

A Correlation of



to the

**Indiana
Academic Standards for
Mathematics**

Grades K-5



G/M-209

INTRODUCTION

This document demonstrates how well ***Investigations in Number, Data, and Space®*** integrates with the *Indiana Academic Standards for Mathematics*. The citations within this correlation provide Investigation Curriculum Unit titles, and Investigation and Session numbers or Focus Time/Choice Time titles correlated to the objectives of the *Indiana Academic Standards for Mathematics*.

Investigations in Number, Data, and Space® is a Kindergarten through Grade 5 curriculum consisting of a series of Teacher's Editions that focus on major mathematical ideas, content, and pedagogy. Each book emphasizes depth of mathematical thinking over fragmented topics. Students invent strategies and approaches to solving problems and rely less on rote learning stressed in traditional textbooks. The program blends concrete materials with appropriate technology, including calculators in everyday mathematical lessons.

Developed by TERC under a grant from the National Science Foundation, ***Investigations in Number, Data, and Space®*** is comprehensive in its approach to students of diverse cultural, ethnic and language groups. In an effort to give mathematical lessons a broader spectrum, students are encouraged to explore working in groups, individually and as a whole class. By incorporating these methods into everyday learning, students learn to express mathematical thinking through talking, drawing, and writing.

Investigations in Number, Data and Space® was developed after three years of nationwide field-testing and includes teacher's practical suggestions, student dialogues, and teacher notes.

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**Investigations in Number, Data, and Space
to the
Indiana Academic Standards for Mathematics**

Kindergarten

Standard 1

Number Sense

Students understand the relationship between numbers and quantities up to 10, and that a set of objects has the same number in all situations regardless of the position or arrangement of the objects. * set: collection of objects, numbers, etc.*

**K.1.1 Match sets of objects one-to-one.
Example: Take crayons from the box and give one to each student in the group. Explain what you are doing.**

Mathematical Thinking in Kindergarten

Investigation 1: Focus Time: Attendance

Counting Ourselves and Others

Investigation 1

**K.1.2 Compare sets of up to ten objects and identify whether one set is equal to, more than, or less than another.
Example: Compare the blocks in two boxes. Tell which box contains more blocks and explain the way in which you decided on your answer.**

Mathematical Thinking in Kindergarten

Investigation 4: Focus Time: Today's Question

Counting Ourselves and Others

Investigation 4

Collecting, Counting, and Measuring

Investigations 3, 4, 5, 6

Classroom Routines: Attendance, The Counting Jar, The Calendar

**K.1.3 Know that larger numbers describe sets with more objects in them than sets described by smaller numbers.
Example: Understand that a set of 7 apples contains more apples than a set of 3 apples.**

How Many in All?

Investigation 2: Choice Time: Grab Two Handfuls

Counting Ourselves and Others

Investigation 4

- K.1.4 Divide sets of ten or fewer objects into equal groups.**
Example: Take 6 blocks and give the same number to each of 3 children.
In the following investigations, students recognize equal quantities and sets.
Collecting, Counting, and Measuring
Investigations 4, 5, 6
- K.1.5 Divide shapes into equal parts.**
Example: Divide a piece of paper into 4 equal pieces.
In a geometric application of this concept, Kindergarten students using *Investigations in Number, Data, and Space* find combinations of shapes that fill an area and explore relationships between pattern block shapes. Grade 1 students divide shapes and groups into equal parts and equal groups.
Reference:
Making Shapes and Building Blocks
Investigation 4: Choice Time: Fill the Hexagons
- K.1.6 Count, recognize, represent, name, and order a number of objects (up to 10). Example: Count a group of seven pennies. Recognize that 7 is the number for this set.**
Mathematical Thinking in Kindergarten
Investigations 1, 2, 3, 4
Collecting, Counting, and Measuring
Investigations 1, 2, 3, 4, 5, 6
Counting Ourselves and Others
Investigations 1, 3, 4
How Many in All?
Investigations 1, 2, 3, 4
Classroom Routines: Attendance, The Counting Jar, Calendar
- K.1.7 Find the number that is one more than or one less than any whole number* up to 10. Example: You have a bag of 7 apples. How many apples are in a box that holds one less than the bag of apples?**
*** whole numbers: 0, 1, 2, 3, etc.**
Collecting, Counting, and Measuring
Investigation 1: Focus Time: Counting Books

K.1.8 Use correctly the words one/many, none/some/all, more/less, and most/least.

Example: Take some of the blocks out of this box, but not all of them.

Mathematical Thinking in Kindergarten

Investigation 4: Focus Time: Today's Question

How Many In All?

Investigation 2: Choice Time: Grab Two Handfuls

Investigation 3: Choice Time: Double Compare

Investigation 4: Focus Time: Blue and Red Crayons

Collecting, Counting, and Measuring

Investigations 3, 4, 5, 6

K.1.9 Record and organize information using objects and pictures.

Example: Ask some of your friends what pets they have. Use pictures of animals to show the number of pets your friends have.

Mathematical Thinking in Kindergarten

Investigation 4: Focus Time: Today's Question

Pattern Trains and Hopscotch Paths

Investigations 1, 2, 3, 4

How Many in All?

Investigations 1, 2, 3, 4

Counting Ourselves and Others

Investigations 1, 2, 3, 4

Collecting, Counting, and Measuring

Investigation 1: Choice Time: My Counting Book, Grab and Count

Investigations 2, 3, 6

Standard 2

Computation

Students understand and describe simple additions and subtractions.

K.2.1 Model addition by joining sets of objects (for any two sets with fewer than 10 objects when joined).

Example: Put together 3 pencils and 2 pencils. Count the total number of pencils.

How Many in All?

Investigation 1: Choice Time: Collect 15 Together, Inventory Bags
Investigations 2, 3, 4

Collecting, Counting, and Measuring

Investigation 4: Choice Time: Collect 10 Together
Investigation 5: Choice Time: Racing Bears
Investigation 6

K.2.2 Model subtraction by removing objects from sets (for numbers less than 10).

Example: From a pile of 9 crayons, take away 6 crayons. Count the number of crayons left in the pile.

How Many in All?

Investigation 3

Counting Ourselves and Others

Investigation 4

K.2.3 Describe addition and subtraction situations (for numbers less than 10).

Example: In the last example, explain what operation you were using when you took away crayons from the pile.

How Many in All?

Investigation 3

Standard 3

Algebra and Functions

Students sort and classify objects.

K.3.1 Identify, sort, and classify objects by size, number, and other attributes. Identify objects that do not belong to a particular group.

Example: Find the squares in a collection of shapes. Sort these squares into large ones and small ones and explain how you decided which squares went in each pile.

Mathematical Thinking in Kindergarten

Investigation 1: Choice Time: Exploring Color Tiles, Exploring Pattern Blocks, Exploring Pattern Blocks

Investigation 3: Choice Time: Measuring Table

Patterns, Trains, and Hopscotch Paths

Investigation 1

Investigation 4: Choice Time: Staircase Patterns

Counting Ourselves and Others

Investigation 1: Choice Time: Self-Portraits

Investigation 2

**K.3.2 Identify, copy, and make simple patterns with numbers and shapes.
Example: Make a pattern of squares and circles with one square, one circle, one square, one circle, etc.**

Mathematical Thinking in Kindergarten

Investigation 1

Patterns, Trains, and Hopscotch Paths

Investigations 1, 2, 3, 4

Classroom Routines: Calendar, Patterns on the Pocket Chart

Standard 4

Geometry

Students identify common objects around them and describe their geometric features and position.

K.4.1 Identify and describe common geometric objects: circle, triangle, square, rectangle, and cube.

Example: Look for cubes and circles at home and at school.

Mathematical Thinking in Kindergarten

Investigation 1: Choice Time: Exploring Pattern Blocks, Exploring Geoblocks

Making Shapes and Building Blocks

Investigations 1, 2, 3, 4, 5

K.4.2 Compare and sort common objects by position, shape, size, roundness, and number of corners.

Example: Compare the numbers of corners of triangles, squares, and rectangles.

Mathematical Thinking in Kindergarten

Investigation 1: Choice Time: Exploring Pattern Blocks, Exploring Geoblocks

Making Shapes and Building Blocks
Investigations 1, 2, 3, 4

K.4.3 Identify and use the terms: inside, outside, between, above, and below. Example: Tell when a block is inside or outside a box.

Making Shapes and Building Blocks
Investigation 2: Choice Time: Pattern Block Puzzles

Standard 5

Measurement

Students understand the concept of time and units to measure it. They understand that objects have length, capacity, weight, and temperature, and that they can compare objects using these qualities.

K.5.1 Make direct comparisons of the length, capacity, weight, and temperature of objects and recognize which object is shorter, longer, taller, lighter, heavier, warmer, cooler or holds more. Example: Hold two books side by side to see which is shorter. Hold one in each hand to see which is heavier.

How Many in All?
Investigation 1
Collecting, Counting and Measuring
Investigation 3

K.5.2 Understand concepts of time: morning, afternoon, evening, today, yesterday, tomorrow, week, month, and year. Understand that clocks and calendars are tools that measure time. Example: Use a calendar to find the number of days in the month of your birthday.

Mathematical Thinking in Kindergarten
Investigation 3: Focus Time: Calendar
Classroom Routines: Calendar

Standard 6**Problem Solving**

Students make decisions about how to set up a problem.

K.6.1 Choose the approach, materials, and strategies to use in solving problems.

**Example: Solve the problem: “There are four blocks on the table and a box of blocks that is closed. The teacher says that there are five blocks in the box. Find the number of blocks in all, without opening the box.”
Decide to draw a picture.**

Counting Ourselves and Others

Investigations 1, 3, 4

How Many in All?

Investigation 3: Focus Time: Story Problems

Investigation 4: Focus Time: Five Crayons in All

K.6.2 Use tools such as objects or drawings to model problems.

Example: In the first example, draw a picture of the four blocks that you can see, and then draw five more blocks for the ones that you cannot see.

Throughout this standards-based program, students work with a variety of objects and make drawings to solve problems. These are a few of the many examples.

Mathematical Thinking in Kindergarten

Investigations 2, 3

Pattern Trains and Hopscotch Paths

Investigations 1, 3, 4

Collecting, Counting, and Measuring

Investigation 3

Counting Ourselves and Others

Investigation 1

Making Shapes and Building Blocks

Investigations 1, 2, 4

How Many in All?

Investigation 4

Students solve problems in reasonable ways and justify their reasoning.

**K.6.3 Explain the reasoning used with concrete objects and pictures.
Example: In the first example, count the number of blocks that you have drawn and write the number that represents the total.**

Pattern Trains and Hopscotch Paths

Investigations 3, 4

Counting Ourselves and Others

Investigations 1, 2

Investigation 3: Choice Time: Yes/No Surveys

**K.6.4 Make precise calculations and check the validity of the results in the context of the problem.
Example: In the first example, open the box of blocks and place them on the table. Count the total number of blocks on the table to see whether your drawing was correct.**

Collecting, Counting, and Measuring

Investigation 2

Investigation 4: Focus Time: Letters in Our Name

Investigation 4: Choice Time: Collect 10 Together

How Many in All

Investigation 2: Choice Time: Two Tiles

Investigations 3, 4

**Investigations in Number, Data, and Space
to the
Indiana Academic Standards for Mathematics**

Grade One

Standard 1

Number Sense

Students understand symbols, objects, and pictures used to represent numbers up to 100 and show an understanding of fractions.

1.1.1 Count, read, and write whole numbers* up to 100.

**whole numbers: 0, 1, 2, 3, etc.*

Example: Read “seventy-two” for the number 72.

Mathematical Thinking at Grade 1

Investigation 1: Sessions 2–4

Investigation 2: Sessions 1–6

Investigation 4: Sessions 1–6

Investigation 5: Sessions 1–6

Building Number Sense

Investigation 1: Sessions 1–8

Investigation 2: Sessions 1–6, 8–9

Investigation 3: Sessions 1–7, 9

Investigation 4: Sessions 1–10

Number Games and Story Problems

Investigation 2: Sessions 6–12

Bigger, Taller, Heavier, Smaller

Investigation 2: Sessions 1–7

Classroom Routines: Counting

- 1.1.2 Count and group objects in ones and tens.**
Example: Separate a group of 34 blocks into three groups of 10 blocks and 4 single blocks.
Number Games and Story Problems
Investigation 2: Sessions 10–12
- 1.1.3 Identify the number of tens and ones in numbers less than 100.**
Example: How many tens and how many ones are in 56? Explain your answer.
Number Games and Story Problems
Investigation 2: Sessions 10–12
- 1.1.4 Name the number that is one more than or one less than any number up to 100.**
Example: Name the number one less than 78.
These counting activities provide opportunities to introduce this concept.
Mathematical Thinking at Grade 1
Investigation 4: Session 5
Building Number Sense
Investigation 3: Sessions 1–9
- 1.1.5 Compare whole numbers up to 10 and arrange them in numerical order.**
Example: Arrange the numbers 5, 2, and 9 in order from greatest to least.
Mathematical Thinking at Grade 1
Investigation 2: Sessions 2, 3, 5–6
Number Games and Story Problems
Investigation 1: Sessions 7–9
- 1.1.6 Match the number names first, second, third, etc. with an ordered set of up to 10 items.**
Example: Point out the fifth child from the front of a line of children.
Several activities provide opportunities for practice with ordinal numbers. Notes to the teacher point out these opportunities.
Mathematical Thinking at Grade 1
Investigation 2: Sessions 2 and 3 (see p. 37)
Building Number Sense
Investigation 3: Sessions 1–2

- 1.1.7 Recognize when a shape is divided into congruent (matching) parts.**
Example: Given a rectangle with lines dividing it into parts, decide whether the parts are the same size.
In the following activities, students combine pattern blocks, some of which are congruent, to fill a variety of shapes.
Quilt Squares and Block Towns
Investigation 1: Sessions 7-10
- 1.1.8 For a shape divided into 8 or fewer congruent (matching) parts, describe a shaded portion as “__ out of __ parts” and write the fraction.**
Example: Given a circle divided into 4 equal parts with 3 of the parts shaded, describe the shaded portion as “3 out of 4 parts” and write the fraction for the shaded portion.
In the following activities, students shade congruent triangles and squares to make quilt patterns.
Quilt Squares and Block Towns
Investigation 1: Sessions 13–15
- 1.1.9 For a set of 8 or fewer objects, describe a subset as “__ out of __ parts” and write the fraction.**
Example: Given 3 red pencils and 2 blue pencils, describe the subset of red pencils as “3 out of 5 parts” and write the fraction of the pencils that are red.
In these activities students determine “the number out of a group” that belong to a subset, for example because of particular attributes. The concept of fractions begins in *Investigations in Number, Data, and Space*, Grade 2.
Mathematical Thinking in Grade 1
Investigation 5: Sessions 2–4
Number Games and Story Problems
Investigation 1: Sessions 7–9
About Classroom Routines: Counting
- 1.1.10 Represent, compare, and interpret data using pictures and picture graphs.**
Example: Use a picture graph to show how many dogs, cats, etc. your friends have. Which kind of pet appears most often? Explain your answer.
Mathematical Thinking at Grade 1
Investigation 5: Sessions 5–6

Survey Questions and Secret Rules

Investigation 3: Sessions 1–3

Investigation 4: Sessions 2–5

Standard 2

Computation

Students demonstrate the meaning of addition and subtraction and use these operations to solve problems.

