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| 4th Grade Mathematics  Unit 2: Multi-Digit Multiplication |
| Teacher Resource Guide |
| 2012 - 2013 |

In Grade 4, instructional time should focus on three critical areas:

1. Developing understanding and fluency with multi-digit multiplication, and developing understanding of dividing to find quotients involving multi-digit dividends;

Students apply their understanding of models for multiplication (equal-sized groups, arrays, area models) and models for division, place value, and the distributive property as they discuss and use efficient methods to estimate and compute products and quotients. They develop fluency with efficient procedures for multiplying whole numbers, understand and explain why the procedures work based on place value and properties, and use them to solve problems. Students interpret remainders based upon the context of the problem.

1. Developing an understanding of fraction equivalence, addition and subtraction of fractions with like denominators, and multiplication of fractions by whole numbers;

Students recognize that two different fractions can be equal (12/4 = 6/2), and they develop methods for generating and recognizing equivalent fractions. Students extend understandings about how fractions are built from unit fractions (3/4 = ¼ + ¼ + ¼), and use the meaning of multiplication to multiply a fraction by a whole number.

1. Understanding that geometric figures can be analyzed and classified based on their properties, such as having parallel sides, perpendicular sides, particular angle measures, and symmetry.

Students describe, analyze, compare, and classify two-dimensional shapes. Through building, drawing, and analyzing two-dimensional shapes, students understand properties of two-dimensional objects and solve problems involving symmetry.

4th Grade Mathematics 2012 - 2013

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|  | Unit | Time Frame | | Test By |
| **TRIMESTER 1** | 1: Multiplication and Division Concepts | 6 weeks | 8/27 – 10/5 | October 5 |
| 2: Multi-Digit Multiplication | 6 weeks | 10/8 – 11/16 | November 16 |
| **TRIMESTER 2** | 3: Measurement/Geometry | 4 weeks | 11/19 – 12/21 | December 21 |
| 4: Multi-Digit Division | 7 weeks | 1/2- 2/22 | February 22 |
| **TRIMESTER 3** | 5: Fractions | 7 weeks | 2/25-4/19 | April 19 |
| 6: Decimal Fractions | 6 weeks | 4/22 – 5/29 | May 29 |

Math Wiki: <http://dmps-mathematics.wikispaces.com>

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| ***Big Ideas*** | ***Essential Questions*** |
| Estimation helps us determine if an answer is reasonable. We can use estimation when an approximate answer is acceptable. | Why do we use estimation? |

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| Identifier | | Standards | Mathematical Practices |
| **STANDARDS** | **4.NBT.5**  4.OA.1  4.NBT.1 | **Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.**  Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.  Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. | 1) Make sense of problems and persevere in solving them.  2)Reason abstractly and quantitatively.  3) Construct viable arguments and critique the reasoning of others.  4) Model with mathematics.  5) Use appropriate tools strategically.  6) Attend to precision.  7) Look for and make use of structure.  8) Look for and express regularity in  repeated reasoning. |
| **4.OA.3**  4.OA.2  4.MD.1  4.MD.2 | * **Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.**   Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.  Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.  Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. |

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| Identifier | | Standards | Bloom’s | Skills | Concepts |
| **STANDARDS** | **4.NBT.5**  4.OA.1  4.NBT.1 | **Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.**  Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.  Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. | Apply (3) | Multiply (whole numbers of up to four- digits and 2 two-digits) | multiply  whole number |
| **4.OA.3**  4.OA.2  4.MD.1  4.MD.2 | * **Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.**   Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.  Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table.  Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale. | Apply (3)  Understand (2)  Evaluate (5) | Solve (multi-step word problems)  Represent (equations)  Assess (reasonableness of answers) | whole number  remainder  equation |

