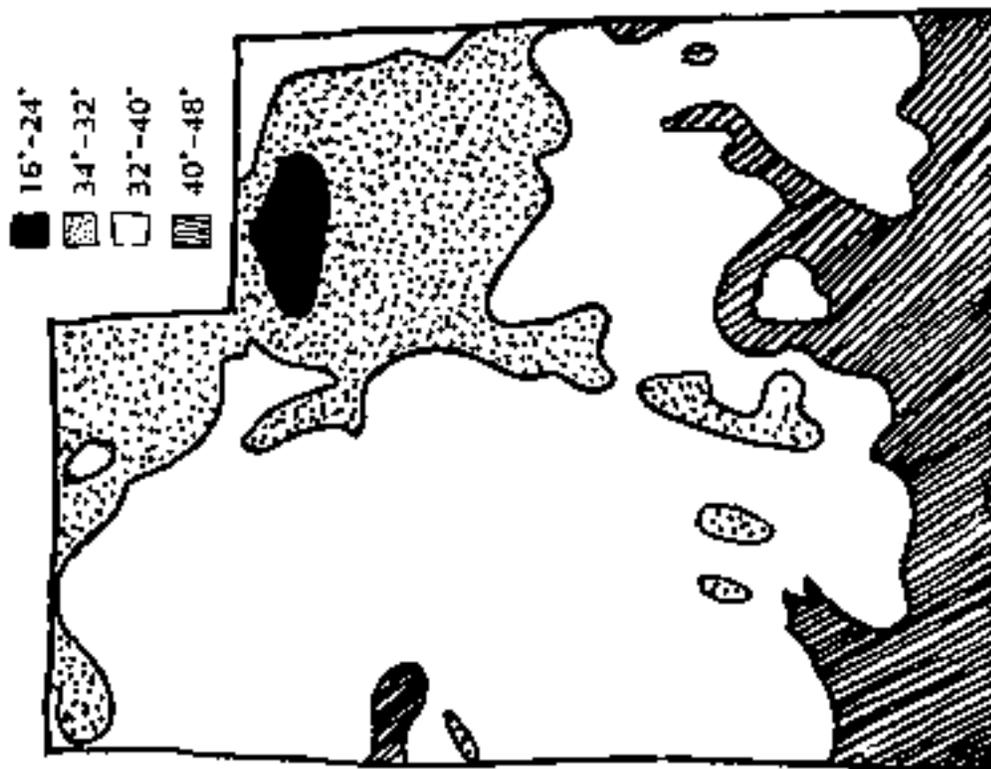


# Utah Maps

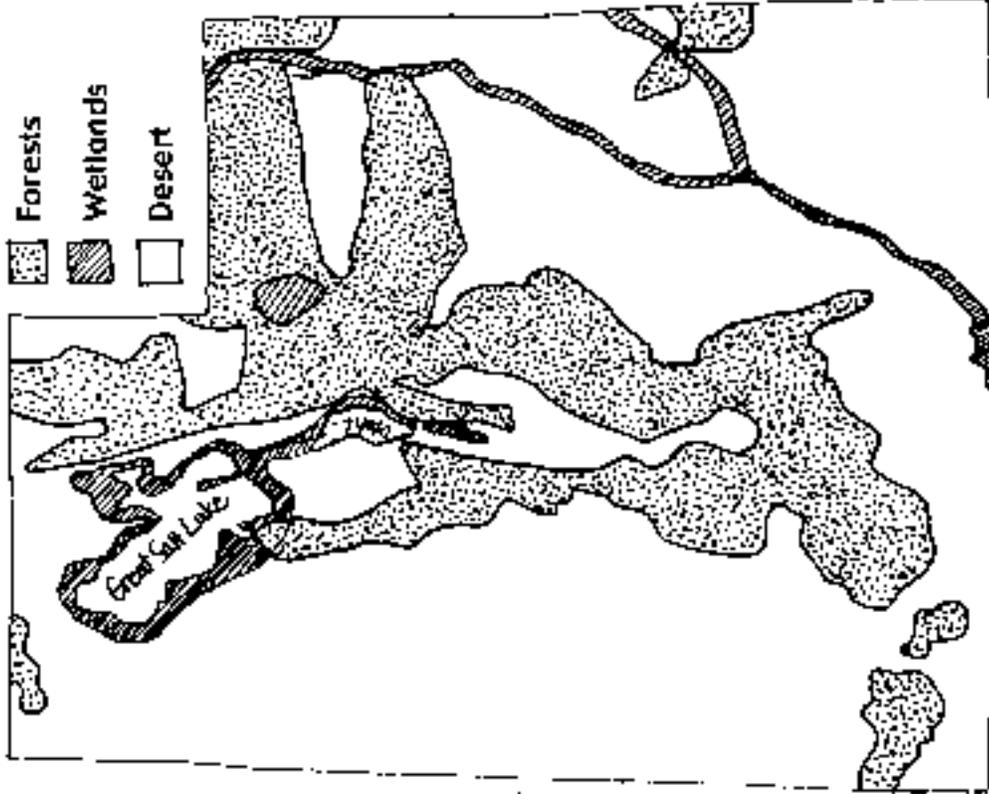
**B. Elevation**



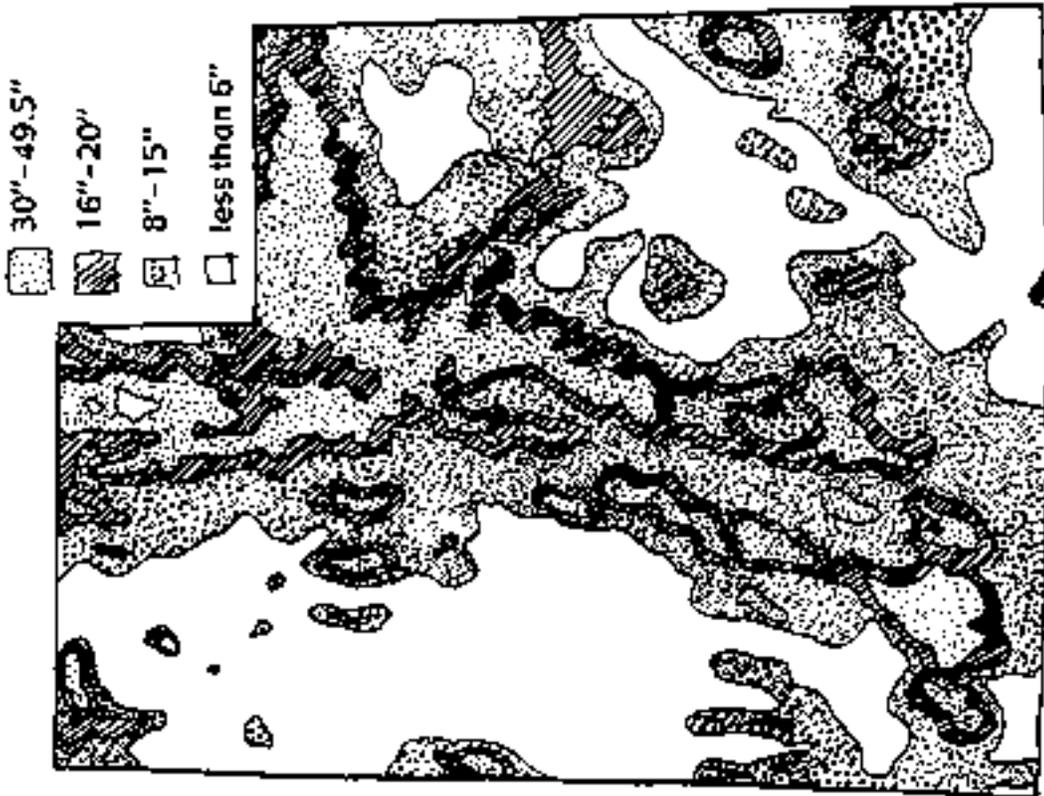
**A. Temperature (January)**



### D. Utah Environments



### C. Annual Normal Precipitation



# Utah Art Graphic Organizer

The graphic organizer is designed to help students analyze a painting of a Utah landscape. It includes a central illustration of a mountain range with a valley. The organizer is divided into several sections for data collection:

- Painting Information:**
  - Name of Painting: \_\_\_\_\_
  - Artist: \_\_\_\_\_
- we think...:**
  - Rainfall: \_\_\_\_\_
  - Temperature: \_\_\_\_\_
  - Clues: \_\_\_\_\_
  - because: \_\_\_\_\_
  - Clues: \_\_\_\_\_
- Elevation Observations:** \_\_\_\_\_
- LANDFORMS:**
  - Name: \_\_\_\_\_
  - Shapes, colors, Common lines: \_\_\_\_\_
- PLANTS:**
  - Name: \_\_\_\_\_
  - Shapes, colors, Common lines: \_\_\_\_\_
- ANIMALS:**
  - Name: \_\_\_\_\_
  - Shapes, colors, Common shapes: \_\_\_\_\_

The bottom section of the form consists of a 3x3 grid of boxes for recording the data from the sections above.