1.2.1 Show the meaning of addition (putting together, increasing) using objects.

Example: Put together 3 pencils and 5 pencils. Tell how many pencils you have and explain what you are doing.

Mathematical Thinking at Grade 1

Investigation 2: Sessions 1–6

Investigation 4: Sessions 2–4, 6

Investigation 5: Sessions 2–4

Building Number Sense

Investigation 1: Sessions 3–9

Number Games and Story Problems

Investigation 1: Sessions 1–10

1.2.2 Show the meaning of subtraction (taking away, comparing, finding the difference) using objects.

Example: Take away 6 blocks from a group of 10. Tell how many blocks are left and explain what you are doing.

Building Number Sense

Investigation 4: Sessions 1–5, 7–10

Number Games and Story Problems

Investigation 3: Sessions 1–8, 10–13

1.2.3 Show equivalent forms of the same number (up to 20) using objects, diagrams, and numbers.**Example: Write 15 as $8 + 7$, $5 + 5 + 5$, $10 + 5$, $15 + 0$, $17 - 2$, etc.**

Building Number Sense

Investigation 1: Sessions 1–9

Investigation 2: Sessions 1, 4–8

Number Games and Story Problems

Investigation 1: Sessions 4–5, 7–9

Investigation 3: Sessions 3–8, 10–12

1.2.4 Demonstrate mastery of the addition facts (for totals up to 20) and the corresponding subtraction facts.**Example: Add $11 + 8$, subtract $16 - 9$, add $4 + 7$.**

Mathematical Thinking at Grade 1

Investigation 2: Sessions 4–6

Investigation: Session 4

Building Number Sense

Investigation 1: Sessions 1–9

Investigation 2: Sessions 1–9

Investigation 4: Sessions 1–10

Number Games and Story Problems

Investigation 1: Sessions 1–10

Investigation 2: Sessions 1–8, 10–12

Investigation 3: Sessions 1–8

1.2.5 Understand the meaning of the symbols $+$, $-$, and $=$.**Example: Use symbols to write the number sentence “one added to three equals four.”**

Building Number Sense

Investigation 2: Session 2

Investigation 4: Sessions 1–2

Number Games and Story Problems

Investigation 1: Sessions 1–10

1.2.6 Understand the role of zero in addition and subtraction.

Example: You start with 6 eggs and then give away 0 eggs. How many eggs do you have now?

Building Number Sense

Investigation 1: Sessions 7–8 (See p. 27)

Investigation 2: Sessions 4–5, 6–8 (See pp. 65, 71)

1.2.7 Understand and use the inverse relationship between addition and subtraction facts (such as $4 + 2 = 6$, $6 - 2 = 4$, etc.) to solve simple problems.

Example: List three other facts using addition or subtraction that are related to $3 + 5 = 8$.

Several activities in *Investigations in Number, Data, and Space*, Grade 1 explore the relationship between addition and subtraction. A more formal treatment of this concept begins in *Investigations in Number, Data, and Space* Grade 2.

Mathematical Thinking in Grade 1

Investigation 5: Session 2

Building Number Sense

Investigation 2: Sessions 4–5

Investigation 4: Sessions 3–5

Standard 3**Algebra and Functions**

Students use number sentences with the symbols $+$, $-$, and $=$ to solve problems.

1.3.1 Write and solve number sentences from problem situations involving addition and subtraction.

Example: You have 3 pencils and your friend has 2 pencils. You want to know how many pencils you have altogether. Write a number sentence for this problem and use it to find the total number of pencils.

Building Number Sense

Investigation 2: Sessions 1–2, 6–9

Investigation 4: Sessions 1–5, 7–10

Number Games and Story Problems

Investigation 1: Sessions 1–10

- 1.3.2 Create word problems that match given number sentences involving addition and subtraction.**
Example: Tell a story or draw a picture for a problem that can be solved using the number sentence $3 + 6 = 9$.
Number Games and Story Problems
Investigation 1: Session 10
- 1.3.3 Recognize and use the relationship between addition and subtraction.**
Example: Start with 8 blocks. Add 5 more blocks. How many do you have? Now take away 5 blocks. How many do you have now? Explain your answer.
Several activities in *Investigations in Number, Data, and Space*, Grade 1 explore the relationship between addition and subtraction. A more formal treatment of this concept begins in *Investigations in Number, Data, and Space* Grade 2.
Mathematical Thinking in Grade 1
Investigation 5: Session 2
Building Number Sense
Investigation 2: Sessions 4–5
Investigation 4: Sessions 3–5
- 1.3.4 Create and extend number patterns using addition.**
Example: A number pattern begins with these numbers: 1, 3, 5, ... Tell what the next number will be and explain how you decided on that number.
Mathematical Thinking at Grade 1
Investigation 3: Sessions 1–6
Investigation 4: Sessions 2–3, 4–6
Building Number Sense
Investigation 3: Sessions 1–8
Investigation 4: Session 10
Number Games and Story Problems
Investigation 2: Sessions 2, 6–9

Standard 4**Geometry**

Students identify common geometric shapes, classify them by common attributes, and describe their relative position or their location in space.

1.4.1 Identify, describe, compare, sort, and draw triangles, rectangles, squares, and circles.

Example: Draw a square and a circle and write their names next to them.

Mathematical Thinking at Grade 1

Investigation 1: Sessions 1–4

Quilt Squares and Block Towns

Investigation 1: Sessions 1, 3–6, 8–15

Investigation 3: Sessions 3–4

1.4.2 Identify triangles, rectangles, squares, and circles as the faces* of three-dimensional objects. *face: flat side, like the front of the cereal box

Example: Look at a collection of solid objects and find triangles and squares on their sides.

Quilt Squares and Block Towns

Investigation 2: Sessions 1–10

Investigation 3: Sessions 1–5

1.4.3 Classify and sort familiar plane and solid objects by position, shape, size, roundness, and other attributes. Explain the rule you used.

Example: Group a collection of objects by something they have in common. Explain your grouping.

Quilt Squares and Block Towns

Investigation 1: Sessions 11–12

Investigation 2: Sessions 1–3, 4–10

1.4.4 Identify objects as two- or three-dimensional.

Example: Sort various objects (cube, square, triangle, prism) into the categories “two- dimensional” and “three-dimensional”. Explain your choices.

In the following activities, students compare attributes of two-dimensional figures and three-dimensional figures.

Quilt Squares and Block Towns

Investigation 2: Sessions 3–6

Investigation 3: Sessions 1–2

1.4.5 Give and follow directions for finding a place or object.

Example: Show someone how to get to the school library by making a map or diagram.

Quilt Squares and Block Towns

Investigation 3: Sessions 6–7

1.4.6 Arrange and describe objects in space by position and direction: near, far, under, over, up, down, behind, in front of, next to, to the left or right of.

Example: Name objects that are near your desk and objects that are in front of it. Explain why there may be some objects in both groups.

Quilt Squares and Block Towns

Investigation 3: Sessions 6–7

1.4.7 Identify geometric shapes and structures in the environment and specify their location.

Example: Find as many rectangles as you can in your classroom. Record the rectangles that you found by making drawings or using a camera.

Quilt Squares and Block Towns

Investigation 1: Session 1

Investigation 3: Sessions 3–4

Standard 5**Measurement**

Students learn how to measure length, as well as how to compare, order, and describe other kinds of measurement.

1.5.1 Measure the length of objects by repeating a non-standard unit or a standard unit.

Example: Measure the length of your desk in pencil-lengths.

Bigger, Taller, Heavier, Smaller

Investigation 3: Sessions 2, 4–5

1.5.2 Use different units to measure the length of the same object and predict whether the measure will be greater or smaller when a different unit is used.

Example: If you measure your desk with a shorter pencil, will the number of pencil-lengths be more or less? Measure the desk to find out your answer.

Bigger, Taller, Heavier, Smaller

Investigation 3: Sessions 1–3

1.5.3 Recognize the need for a fixed unit of length.

Example: Give students different lengths of string and have them measure the width of a doorway. Talk about why their answers are different and the kinds of problems this can cause.

Bigger, Taller, Heavier, Smaller

Investigation 3: Session 2

1.5.4 Measure and estimate the length of an object to the nearest inch and centimeter.

Example: Have some students measure the width of the doorway in inches and some measure it in centimeters. Discuss why these are better ways of measuring than using the pieces of string.

In the following activities, students use standard units (interlocking cubes) to measure objects.

Bigger, Taller, Heavier, Smaller

Investigation 3: Sessions 4–5

1.5.5 Compare and order objects according to area, capacity, weight, and temperature, using direct comparison or a non-standard unit.

Example: Use a scale or balance to see how many crayons weigh the same as a shoe.

Bigger, Taller, Heavier, Smaller

Investigation 1: Sessions 1–7

Investigation 2: Sessions 1–7

1.5.6 Tell time to the nearest half-hour and relate time to events (before/after, shorter/longer).

Example: Is recess before or after lunch?

Classroom Routines described in an appendix at the end of each of the texts in the *Investigations in Number, Data, and Space* series include Understanding Time and Changes, which consists of activities in which students sequence events, explore units of time and relationships among them, and use a calendar to solve problems. The only other references to time in the Grade 1 texts of the *Investigations in Number, Data, and Space* series are to dates and months on a calendar. Students become familiar with calendar features; observe the cyclical nature of the sequence of months; and group, describe, organize, and order data about birthdays. Students investigate clock time beginning in Grade 2.

Calendar References:

Survey Questions and Secret Rules

Investigation 3: Sessions 1–3

1.5.7 Identify and give the values of pennies, nickels, and dimes.

Example: How many pennies have the same value as two nickels?

Building Number Sense

Investigation 3: Sessions 5–7 (See p. 101)

Number Games and Story Problems

Investigation 2: Sessions 3–8

Standard 6**Problem Solving**

Students make decisions about how to set up a problem.

1.6.1 Choose the approach, materials, and strategies to use in solving problems.

Example: Solve the problem: “The number 10 can be written in different ways using addition: $10 = 4 + 6$ or $10 = 1 + 9$... Find how many ways you can write 10 by adding two numbers.” Use blocks to set up the problem.

Throughout *Investigations in Number, Data, and Space* series students are encouraged to use different materials and strategies to solve problems. The following are some of the many examples.

Mathematical Thinking at Grade 1

Investigation 2: Sessions 4–6

Investigation 4: Session 4

Building Number Sense

Investigation 1: Sessions 1–9

Investigation 2: Sessions 1–9

Investigation 4: Sessions 6–9

1.6.2 Use tools such as objects or drawings to model problems.

Example: In the first example, show the number 10 using addition of whole numbers by counting out ten blocks. Divide them into two piles and write a number sentence that shows the number in each pile of blocks.

Mathematical Thinking at Grade 1

Investigation 2: Sessions 4–6

Investigation 4: Sessions 4–6

Building Number Sense

Investigation 1: Sessions 7–9

Investigation 2: Sessions 1–2, 4–9

Investigation 3: Session 9

Investigation 4: Sessions 1–10

Number Games and Story Problems

Investigation 1: Sessions 1–10

Investigation 3: Sessions 1–13

Bigger, Taller, Heavier, Smaller

Investigation 3: Sessions 2, 4–5

Students solve problems and justify their reasoning.

1.6.3 Explain the reasoning used and justify the procedures selected in solving a problem.

Example: In the first example, make two piles of ten blocks; separate one block from the first pile and count the number of blocks left.

Separate two blocks from the second pile and count the number left.

Describe any pattern of numbers that you find.

Mathematical Thinking at Grade 1

Investigation 4: Session 5

Building Number Sense

Investigation 2: Sessions 1–2, 6–9

Investigation 4: Sessions 1–5, 7–10

Survey Questions and Secret Rules

Investigation 2: Sessions 1–2, 5–6

Number Games and Story Problems

Investigation 1: Sessions 7–9

Investigation 3: Sessions 1–13

Bigger, Taller, Heavier, Smaller

Investigation 2: Sessions 1–7

Investigation 3: Sessions 1–5

1.6.4 Make precise calculations and check the validity of the results in the context of the problem.

Example: In the first example, check your results by setting out 10 blocks showing $1 + 9$, another 10 blocks showing $2 + 8$, and so on.

Continue to count out piles of 10 blocks to find the total number of ways that ten blocks can be separated into two piles. Describe the patterns that you find and how you know that you have found all of them.

In many activities, teachers observe students to see if they have developed strategies for checking that their solutions are correct. The following are some of the many examples:

Mathematical Thinking at Grade 1

Investigation 2: Sessions 5, 6

Investigation 4: Session 6

Building Number Sense

Investigation 2: Session 1

1.6.5 Understand and use connections between two problems.

Example: Use the problem you have just solved to find how many ways you can write 16 by adding two numbers.

Mathematical Thinking in Grade 1

Investigation 2: Sessions 4–6

Investigation 4: Session 4

Building Number Sense

Investigation 2: Sessions 1, 6–9

Number Games and Story Problems

Investigation 1: Sessions 4–5

**Investigations in Number, Data, and Space
to the
Indiana Academic Standards for Mathematics**

Grade Two

Standard 1

Number Sense

Students understand the relationships among numbers, quantities, and place value in whole numbers up to 100. They understand that fractions may refer to parts of a set* and parts of a whole.*

** whole numbers: 0, 1, 2, 3, etc.*

** set: collection of objects, numbers, etc.*

2.1.1 Count by ones, twos, fives, and tens to 100.

Example: Count 74 pencils by groups of tens and twos.

Mathematical Thinking in Grade 2

Investigation 2: Session 6

Investigation 4: Sessions 1–4

Investigation 5: Sessions 4–5

Coins, Coupons, and Combinations

Investigation 2: Sessions 1–5

2.1.2 Identify the pattern of numbers in each group of ten, from tens through nineties.

Example: Where on a hundreds chart are the numbers 12, 22, 32, etc.?

