



ALGEBRA: INTO THE UNKNOWN

An Interactive Unit that Incorporates Activities Promoting Algebraic Thinking and Reasoning

JUDY BIPPERT is a credentialed teacher with a master's degree in educational administration. She has more than 30 years of experience teaching junior high school mathematics, coordinating Gifted Education programs, teaching math methods to preservice teachers, and supervising student teachers. Judy is a member of the faculty of the School of Education at San Diego State University in San Diego, California. Best selling titles she has co-authored include: *A-MAZE-ING SHAPES*, *GAME FACTORY*, *PROJECT POLARIS*, and *SPACE PROBE* among many other math and science units.

LOUISE VANDLING is a credentialed teacher and administrator with a master's degree. She has more than 30 years of experience as an elementary teacher, administrator, district math mentor, part-time university math methods instructor, and staff developer. Louise is currently a mathematics specialist at Casita Center, a technology, science, and math magnet school in Vista Unified School District, Vista, California. Best selling titles she has co-authored include: *A-MAZE-ING SHAPES*, *GAME FACTORY*, *PROJECT POLARIS*, and *SPACE PROBE*.

©2001 Interact
10200 Jefferson Boulevard
P.O. Box 802
Culver City, CA 90232-0802
(800) 421-4246 • www.teachinteract.com
ISBN# 978-1-57336-348-8

Project Editor: Stephanie Lowe
Graphics Editor: Steve Roberts
Managing Editor: Heather Nielsen

All rights reserved. Only those pages of this simulation intended for student use as handouts may be reproduced by the teacher who has purchased this teaching unit from Interact. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means—electronic, mechanical, photocopying, recording—without prior written permission from the publisher.

INTO THE UNKNOWN

The nationwide movement for high standards has not only determined what students should learn, but also has mandated that students demonstrate what they know. Teachers who choose INTO THE UNKNOWN will find it is a standards-based program addressing many National Mathematics Standards. What makes INTO THE UNKNOWN especially effective is that it not only targets most state frameworks for problem solving and computation, it also specifically addresses algebra at the elementary level. INTO THE UNKNOWN provides many opportunities for both written and observational performance assessment. Students, working in pairs called Math Mates, demonstrate their understanding of equations, patterns, functions, and variables as they solve problems. They use writing to explain how they arrived at an answer and to clarify their thinking. As a culminating activity students become Algebra Architects and apply what they have learned about algebra to construct an underwater research center. The peer-teaching and cooperative problem solving required in INTO THE UNKNOWN also addresses Applied Learning standards.

NATIONAL STANDARDS FOR SCHOOL MATHEMATICS

Number and Operations Standard

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems
- Understand meanings of operations and how they relate to one another
- Compute fluently and make reasonable estimates

Algebra Standard

- Understand patterns, relations, and functions
- Represent and analyze mathematical situations and structures using algebraic symbols
- Use mathematical models to represent and understand quantitative relationships

Problem-Solving Standard

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

STANDARDS

STANDARDS

INTO THE UNKNOWN

STANDARDS

Communication Standard

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

CALIFORNIA APPLIED LEARNING STANDARDS

Standard 3: Students will understand how to solve problems through teaching and learning. Students will develop and implement a teaching-learning program.

Standard 6: Students will understand how to apply communication skills and techniques. Students will demonstrate ability to communicate orally and in writing.

Standard 8: Students will understand the importance of teamwork. Students will work on teams to achieve project objectives.