# Utah Art Graphic Organizer

**Name of Painting** \_\_\_\_\_

**Artist** \_\_\_\_\_

**we think...**

Rainfall _____	Temperature _____
Clues _____	Clues _____

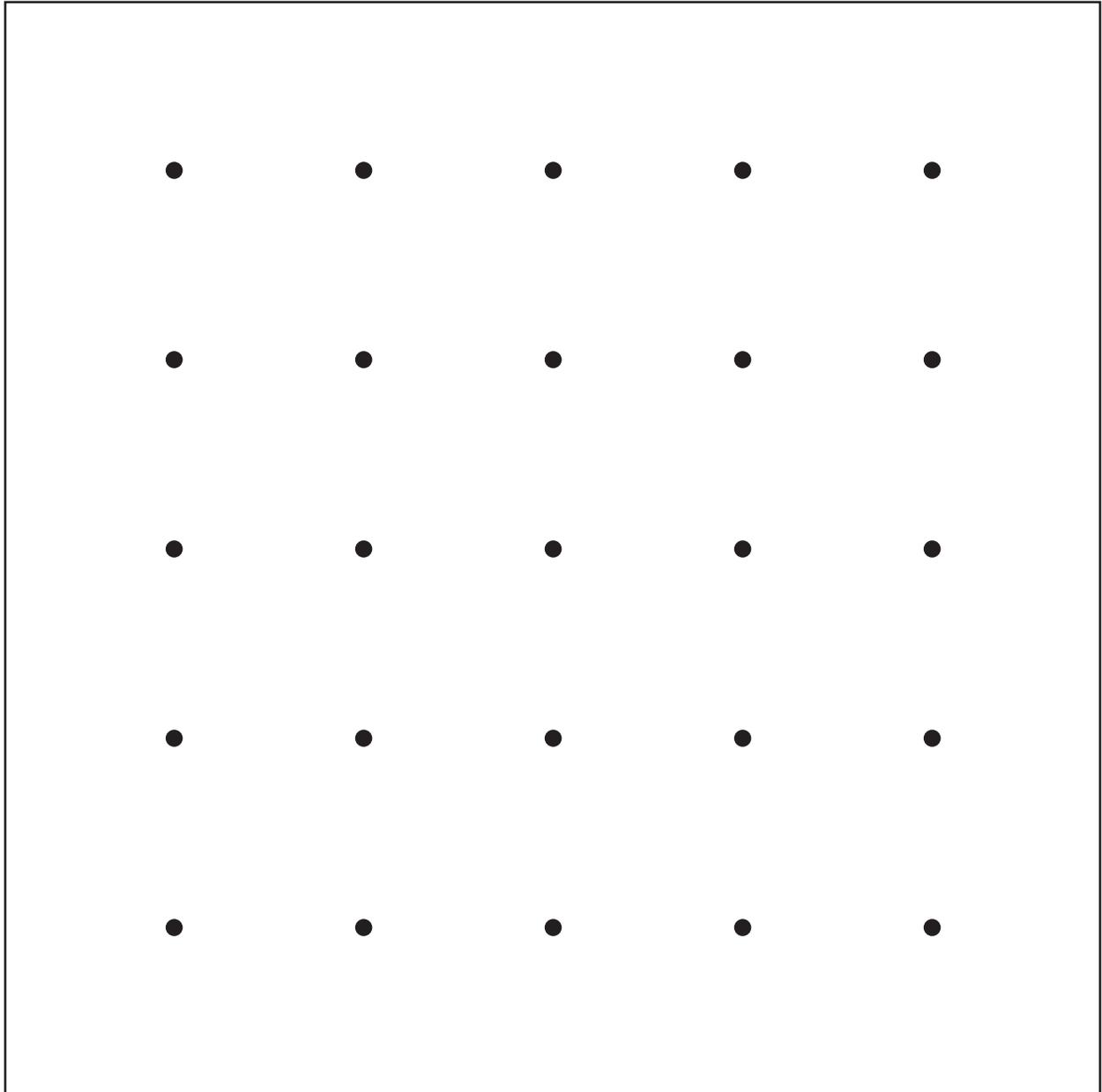
**because**

**Elevation Observations** \_\_\_\_\_

LANDFORMS	PLANTS	ANIMALS
Name _____	Name _____	Name _____
Shapes, colors, Common lines _____	Shapes, colors, Common lines _____	Shapes, colors, Common lines _____

# *Geodot Paper*





# ***-Notes-***

**-Notes-**

# ***-Notes-***

**-Notes-**

# ***-Notes-***

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