

SCOTT FORESMAN

Investigations

IN NUMBER, DATA, AND SPACE®

Information and Ideas for Parents

Investigations in Number, Data, and Space® is a K-5 mathematics curriculum designed to engage students in making sense of mathematical ideas. It has just been revised by the TERC authors through a National Science Foundation Grant. This 2nd edition curriculum is designed to:

- Support students to make sense of mathematics and learn that they can be mathematical thinkers
- Focus on computational fluency with whole numbers as a major goal of the elementary grades
- Provide substantive work in important areas of mathematics – rational numbers, geometry, measurement, data and early algebra – and connections among them
- Emphasize reasoning about mathematical ideas
- Engage the range of learners in understanding mathematics

Underlying these goals is a guiding principle for the Investigations authors as they approached students as agents of their own learning:

- *Students have mathematical ideas.* Students come to school with ideas about numbers, shapes and measurements, patterns, and data. If given the opportunity to learn in an environment that stresses making sense of mathematics, students build on the ideas they already have and learn about new mathematics they have never encountered. Students learn that they are capable of having mathematical ideas, applying what they know to new situations, and thinking and reasoning about unfamiliar problems.

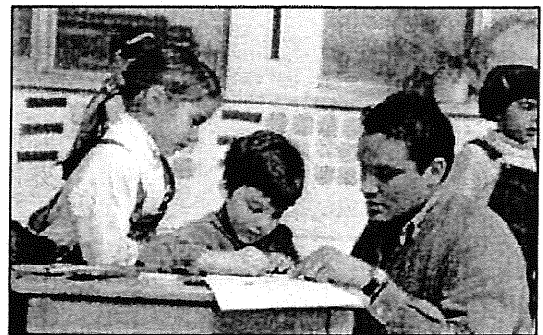
Program

Investigations is based on experience from research and practice, including field testing that involved documentation of thousands of hours in classrooms, observations of students, input from teachers, and analysis of student work. As a result, the curriculum addresses the learning needs of real students in a wide range of classrooms and communities. The investigations are carefully designed to invite all students into mathematics – girls and boys; members of diverse cultural, ethnic, and language groups; and students with a wide variety of strengths, needs, and interests.

Based on this extensive classroom testing, the curriculum takes seriously the time students need to develop a strong conceptual foundation and skills based on that foundation. Each curriculum unit focuses on an area of content in depth, providing time for students to develop and practice ideas across a variety of activities and contexts that build on each other. Daily guidelines for time spent on class sessions, Classroom Routines (K-3), and Ten Minute Math (3-5) reflect the commitment to devoting adequate time to mathematics in each school day.

Things You May Observe in an Investigations Classroom

- ❑ Students are actively involved in all aspects of the lesson
- ❑ Students use concrete mathematical manipulative objects as a natural part of instruction
- ❑ Students solve problems as their primary purpose in math class
- ❑ Students work fewer computations, but more problems that require higher-order thinking
- ❑ Students use calculators as a tool, as called for in the class sessions
- ❑ Students engage in activities that help develop spatial and number sense
- ❑ Students participate in individual, small group and whole class learning experiences
- ❑ Students record and reflect their thinking in math journals/logs/recording papers
- ❑ Students' estimation skills are incorporated in routines and investigations
- ❑ Students learn math facts through repeated work in activities and games
- ❑ Students use Shapes/LogoPaths software for computer work in geometry
- ❑ Students demonstrate and explain their strategies for the teacher to notate and display
- ❑ Students are assessed with formal and informal assessment
- ❑ Students work on extended problems
- ❑ Students study an algorithm to analyze & compare to strategies they know and understand
- ❑ Students reinforce mental mathematics daily
- ❑ Students participate in data collection and analysis
- ❑ Students ask questions of their peers and their teacher
- ❑ Students take home Family Math Letters regularly
- ❑ Students are asked to justify and explain their thinking



Family Letters in Investigations

Just as it is important for children to read at home, it is essential for them to do math at home and to sometimes involve family. The first Family Letter in each Unit called, About the Mathematics in This Unit introduces families to the Benchmark expectations for mastery and shows what the mathematics looks like that the children will be doing.