TABLE OF CONTENTS

INTO THE UNKNOWN

Purpose	1
Overview	2
Setup Directions	3
Unit Time Chart	11
Answer Key	12
Reproducible Masters	
SUBMARINE	17
MY WATER LOG	18
OBSERVATION CHECKLIST	19
SAND DOLLARS	20
SAND DOLLAR RECORD CHART	21
COINS: PENNIES	22
COINS: NICKELS	23
COINS: DIMES	24
COINS: QUARTERS	25
COINS: HALF DOLLARS	26
DOMINOS	27
PATTERN BLOCK HEXAGONS	28
PATTERN BLOCK RHOMBUSES	29
PATTERN BLOCK SQUARES	30
PATTERN BLOCK TRAPEZOIDS	31
PATTERN BLOCK TRIANGLES	32
MATH MATE RUBRIC	33
Before Day 1	34
Sea Depth 1 Summary Chart	35
Sea Depth 1: Daily Directions	
Day 1: Pattern Block Equations	37
Day 2: Coin Equations	40
Day 3: Domino Equations	42
Day 4: Seaside Diner Equations	45
Day 5: Phase Finale	47
Reproducible Masters	
PATTERN BLOCK EQUATIONS	48
SAMPLE PATTERN BLOCK DESIGN	49
COIN EQUATIONS	50
DOMINO EQUATIONS	51
SEASIDE DINER EQUATIONS	52
PATTERN BLOCK EQUATIONS LEARNING LAB	53
COIN EQUATIONS LEARNING LAB	54
DOMINO EQUATIONS LEARNING LAB	55
SEASIDE DINER EQUATIONS LEARNING LAB	56
AQUATIC EQUATIONS ASSESSMENT	57
AQUATIC EQUATIONS ASSESSMENT RUBRIC	58

STATEMENTS

TABLE OF CONTENTS

INTO THE UNKNOWN

CONTENTS

Sea Depth 2 Summary Chart	59
Sea Depth 2: Daily Directions	
Day 1: Sea Creature Detective	61
Day 2: Grid Detective	63
Day 3: Balance Scale Detective	65
Day 4: Domino Detective	70
Day 5: Phase Finale	73
Reproducible Masters	
SEA CREATURE DETECTIVE	74
GRID DETECTIVE	92
BALANCE SCALE DETECTIVE	110
DOMINO DETECTIVE/DOMINO DETECTIVE RECORD	130
COIN COMBINATIONS LEARNING LAB	140
COIN COMBINATIONS	141
DOMINO GRIDS LEARNING LAB	142
DEALING DOMINOS LEARNING LAB	143
VARIABLE VOYAGE ASSESSMENT I (Grade 2)	144
VARIABLE VOYAGE ASSESSMENT II (Grades 3 & 4)	145
VARIABLE VOYAGE ASSESSMENT RUBRIC	146
Sea Depth 3 Summary Chart	147
Sea Depth 3: Daily Directions	
Day 1: Pattern T-Tables	150
Day 2: Pattern Blocks (Squares & Triangles)	152
Day 3: Pattern Blocks (Triangle & Rhombuses)	158
Day 4: Toothpick Patterns: Squares and Triangles	162
Day 5: Phase Finale	168
Reproducible Masters	
PATTERN T-TABLE 1	170
PATTERN T-TABLE 2	171
PATTERN T-TABLE 3	172
PATTERN BLOCK RECORD	173
PATTERN TOOTHPICK RECORD	174
COUNTING SQUARES LEARNING LAB	175
FISH FOOD LEARNING LAB	176
PATTERN PLUNGE & FISHY FUNCTIONS ASSESSMENT	177
PATTERN PLUNGE & FISHY FUNCTIONS ASSESSMENT RUBRIC	178
Culminating Activity: Daily Directions	179
Reproducible Masters	
RESEARCH STATION DESIGNS	182
DESIGN PLAN	183
CUBE PATTERN I	184
CUBE PATTERN II	185
CUBE PATTERN III	186

INTO THE UNKNOWN

INTO THE UNKNOWN explores the world of algebra for young learners grades 2–4. It is important to recognize algebraic thinking as it emerges at the elementary level and to structure real situations that encourage children to use symbols to represent patterns and relationships. Algebra helps students develop essential ways of thinking, interpreting, and understanding situations in daily life.

Familiarizing young learners with equations, variables, and patterns and functions establishes the foundation for understanding “the unknown.” A variety of activities tap into the students’ capacity to learn through pictures and symbols. Students gain confidence in their mathematical abilities by practicing algebraic skills and applying them to problem-solving strategies. Using algebraic reasoning provides a rich context for advancing mathematical understanding and promotes success in the formalized study of algebra at higher levels.