Coins, Coupons, and Combinations

Investigation 1: Sessions 7, 10

Investigation 4: Sessions 2–4

2.1.3 Identify numbers up to 100 in various combinations of tens and ones.

Example: $32 = 3 \text{ tens} + 2 \text{ ones} = 2 \text{ tens} + 12 \text{ ones}$, etc.

This activity helps students build visual images to see number in terms of 10.

Classroom Routines: Quick Images

- 2.1.4 Name the number that is ten more or ten less than any number 10 through 90.**
Example: Name the number ten more than 54.
Coins, Coupons, and Combinations
Investigation 2: Sessions 4–5, 10
Putting Together and Taking Apart
Investigation 2: Sessions 1–4
- 2.1.5 Compare whole numbers up to 100 and arrange them in numerical order.**
Example: Put the numbers in order of size: 95, 28, 42, 31.
Coins, Coupons, and Combinations
Investigation 4: Sessions 1–4
Putting Together and Taking Apart
Investigation 2: Sessions 3–7
Investigation 4: Session 1
- 2.1.6 Match the number names *first, second, third, etc.* with an ordered set of up to 100 items.**
Example: Identify the seventeenth letter of the alphabet.
Several activities provide opportunities for practice with ordinal numbers. Notes to the teacher can help point out these opportunities. The following are some examples:
Mathematical Thinking at Grade 2
Investigation 2: Sessions 1, 6
Investigation 3: Session 3–6
Investigation 4: Sessions 1–4
Investigation 5: Sessions 3–5
- 2.1.7 Identify odd and even numbers up to 100.**
Example: Find the odd numbers in this set: 44, 31, 100, 57, 28.
This concept is covered in Grade 3 of the *Investigations in Number, Data, and Space* series.
- 2.1.8 Recognize fractions as parts of a whole or parts of a group (up to 12 parts).**
Example: Divide a cardboard rectangle into 8 equal pieces. Shade 5 pieces and write the fraction for the shaded part.
Shapes, Halves, and Symmetry
Investigation 3: Sessions 1–8

- 2.1.9 Recognize, name, and compare the unit fractions: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$, and $\frac{1}{12}$.**
Example: Which is larger, $\frac{1}{3}$ or $\frac{1}{6}$? Explain your answer.
Shapes, Halves, and Symmetry
Investigation 3: Sessions 1–8
- 2.1.10 Know that, when all fractional parts are included, the result is equal to the whole and to one.**
Example: What is another way of saying six sixths? Explain your answer.
Shapes, Halves, and Symmetry
Investigation 3: Sessions 1–8
- 2.1.11 Collect and record numerical data in systematic ways.**
Example: Measure the hand span in whole centimeters of each student in your class. Keep a record of the answers they give you.
Coins, Coupons, and Combinations
Investigation 2: Sessions 2–5, 10
Does it Walk, Crawl, or Swim?
Investigation 1: Sessions 1–3
Investigation 4: Sessions 1–3
How Many Pockets? How Many Teeth?
Investigation 1: Sessions 2–3
Investigation 2: Sessions 1–5
Investigation 3: Sessions 2–4
Classroom Routine: Keeping track of the number of days in school, Collecting and recording data about pockets
- 2.1.12 Represent, compare, and interpret data using tables, tally charts, and bar graphs.**
Example: Make a tally of your classmates' favorite colors and draw a bar graph. Name the color that is most popular and the color that is the favorite of the fewest people.
Mathematical Thinking at Grade 2
Investigation 2: Session 6
Investigation 5: Sessions 1–2

Does it Walk, Crawl, or Swim?

Investigation 1: Sessions 1–3

Investigation 2: Sessions 3–4

Investigation 3: Sessions 1–3

How Many Pockets? How Many Teeth

Investigation 1: Sessions 1–5

Investigation 2: Sessions 1–5

Investigation 3: Sessions 1–5

Standard 2

Computation

Students solve simple problems involving addition and subtraction of numbers up to 100.

**2.2.1 Model addition of numbers less than 100 with objects and pictures.
Example: Use blocks to find the sum of 26 and 15.**

Mathematical Thinking at Grade 2

Investigation 1: Session 1

Investigation 2: Sessions 2–3, 6, 8

**2.2.2 Add two whole numbers less than 100 with and without regrouping.
Example: $36 + 45 = ?$**

Mathematical Thinking at Grade 2

Investigation 4: Sessions 1, 5

Investigation 5: Sessions 3

Coins, Coupons, and Combinations

Investigation 1: Sessions 1–3, 10

Investigation 2: Session 7–9

Investigation 3: Sessions 1–2

Investigation 4: Sessions 2–4, 5

Putting Together and Taking Apart

Investigation 2: Sessions 1–4

Investigation 4: Sessions 1–4

Investigation 5: Session 6

2.2.3 Subtract two whole numbers less than 100 without regrouping.**Example: $86 - 55 = ?$**

Coins, Coupons, and Combinations

Investigation 3: Sessions 1–5

Investigation 4: Sessions 2–4

Putting Together and Taking Apart

Investigation 1: Sessions 2–4

Investigation 2: Sessions 2–4

Investigation 3: Sessions 1–5

Investigation 5: Sessions 2–3, 6, 8

2.2.4 Understand and use the inverse relationship between addition and subtraction.**Example: Understand that $89 - 17 = 72$ means that $72 + 17 = 89$.**

Coins, Coupons, and Combinations

Investigation 3: Sessions 3, 4-5

Putting Together and Taking Apart

Investigation 1: Sessions 1, 2

Investigation 3: Session 2

2.2.5 Use estimation to decide whether answers are reasonable in addition problems.**Example: Your friend says that $13 + 24 = 57$. Without solving, explain why you think the answer is wrong.**

Classroom Routine: How Many Pockets?

2.2.6 Use mental arithmetic to add or subtract 0, 1, 2, 3, 4, 5, or 10 with numbers less than 100.**Example: In a game, Mia and Noah are making addition problems. They make two two-digit numbers out of the four given numbers 1, 2, 3, and 4. Each number is used exactly once. The winner is the one who makes two numbers whose sum is the largest. Mia had 24 and 31; Noah had 21 and 43. Who won the game? How do you know? Show a way to beat both of them.**

Coins, Coupons, and Combinations

Investigation 1: Sessions 8–9

Investigation 2: Session 10

Classroom Routine: How Many Pockets?

Standard 3**Algebra and Functions**

Students model, represent, and interpret number relationships to create and solve problems involving addition and subtraction.

2.3.1 Relate problem situations to number sentences involving addition and subtraction.

Example: You have 13 pencils and your friend has 12 pencils. You want to know how many pencils you have altogether. Write a number sentence for this problem and use it to find the total number of pencils.

Mathematical Thinking at Grade 2

Investigation 1: Session 1

Investigation 2: Session 6

Coin, Coupons, and Combinations

Investigation 1: Sessions 1–3, 6, 10–11

Investigation 2: Session 1

Investigation 3: Session 2

Putting Together and Taking Apart

Investigation 1: Sessions 1–6

Investigation 2: Sessions 1–7

Investigation 3: Sessions 1–5

Investigation 4: Sessions 1–4

Investigation 5: Sessions 1–8

2.3.2 Use the commutative* and associative* rules for addition to simplify mental calculations and to check results.

Example: Add the numbers 5, 17, and 13 in this order. Now add them in the order 17, 13, and 5. Which was easier? Why?

****commutative rule: the order when adding numbers makes no difference (e.g., $5 + 3 = 3 + 5$). Note that this rule is not true for subtraction.***

****associative rule: the grouping when adding numbers makes no difference (e.g., in $5 + 3 + 2$, adding 5 and 3 and then adding 2 is the same as 5 added to $3 + 2$). Note that this rule is not true for subtraction.***

Coins, Coupons, and Combinations

Investigation 1: Sessions 6, 10

Investigation 4: Session 5

Putting Together and Taking Apart

Investigation 2: Session 1

Investigation 4: Sessions 1–4

Investigation 5: Session 6

2.3.3 Recognize and extend a linear pattern by its rules.

Example: One horse has 4 legs, two horses have 8 legs, and so on. Continue the pattern to find how many legs five horses have.

Coins, Coupons, and Combinations

Investigation 2: Sessions 1, 4–5

Timelines and Rhythm Patterns

Investigation 2: Sessions 1–5

2.3.4 Create, describe, and extend number patterns using addition and subtraction.

Example: What is the next number: 23, 21, 19, 17, ...? How did you find your answer?

Mathematical Thinking at Grade 2

Investigation 4: Sessions 2–4

Coins, Coupons, and Combinations

Investigation 2: Sessions 2–5

Putting Together and Taking Apart

Investigation 2: Sessions 1–2

Standard 4

Geometry

Students identify and describe the attributes of common shapes in the plane and of common objects in space.

2.4.1 Construct squares, rectangles, triangles, cubes, and rectangular prisms* with appropriate materials.

Example: Use blocks to make a rectangular prism.

****rectangular prism: box with 6 rectangles for sides, like a cereal box***

Shapes, Halves, and Symmetry

Investigation 1: Sessions 2–5

Investigation 2: Sessions 4–5

Investigation 3: Sessions 1–8

- 2.4.2 Describe, classify, and sort plane and solid geometric shapes (triangle, square, rectangle, cube, rectangular prism) according to the number and shape of faces*, and the number of edges and vertices*.**

Example: How many vertices does a cube have?

***face: flat side, like the front of the cereal box *vertices: corners (vertex: corner)**

Shapes, Halves, and Symmetry

Investigation 1: Session 1

Investigation 2: Session 2

- 2.4.3 Investigate and predict the result of putting together and taking apart two- and three-dimensional shapes.**

Example: Use objects or a drawing program to find other shapes that can be made from a rectangle and a triangle. Use sketches or a drawing program to show several ways that a rectangle can be divided into three triangles.

Shapes, Halves, and Symmetry

Investigation 1: Sessions 2–8

Investigation 2: Sessions 3, 6

Investigation 4: Sessions 1–4

- 2.4.4 Identify congruent* two-dimensional shapes in any position.**

Example: In a collection of rectangles, pick out those that are the same shape and size.

***congruent: same shape and size, like the front and back of the cereal box**

Shapes, Halves, and Symmetry

Investigation 3: Sessions 1–8

Investigation 4: Sessions 5–6

- 2.4.5 Recognize geometric shapes and structures in the environment and specify their locations.**

Example: Look for combinations of shapes in the buildings around you.

Shapes, Halves, and Symmetry

Investigation 1: Session 1

Standard 5**Measurement**

Students understand how to measure length, temperature, capacity, weight, and time in standard units.

2.5.1 Measure and estimate length to the nearest inch, foot, yard, centimeter, and meter.

Example: Measure the length of your classroom to the nearest foot.

Grade 2 students using *Investigations in Number, Data, and Space* explore linear measurement using direct and indirect comparison, nonstandard units, and *GeoLogo* software. They construct, compare, and measure simple paths in both on-computer and off-computer activities.

References:

How Long? How Far?

Investigation 1: Sessions 1–8

Investigation 2: Sessions 4–5

2.5.2 Describe the relationships among inch, foot, and yard. Describe the relationship between centimeter and meter.

Example: How many inches are in a yard?

Students begin work with units of standard and metric measurements in *Investigations in Number, Data, and Space*, Grade 3.

2.5.3 Decide which unit of length is most appropriate in a given situation. Example: Would you use yards or inches to measure the length of your school books? Explain your answer.

In the following activity, students make choices about non-standard units. Work with standard and metric measurements begins in grade 3.

How Long? How Far?

Investigation 1: Session 8

- 2.5.4 Estimate area and use a given object to measure the area of other objects.**
Example: Make a class estimate of the number of sheets of notebook paper that would be needed to cover the classroom door. Then use measurements to compute the area of the door.
In the following activity, students compare the areas of different size rectangles by using color tiles.
Shapes, Halves, and Symmetry
Investigation 2: Session 2
- 2.5.5 Estimate and measure capacity using cups and pints.**
Example: Make a reasonable estimate of the number of pints a juice pitcher holds.
Related content in Grade 3:
Exploring Solids and Boxes
Investigation 4: Session 1
Investigation 5: Sessions 1–4
- 2.5.6 Estimate weight and use a given object to measure the weight of other objects.**
Example: About how many jellybeans will you need to put on one side of a balance scale to balance with a box of chalk? Count out the number of jellybeans that you guessed would be needed and see whether your estimate was close. Explain the results of your estimation and weighing.
Related content in Grade 3:
Combining and Comparing
Investigation 2: Sessions 1–2
- 2.5.7 Recognize the need for a fixed unit of weight.**
Example: Estimate the number of paperclips needed to balance with a box of chalk. Will it be the same as the number of jellybeans? Explain your answer.
Related content in Grade 3:
Combining and Comparing
Investigation 2: Sessions 1–2
- 2.5.8 Estimate temperature. Read a thermometer in Celsius and Fahrenheit.**
Example: What do you think the temperature is today? Look at the thermometer to check.
See Grade 3.

2.5.9 Tell time to the nearest quarter hour, be able to tell five-minute intervals, and know the difference between a.m. and p.m.

Example: When does your favorite TV program start?

The Appendix: *About Classroom Routines*, which appears in every text in the *Investigations in Number, Data, and Space* series, includes a feature entitled, Time and Time Again. This section describes time-related activities that students can do on a daily basis, including discussion of the daily schedule at school each day, identification of relevant clock times and durations, the setting of a timer to go off at specified intervals, the development of a schedule of important times at home, comparison of important times in different students' days, descriptions of types of clocks students have in their homes, and the creation of a timeline of a student's life, called a Life Line. Time-related topics covered in the investigations in the series include sequencing events in time, comparing durations of time within a day, representing events in time, and interpreting traditional representations of time.

Timelines and Rhythm Patterns

Investigation 1: Sessions 4–5

Investigation 2: Sessions 4–5

Classroom Routines: Time and Time Again

2.5.10 Know relationships of time: seconds in a minute, minutes in an hour, hours in a day, days in a week, and days, weeks, and months in a year.
Example: How many days are in a year?

See reference for 2.5.9.

2.5.11 Find the duration of intervals of time in hours.

Example: Your trip began at 9:00 a.m. and ended at 3:00 p.m. How long were you traveling?

Timelines and Rhythm Patterns

Investigation 1: Sessions 4–5

2.5.12 Find the value of a collection of pennies, nickels, dimes, quarters, half-dollars, and dollars.

Example: You have 3 pennies, 4 nickels, and 2 dimes. How much money do you have? Explain your answer.