A second letter in each Unit called, Related Activities to Try at Home is sent home a few days after the first letter. It suggests related activities that families can do together. It also has a list of children's books that support students' work in mathematics. These books may be available at your public library.

An additional letter in the first Unit called, About Mathematics Homework, gives suggestions for helping students with their homework, setting up a good working environment, and asking productive questions.


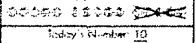
Name _____ Date _____

Solving Story Problems Family Letter

About the Mathematics in This Unit (page 1 of 2)

Dear Families,

Our class is starting a new unit in mathematics called *Solving Story Problems*. We will be working on mathematical ideas such as adding and subtracting whole numbers, counting to higher numbers, counting sets of objects, and finding multiple combinations of a number. Throughout this unit, students will be working toward the following goals:

BENCHMARK/GOALS	EXAMPLES
Find or read 3 combinations of 2 addends for a number up to 15.	$2 + 3 = 4$ $9 + 2 = 7$ $2 + 8 = 1$
Combine two small quantities.	You rolled a number cube and a dot cube. How much did you roll? 
Interpret (read) the action and sequence and solve addition and subtraction story problems.	There were 9 children playing in the park. Then 5 more came to play. How many children were at the park?
Subtract one small quantity from another.	Maria had 15 pennies. She spent 5. How many pennies did she have left? 
Represent numbers by using equivalent expressions.	Today's Number 10 $1 + 7$ $20 - 10$ $2 + 2 + 6$

(continued)

Grade 1

Name _____ Date _____


Unit Title To Come Family Letter

About Mathematics Homework

Dear Families and After-school Providers,

Homework is an important link between learning in and out of school. Homework assignments provide reinforcement of the work students do in math class. Here are some suggestions for making the homework experience successful for your child:

- Set a regular time every day for homework and establish a quiet place for your child to work (whether at home, in an after-school program, or some other place).
- Establish a system for bringing homework back and forth from school. Use an assignment book, a homework folder, or other organizational tools.
- Students will bring home the materials and directions needed to do homework activities. Certain materials will be used, again and again throughout the year. Since they will rely on these items, please help your child find a safe place to store these math materials—maybe in a math folder, box, or envelope—so that they can be easily located and used when needed. If your child regularly does homework in more than one place, we can talk about how to obtain the necessary materials.



(continued)

Section 1.3 M29

Grade 1

Investigations' Student Math Handbook

The *Student Math Handbook* is for students, teachers and parents to use. The Handbook has 2 kinds of pages, Math Words and Ideas, and Games.

The Math Words and Ideas pages highlight the major mathematical words and ideas, skills and concepts of the grade. It is a concise and visual summary of mathematics. Each Daily Page and Homework page has a Note to Parents with a Student Math Handbook reference page when appropriate. At home students can use the Handbook to review or for reference, or to share their mathematical thinking and ideas with parents. Parents can use the Handbook to browse through the mathematics of the grade level, see visual representations their students are using and refresh mathematical terms and ideas they may have forgotten.

All of the games of Investigations for that grade are in the back of the Student Math Handbook! If the game has a recording sheet, it is pictured as a mini-page so everyone knows what needs to be recorded.

The Handbook may be a Big Book used in the classroom in grades K-2. The Handbooks K-5 are also accessible online.

Math Words and Ideas

Multiple Turn Over

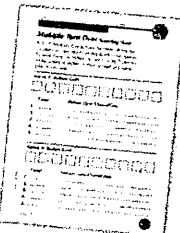
You need:

- Deck of Multiple Cards
- Calculators (optional)
- Multiple Turn Over Recording Sheet

Basic Game: Numbers 2-20
Intermediate Game: Numbers 2-80
Advanced Game: Numbers 2-110

Play with a partner or in a small group.

