Critical Questions for Investigations Grade 4

Mathematical Thinking

Investigation 1: How Many Hundreds?

1 Getting Started with Interlocking Cubes	Suppose someone was trying to estimate how many cubes were in an object. What advice would you give that person? (RL)
2, 3 How Many Hundreds?	Can you find another method to answer the question? If your estimate was very different from the exact answer, how could you adjust your method to get closer? (SP, RL)
4 Close to 100 Assessment	Write down one strategy that you use to get close to 100. (CU)

Investigation 2: How Many Dollars?

1, 2 How Much Money? Assessment	How much money? Decide which of the 3 ways is the best way to count coins and explain why. (MC, SP, CU)
3,4 Number Sense and Coins	

Investigation 3: Using Number Patterns

1,2 The 300 Chart	The 300 Chart (SP, RL) What patterns are you using to fill in the numbers? How are you computing the differences?
3 Related Problem Sets	What did you learn from one problem that helped solve a problem on another? How are the problems similar? (CU, MC, RL)
4,5 Addition and Subtraction Strategies Assessment	Give students a starting number, have them count by 10's or 20's or subtract 10, have them write down what they think about when doing each of the above. (SP)

Investigation 4: Making Geometric Patterns

1 Patterns with Mirror Symmetry	Explain to your neighbor, what mirror symmetry is and then write down your definition. (CU)
2 Patterns with Rotational Symmetry	How are mirror symmetry and rotational symmetry alike, different? (CU, RL)
3,4 Patterns and Non Patterns Assessment	Indicate a line of symmetry in a pattern with mirror symmetry Point to the center of a design with rotational symmetry Point out how a pattern has rotational symmetry but not mirror symmetry (RL, CU)
5,6 Symmetrical Geo-Board Patterns Assessment	Identify a given design that has mirror symmetry Identify a design with rotational symmetry and explain how it works (SP, CU)

Arrays and Shares

Investigation 1: Multiples on the 100 Chart

1,2 Multiples on the 100 Chart	What do you notice about the patterns on the 100 chart? (CU)
3 Skip Counting and Multiplying Assessment	What is a problem you already know that will help you solve 14 x 3? (SP)

Investigation 2: Arrays

1 Things That Come in Arrays	How does multiplication notation relate to arrays? (SP, RL)
2,3 Making Arrangements	Have you found all the arrays for your number? How do you know? (SP, RL)
4 Preparing a Set of Arrays	How can you compare two arrays to determine which is bigger? (RL)
5,6 Array Games Assessment	How could you break 12 x 4 into more familiar parts you know? (SP)
7,8 Looking at Division Assessment	How would you use arrays to help you solve a division problem? (RL, SP)

Investigation 3: Multiplication and Division Choices

1 Multiplication Clusters	What are some strategies for solving multiplication clusters? (SP, CU)
2,3,4 Multiplication and Division Choices	What is a strategy for solving a 2-digit multiplication problem? (SP, CU, MC)
5 Problems That Look Hard But Aren't Assessment	I learned… (CU)

Landmarks in the Thousands

Investigation 1: Working with 100

1 Ways to Count to 100	Explain why 15 is not a factor of 100. (CU, RL)
2 100 In a Box	Do factors always come in pairs? (SP)
3 Moving Around on the 100 Chart	What strategy would you use to figure the following problem: Start at 23. How many jumps to 100? (SP, CU)

Investigation 2: Exploring Multiples of 100

1 Factors of 100, 200, and 300	How does knowing the factors of 100 help you find the factors of 300? (SP, RL)
2,3,4 Using Landmarks to Add and Subtract	Write a related problem or problems to help you solve 200 – 124 = ____. (SP, CU)
5 Solving Problems in the Hundreds	What is standard notation for multiplication and division? Give examples. (CU)

Investigation 2: Exploring Multiples of 100

1 Numbers to 1000	How can you write some numbers on each chart, but not write all of them, so you could still find the place for any number in the whole book? (SP, RL)
2 Moving Around in the 1000 Book	Is 20 a factor of 1000? How do you know? (SP, RL)
3,4,5 Estimating, Adding, and Subtracting to 1000	How could you use landmark numbers to help you solve a problem such as 576 – 156? (SP, RL, CU) *Connect to Close to 100 strategy 90 + 10*