Mathematical Thinking at Grade 2

Investigation 4: Sessions 2–4

Coins, Coupons, and Combinations

Investigation 2: Sessions 6–9

Standard 6**Problem Solving**

Students make decisions about how to set up a problem.

2.6.1 Choose the approach, materials, and strategies to use in solving problems.

Example: Solve the problem: “Count the number of squares on the surface of a cube. Put two cubes together and count the number of visible squares. Repeat this step with 3, 4, 5, ... cubes in a line. Find a rule for the number of squares.” Use blocks to set up the problem.

Throughout *Investigations in Number, Data, and Space* series students are encouraged to use different materials and strategies to solve problems. The following are some of the many examples.

Mathematical Thinking at Grade 2

Investigation 3: Sessions 1–4

Investigation 5: Sessions 1–5

Coins, Coupons, and Combinations

Investigation 2: Sessions 4–6

Investigation 4: Sessions 1–5

Does it Walk, Crawl, or Swim?

Investigation 1: Session 6

Investigation 2: Sessions 1–4

Shapes, Halves, and Symmetry

Investigation 1: Sessions 6–8

Investigation 4: Sessions 1–6

How Long? How Far?

Investigation 1: Sessions 5–7

Investigation 2: Sessions 1–5

2.6.2 Use tools such as objects or drawings to model problems.

Example: In the first example, place blocks together. Each time you add a block, count the number of squares and record it.

Throughout *Investigations in Number, Data, and Space* series students use a variety of drawings and objects to solve problems. The following are some of the many examples.

Mathematical Thinking at Grade 2

Investigation 5: Sessions 1–6

Coins, Coupons, and Combinations

Investigation 1: Sessions 4–5

Investigation 2: Session 2

Does It Walk, Crawl, or Swim?

Investigation 2: Sessions 1–2

Putting Together and Taking Apart

Investigation 2: Sessions 3–4

Investigation 3: Session 1

Shapes, Halves, and Symmetry

Investigation 2: Session 3

Investigation 3: Sessions 1–8

How Far? How Long?

Investigation 2: Sessions 1–8

How Many Pockets? How Many Teeth?

Investigation 1: Sessions 2–3

Timelines and Rhythm Patterns

Investigation 2: Sessions 2–4

Students solve problems and justify their reasoning.

2.6.3 Explain the reasoning used and justify the procedures selected in solving a problem.

Example: In the first example, notice that the number goes up by 4 each time a block is added. Observe that, as you add each cube, you gain 6 squares but lose 2 where the blocks are joined.

Mathematical Thinking at Grade 2

Investigation 4: Sessions 1, 5

Coins, Coupons, and Combinations

Investigation 1: Sessions 1, 6, 10

Investigation 2: Sessions 1, 4, 6

Investigation 3: Sessions 1–2

2.6.4 Make precise calculations and check the validity of the results in the context of the problem.

Example: In the first example, check your results by setting out 10 blocks and counting the number of squares on each long side and then the two at the ends. See how this fits with your rule of adding 4 each time.

In many activities, it is suggested that teachers observe students or ask them to show strategies for checking that their solutions are correct. The following are some of the many examples:

Mathematical Thinking at Grade 2

Investigation 4: Session 1

Coins, Coupons, and Combinations

Investigation 2: Session 1

Investigation 3: Sessions 1, 3, 4–5

Putting Together and Taking Apart

Investigation 1: Sessions 1–4

Investigation 2: Sessions 3–4, 7

Investigation 3: Sessions 3–5

Investigation 5: Sessions 1–3

2.6.5 Understand and use connections between two problems.

Example: Use the method of the problem you have just solved to find what happens when the cubes are not all in a line.

Mathematical Thinking at Grade 2

Investigation 2: Session 6

Investigation 4: Sessions 1–4

Investigation 3: Sessions 3–4

Coins, Coupons, and Combinations

Investigation 1: Session 10

Investigation 2: Sessions 1, 4–5

Investigation 3: Sessions 1–5

How Many Pockets? How Many Teeth?

Investigation 2: Sessions 1–2, 4–5

**Investigations in Number, Data, and Space
to the
Indiana Academic Standards for Mathematics**

Grade Three

Standard 1

Number Sense

Students understand the relationships among numbers, quantities, and place value in whole numbers up to 1,000. They understand the relationship among whole numbers, simple fractions, and decimals. * whole numbers: 0, 1, 2, 3, etc.*

3.1.1 Count, read, and write whole numbers up to 1,000.

Example: Write 349 for the number “three hundred forty-nine”.

Mathematical Thinking at Grade 3

Investigation 1: Sessions 1–3

Investigation 3: Sessions 3–4

Landmarks in the Hundreds

Investigation 1: Sessions 1, 2–3

Investigation 2: Sessions 5–6

Investigation 3: Sessions 2–3

Combining and Comparing

Investigation 4: Sessions 3–4

3.1.2 Identify and interpret place value in whole numbers up to 1,000.

Example: Understand that the 7 in 479 represents 7 tens or 70.

Mathematical Thinking at Grade 3

Investigation 1: Sessions 1–3

Things That Come in Groups

Investigation 2: Sessions 1–6

Landmarks in the Hundreds

Investigation 1: Sessions 4–7

Investigation 2: Sessions 1–3

Combining and Comparing

Investigation 4: Sessions 3–4

3.1.3 Use words, models, and expanded form to represent numbers up to 1,000.**Example: Recognize that $492 = 400 + 90 + 2$.**

Mathematical Thinking at Grade 3

Investigation 1: Sessions 1–3

Investigation 2: Session 1

Ten-Minute Math: Calendar Math

Things That Come in Groups

Investigation 1: Session 2

Investigation 3: Sessions 1–5

Investigation 4: Sessions 1–2

Flips, Turns, and Area

Ten-Minute Math: Broken Calculator

Landmarks in the Hundreds

Investigation 1: Sessions 1–7

Investigation 2: Sessions 1–6

Investigation 3: Session 1; Ten-Minute Math: Calendar Math

Up and Down the Number Line

Investigation 1: Sessions 3–4, 6–7

3.1.4 Identify any number up to 1,000 in various combinations of hundreds, tens, and ones.**Example: 325 can be written as 3 hundreds, 2 tens, and 5 ones, or as 2 hundreds, 12 tens, and 5 ones, etc.**

The following activities provide practice with the concept of hundreds, tens, and ones.

Mathematical Thinking at Grade 3

Investigation 1: Sessions 1–3

Landmarks in the Hundreds

Investigation 1: Sessions 4–5

Investigation 2: Sessions 1–3

Investigation 3: Session 1

Combining and Comparing

Investigation 4: Sessions 3–4

3.1.5 Compare whole numbers up to 1,000 and arrange them in numerical order.

Example: What is the smallest whole number you can make using the digits 4, 9, and 1? Use each digit exactly once.

Mathematical Thinking at Grade 3

Investigation 3: Sessions 3–4

Combining and Comparing

Investigation 1: Sessions 1–3

Investigation 2: Sessions 1–2

Investigation 3: Session 1

Investigation 4: Sessions 1–2

Investigation 5: Sessions 1–3

Fair Shares

Investigation 2: Session 3

3.1.6 Round numbers less than 1,000 to the nearest ten and the nearest hundred.

Example: Round 548 to the nearest ten.

The following activities involve concepts that prepare students for rounding numbers to the nearest ten and the nearest hundred.

Comparing and Combining

Investigation 1: Session 1

Investigation 2: Sessions 1, 2

Investigation 3: Session 1

3.1.7 Identify odd and even numbers up to 1,000 and describe their characteristics.

Example: Find the even number: 47, 106, 357, 629.

Mathematical Thinking at Grade 3

Investigation 4: Sessions 1, 2, 3

- 3.1.8 Show equivalent fractions* using equal parts.**
Example: Draw pictures to show that $\frac{3}{5}$, $\frac{6}{10}$, and $\frac{9}{15}$ are equivalent fractions.
***equivalent fractions: fractions with the same value (e.g. $\frac{1}{2}$, $\frac{2}{4}$, $\frac{3}{6}$, etc.)**
Fair Shares
Investigation 2: Sessions 1–2, 4, 5–6, 7
Investigation 3: Sessions 1–2
- 3.1.9 Identify and use correct names for numerators and denominators.**
Example: In the fraction $\frac{3}{5}$, name the numerator and denominator.
Fair Shares
Investigation 1: Sessions 1–4
- 3.1.10 Given a pair of fractions, decide which is larger or smaller by using objects or pictures.**
Example: Is $\frac{3}{4}$ of a medium pizza larger or smaller than $\frac{1}{2}$ of a medium pizza? Explain your answer
Fair Shares
Investigation 1: Sessions 3, 4
Investigation 2: Session 3
- 3.1.11 Given a set* of objects or a picture, name and write a decimal to represent tenths and hundredths.**
Example: You have a pile of 100 beans and 72 of them are lima beans. Write the decimal that represents lima beans as a part of the whole pile of beans. * set: collection of objects, numbers, etc.
The following activities explore the relationship among fractions, decimals, and money.
Fair Shares
Investigation 3: Sessions 1–3
- 3.1.12 Given a decimal for tenths, show it as a fraction using a place-value model.**
Example: Show the decimal 0.7 as a fraction using pennies.
The following activities explore the relationship among fractions, decimals, and money.
Fair Shares
Investigation 3: Sessions 1–3

- 3.1.13 Interpret data displayed in a circle graph and answer questions about the situation.**

Example: Have the students in your class choose the pizza they like best from these choices: cheese, sausage, pepperoni. Use a spreadsheet to enter the number of students who chose each kind and make a circle graph of the data. Determine the most popular and the least popular kind of pizza, and explain what the circle and each pie slice represent.

In the following activity, students study equal parts of geometric figures and assign fractional names to these equal parts.

Fair Shares

Investigation 1: Sessions 1–2

Investigation 2: Sessions 1–2

- 3.1.14 Identify whether everyday events are certain, likely, unlikely, or impossible.**

Example: It is raining in your neighborhood. Is it certain, likely, unlikely, or impossible that the tree in your front yard will get wet?

Exploring Solids and Boxes

Investigation 4: Session 2 (Ten-Minute Math)

Investigation 5: Sessions 1–4 (Ten-Minute Math)

- 3.1.15 Record the possible outcomes for a simple probability experiment.**

Example: Predict how many heads and tails will occur if a coin is tossed 10 times. Have a partner toss a coin while you keep a tally of the outcomes. Exchange places with your partner and repeat the experiment. Explain your results to the class.

Predicting outcomes of experiments is covered in *Investigations in Numbers, Data, and Space*, Grade 5.

Standard 2**Computation**

Students solve problems involving addition and subtraction of whole numbers. They model and solve simple problems involving multiplication and division.

- 3.2.1 Add and subtract whole numbers up to 1,000 with or without regrouping, using relevant properties of the number system. Example: $854 - 427 = ?$ Explain your method.**

Mathematical Thinking at Grade 3

Investigation 1: Session 1

Investigation 2: Sessions 3–4, 5–7

Landmarks in the Hundreds

Investigation 3: Sessions 2–3

Combining and Comparing

Investigation 1: Session 1

Investigation 2: Sessions 1, 2

Investigation 3: Sessions 1–2, 3

Investigation 4: Sessions 2, 3–4

Ten-Minute Math

- 3.2.2 Represent the concept of multiplication as repeated addition. Example: Lynn made 3 baskets each week for 4 weeks. Draw a picture to show how many baskets she made.**

Using Landmarks to Solve Problems

Investigation 2: Sessions 5–6

Things That Come in Groups

Investigation 1: Session 2

Investigation 2: Session 2

Investigation 3: Sessions 1–5

- 3.2.3 Represent the concept of division as repeated subtraction, equal sharing, and forming equal groups. Example: Bob shared 10 cookies among 5 friends. Draw a picture to show how many cookies each friend got.**

Using Landmarks to Solve Problems

Investigation 2: Sessions 5–6

Things That Come in Groups

Investigation 3: Sessions 1, 2, 3

Investigation 4: Sessions 1, 2, 3–4

Investigation 5: Session 1

3.2.4 Know and use the inverse relationship between multiplication and division facts, such as $6 \times 7 = 42$, $42 \div 7 = 6$, $7 \times 6 = 42$, $42 \div 6 = 7$.

Example: Find other facts related to $8 \times 3 = 24$.

Things That Come in Groups

Investigation 1: Session 3 (The Relationship Between Multiplication and Division)

Investigation 3: Sessions 3, 4

Investigation 4: Session 1

Investigation 5: Session 4

3.2.5 Show mastery of multiplication facts for 2, 5, and 10.

Example: Know the answer to 6×5 .

Things That Come in Groups

Investigation 1: Session 4

Investigation 2: Sessions 1, 2, 3–4, 5–6

Investigation 5: Sessions 1, 3

3.2.6 Add and subtract simple fractions with the same denominator.

Example: Add $\frac{3}{8}$ and $\frac{1}{8}$. Explain your answer.

Fair Shares

Investigation 2: Sessions 1–2, 4, 5–6, 7

Investigation 3: Sessions 1–2, 3, 4

3.2.7 Use estimation to decide whether answers are reasonable in addition and subtraction problems.

Example: Your friend says that $79 - 22 = 27$. Without solving, explain why you think the answer is wrong.

From Paces to Feet

Investigation 1: Sessions 2, 5–6 (Ten-Minute Math)

Combining and Separating

Investigation 1: Sessions 1–2

Investigation 3: Sessions 1–2

Investigation 4: Sessions 1, 3–4 (Ten-Minute Math)

3.2.8 Use mental arithmetic to add or subtract with numbers less than 100.
Example: Subtract 35 from 86 without using pencil and paper.

Up and Down the Number Line

Investigation 1: Sessions 3, 4, 5 (Ten-Minute Math)

Combining and Separating

Investigation 1: Sessions 1–2

Investigation 3: Sessions 1–2

Investigation 4: Sessions 1, 3–4 (Ten-Minute Math)

Standard 3

Algebra and Functions

Students select appropriate symbols, operations, and properties to represent, describe, simplify, and solve simple number and functional relationships.

3.3.1 Represent relationships of quantities in the form of a numeric expression or equation.
Example: Bill’s mother gave him money to buy three drinks that cost 45 cents each at the concession stand. When he returned to the bleachers, he gave 25 cents change to his mother. Write an equation to find the amount of money Bill’s mother originally gave him.

Things That Come in Groups

Investigation 1: Sessions 2, 3, 4

Investigation 2: Sessions 3–4

Investigation 4: Sessions 1–2, 3–4

Landmarks in the Hundreds

Investigation 1: Sessions 6–7

Investigation 2: Sessions 5–6

Combining and Comparing

Investigation 1: Session 1

Investigation 4: Session 2

3.3.2 Solve problems involving numeric equations.
Example: Use your equation from the last example to find the amount of money that Bill’s mother gave him, and justify your answer.