- 1 Deal out 10 Multiple Cards to each player.
- 2 Players arrange the Multiple Cards faceup in front of them. Each player should be able to see everyone's Multiple Cards.
- 3 The player with the smallest multiple begins. This player calls out any whole number (except 1). Each player records that factor on the Multiple Turn Over Recording Sheet.
- 4 All the players (including the player who called out the number) search for cards that are multiples of that number. Write those multiples on the recording sheet and turn the cards facedown.
- 5 Players take turns calling out numbers. The game is over when one player turns over all 10 Multiple Cards.



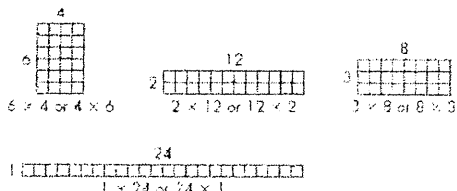
10 ten

Grade 4

Math Words and Ideas


Factors of 24

These are all the possible rectangular arrays that we can make with 24 square tiles:



Each dimension of these rectangles is a factor of 24.

Listed in order, the factors of 24 are:



Pairs of factors can be multiplied to get a product of 24:

$1 \times 24 = 24$	$2 \times 12 = 24$	$3 \times 8 = 24$	$4 \times 6 = 24$
$24 \times 1 = 24$	$12 \times 2 = 24$	$8 \times 3 = 24$	$6 \times 4 = 24$

? What are some other factors of 32?

seven 7

Grade 4

Homework and Daily Practice in Investigations

In Investigations, Homework and Daily Practice pages from the *Student Activity Book* are vehicles for connecting school mathematics with students' everyday lives. Homework and Daily Practice are extensions of classroom work that extend and solidify their mathematical understanding. Sometimes they offer review and practice of work done in class, sometimes preparation for upcoming activities, and sometimes numerical practice that revisits work in earlier units. It may include:

- Number games that may be played more than once to give students multiple opportunities to clarify mathematical ideas and reinforce basic facts.
- Problems to solve that ask students to use their prior knowledge of math skills and ideas.
- Tasks such as collecting data or taking measurements to be used solving a problem in class
- Facts to practice to become competent in estimating, and accurate and fluent in computation.

Homework and Daily Practice play roles both in supporting students' learning and in helping inform families about the ways in which students work with mathematical ideas in Investigations. Also, each Daily Page and Homework page has a Note to Parents with a *Student Math Handbook* reference page when appropriate.

Name _____ Date _____

More Coin Problems

Solve each problem.
Show your work.

1. How many dimes are in 75¢?

2. How many nickels are in 75¢?

3. Sally has 8 nickels and 7 dimes.
How much money does she have?

28

Grade 2

Name _____ Date _____

Patty's Pattern

Patty looked for patterns along the slanted "paths" of her multiplication table. She noticed a pattern in the amount you have to add to get from one number on the path to the next.

NOTE: Students have been discussing patterns in their multiplication table. Discuss your results with the class.

8 12 21 32 45 60 77 96

+7 +5 +7 +5 +7 +5 +7 +5

To get to the next number, you add 2 more each time.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3	6	9	12	15	18	21	24	27	30	33	36
4	8	12	16	20	24	28	32	36	40	44	48
5	10	15	20	25	30	35	40	45	50	55	60
6	12	18	24	30	36	42	48	54	60	66	72
7	14	21	28	35	42	49	56	63	70	77	84
8	16	24	32	40	48	56	64	72	80	88	96
9	18	27	36	45	54	63	72	81	90	99	108
10	20	30	40	50	60	70	80	90	100	110	120
11	22	33	44	55	66	77	88	99	110	121	132
12	24	36	48	60	72	84	96	108	120	132	144

1. Look at the other shaded path.
Does Patty's pattern work? Show why or why not.

Grade 4

The Importance of Playing Games More Than Once

Multiple Turn Over

You need:

- Deck of Multiple Cards
- Calculators (optional)
- Multiple Turn Over Recording Sheet

Basic Game: Numbers 2-50
Intermediate Game: Numbers 2-60
Advanced Game: Numbers 2-100

Play with a partner or in a small group.