The Shape of Data

Investigation 1: Introduction to Data Analysis

1 How Many Raisins In a Box?	What is a question you could write related to your class raisin graph? (CU, SP)
2,3 How Many People In a Family?	What is typical? (CU)

Investigation 2: Landmarks in the Data

1 How Tall are Fourth Graders? Assessment	What can you say about how tall people in this class are? (RL, CU, MC)
2,3 Fourth and First Graders: How Much Taller?	What did you discover from comparing your measurements to the first graders? (CU, MC)
4 Looking at Mystery Data Assessment	What clues did you use to figure out the answers to the mystery data? (MC, CU)
5 Finding the Median Assessment	What is the median? (CU)
6,7 Using Landmarks in Data Assessment	What is important to know or find out when you are comparing two sets of data? (CU, RL)

Measurement

Investigation 1: Metric Stations

1,2 Metric Stations	What are benchmarks for 1 meter, 10 centimeters, 500 grams, 1 kilogram, and 1 liter?

Investigation 2: Scavenger Hunt

1 The Hunt	What kinds of tools are used to measure and what to they do? What are the benchmarks for…?

Investigation 3: Measurement Olympics

1,2 Olympic Games	When is it important to measure exactly and when would an estimate be enough?

Sunken Ships and Grid Patterns

Investigation 1: Locating Houses and Ships on a Grid

1 Coordinates and Distances on a Grid	Locate 2 points in Grid City. *(choose two for the students to find individually)* (SP)
2 Introducing Negative Coordinates	Were you able to solve another person's mystery picture? Why or why not? (RL, CU)
3,4 Playing Sunken Ships Assessment	What strategies did you use to make a guess? (RL)
5,6 Distances On and Off the Computer Assessment	How did you determine the shortest distance between two points on the grid? Label all 4 coordinates on a grid. (RL, CU)

Investigation 2: Rectangles, Turns, and Coordinates

1 Making Rectangles	What is a rectangle? (CU)
2,3 Rectangles Coordinates, and Symmetry Assessment	What is symmetry? (CU)
4 Properties of Rectangles	How did finding patterns help you draw the different shapes? (RL)
5 Turns	Draw a 30, 90, and 180 degree turn. (CU)
6,7 Turning and Repeating Rectangles Assessment	Why is a parallelogram not a rectangle? (CU, RL)
8,9 Designing Rectangle Patterns Assessment	I learned… (CU)

Different Shapes, Equal Pieces

Investigation 1: Parts of Squares: Halves, Fourths, and Eighths

1 Finding Halves of Crazy Cakes	How did you prove a crazy cake was divided in half? (RL)
2,3,4 Halves, Fourths, and Eighths with Geo-boards Assessment	How can you use a pattern created for fourths to help you create more eighths? (SP, RL)
5 Combining Fractions in a Design	Prove 1 = 2/8 + ½ + ¼ using a square. (RL)

Investigation 2: Parts of Rectangles: Thirds, Sixths, and Twelfths

1,2 Thirds, Sixths, and Twelfths	How did you prove a rectangle was divided into thirds? (RL, CU)
3 More Fraction Designs Assessment	How is 1/3 and 1/6 related? (RL, SP)
4 Working with 2/3, ¾, 5/6, and 7/8 Assessment	How do you compare 3/2 to 2/3? (RL, SP, MC)

Investigation 3: Ordering Fractions

1,2 Making Fraction Cards	What are some other ways to write ½? (RL, SP)
3 Ordering Fractions with Respect to Landmarks	What strategy did you use to figure out which fractions were larger than one? (SP)
4,5 Making a Fraction Number Line Assessment	How did you decide which fraction is larger than the other? (RL, CU)