Things That Come in Groups

Investigation 1: Sessions 3, 4

Investigation 2: Sessions 3–4

Investigation 4: Sessions 1–2, 3–4

Landmarks in the Hundreds

Investigation 1: Sessions 6–7

Investigation 2: Sessions 5–6

Combining and Comparing

Investigation 1: Session 1

Investigation 4: Session 2

3.3.3 Choose appropriate symbols for operations and relations to make a number sentence true.

Example: What symbol is needed to make the number sentence $4 _ 3 = 12$ true?

In the following activity, students work with numbers and story problems, deciding whether to multiply or divide and writing appropriate number sentences.

Things That Come in Groups

Investigation 4: Sessions 1–2, 3–4

3.3.4 Understand and use the commutative* and associative* rules of multiplication.

Example: Multiply the numbers 7, 2, and 5 in this order. Now multiply them in the order 2, 5, and 7. Which was easier? Why?

****commutative rule: the order when multiplying numbers makes no difference (e.g., $5 \times 3 = 3 \times 5$), but note that this rule is not true for division***

****associative rule: the grouping when multiplying numbers makes no difference (e.g., in $5 \times 3 \times 2$, multiplying 5 and 3 and then multiplying by 2 is the same as 5 multiplied by 3×2), but note that this rule is not true for division***

Things That Come in Groups

Investigation 3: Sessions 1-2, 3-4

3.3.5 Create, describe, and extend number patterns using multiplication.

Example: What is the next number: 3, 6, 12, 24, ...? How did you find your answer?

Things That Come in Groups

Investigation 2: Sessions 1, 2, 3–4, 5–6

Investigation 5: Session 1

- 3.3.6 Solve simple problems involving a functional relationship between two quantities.**
Example: Ice cream sandwiches cost 20 cents each. Find the costs of 1, 2, 3, 4, ... ice cream sandwiches. What pattern do you notice? Continue the pattern to find the cost of enough ice cream sandwiches for the class.

Things That Come in Groups

Investigation 4: Sessions 1–2

Investigation 5: Sessions 1, 2, 3

- 3.3.7 Plot and label whole numbers on a number line up to 10.**
Example: Mark the position of 7 on a number line up to 10.

Up and Down the Number Line

Investigation 1: Sessions 6–7

Standard 4

Geometry

Students describe and compare the attributes of plane and solid geometric shapes and use their understanding to show relationships and solve problems.

- 3.4.1 Identify quadrilaterals* as four-sided shapes.**
Example: Which of these are quadrilaterals: square, triangle, rectangle?
***quadrilateral: a two-dimensional figure with four sides**

In these activities, students describe and compare polygons that are the faces of solids.

Exploring Solids and Boxes

Investigation 1: Sessions 1, 2

Investigation 2: Sessions 1, 2

- 3.4.2 Identify right angles in shapes and objects and decide whether other angles are greater or less than a right angle.**
Example: Identify right angles in your classroom. Open the classroom door until it makes a right angle with one wall and explain what you are doing.

Turtle Paths

Investigation 1: Sessions 1, 3–4

Investigation 2: Sessions 1–2, 3, 4

3.4.3 Identify, describe, and classify: cube, sphere*, prism*, pyramid, cone, cylinder.

Example: Describe the faces of a pyramid and identify its characteristics.

****sphere: round ball like a baseball***

****prism: solid shape with fixed cross-section (a right prism is a solid shape with two parallel faces that are congruent polygons and other faces that are rectangles)***

Exploring Solids and Boxes

Investigation 1: Sessions 1, 2

Investigation 2: Sessions 1, 2, 3, 4, 5

Investigation 3: Session 1

3.4.4 Identify common solid objects that are the parts needed to make a more complex solid object.

Example: Describe and draw a house made from a prism and a pyramid.

Exploring Solids and Boxes

Investigation 5: Sessions 1–4

3.4.5 Draw a shape that is congruent* to another shape.

Example: Draw a triangle that is congruent to a given triangle. You may use a ruler and pencil or the drawing program on a computer.

****congruent: two figures that are the same shape and size***

Flips, Turns, and Area

Investigation 1: Session 1

Investigation 2: Sessions 2–3, 4–5

Turtle Paths

Investigation 3: Sessions 1–2, 3–5

3.4.6 Use the terms point, line, and line segment in describing two-dimensional shapes.

Example: Describe the way a triangle is made of points and line segments and how you know it is a triangle.

The *Investigations in Number, Data, and Space* series uses the *Geo-Logo* computer program to study a variety of geometric figures. Students explore the components of these figures. Here are some examples:

Turtle Paths

Investigation 2: Sessions 1–2, 3, 4

Investigation 3: Sessions 1–2, 3–5

3.4.7 Draw line segments and lines.**Example: Draw a line segment three inches long.**

In the examples given for standard 3.4.6, students draw line segments with a computer program. In the activities listed below, students construct line segments of different sizes to make drawings.

From Paces to Feet

Investigation 4: Sessions 1–3

3.4.8 Identify and draw lines of symmetry in geometric shapes (by hand or using technology).**Example: Use pencil and paper or a drawing program to draw lines of symmetry in a square. Discuss your findings.**

The concept of symmetry is covered in detail in Grade 2.

3.4.9 Sketch the mirror image reflections of shapes.**Example: Hold up a cardboard letter F to a mirror. Draw the letter and the shape you see in the mirror.**

Mathematical Thinking at Grade 3

Investigation 2: Session 1

3.4.10 Recognize geometric shapes and their properties in the environment and specify their locations.**Example: Write the letters of the alphabet and draw all the lines of symmetry that you see.**

Flips, Turns, and Area

Investigation 2: Sessions 2–3

Exploring Solids and Boxes

Investigation 1: Session 1 (Follow-Up)

Investigation 2: Sessions 1–2 (Follow-Up)

Standard 5**Measurement**

Students choose and use appropriate units and measurement tools for length, capacity, weight, temperature, time, and money.

- 3.5.1 Measure line segments to the nearest half-inch.
Example: Measure the length of a side of a triangle.**

From Paces to Feet

Investigation 2: Sessions 2, 3–4

- 3.5.2 Add units of length that may require regrouping of inches to feet or centimeters to meters.
Example: Add the lengths of three sheets of paper. Give your answer in feet and inches.**

The following activities provide opportunities for students to explore the relationship between inches and feet and centimeters and meters.

From Paces to Feet

Investigation 2: Sessions 1, 2 (Follow-Up)

Investigation 2: Sessions 5 (Follow-Up), 6–7

This activity involves adding units of length (inches).

Combining and Comparing

Investigation 3: Sessions 1–2

- 3.5.3 Find the perimeter of a polygon*.
Example: Find the perimeter of a table in centimeters. Explain your method.
polygon: two-dimensional shape with straight sides (e.g., triangle, rectangle, pentagon)*

Turtle Paths

Investigation 3: Sessions 1–2, 6–7

Ten-Minute Math: Lengths and Perimeters

- 3.5.4 Estimate or find the area of shapes by covering them with squares.
Example: How many square tiles do we need to cover this desk?**

Flips, Turns, and Area

Investigation 1: Sessions 1, 2–3, 4–5

Investigation 2: Sessions 2–3, 4–5

3.5.5 Estimate or find the volume of objects by counting the number of cubes that would fill them.

Example: How many of these cubes will fill the box?

Exploring Solids and Boxes

Investigation 4: Session 1

Investigation 5: Sessions 1–4

3.5.6 Estimate and measure capacity using quarts, gallons, and liters. Example: This bottle holds one liter. Estimate how many liters the sink holds.

The units mentioned in this standard are introduced in Grade 5. The following activity deals with the concept of volume/capacity.

Exploring Solids and Boxes

Investigation 4: Sessions 1–3

Investigation 5: Sessions 1–4

3.5.7 Estimate and measure weight using pounds and kilograms.

Example: Estimate the weight of your book bag in pounds.

Pounds and kilograms are introduced in grade 5. The following activity uses the concept of weight with a pan balance.

Combining and Comparing

Investigation 2: Sessions 1, 2

3.5.8 Compare temperatures in Celsius and Fahrenheit.

Example: Measure the room temperature using a thermometer that has both Celsius and Fahrenheit units. If the temperature in the room measures 70°F, will the Celsius measurement be higher or lower?

Related content:

Up and Down the Number Line

Investigation 1: Session 1–2, 8

3.5.9 Tell time to the nearest minute and find how much time has elapsed.

Example: You start a project at 9:10 a.m. and finish the project at 9:42 a.m. How much time has passed?

Combining and Comparing

Investigation 3: Session 3

3.5.10 Find the value of any collection of coins and bills. Write amounts less than a dollar using the ¢ symbol and write larger amounts in decimal notation using the \$ symbol.

Example: You have 5 quarters and 2 dollar bills. How much money is that? Write the amount.

Mathematical Thinking at Grade 3

Investigation 2: Sessions 5–7

Combining and Comparing

Investigation 3: Sessions 1–2, 3

3.5.11 Use play or real money to decide whether there is enough money to make a purchase.

Example: You have \$5. Can you buy two books that cost \$2.15 each? What about three books that cost \$1.70 each? Explain how you know.

Combining and Comparing

Investigation 3: Sessions 1–2, 3

3.5.12 Carry out simple unit conversions within a measurement system (e.g., centimeters to meters, hours to minutes).

From Paces to Feet

Investigation 2: Sessions 1, 2 (Follow-Up)

Investigation 2: Sessions 5 (Follow-Up), 6–7

Combining and Comparing

Investigation 3: Sessions 1–2, 3

Investigation 5: Session 1

Standard 6

Problem Solving

Students make decisions about how to approach problems and communicate their ideas.

3.6.1 Analyze problems by identifying relationships, telling relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.

Example: Solve the problem: “Start with any number. If it is even, halve it. If it is odd, add 1. Do the same with the result and keep doing that. Find what happens by trying different numbers.” Try two or three numbers and look for patterns.

Mathematical Thinking at Grade 3
Investigation 4: Sessions 1, 3
Things That Come in Groups
Investigation 2: Sessions 1, 5–6
Investigation 5: Session 4
From Paces to Feet
Investigation 1: Session 2
Combining and Comparing
Investigation 4: Session 1

3.6.2 Decide when and how to break a problem into simpler parts.
Example: In the first example, find what happens to all the numbers up to 10.

Things That Come in Groups
Investigation 5: Session 1
Investigation 5: Session 4
Flips, Turns, and Areas
Investigation 1: Session 5

Students use strategies, skills, and concepts in finding and communicating solutions to problems.

3.6.3 Apply strategies and results from simpler problems to solve more complex problems.
Example: In the first example, use your results for the numbers up to 10 to find what happens to all the numbers up to 20.

Mathematical Thinking at Grade 3
Investigation 2: Sessions 2, 3–4
Landmarks in the Hundreds
Investigation 1: Sessions 4–5
Investigation 2: Sessions 1–3
Up and Down the Number Line
Investigation 1: Sessions 6–7

3.6.4 Express solutions clearly and logically by using the appropriate mathematical terms and notation. Support solutions with evidence in both verbal and symbolic work.

Example: In the first example, explain what happens to all the numbers that you tried.

Mathematical Thinking at Grade 3

Investigation 1: Session 1

Investigation 4: Session 3

Things That Come in Groups

Investigation 1: Session 2

Investigation 2: Sessions 1–2

Flips, Turns, and Area

Investigation 2: Sessions 4–5

Landmarks in the Hundreds

Investigation 2: Session 4

Combining and Comparing

Investigation 4: Session 2

3.6.5 Recognize the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.

Example: Measure the length and width of a room to the nearest meter to find how many student desks will fit in it. Would this be an accurate enough method if you were carpeting the room?

Mathematical Thinking at Grade 3

Investigation 3: Sessions 3–4

From Paces to Feet

Investigation 1: Sessions 5–6

Investigation 2: Session 1

3.6.6 Know and use strategies for estimating results of whole-number addition and subtraction.

Example: You buy 2 bags of candy for \$1.05 each. The cashier tells you that will be \$1.70. Does that surprise you? Why or why not?

Mathematical Thinking at Grade 3

Investigation 1: Session 1

Combining and Comparing

Investigation 2: Sessions 1–2

Investigation 3: Sessions 1–2

Investigation 4: Sessions 3–4 (Ten-Minute Math)

Investigation 5: Session 1 (Ten-Minute Math)

Ten-Minute Math: Estimation and Number Sense

3.6.7 Make precise calculations and check the validity of the results in the context of the problem.

Example: In the first example, notice that the result of adding 1 to an odd number is always even. Use this to check your calculations.

Up and Down the Number Line

Investigation 1: Session 5

Students determine when a solution is complete and reasonable and move beyond a particular problem by generalizing to other situations.

3.6.8 Decide whether a solution is reasonable in the context of the original situation.

Example: In the example about fitting desks into a room, would an answer of 1,000 surprise you?

Landmarks in the Hundreds

Investigation 1: Session 1

Combining and Comparing

Investigation 3: Sessions 1–2, 3

3.6.9 Note the method of finding the solution and show a conceptual understanding of the method by solving similar problems.

Example: Change the first example so that you multiply odd numbers by 2 or 3 or 4 or 5, before adding 1. Describe the pattern you see.

Things That Come in Groups

Investigation 2: Session 2

Investigation 4: Sessions 1–2

Landmarks in the Hundreds

Investigation 1: Sessions 6–7

**Investigations in Number, Data, and Space
to the
Indiana Academic Standards for Mathematics**

Grade Four

Standard 1

Number Sense

Students understand the place value of whole numbers and decimals to two decimal places and how whole numbers and decimals relate to simple fractions.*

**whole numbers: 0, 1, 2, 3, etc*

4.1.1 Read and write whole numbers up to 1,000,000.

Example: Read aloud the number 394,734.

Mathematical Thinking at Grade 4

Investigation 1: Sessions 1–5

Different Shapes, Equal Pieces

Investigation 1: Sessions 1–5

Investigation 2: Sessions 1–4

Investigation 3: Sessions 1–5

Money, Miles, and Large Numbers

Investigation 2: Sessions 1–4

Sunken Ships and Grid Patterns

Investigation 2: Session 5

Three Out of Four Like Spaghetti

Investigation 1: Sessions 1–4

4.1.2 Identify and write whole numbers up to 1,000,000, given a place-value model.

Example: Write the number that has 2 hundred thousands, 7 ten thousands, 4 thousands, 8 hundreds, 6 tens, and 2 ones.