- 1 Deal out 10 Multiple Cards to each player.
- 2 Players arrange the Multiple Cards faceup in front of them. Each player should be able to see everyone's Multiple Cards.
- 3 The player with the smallest multiple begins. This player calls out any whole number (except 1). Each player records that factor on the Multiple Turn Over Recording Sheet.
- 4 All the players (including the player who called out the number) search for cards that are multiples of that number. Write those multiples on the recording sheet and turn the cards facedown.
- 5 Players take turns calling out numbers. The game is over when one player turns over all 10 Multiple Cards.

Grade 4

Games are used throughout the Investigations program as a way to engage students in important mathematical ideas. The game format is one that students enjoy, so the potential for repeated experiences with a concept or skill is great. Because most games involve at least one other player, students are likely to learn strategies from each other whether they are playing cooperatively or competitively.

The more times students play a mathematical game, the more opportunities they have to practice important skills and to think and reason mathematically. The first time or two that students play, they focus on learning the rules. Once they have mastered the rules, their real work with the mathematical content begins.

Students need many opportunities to play mathematical games, not just during math time, but other times as well. Games played as homework can be a wonderful way of communicating with parents.

The game directions may come home as homework, or as a student sheet used in class. The game directions may also be accessed online.

How Many Am I Hiding?

You need:

- cubes
- recording sheet

Play with a partner.

- 1 Make a tower with some cubes and show your partner.
- 2 Each of you should count the cubes and write the number at the top of your recording sheet.
- 3 Now tell your partner not to look. Break off some of the cubes and hide them behind your back.
- 4 See if your partner can figure out how many cubes are hidden.
- 5 If your partner is right, you should each record the combination on the recording sheet.
- 6 Use the same total number of cubes and play again. This time your partner hides some of the cubes.

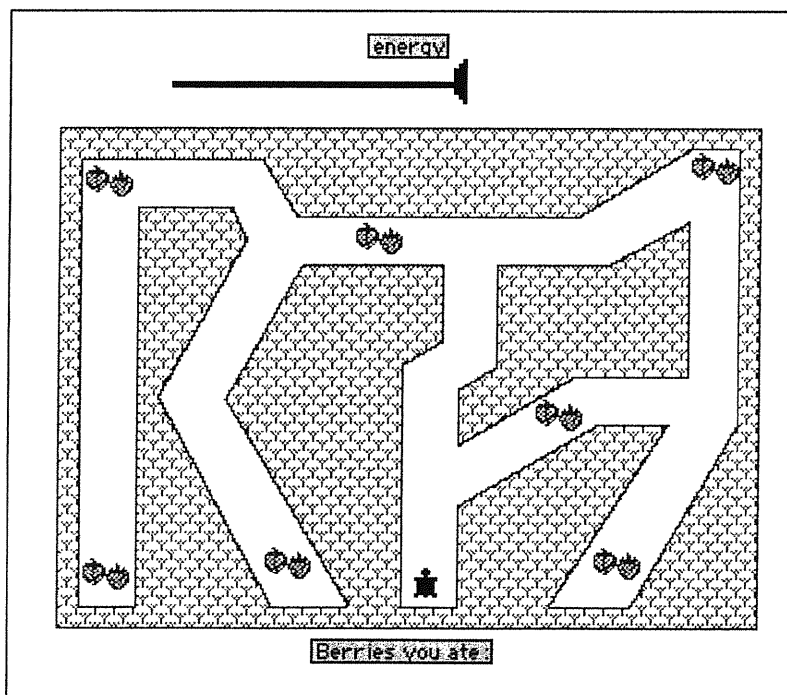
Grade 1

Technology in Investigations

The Investigations curriculum incorporates two forms of technology in the classroom: calculators and computers.

Calculators are assumed to be standard mathematical tools, available for student use as appropriate. Students need to learn how to use the calculator effectively and appropriately as a tool, just as they need to learn to read a clock, interpret a map, measure with a ruler, or use coins. They might use calculators at home for sensible purposes – just as you do – not as a replacement for mental calculations or for paper and pencil calculations they are learning to do. Calculators are recommended for only a few specific activities in the units.

