

Multiplication in Investigations

Grade One

Mathematical Thinking

- Finding combinations of numbers up to about 10

Building Number Sense

- Exploring different ways to arrange sets of objects, such as rectangular arrays and equal-sized groups
- Making and describing repeating patterns

Number Games and Story Problems

- Finding combinations of numbers up to 20
- Developing strategies for counting and combining dots arranged in rows or groups
- Working with different models for grouping 2's, 4's, 5's and 10's
- Beginning to develop meaning for counting by 2's
- Becoming familiar with combinations of 10 and 20
- Reasoning about combinations of 10

Grade Two

Mathematical Thinking

- Making combinations of 10, 11, and 12
- Counting by 2's, 5's, and 10's and in other ways

Coins, Coupons, and Combinations

- Developing familiarity with 10 or an important landmark in our number system
- Becoming familiar with number combinations of 10 and doubles
- Exploring patterns in and developing fluency with skip counting by 2's, 5's, and 10's
- Exploring 5 and multiples of 5
- Becoming familiar with the relations between skip counting and group (e.g. as you count 5, 10, 15, you are adding a group of 5 to each successive total)
- Exploring ways of recording and keeping track when counting large groups
- Using money as a model for counting by 5's and 10's

Shapes, Halves, and Symmetry

- Visualizing, constructing, and drawing rectangular arrays
- Constructing arrays to represent numbers and identifying halves of the arrays

Putting Together and Taking Apart

- Using coins as a model for adding and subtracting multiples of 5 and 10

Grade Three

Mathematical Thinking at Grade 3

- Using grouping to count
- Exploring what numbers can be divided evenly

Things That Come in Groups

- Finding things that come in groups
- Using multiplication to mean groups

- Recognizing that skip counting represents multiples of the same number and has a connection to multiplication
- Finding patterns in multiples of 2, 3, 4, 5, 5, 9, 10, 11, and 12 by using the 100 chart and the calculator
- Understanding that number patterns can help in multiplication
- Recognizing that multiplication can be used to find the area of a rectangle
- Using arrays to skip count; multiplying and dividing with skip counting
- Finding factor pairs
- Understanding relationships between multiplication and division
- Identifying whether word problems can be solved using division and/or multiplication
- Using multiplication and/or division notation to write number sentences
- Using patterns to solve multiplication and division problems

Landmarks in the Hundreds

- Becoming familiar with the relationships among commonly used factors and multiples
- Developing familiarity with the factors of 100 and their relationship to 100 using cubes, coins, and 100 charts
- Using knowledge about factors of 100 to understand the structure of multiples of 100
- Developing strategies to solve problems in multiplication and division situations by using knowledge of factors and multiples
- Reading and using standard multiplication and division notation to record

Grade Four

Arrays and Shares

- Using skip counting as a model for multiplication
- Seeing multiplication as an accumulation of groups of a number
- Looking for the multiplication patterns of numbers
- Using known multiplication relationships to solve harder relationships
- Using an array as a model for multiplication
- Recognizing prime numbers as those that have only one pair of factors and only one array
- Understanding how division notation represents a variety of division situations (including sharing and partitioning situations)
- Determining what to do with leftovers in division, depending on the situation
- Partitioning numbers to multiply them more easily
- Learning about patterns that are useful for multiplying by multiples of 10

Landmarks in the Thousands

- Finding and counting by factors of 100
- Recognizing factor pairs (e.g., 4 rows of 25 cubes make 100, 25 rows of 4 cubes make 100)
- Making conjectures about factors of 100
- Using knowledge of the factors of 100 to explore multiples of 100 (e.g., if there are four 25's in 100, then there are eight in 200)

- Relating knowledge of factors to division situations and to standard division notations

Packages and Groups

- Looking for and using multiplication patterns of numbers (e.g., identifying multiples of 5 by seeing that the units digit is either a 5 or a 0)
- Finding multiples and becoming familiar with the multiples of larger numbers
- Identifying factors of larger numbers
- Partitioning large numbers to multiply them more easily (e.g., 24×8 is thought of as $20 \times 8 + 4 \times 8$)
- Solving double-digit multiplication problems
- Understanding how division notation can represent a variety of division situations, including sharing and grouping situations
- Creating a context that is representative of a division equation (e.g., representing $152 \div 4 = 38$ with 152 apples divided into 38 packages of 4)
- Using multiplication and division relationships in order to solve problems

Grade Five

Mathematical Thinking at Grade 5

- Reasoning about and describing number characteristics and relationships such as multiple, factor, even, odd, prime, and square
- Representing factor pairs as dimensions of a rectangular array
- Developing a variety of strategies for exploring number composition (e.g. repeated addition, skip counting, finding factors and factor pairs, using a calculator to check divisibility)
- Becoming familiar with skip-counting patterns leading to 1000
- Becoming familiar with factors and factor pairs of 1000 and 10,000
- Developing mental multiplication and division strategies that rely on landmarks up to 10,000

Building on Numbers You Know

- Skip counting by 2-, 3-, and 4-digit numbers (including landmark numbers)
- Relating skip counting to multiplication and division
- Finding and using patterns in sequences of multiples
- Developing, recording, explaining, and comparing strategies for estimating and solving multiplication and division problems in more than one way.
- Making sense of remainders in a variety of contexts
- Interpreting, recording, and using division and multiplication notation in a variety of situations
- Using a rectangular array model to represent factor pairs of number 10,000 and larger

Containers and Cubes

- Applying multiplication to find the number of cubes in a box
- Determining the relationship between the number of cubes that fill a rectangular box and its dimensions