Landmarks in the Thousands

Investigation 3: Session 1

Investigation 4: Session 1

- 4.1.3 Round whole numbers up to 10,000 to the nearest ten, hundred, and thousand.**
Example: Is 7,683 closer to 7,600 or 7,700? Explain your answer.
Mathematical Thinking at Grade 4
Investigation 1: Sessions 2–3 (Also see p. 19)
- 4.1.4 Order and compare whole numbers using symbols for “less than” (<), “equal to” (=), and “greater than” (>).**
Example: Put the correct symbol in 328 ___ 142.
The following activities provide opportunities for students to compare and order whole numbers.
Landmarks in the Thousands
Investigation 3: Sessions 1, 2
Investigation 4: Sessions 1–3
- 4.1.5 Rename and rewrite whole numbers as fractions.**
Example: $3 = 6/2 = 9/3 = ?/4 = ?/5$.
Different Shapes, Equal Pieces
Investigation 3: Sessions 1–2
- 4.1.6 Name and write mixed numbers, using objects or pictures.**
Example: You have 5 whole straws and half a straw. Write the number that represents these objects.
Different Shapes, Equal Pieces
Investigation 3: Sessions 1–2
- 4.1.7 Name and write mixed numbers as improper fractions, using objects or pictures.**
Example: Use a picture of 3 rectangles, each divided into 5 equal pieces, to write $2 \frac{3}{5}$ as an improper fraction.
Different Shapes, Equal Pieces
Investigation 3: Sessions 1–2
- 4.1.8 Write tenths and hundredths in decimal and fraction notations. Know the fraction and decimal equivalents for halves and fourths (e.g., $1/2 = 0.5 = 0.50$, $7/4 = 1 \frac{3}{4} = 1.75$).**
Example: Write $26/100$ and $23/4$ as decimals.
Money, Miles, and Large Numbers
Investigation 2: Sessions 1–2, 3

- 4.1.9 Round two-place decimals to tenths or to the nearest whole number.**
Example: You ran the 50-yard dash in 6.73 seconds. Round your time to the nearest tenth.

Mathematical Thinking at Grade 4

Investigation 2: Sessions 1–2 (Ten-Minute Math)

Money, Miles, and Large Numbers

Investigation 1: Sessions 1–2, 4–5

Standard 2

Computation

Students solve problems involving addition, subtraction, multiplication, and division of whole numbers and understand the relationships among these operations. They extend their use and understanding of whole numbers to the addition and subtraction of simple fractions and decimals.

- 4.2.1 Understand and use standard algorithms* for addition and subtraction.**
Example: $45,329 + 6,984 = ?$, $36,296 - 12,075 = ?$
***algorithm: a step-by-step procedure for solving a problem.**

Mathematical Thinking at Grade 4

Investigation 1: Session 4

- 4.2.2 Represent as multiplication any situation involving repeated addition.**
Example: Each of the 20 students in your physical education class has 3 tennis balls. Find the total number of tennis balls in the class.

Arrays and Shares

Investigation 1: Sessions 1–2, 3

Investigation 2: Sessions 1, 2–3, 4, 5–6

Packages and Groups

Investigation 3: Sessions 1–2

- 4.2.3 Represent as division any situation involving the sharing of objects or the number of groups of shared objects.**
Example: Divide 12 cookies equally among 4 students. Divide 12 cookies equally so that each person gets 4 cookies. Compare your answers and methods.

Arrays and Shares

Investigation 1: Session 3

Investigation 2: Sessions 7–8

Packages and Groups

Investigation 3: Sessions 1–2

4.2.4 Demonstrate mastery of the multiplication tables for numbers between 1 and 10 and of the corresponding division facts.

Example: Know the answers to 9×4 and $35 \div 7$.

Arrays and Shares

Investigation 1: Session 3

Investigation 2: Sessions 1, 2–3, 4, 5–6, 7–8

Investigation 3: Sessions 1, 2–4

Packages and Groups

Investigation 1: Sessions 1–2, 3

4.2.5 Use a standard algorithm to multiply numbers up to 100 by numbers up to 10, using relevant properties of the number system.

Example: $67 \times 3 = ?$

Packages and Groups

Investigation 2: Sessions 1, 2–3

Investigation 3: Sessions 4–6

4.2.6 Use a standard algorithm to divide numbers up to 100 by numbers up to 10 without remainders, using relevant properties of the number system.

Example: $69 \div 3 = ?$

Packages and Groups

Investigation 3: Sessions 3, 4–6, 10

4.2.7 Understand the special properties of 0 and 1 in multiplication and division.

Example: Know that $73 \times 0 = 0$ and that $42 \div 1 = 42$.

Arrays and Shares

Investigation 2: Sessions 2 and 3

Investigation 3: Sessions 2–4 (See p. 54)

- 4.2.8 Add and subtract simple fractions with different denominators, using objects or pictures.**
Example: Use a picture of a circle divided into 6 equal pieces to find $5/6 - 1/3$.
Different Shapes, Equal Pieces
Investigation 1: Session 5
Investigation 2: Session 3
- 4.2.9 Add and subtract decimals (to hundredths), using objects or pictures.**
Example: Use coins to help you find $\$0.43 - \0.29 .
Mathematical Thinking at Grade 4
Investigation 2: Sessions 1–2, 3–4
Money, Miles, and Large Numbers
Investigation 1: Sessions 1–2
- 4.2.10 Use a standard algorithm to add and subtract decimals (to hundredths).**
Example: $0.74 + 0.80 = ?$
Money, Miles, and Large Numbers
Investigation 1: Sessions 6, 7–8
Investigation 2: Sessions 1–2, 4
- 4.2.11 Know and use strategies for estimating results of any whole-number computations.**
Example: Your friend says that $45,329 + 6,984 = 5,213$. Without solving, explain why you think the answer is wrong.
Landmarks in the Thousands
Investigation 3: Sessions 3–5
Money, Miles, and Large Numbers
Investigation 3: Session 1
- 4.2.12 Use mental arithmetic to add or subtract numbers rounded to hundreds or thousands.**
Example: Add 3,000 to 8,000 without using pencil and paper.
Landmarks in the Thousands
Investigation 3: Sessions 3–5

Standard 3**Algebra and Functions**

Students use and interpret variables, mathematical symbols, and properties to write and simplify numerical expressions and sentences. They understand relationships among the operations of addition, subtraction, multiplication, and division.

- 4.3.1 Use letters, boxes, or other symbols to represent any number in simple expressions, equations, or inequalities (i.e., demonstrate an understanding of and the use of the concept of a variable). Example: In the expression $3x + 5$, what does x represent?**

Changes Over Time

Investigation 1: Sessions 5–6

- 4.3.2 Use and interpret formulas to answer questions about quantities and their relationships. Example: Write the formula for the area of a rectangle in words. Now let l stand for the length, w for the width, and A for the area. Write the formula using these symbols.**

Formulas are covered in Grade 5. See *Patterns of Change*.

- 4.3.3 Understand that multiplication and division are performed before addition and subtraction in expressions without parentheses. Example: You go to a store with 90¢ and buy 3 pencils that cost 20¢ each. Write an expression for the amount of money you have left and find its value.**

The following activities provide opportunities for discussing this concept.

Arrays and Shares

Investigation 2: Sessions 5–6

Packages and Groups

Investigation 2: Session 1

- 4.3.4 Understand that an equation such as $y = 3x + 5$ is a rule for finding a second number when a first number is given.**

Example: Use the formula $y = 3x + 5$ to find the value of y when $x = 6$.

This concept is covered in Grade 5. See *Patterns of Change*.

- 4.3.5 Continue number patterns using multiplication and division.**

Example: What is the next number: 160, 80, 40, 20, ...? Explain your answer.

Landmarks in the Thousands

Investigation 1: Session 1

Investigation 2: Session 1

Packages and Groups

Investigation 1: Sessions 1–2, 3, 4–5

- 4.3.6 Recognize and apply the relationships between addition and multiplication, between subtraction and division, and the inverse relationship between multiplication and division to solve problems.**

Example: Find another way of writing $13 + 13 + 13 + 13 + 13$.

Arrays and Shares

Investigation 1: Session 3

Investigation 2: Sessions 2–3

Landmarks in the Thousands

Investigation 2: Session 1

Packages and Groups

Investigation 3: Sessions 1–2

- 4.3.7 Relate problem situations to number sentences involving multiplication and division.**

Example: You have 150 jelly beans to share among the 30 members of your class. Write a number sentence for this problem and use it to find the number of jelly beans each person will get.

Arrays and Shares

Investigation 2: Sessions 1, 2–3, 7–8

Investigation 3: Sessions 2–4

Landmarks in the Thousands

Investigation 2: Session 5

Packages and Groups

Investigation 3: Sessions 1–2, 4–6

- 4.3.8 Plot and label whole numbers on a number line up to 100. Estimate positions on the number line.**
Example: Draw a number line and label it with 0, 10, 20, 30, ..., 90, 100. Estimate the position of 77 on this number line.

Students name and locate points on a coordinate grid with ordered pairs of numbers.

Reference

Sunken Ships and Grid Patterns

Investigation 1: Sessions 2, 3–4

Standard 4

Geometry

Students show an understanding of plane and solid geometric objects and use this knowledge to show relationships and solve problems.

- 4.4.1 Identify, describe, and draw rays, right angles, acute angles, obtuse angles and straight angles using appropriate mathematical tools and technology.**
Example: Draw two rays that meet in an obtuse angle.

Sunken Ships and Grid Patterns

Investigation 1: Sessions 3–4, 5–6

Investigation 2: Sessions 1, 2–3, 5, 6–7

- 4.4.2 Identify, describe and draw parallel, perpendicular, and oblique lines using appropriate mathematical tools and technology.**
Example: Use the markings on the gymnasium floor to identify two lines that are parallel. Place a jump rope across the parallel lines and identify any obtuse angles created by the jump rope and the lines.

Sunken Ships and Grid Patterns

Investigation 1: Sessions 3–4

Investigation 2: Sessions 1, 2–3

- 4.4.3 Identify, describe, and draw parallelograms*, rhombuses*, and trapezoids*, using appropriate mathematical tools and technology. Example: Use a geoboard to make a parallelogram. How do you know it is a parallelogram?**

****parallelogram: a four-sided figure with both pairs of opposite sides parallel***

****rhombus: a parallelogram with all sides equal***

****trapezoid: a four-sided figure with one pair of opposite sides parallel***

Mathematical Thinking in Grade 4

Investigation 4: Sessions 1, 2, 3–4, 5–6

Seeing Solids and Silhouettes

Investigation 2: Sessions 1–2

Sunken Ships and Grid Patterns

Investigation 2: Session 1, 2–3, 6–7

- 4.4.4 Identify congruent* quadrilaterals* and give reasons for congruence using sides, angles, parallels and perpendiculars. Example: In a collection of parallelograms, rhombuses, and trapezoids, pick out those that are the same shape and size and explain your decisions.**

****congruent: two figures that are the same shape and size***

****quadrilateral: a two-dimensional figure with four sides***

Mathematical Thinking at Grade 4

Investigation 4: Sessions 1, 2, 3–4, 5–6

- 4.4.5 Identify and draw lines of symmetry in polygons. Example: Draw a rectangle and then draw all its lines of symmetry.**

Mathematical Thinking in Grade 4

Investigation 4: Session 1, 2, 3–4, 5–6

Sunken Ships and Grid Patterns

Investigation 2: Sessions 2–3

- 4.4.6 Construct cubes and prisms* and describe their attributes. Example: Make a 6-sided prism from construction paper. **prism: solid shape with fixed cross-section (right prism is a solid shape with two parallel faces that are congruent polygons and other faces that are rectangles)***

Seeing Solids and Silhouettes

Investigation 1: Sessions 1, 2

Investigation 2: Sessions 1–2, 3–4, 5

Investigation 3: Session 1

Standard 5

Measurement

Students understand perimeter and area, as well as measuring volume, capacity, time, and money.

4.5.1 Measure length to the nearest quarter-inch, eighth-inch, and millimeter. Example: Measure the width of a sheet of paper to the nearest millimeter.

The Shape of Data

Investigation 2: Sessions 2–3

Changes Over Time

Unit Preparation: Preparation Session 3

4.5.2 Subtract units of length that may require renaming of feet to inches or meters to centimeters. Example: The shelf was 2 feet long. Jane shortened it by 8 inches. How long is the shelf now?

The Shape of Data

Investigation 2: Session 4

4.5.3 Know and use formulas for finding the perimeters of rectangles and squares.

Example: The length of a rectangle is 4 cm and its perimeter is 20 cm. What is the width of the rectangle?

Ten-Minute Math: Lengths and Perimeters

4.5.4 Know and use formulas for finding the areas of rectangles and squares. Example: Draw a rectangle 5 inches by 3 inches. Divide it into one-inch squares and count the squares to find its area. Can you see another way to find the area? Do this with other rectangles.

Different Shapes, Equal Pieces

Investigation 1: Sessions 1, 2–4

- 4.5.5 Estimate and calculate the area of rectangular shapes by using appropriate units, such as square centimeter (cm^2), square meter (m^2), square inch (in^2), or square yard (yd^2).**

Example: Measure the length and width of a basketball court and find its area in suitable units.

The following activities provide opportunities for introducing square units when discussing area.

Different Shapes, Equal Pieces

Investigation 1: Sessions 1, 2–4

- 4.5.6 Understand that rectangles with the same area can have different perimeters and that rectangles with the same perimeter can have different areas.**

Example: Make a rectangle of area 12 units on a geoboard and find its perimeter. Can you make other rectangles with the same area? What are their perimeters?

The following activities provide the opportunity for discussing the relationship between perimeter and area of rectangles.

Different Shapes, Equal Pieces

Investigation 1: Sessions 1, 2–4

Sunken Ships and Grid Patterns

Investigation 2: Sessions 2–3, 4

- 4.5.7 Find areas of shapes by dividing them into basic shapes such as rectangles.**

Example: Find the area of your school building.

Different Shapes, Equal Pieces

Investigation 1: Sessions 2–4

- 4.5.8 Use volume and capacity as different ways of measuring the space inside a shape.**

Example: Use cubes to find the volume of a fish tank and a pint jug to find its capacity.

Seeing Solids and Silhouettes

Investigation 1: Session 1

- 4.5.9 Add time intervals involving hours and minutes.**
Example: During the school week, you have 5 recess periods of 15 minutes. Find how long that is in hours and minutes.
Changes Over Time
Investigation 1: Sessions 1–2
- 4.5.10 Determine the amount of change from a purchase.**
Example: You buy a chocolate bar priced at \$1.75. How much change do you get if you pay for it with a five-dollar bill?
Money, Miles, and Large Numbers
Investigation 1: Sessions 6, 7–8

Standard 6

Data Analysis and Probability

Students organize, represent, and interpret numerical and categorical data and clearly communicate their findings. They show outcomes for simple probability situations.