Computers are explicitly linked to one or more curriculum units at each grade level. Shapes software is for grades K-2. LogoPaths software is for grades 3-5. Students' activities on the computers allow them to approach and visualize mathematical situations in new ways. With Shapes students have free exploration and structured activities. They can compose and decompose shapes, pattern a quilt, or tile a plane, and print copies of the entire workspace for you to see. explore the properties of geometric figures by drawing and manipulating them. LogoPaths provides an interactive environment where students can learn about math and computer programming through exploration activities. They can explore distance and angles, supplementary angles and regular polygons, symmetry and similarity.



LogoPaths

Assessment in Investigations

Problem 2
Benchmark addressed:
• Benchmark 3: Find the factors of 2-digit numbers.
In order to meet the benchmark, students' work should:
• Show all of the possible arrays for the number 36;
• List all of the factors of 36.

Meeting the Benchmark
These students tend to approach this task in an organized manner that helps them to be sure that all of the factors have been listed (for example, writing the factors in pairs before making the list and then writing the factors in order from either largest to smallest or from smallest to largest).

Partially Meeting the Benchmark
These students successfully construct most but not all of the arrays for 36 and list most but not all of the factors. They tend to be less organized in their approach to this task, not listing the factors in pairs or in order. For example, they may list 1 as a factor of 36 but fail to include 36 as a factor as well.

Not Meeting the Benchmark
Students who make an array or only a couple of arrays for this number may need more practice in making arrays for numbers smaller than 36. Ask these students to make arrays for the number 12 and help them to think about the pairs of factors for this number and how to put these factors in order.

Professional Development Teacher Notes 131

Assessment plays a critical role in teaching and learning, and it is an integral part of the Investigations Curriculum. A set of Benchmarks for each grade for each Unit establish what is expected to be mastered. These are shared in the first Family Letter of each Unit.

Assessment is an ongoing process toward the Benchmarks. Teachers may use Observation Checklists as they observe students' discussions and explanations of their strategies on a daily basis and examine their work as it evolves. Daily Practice gives the teacher a snapshot of skills and concepts learned. Individual assessment activities involve writing and reflecting, a discussion or brief interaction between student and teacher, or the creation and explanation of a product. And the End-of-Unit Assessment gives another opportunity to show mastery of the Benchmarks. Teachers have sample student work (see above) provided by the authors to help assess student's mastery of the benchmarks.

Teachers may also use ExamView practice sheets and tests, and SuccessTracker online tests to assess skills and concepts in a more standardized test format.

Encouraging Students to Think, Reason and Share Ideas

In the Investigations program students need to take an active role in mathematics. They must do more than get the correct answers; they must think critically about their ideas, give reasons for their answers, and communicate their ideas.

You can help your student develop their thinking and reasoning by asking questions such as:
Does this remind you of other problems you've worked?

What have you come up with so far?

Where do you think you should start?

What is the problem asking you to do?

Would drawing a picture help?

How can I help you?

How did you find your answer?

Why does that work?


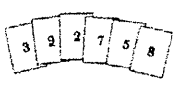
Is there another way?

How do you know it solves the problem?

Over time, students become more comfortable thinking about their solution, recording it, and explaining it to others. Your interest in their thinking is a great motivator!

Who Is Closer to 100?

Two students are playing Close to 100.

Student 1 has  Student 2 has 

Find the 4 cards that will get each player as close as possible to 100.

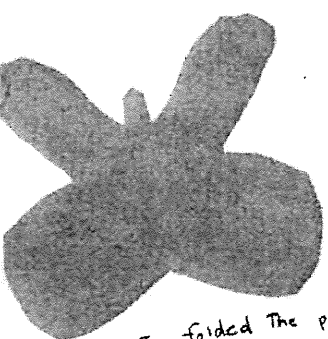
Student 1 $6 + 3 + 5 = 14$ Student 2 $7 + 5 + 2 + 3 = 17$

Who got closer to 100? Student 1

Choose one student's hand. Explain why this is as close as you can get to 100 with those six cards.