Specifically, your students will experience the following:

Knowledge

- Identify equations and equalities
- Understand the concepts of unknowns and variables
- Understand various types of patterns
- Comprehend functional relationships
- Analyze change in both real and abstract contexts
- Learn new strategies for solving problems

Skills

- Understand how to solve equations that use unknowns
- Identify, analyze, and extend patterns
- Describe how both repeating and growing patterns are generated
- Represent and record patterns using tables and graphs
- Use mathematical models
- Utilize symbolic form to represent mathematical situations
- Identify and describe relationships between two quantities that vary together
- Write to explain their thinking

Attitudes

- Develop a sense of the relevance for algebraic thinking
- Recognize the need for examining patterns in an organized way
- Form a positive attitude toward math
- Build self-confidence in ability to use algebra

PURPOSE

OVERVIEW

INTO THE UNKNOWN

INTO THE UNKNOWN introduces basic algebraic concepts including equations, variables, and patterns and functions. Students learn algebraic language and practice basic math operations while investigating algebra in an ocean environment. The purpose of their exploration is to reach the ocean floor where they build an underwater research facility. The sea theme provides motivation and continuity as students learn how to display mathematical relationships through symbols, diagrams, tables, and graphs.

Students begin INTO THE UNKNOWN by taking a Pretest to gauge their understanding of basic algebra. Over a three-week period, student pairs or “Math Mates” examine elementary algebraic concepts, one concept per week. Each Sea Depth (or phase) consists of discrete lessons and assessment of that week’s concept. As Math Mates successfully complete their activities, they progress through three levels of accomplishment (**Aquatic Investigators**, **Diving Detectives**, and **Sea Sleuths**), earn “Sand Dollars,” and move closer to their goal—the bottom of the ocean!

Follow-up Learning Lab activities for each area of study reinforce the concept of the week and the topic of each day. Students may do one or more of the Learning Labs per phase as a follow-up to whole class learning at the end of the week or they may be rotated through all of the labs after the completion of the Sea Depths.

As a culminating activity, students apply what they have learned about algebra to construct an underwater research center. Students become **Algebra Architects** as they build a facility from cubes purchased with Sand Dollars they earned throughout the unit. Upon completion of their structures, students write a letter to Mr. Rip Tide, Chief Oceanographer, to explain the function of their underwater research center. The unit ends with a research station presentation and an INTO THE UNKNOWN party!

OVERVIEW

SETUP DIRECTIONS

INTO THE UNKNOWN

1. **Before You Begin**

Carefully read INTO THE UNKNOWN in its entirety to become familiar with its elements, formats, and procedures. Plan your time and adjust this unit to meet your students' needs and abilities.

2. **Prepare Your Classroom**

Developing an ocean environment will enhance the atmosphere of the unit.

- Display the INTO THE UNKNOWN CHART prominently in your classroom. Use this chart as a large-scale gameboard. Leave space around the chart to display student activities and projects created during the unit.
- Before you begin the unit provide each pair of students with a submarine (template on page 17) to decorate as their movable marker.
- Collect books about the ocean, sea creatures, and submarines. Make them accessible to students during their free time.

By the end of the unit, your entire classroom could be submerged *Into the Unknown!*

3. **Timing**

Each lesson will take approximately one hour each day for three weeks—one week for each Sea Depth or phase. The final day(s) of the unit concludes with the culminating activity.

4. **Grouping Students**

Divide your class into pairs or Math Mates. Encourage each pair to choose a sea-related name. Each day students work with their Math Mate following whole class instruction. Every lesson ends with individual work time.

5. **INTO THE UNKNOWN Folders** (Optional)

To help your students organize their work for this unit, use pocket folders to keep all of their INTO THE UNKNOWN activities, Water Logs, and Sand Dollars. You may give a pocket folder to each student or create folders using a large piece of construction paper.



*Unit Length: Approximately
15+ hours*

Take time to carefully look at the schedule and adapt the unit to fit the needs of your classroom and your students.



*Pairs or Math Mates
Students work in the same pairs
throughout the unit, so pair
students carefully.*