Packages and Groups/Building on Numbers You Know

Investigation 1: Multiplication Tables

1,2 Making a Multiplication Table	Some numbers occur more often on the table. Which ones? Why do you think that is? Are they related in any way? (RL, SP)
3 Multiple Plaids	How does knowing that the multiplication chart have symmetry help with recalling the facts? (CU, RL)
4,5 Multiples of Larger Numbers	How does skip counting help with division and multiplication? (CU, RL)

Investigation 2: Double-Digit Multiplication

1 Multiplying Two-Digit Numbers	What strategies do you have for solving 2-digit multiplication problems? (SP)
2,3 Solving and Creating Cluster Problems	What strategies do you use to help find an estimate? (CU, SP)

Investigation 3: Multiplication and Division Choices

1,2 Division Notation and Situations	Write an equation in 3 different ways for the following: There were 24 cookies and 6 children. How many did each child get to eat?(CU)
3 Looking More Closely At Division Problems	What strategies do you use to divide large numbers in to equal groups? (SP)
4,5,6 Choice Time	Write about what you did today sharing a strategy or idea you have discovered or are working on. (CU)
7, 8 What Are Numbers Divisible By?	How does knowing the divisibility rules make division and multiplication easier? (RL)
9 Division Bingo	How are you figuring out the factors of the large numbers? (CU, RL)
10 Assessing Students' Understanding of Division	How do you know your division situation or story reflect the problem? (MC, SP, RL)

Investigation 5: Understanding Operations (*Building On Numbers You Know*)

1,2 The Estimation Game	What strategies do you use to estimate the answers to difficult problems? (CU, SP)
3 Solving Difficult Problems Assessment	How do you choose which strategy to use? (RL)
4,5,6 Exploring	Which choice did you like the best? Why? (RL, CU)

Operations	
7 Assessing Student Understanding Assessment optional	I learned… (CU)

Money, Miles and Large Numbers

Investigation 1: Everyday Uses of Money

1,2 Groceries, Lunch, and Book Orders Assessment	How did you estimate the totals? (CU, RL, MC)
3 Making a Dollar	What strategy are you using to find 100 or $1.00? (SP, MC)
4,5 Making Sense (Cents) of Money on the Calculator	What would you enter into your calculator to do this problem? 60 cents plus 30 cents (SP, CU, MC)
6 Making Change Assessment	I bought something for 43 cents and gave the clerk a dollar. How much change should I get back? (SP, MC)
7, 8 Shopping Smart - Assessment	What strategy did you use to make a reasonable estimate? (RL, MC)

Investigation 2: How Far? Measuring in Miles and Tenths

1, 2 Miles and Tenths of a Mile Assessment	Which is farther 3.25 miles or 3.5 miles? How do you know? (SP, RL)
3 How Far is 1/10 of a Mile? (Excursion)	What would be the best tool for measuring 1/10 of a mile? Why? (RL, SP, MC)
4 A Tour of Our Town Assessment	I learned… (CU)

Investigation 3: Calculating Longer Distances

1 Close to 1,000	What is your strategy for calculating large numbers? (CU)
2, 3, 4 A Trip Around the United States Assessment	How did you use the scale to help you calculate the miles for your trip? (CU, MC)

Three Out of Four Like Spaghetti

Investigation 1: Using Fractions to Describe Data

1 Playing Guess My Rule	What did you notice about the fractions discussed today? (CU, RL)
2 Finding Familiar Fractions	Which is bigger 1/8 or 1/5? How do you know? (RL)
3 Comparing Data with Familiar Fractions Assessment	What was an interesting difference between our class data and the national data? (RL, CU, MC)
4 Using Fractions to Compare Data	How did you think about solving the problem? (SP)

Investigation 2: Looking at Data in Categories

1 Games We Play	What can you tell from the graph? (CU, RL)
2 More Games, and What Have We Eaten? Assessment	What do you know about your data? (RL, CU)
3 What Do You Want To Be When You Grow Up?	How do you think the first grade data is going to be different from ours? (RL)
4 Organizing Some First and Fourth Grade Data	What did you do with the data that seemed to fit in more than one category? (RL, SP)
5,6,7 Making Comparisons with All the Data Assessment	I learned… (CU)