- 4.6.1 Represent data on a number line and in tables, including frequency tables.**
Example: The students in your class are growing plants in various parts of the classroom. Plan a survey to measure the height of each plant in centimeters on a certain day. Record your survey results on a line plot.
The Shape of Data
Investigation 1: Sessions 1, 2–3
Investigation 2: Sessions 1, 2–3, 6–7
Investigation 3: Sessions 3–5
Changes Over Time
Investigation 1: Sessions 1–2, 3–4
Investigation 2: Session 3
Investigation 3: Sessions 1–2, 3, 4, 7–8
Three Out of Four Like Spaghetti
Investigation 2: Sessions 1, 2, 3, 4

- 4.6.2 Interpret data graphs to answer questions about a situation.**
Example: The line plot below shows the heights of fast-growing plants reported by third-grade students. Describe any patterns that you can see in the data using the words “most,” “few,” and “none.”

The Shape of Data

Investigation 1: Sessions 1, 2–3

Investigation 2: Sessions 1, 2–3, 4, 5, 6–7

Investigation 3: Sessions 3–5

Changes Over Time

Investigation 1: Sessions 1–2

Investigation 2: Sessions 1–2

Investigation 3: Sessions 1–2, 3, 4, 5, 6, 7–8

Three Out of Four Like Spaghetti

Investigation 2: Sessions 4, 5–7

- 4.6.3 Summarize and display the results of probability experiments in a clear and organized way.**

Example: Roll a number cube 36 times and keep a tally of the number of times that 1, 2, 3, 4, 5, and 6 appear. Draw a bar graph to show your results.

Three Out of Four Like Spaghetti

Ten-Minute Math: What Is Likely?

There are additional probability experiments in Grade 5.

Standard 7

Problem Solving

Students make decisions about how to approach problems and communicate their ideas.

- 4.7.1 Analyze problems by identifying relationships, telling relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.**
Example: Solve the problem: “Find a relationship between the number of faces, edges, and vertices of a solid shape with flat surfaces.” Try two or three shapes and look for patterns.

Mathematical Thinking in Grade 4

Investigation 3: Session 3

The Shape of Data

Investigation 3: Sessions 1–2, 3–5

Money, Miles, and Large Numbers

Investigation 1: Sessions 7–8

Changes Over Time

Investigation 1: Sessions 1–2, 3–4

Investigation 2: Sessions 1–2

Investigation 3: Session 4

- 4.7.2 Decide when and how to break a problem into simpler parts.**
Example: In the first example, find what happens to cubes and rectangular solids.

Arrays and Shapes

Investigation 3: Session 1

Money, Miles and Large Numbers

Investigation 2: Session 4

Students use strategies, skills, and concepts in finding and communicating solutions to problems.

- 4.7.3 Apply strategies and results from simpler problems to solve more complex problems.**

Example: In the first example, use your method for cubes and rectangular solids to find what happens to other prisms and to pyramids.

Arrays and Shapes

Investigation 3: Session 5

Landmarks in the Thousands

Investigation 3: Sessions 2–4

Money, Miles, and Large Numbers

Investigation 1: Sessions 7–8

Changes Over Time

Investigation 1: Sessions 3–4

Packages and Groups

Investigation 2: Sessions 1, 2–3

- 4.7.4 Use a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, tools, and models to solve problems, justify arguments, and make conjectures.**

Example: In the first example, make a table to help you explain your results to another student.

The Shape of Data

Investigation 1: Sessions 1, 2–3

Investigation 2: Sessions 1, 2–3, 6–7

Money, Miles, and Large Numbers

Investigation 1: Sessions 7–8

Investigation 3: Sessions 2–4

Changes Over Time

Investigation 1: Sessions 1–2

Investigation 2: Session 3

Packages and Groups

Investigation 3: Sessions 7–8, 9

Three out of Four Like Spaghetti

Investigation 2: Session 1

- 4.7.5 Express solutions clearly and logically by using the appropriate mathematical terms and notation. Support solutions with evidence in both verbal and symbolic work.**

Example: In the first example, explain what happens with all the shapes that you tried.

Money, Miles, and Large Numbers

Investigation 1: Sessions 7–8

Investigation 3: Sessions 2–4

Changes Over Time

Investigation 1: Sessions 1–2

Packages and Groups

Investigation 3: Session 10

- 4.7.6 Recognize the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.**

Example: You are telling a friend the time of a TV program. How accurate should you be: to the nearest day, hour, minute, or second?

Money, Miles, and Large Numbers

Investigation 2: Session 4

Investigation 3: Sessions 2–4

4.7.7 Know and use appropriate methods for estimating results of whole-number computations.

Example: You buy 2 CDs for \$15.95 each. The cashier tells you that will be \$49.90. Does that surprise you?

Landmarks in the Thousands

Investigation 3: Sessions 3–5

Money, Miles, and Large Numbers

Investigation 1: Sessions 1–2, 4–5

4.7.8 Make precise calculations and check the validity of the results in the context of the problem.

Example: The buses you use for a school trip hold 55 people each. How many buses will you need to seat 180 people?

Arrays and Shares

Investigation 3: Sessions 2–4

Landmarks in the Thousands

Investigation 1: Session 1

Money, Miles and Large Numbers

Investigation 1: Sessions 1–2, 4–5, 6, 7–8

Students determine when a solution is complete and reasonable and move beyond a particular problem by generalizing to other situations.

4.7.9 Decide whether a solution is reasonable in the context of the original situation.

Example: In the last example, would an answer of 3.27 surprise you?

Landmarks in the Thousands

Investigation 3: Session 3–5

Money, Miles and Large Numbers

Investigation 1: Sessions 1–2, 4–5, 6, 7–8

4.7.10 Note the method of finding the solution and show a conceptual understanding of the method by solving similar problems.

Example: Change the first example so that you look at shapes with curved surfaces.

Landmarks in the Thousands

Investigation 2: Session 1

**Investigations in Number, Data, and Space
to the
Indiana Academic Standards for Mathematics**

Grade Five

Standard 1

Number Sense

Students compute with whole numbers, decimals, and fractions and understand the relationship among decimals, fractions, and percents. They understand the relative magnitudes of numbers. They understand prime* and composite* numbers.*

**whole numbers: 0, 1, 2, 3, etc.*

**prime number: number that can be evenly divided only by 1 and itself (e.g., 2, 3, 5, 7, 11)*

**composite number: not a prime number (e.g., 4, 6, 8, 9, 10)*

5.1.1 Convert between numbers in words and numbers in figures, for numbers up to millions and decimals to thousandths.

Example: Write the number 198.536 in words.

Mathematical Thinking at Grade 5

Investigation 1: Sessions 1–3

Investigation 2: Session 5

Name That Portion

Investigation 1: Sessions 1, 2

Investigation 2: Sessions 1–8

Investigation 3: Sessions 1–4, 7–8

Investigation 4: Sessions 1, 5–7

Between Never and Always

Investigation 1: Sessions 1–2

Building on Numbers You Know

Investigation 2: Session 7

Investigation 4: Sessions 1, 4

Data: Kids, Cats, and Ads

Investigation 3: Sessions 1, 4

Investigation 4: Session 2

- 5.1.2 Round whole numbers and decimals to any place value.**
Example: Is 7,683,559 closer to 7,600,000 or 7,700,000? Explain your answer.

Mathematical Thinking at Grade 5

Investigation 3: Session 1

Investigation 4: Session 1

Name That Portion

Investigation 3: Sessions 2–4, 7

Building on Numbers You Know

Investigation 1: Session 2

Investigation 2: Session 4

Patterns of Change

Ten-Minute Math: Nearest Answer

- 5.1.3 Arrange in numerical order and compare whole numbers or decimals to two decimal places by using the symbols for less than ($<$), equals ($=$), and greater than ($>$).**

Example: Write from smallest to largest: 0.5, 0.26, 0.08.

Mathematical Thinking at Grade 5

Investigation 2: Session 5

Investigation 4: Sessions 2–4

Name That Portion

Investigation 1: Session 7

Investigation 2: Sessions 3–9

Investigation 3: Sessions 2–6, 7–8

Building on Numbers You Know

Investigation 1: Sessions 1–2, 5

Investigation 5: Sessions 4–6

Patterns of Change

Ten-Minute Math: Nearest Answer

Data: Kids, Cats, and Ads

Investigation 1: Sessions 1–3

Investigation 3: Sessions 1–3

Investigation 4: Sessions 1, 3

Investigation 5: Sessions 3–5

5.1.4 Interpret percents as a part of a hundred. Find decimal and percent equivalents for common fractions and explain why they represent the same value.

Example: Shade a 100-square grid to show 30%. What fraction is this?

Name That Portion

Investigation 1: Sessions 1, 2, 3–4, 5–6, 7

Investigation 3: Sessions 1, 2, 5–6

Investigation 4: Sessions 3–4, 5–6

Between Never and Always

Investigation 1: Sessions 1–2, 3–4, 7

Data: Kids, Cats, and Ads

Investigation 3: Sessions 1–4

Investigation 4: Session 3

Investigation 5: Sessions 3–5

5.1.5 Explain different interpretations of fractions: as parts of a whole, parts of a set, and division of whole numbers by whole numbers.

Example: What fraction of a pizza will each person get when 3 pizzas are divided equally among 5 people?

Name That Portion

Investigation 1: Sessions 1, 2, 3–4, 5–6, 7

Investigation 2: Sessions 1–2, 3, 9

Investigation 3: Session 8

Investigation 4: Sessions 1, 2

Between Never and Always

Investigation 1: Sessions 1–2, 7

Data: Kids, Cats, and Ads

Investigation 1: Sessions 1–4

Investigation 2: Sessions 1–3

Investigation 3: Sessions 1–4

Investigation 4: Sessions 1–3

Investigation 5: Sessions 3–5

- 5.1.6 Describe and identify prime and composite numbers.**
Example: Which of the following numbers are prime: 3, 7, 12, 17, 18?
Justify your choices.

Mathematical Thinking at Grade 5

Investigation 1: Sessions 1–3, 4–6

- 5.1.7 Identify on a number line the relative position of simple positive fractions, positive mixed numbers, and positive decimals.**
Example: Find the positions on a number line of $1\frac{1}{4}$ and 1.4.

Name That Portion

Investigation 2: Sessions 4–5

Standard 2

Computation

Students solve problems involving multiplication and division of whole numbers and solve problems involving addition, subtraction, and simple multiplication and division of fractions and decimals.

- 5.2.1 Solve problems involving multiplication and division of any whole numbers.**

Example: $2,867 \times 34 = ?$ Explain your method.

Mathematical Thinking at Grade 5

Investigation 3: Sessions 2–4, 5

Investigation 4: Sessions 5–6

Building on Numbers You Know

Investigation 1: Sessions 1, 3–4, 5

Investigation 2: Sessions 1–2, 3, 4

Investigation 3: Sessions 1–3, 4–6, 7–9, 10

Investigation 4: Session 1

- 5.2.2 Add and subtract fractions (including mixed numbers) with different denominators.**

Example: $3\frac{4}{5} - 2\frac{2}{3} = ?$

Name That Portion

Investigation 2: Sessions 1–2, 3, 6, 7, 9

Investigation 3: Session 7

Data: Kids, Cats, and Ads

Investigation 1: Sessions 1–4

Investigation 2: Sessions 1–3

Investigation 3: Sessions 1–4

Investigation 4: Sessions 1–3

Investigation 5: Sessions 3–5

Ten-Minute Math: Estimation and Number Sense

5.2.3 Use models to show an understanding of multiplication and division of fractions.

Example: Draw a rectangle 5 squares long and 3 squares wide. Shade $\frac{4}{5}$ of the rectangle, starting from the left. Shade $\frac{2}{3}$ of the rectangle, starting from the top. Look at the fraction of the squares that you have double-shaded and use that to show how to multiply $\frac{4}{5}$ by $\frac{2}{3}$.

Name That Portion

Investigation 2: Sessions 6, 9

5.2.4 Multiply and divide fractions to solve problems.

Example: You have $3\frac{1}{2}$ pizzas left over from a party. How many people can have $\frac{1}{4}$ of a pizza each?

Name That Portion

Investigation 2: Sessions 6, 9

Investigation 3: Session 7

5.2.5 Add and subtract decimals and verify the reasonableness of the results. Example: Compute $39.46 - 20.89$ and check the answer by estimating.

Name That Portion

Investigation 3: Sessions 2, 3–4, 7

5.2.6 Use estimation to decide whether answers are reasonable in addition, subtraction, multiplication, and division problems.

Example: Your friend says that $2,867 \times 34 = 20,069$. Without solving, explain why you think the answer is wrong.

Mathematical Thinking at Grade 5

Investigation 4: Sessions 5–6

Name That Portion

Investigation 2: Sessions 6–8

Investigation 3: Sessions 2–4

Building on Numbers You Know

Investigation 1: Sessions 6–8

Investigation 3: Sessions 1–3

- 5.2.7 Use mental arithmetic to add or subtract simple decimals.**
Example: Add 0.006 to 0.027 without using pencil and paper.

Name That Portion

Investigation 3: Sessions 2, 3–4, 7

Standard 3

Algebra and Functions

Students use variables in simple expressions, compute the value of an expression for specific values of the variable, and plot and interpret the results. They use two-dimensional coordinate grids to represent points and graph lines.

- 5.3.1 Use a variable to represent an unknown number.**
Example: When a certain number is multiplied by 3 and then 5 is added, the result is 29. Let x stand for the unknown number and write an equation for the relationship.

Building on Numbers You Know

Investigation 1: Sessions 3–4

Patterns of Change

Investigation 1: Sessions 3–4 (See Teacher Note pages)

Note: There are many opportunities throughout *Patterns of Change* to explore other algebra topics.

- 5.3.2 Write simple algebraic expressions in one or two variables and evaluate them by substitution.**

Example: Find the value of $5x + 2$ when $x = 3$.

Patterns of Change

Investigation 1: Sessions 3–4 (See Teacher Note pages)

Note: There are many opportunities throughout *Patterns of Change* to explore other algebra topics.

5.3.3 Use the distributive property* in numerical equations and expressions.
Example: Rewrite $3(16 - 11)$ by removing the parentheses.