Student 1 has 14. I could not get any closer to 100. It was only 1 away from 100. If there were another 5 I would have got an 100. But I have did not have the 5.

Grade 3



First I folded the paper to find my line of symmetry. I made a hole of a butterfly then I cut it out then I had a butterfly

Grade 2

More Children's Literature

Investigations uses children's literature to support the mathematical ideas the students investigate. The second Family Letter in each unit will give you suggestions for related literature. Below are some more suggestions to look for at the local public library.

K-1	2-3	4-5
Allen, Pamela. <u>Who Sank the Boat?</u>	Carle, Eric. <u>The Very Hungry Caterpillar</u>	Anno, Mitsumasa. <u>Anno's Magic Seeds</u>
Burns, Marilyn. <u>The Greedy Triangle</u>	Dee, Ruby. <u>Two Ways to Count to Ten</u>	Birch, David. <u>The King's Chessboard</u>
Crews, Donald. <u>Ten Black Dots</u>	Emberley, Ed. <u>Ed Emberley's Picture Pie</u>	Clement, Rod. <u>Counting on Frank</u>
Henkes, Kevin. <u>Chrysanthemum</u>	Giganti, Paul, Donald Crews. <u>Each Orange Had 8 Slices</u>	Leedy, Loreen. <u>Fraction Action</u>
Grossman, Virginia <u>Ten Little Rabbits</u>	Hong, Lily Toy. <u>Two of Everything</u>	Mathis, Sharon Bell. <u>The Hundred Penny Box</u>
Lankford, Mary. <u>Hopscotch Around the World</u>	Hutchins, Pat. <u>The Doorbell Rang</u>	Pittman, Helena Clare. <u>A Grain of Rice</u>
Reid, Margarette. <u>The Button Box</u>	Merriam, Eve. <u>12 Ways to Get to 11</u>	Schwartz, David. <u>If You Made a Million</u>
Sturges, Philemon. <u>Ten Flashing Fireflies</u>	Pinczes, Elinor J. <u>One Hundred Hungry Ants</u>	Tompert, Ann. <u>Grandfather Tang's Story</u>



Try-Me Activities

	K-1	2-3	4-5
Money:	Recognize, name, know the value and count coins	Make change, make 25 and 50 cents multiple ways, manage an allowance	Help grocery shop, compare prices, budget allowance for saving/spending short/long term
Counting:	Count things around the home, past 10 Identify numbers on signs and in an elevator; set the table for your family size	Count by 2, 5, 10, count past 100, look for patterns, practice skip counting	Practice skip counting – starting at 2, 3, 7, 9, count past 1000 counting by 25, 50, 250
Math Facts:	Learn single digit facts, start with doubles 1+1, 2+2, 3+3, 5-5, 4-4, 3-3	Know addition and subtraction facts to 20, begin learning multiplication and division fact families ($3 \times 4 = 12$, $4 \times 3 = 12$, $12/3 = 4$, $12/4 = 3$)	Know multiplication and division facts to 12, fluently and accurately
Time:	Read clocks on the hour and half hour; name days of week, months of the year, seasons	Know minutes in an hour, hours in a day, days in a week; read an analog clock	Practice scheduling, time management; determine elapsed time
Measurement:	Compare household items in length, weight, mass	Using measurement tools: ruler, tape measure, scale, etc.	Participate in cooking, building, measuring; rearrange your bedroom
Data:	Count and compare: cars vs trucks; record and compare: sunny/cloudy days	Survey and graph family members “favorites”, describe the data, and ask “why” and “how” questions	Discuss newspaper graphs or charts, discuss the probability of likely and unlikely events
Geometry:	Name shapes (circle, square, rectangle) and find representations in the home and outside	Name and describe differences of 2- and 3-D objects in the home, explore area and volume of cereal boxes	Draw up a proposal for new carpet and paint for your bedroom; determine the cost