**distributive property: e.g., $3 \times (5 + 2) = 3 \times 5 + 3 \times 2$*

Mathematical Thinking at Grade 5

Investigation 3: Sessions 2–4

Building on Numbers You Know

Investigation 1: Sessions 3–4 (See Teacher Note pages.)

Investigation 3: Sessions 1–3

5.3.4 Identify and graph ordered pairs of positive numbers.
Example: Plot the points (3, 1), (6, 2), and (9, 3). What do you notice?

Picturing Polygons

Investigation 1: Sessions 3, 4

Patterns of Change

Investigation 2: Session 2 (Follow-Up), 3, 4, 5

Investigation 3: Sessions 1, 2, 3, 5–6

5.3.5 Find ordered pairs (positive numbers only) that fit a linear equation, graph the ordered pairs, and draw the line they determine.
Example: For $x = 1, 2, 3,$ and $4,$ find points that fit the equation $y = 2x + 1.$ Plot those points on graph paper and join them with a straight line.

Patterns of Change

Investigation 1: Sessions 1–2, 3–4

Investigation 2: Sessions 2 (Follow-Up), 3, 4, 5

Investigation 3: Sessions 1, 2, 3, 5–6

5.3.6 Understand that the length of a horizontal line segment on a coordinate plane equals the difference between the x-coordinates and that the length of a vertical line segment on a coordinate plane equals the difference between the y-coordinates.

Example: Find the distance between the points (2, 5) and (7, 5) and the distance between the points (2, 1) and (2, 5).

These activities provide opportunities to explore this concept.

Patterns of Change

Investigation 1: Sessions 1–2 (See Teacher Note page)

5.3.7 Use information taken from a graph or equation to answer questions about a problem situation.

Example: The speed (v feet per second) of a car t seconds after it starts is given by the formula $v = 12t$. Find the car's speed after 5 seconds.

Patterns of Change

Investigation 2: Sessions 2, 3, 4, 5

Investigation 3: Sessions 1, 2, 3, 4, 5–6

Standard 4

Geometry

Students identify, describe, and classify the properties of plane and solid geometric shapes and the relationships between them.

5.4.1 Measure, identify, and draw angles, perpendicular and parallel lines, rectangles, triangles, and circles by using appropriate tools (e.g., ruler, compass, protractor, appropriate technology, media tools).

Example: Draw a rectangle with sides 5 in and 3 in.

Picturing Polygons

Investigation 2: Sessions 1–3, 4–5, 6–7, 8, 9

Investigation 3: Sessions 1–2, 4

5.4.2 Identify, describe, draw, and classify triangles as equilateral*, isosceles*, scalene*, right*, acute*, obtuse*, and equiangular*.

Example: Draw an isosceles right triangle.

****equilateral triangle: all sides are congruent***

****isosceles triangle: at least two sides are congruent***

****scalene triangle: no sides are equal***

****right triangle: one angle measures 90 degrees***

****acute triangle: all angles are less than 90 degrees***

****obtuse triangle: one angle is more than 90 degrees***

****equiangular triangle: all angles are of equal measure***

Picturing Polygons

Investigation 2: Sessions 1–3, 4–5, 6–7

Investigation 3: Sessions 1–2

- 5.4.3 Identify congruent* triangles and justify your decisions by referring to sides and angles.**
Example: In a collection of triangles, pick out those that are the same shape and size and explain your decisions.
***congruent: two figures that are the same shape and size**
The following activities provide opportunities for discussing congruent triangles.
Picturing Polygons
Investigation 2: Sessions 1–3
- 5.4.4 Identify, describe, draw, and classify polygons*, such as pentagons and hexagons.**
Example: In a collection of polygons, pick out those with the same number of sides.
***polygon: two-dimensional shape with straight sides (e.g., triangle, rectangle, pentagon)**
Picturing Polygons
Investigation 1: Sessions 1, 2, 3, 4
Investigation 3: Sessions 1–2, 3, 4, 5–6
- 5.4.5 Identify and draw the radius and diameter of a circle and understand the relationship between the radius and diameter.**
Example: On a circle, draw a radius and a diameter and describe the differences and similarities between the two.
Related content:
Name That Portion
Investigation 4: Session 7 (Circle Graphs)
Picturing Polygons
Investigation 2: Sessions 6–7
- 5.4.6 Identify shapes that have reflectional and rotational symmetry*.**
Example: What kinds of symmetries have the letters M, N, and O?
***reflectional and rotational symmetry: letter M has reflectional symmetry in a line down the middle; letter N has rotational symmetry around its center**
This concept is covered in Grade 4. See *Mathematical Thinking at Grade 4* and *Sunken Ships and Grid Patterns*.

- 5.4.7** Understand that 90° , 180° , 270° , and 360° are associated with quarter, half, three-quarters, and full turns, respectively.
Example: Face the front of the room. Turn through four right angles. Which way are you now facing?
Picturing Polygons
Investigation 2: Sessions 6–7
- 5.4.8** Construct prisms* and pyramids using appropriate materials.
Example: Make a square-based pyramid from construction paper.
**prism: solid shape with fixed cross-section (right prism is a solid shape with two parallel faces that are polygons and other faces that are rectangles)*
Containers and Cubes
Investigation 1: Sessions 1–2, 3–4
Investigation 2: Sessions 1–2, 3–4
- 5.4.9** Given a picture of a three-dimensional object, build the object with blocks.
Example: Given a picture of a house made of cubes and rectangular prisms, build the house.
This concept is covered in Grade 4. See *Seeing Solids and Silhouettes*.

Standard 5

Measurement

Students understand and compute the areas and volumes of simple objects, as well as measuring weight, temperature, time, and money.

- 5.5.1** Understand and apply the formulas for the area of a triangle, parallelogram, and trapezoid.
Example: Find the area of a triangle with base 4 m and height 5 m.
Related content:
Containers and Cubes
Investigation 1: Sessions 1–2

5.5.2 Solve problems involving perimeters and areas of rectangles, triangles, parallelograms, and trapezoids, using appropriate units.

Example: A trapezoidal garden bed has parallel sides of lengths 14 m and 11 m and its width is 6 m. Find its area and the length of fencing needed to enclose it. Be sure to use correct units.

Picturing Polygons

Investigation 3: Sessions 5–6 (Follow-Up)

Containers and Cubes

Investigation 1: Sessions 1–2, 3–4

Investigation 2: Sessions 3–4, 5

Investigation 3: Sessions 1–2

Ten-Minute Math: Volume and Surface Area

5.5.3 Use formulas for the areas of rectangles and triangles to find the area of complex shapes by dividing them into basic shapes.

Example: A square room of length 17 feet has a tiled fireplace area that is 6 feet long and 4 feet wide. You want to carpet the floor of the room, except the fireplace area. Find the area to be carpeted.

Containers and Cubes

Investigation 1: Sessions 1–2, 3–4

Investigation 2: Sessions 3–4, 5

5.5.4 Find the surface area and volume of rectangular solids using appropriate units.

Example: Find the volume of a shoe box with length 30 cm, width 15 cm, and height 10 cm.

Measurement Benchmarks

Investigation 2: Session 4

Containers and Cubes

Investigation 1: Sessions 1–2, 3–4

Investigation 2: Sessions 1–2, 3–4, 5

Investigation 3: Sessions 1–2, 3, 4

Investigation 4: Sessions 1, 2–3, 4–5, 7–9

Ten-Minute Math: Volume and Surface Area

- 5.5.5 Understand and use the smaller and larger units for measuring weight (ounce, gram, and ton) and their relationship to pounds and kilograms. Example: How many ounces are in a pound?**

Measurement Benchmarks

Investigation 1: Session 1

Investigation 2: Sessions 1–2, 3, 6

- 5.5.6 Compare temperatures in Celsius and Fahrenheit, knowing that the freezing point of water is 0°C and 32°F and that the boiling point is 100°C and 212°F.**

Example: What is the Fahrenheit equivalent of 50°C? Explain your answer.

Related content:

Measurement Benchmarks

Investigation 1: Session 1

Investigation 2: Sessions 1–2, 4

- 5.5.7 Add and subtract with money in decimal notation.**

Example: You buy articles that cost \$3.45, \$6.99, and \$7.95. How much change will you receive from \$20?

This concept is covered in Grade 4. See *Money, Miles, and Large Numbers*

Investigation 1: Sessions 6, 7–8

Standard 6

Data Analysis and Probability

Students collect, display, analyze, compare, and interpret data sets. They use the results of probability experiments to predict future events.

- 5.6.1 Explain which types of displays are appropriate for various sets of data. Example: Conduct a survey to find the favorite movies of the students in your class. Decide whether to use a bar, line, or picture graph to display the data. Explain your decision.**

Name That Portion

Investigation 4: Sessions 2, 3–4, 5–6, 7

Between Never and Always

Investigation 1: Sessions 3–4

Investigation 2: Sessions 1–2, 3–4

Measurement Benchmarks

Investigation 2: Session 7–8

Data: Kids, Cats, and Ads

Investigation 1: Session 1

Investigation 2: Sessions 1–2

Investigation 5: Sessions 3–5

Ten-Minute Math: Exploring Data

- 5.6.2 Find the mean*, median*, mode*, and range* of a set of data and describe what each does and does not tell about the data set.**
Example: Find the mean, median, and mode of a set of test results and describe how well each represents the data.

**mean: the average obtained by adding the values and dividing by the number of values*

**median: the value that divides a set of data written in order of size into two equal parts*

**mode: the most common value in a set of data*

**range: the difference between the largest and the smallest values*

Data, Kids, Cats, and Ads

Investigation 1: Sessions 1–4

Investigation 2: Sessions 1–3

Investigation 3: Sessions 1–4

Investigation 4: Sessions 3–5

- 5.6.3 Understand that probability can take any value between 0 and 1, events that are not going to occur have probability 0, events certain to occur have probability 1, and more likely events have a higher probability than less likely events.**

Example: What is the probability of rolling a 7 with a number cube?

Between Never and Always

Investigation 1: Sessions 1–2, 3–4, 5, 6, 7, 8

Investigation 2: Sessions 1–2, 3, 4–5

- 5.6.4 Express outcomes of experimental probability situations verbally and numerically (e.g., 3 out of 4, $\frac{3}{4}$).**

Example: What is the probability of rolling an odd number with a number cube?

Between Never and Always

Investigation 1: Sessions 1–2, 3–4, 5, 6, 7, 8

Investigation 2: Sessions 1–2, 3, 4–5

Standard 7**Problem Solving**

Students make decisions about how to approach problems and communicate their ideas.

- 5.7.1 Analyze problems by identifying relationships, telling relevant from irrelevant information, sequencing and prioritizing information, and observing patterns.**
Example: Solve the problem: “When you flip a coin 3 times, you can get 3 heads, 3 tails, 2 heads and 1 tail, or 1 head and 2 tails. Find the probability of each of these combinations.” Notice that the case of 3 heads and the case of 3 tails are similar. Notice that the case of 2 heads and 1 tail and the case of 1 head and 2 tails are similar.

Mathematical Thinking at Grade 5

Investigation 1: Sessions 4–6

Picturing Polygons

Investigation 1: Session 1

Investigation 3: Session 4

Between Never and Always

Investigation 1: Sessions 1–2, 3–4, 5, 6, 7, 8

Investigation 2: Sessions 1–2,

Data: Kids, Cats, and Ads

Investigation 5: Sessions 1–5

- 5.7.2 Decide when and how to break a problem into simpler parts.**
Example: In the first example, decide to look at the case of 3 heads and the case of 2 heads and 1 tail.

Mathematical Thinking at Grade 5

Investigation 1: Sessions 4–6

Name That Portion

Investigation 4: Sessions 1, 7

Between Never and Always

Investigation 1: Sessions 3–4

Investigation 2: Session 3

Measurement Benchmarks

Investigation 1: Sessions 7–8

Students use strategies, skills, and concepts in finding and communicating solutions to problems.

- 5.7.3 Apply strategies and results from simpler problems to solve more complex problems.**
Example: In the first example, begin with the situation where you flip the coin twice.

Mathematical Thinking at Grade 5

Investigation 3: Sessions 2–4

Containers and Cubes

Investigation 1: Sessions 3–4

- 5.7.4 Express solutions clearly and logically by using the appropriate mathematical terms and notation. Support solutions with evidence in both verbal and symbolic work.**
Example: In the first example, make a table or tree diagram to show another student what is happening.

Mathematical Thinking at Grade 5

Investigation 1: Sessions 4–6

Investigation 3: Session 5

Investigation 4: Sessions 5–6

Building on Numbers You Know

Investigation 1: Session 1

Investigation 3: Sessions 7–9

Containers and Cubes

Investigation 3: Session 4

- 5.7.5 Recognize the relative advantages of exact and approximate solutions to problems and give answers to a specified degree of accuracy.**
Example: You are buying a piece of plastic to cover the floor of your bedroom before you paint the room. How accurate should you be: to the nearest inch, foot, or yard? Explain your answer.

Measurement Benchmarks

Investigation 1: Sessions 3, 4

Building on Numbers You Know

Investigation 2: Session 7

5.7.6 Know and apply appropriate methods for estimating results of rational-number computations.

Example: Will 7×18 be smaller or larger than 100? Explain your answer.

Mathematical Thinking at Grade 5

Investigation 4: Session 1

Building on Numbers You Know

Investigation 2: Session 7

Investigation 3: Sessions 1–3, 4–6

Patterns of Change

Ten-Minute Math: Nearest Answer

5.7.7 Make precise calculations and check the validity of the results in the context of the problem.

Example: A recipe calls for $\frac{3}{8}$ of a cup of sugar. You plan to double the recipe for a party and you have only one cup of sugar in the house. Decide whether you have enough sugar and explain how you know.

Name That Portion

Investigation 4: Sessions 3–4

Building on Numbers You Know

Investigation 2: Session 4, 5–6

Students determine when a solution is complete and reasonable and move beyond a particular problem by generalizing to other situations.

5.7.8 Decide whether a solution is reasonable in the context of the original situation.

Example: In the first example about flipping a coin, check that your probabilities add to 1.

Mathematical Thinking at Grade 5

Investigation 4: Sessions 5–6

Name That Portion

Investigation 2: Sessions 6–8

Investigation 3: Sessions 2–4

Building on Numbers You Know

Investigation 1: Sessions 6–8

Investigation 2: Sessions 1–2

5.7.9 Note the method of finding the solution and show a conceptual understanding of the method by solving similar problems.
Example: Find the probability of each of the combinations when you flip a coin 4 times.

Between Never and Always

Investigation 1: Session 5

Building on Numbers You Know

Investigation 1: Session 8

Cubes and Containers

Investigation 1: Sessions 3–4