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| ***Instructional Strategies for ALL STUDENTS*** |
| ***Critical Reading Prior to Instruction -***  *Math Expressions, Teacher Edition Volume II,* Houghton Mifflin, 2009, p. 499J-P  *Teaching Student-Centered Mathematics Grades 3-5,* Van de Walle & Lovin, Houghton Mifflin, 2006, p. 113-120 (building resource, SPED)  ***Real-world context –*** For students to reach the level of rigor intended for the operations of multiplication and division in the new *Iowa Core*, they must develop understanding of the operations within real-world contexts. A lesson built around word problems focusing on how students solve the problem is ideal. When the teacher focuses the discussion of the word problems on students’ strategies, attention is turned toward the reasoning and knowledge of the number system necessary to solve the problems. The different procedures outlined in the Expressions resource for multiplication provide opportunities to learn the operations by using knowledge of the number system and developing procedures that have meaning.  ***Multiplication problem types –***There are two types of multiplicative problem types: Equal Groups or Area, and Comparison. The first involves groups of equal size. Typically thisis the problem type used for multiplication and division in earlier grades. Students will need support in realizing that this isnot the only situation for multiplication. Comparative situations in previous grades were additive (How many more? How many less?), so students will need many opportunities to work with Multiplicative Comparison problems in order to recognize the problem type and become proficient. The problem bank pages in Unit One’s guide has examples of Multiplicative Comparison problems.Also see p. 8 in Unit One’s guide for further explanation of the problem types.)  ***Use of models to solve multiplication problems –*** It is essential for students to learn methods for computation that are meaningful. The methods in Expressions are Array, Place Value, and Area. The *Math Expressions Teacher’s Edition* has an in-depth explanation of each method on p. 499J – 499P. Multiplying multi-digit whole numbers is expected to be mastered in **5th**grade.  ***Interpreting a remainder –*** More often than not, division does not result in a simple whole number. If there is no context given for a division problem, a remainder can only be dealt with in two ways: It can either remain a quantity left over or be partitioned into fractions. In real contexts, remainders can have three additional effects on answers: The remainder is discarded leaving a smaller whole-number answer, or the remainder can “force” the answer to the next highest whole number, or the answer is rounded to the nearest whole number for an approximate result. Students should not be led to think of remainders as “R3” or “left over.” Remainders should be put in context and dealt with accordingly. (See Real-world context above.)  ***Estimation (to assess reasonableness of an answer) –*** Approximate numbers and rounding are estimation strategies for multi-digit division. In our number system, some numbers are “nice.” They are easy to think about and work with. Multiples of 10, 100, 5, and 25 are often referred to as nice numbers. Numbers such as 100, 700, and 50 are easier to use than 94, 517, and 762. Multiples of 25 are nice because they are easily combined into multiples of 50 and 100. Flexible thought with numbers and many estimation skills are related to the ability to substitute a nice number for one that is not so nice. This substitution can be helpful in mentally computing an estimate for a multi-digit multiplication problem. Students have primarily been taught to round as an estimation strategy. A context for why it might be necessary to round is typically not emphasized. It is ideal for students to know strategies for nice numbers and rounding and have many opportunities to use the strategies in real-world contexts (adapted from Van de Walle, 2006). |

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| ***Routines/Meaningful Distributed Practice*** |
| **Distributed Practice that is Meaningful and Purposeful**  Practice is essential to learn mathematics. However, to be effective in improving student achievement, practice must be meaningful, purposeful, and distributed.   * Meaningful: Builds on and extends understanding * Purposeful: Links to curriculum goals and targets an identified need based on multiple data sources * Distributed: Consists of short periods of systematic practice distributed over a long period of time  Routines are an excellent way to achieve the mandate of Meaningful Distributed Practice outlined in the Iowa Core Curriculum.. The skills presented during routines do not necessarily reinforce the lesson concept for that day. Routines may be used to address a need for small increments of exposure to a skill or review of skills already taught. Routine activities may be repeated several days in a row, allowing for a build-up of conceptual understanding, or can be visited and re-visited over a period of time. Routines can be inserted as the schedule allows; in short intervals throughout the day or as a lesson opener or closer. Selection of the routine should be made based on informal teacher observation and formative assessments. |
| |  |  |  | | --- | --- | --- | | **Skill** | **Standard** | **Resource** | | Know relative sizes of measurement units  (*May be taught during whole-group lesson, but reinforced during MDP time.*) | 4.MD.1 |  | | A digit in one place represents ten times what it represents in the place to its right. | 4.NBT.1 |  | | Solve word problems involving distance, intervals of time, liquid volumes, masses of objects and money | 4.MD.2 |  | | Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form | 4.NBT.2 |  | | Multiplication and Division fact fluency | 3.OA.3 | Expressions: Fluency Plan | | Round multi-digit whole numbers to any place | 4.NBT.3 |  | | Multi-digit Addition & Subtraction | 4.NBT.4 | Expressions: Unit 3 | | *Other skills students need to develop based on teacher observations and formative assessments.* | | | |

| ***Math Expressions Lesson Bank*** | | |
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| **Lesson** | **Teacher’s Edition**  **Pages** | **Standards**  **Addressed** |
| Unit 2, Lesson 1, Activities 2-3 | 145 | 4.MD.1 |
| Unit 2, Lesson 4, Activities 1-2 | 166 | 4.OA.2 |
| Unit 2, Lesson 5, Activities 1-2 | 172 | 4.OA.2 |
| Unit 2, Lesson 7, Activity 1 | 188 | **4.OA.3** |
| Unit 5, Lesson 1, Activities 1-2 | 500 | **4.NBT.5** |
| Unit 5, Lesson 2, Activity 1 | 508 | 4.NBT.1 |
| Unit 5, Lesson 3, Activities 1-2 | 514 | **4.NBT.5** |
| Unit 5, Lesson 4, Activities 1-2 | 522 |  |
| Unit 5, Lesson 5, Activities 1-2 | 530 | **4.NBT.5** |
| Unit 5, Lesson 6, Activities 1-2 | 536 | **4.NBT.5** |
| Unit 5, Lesson 7, Activities 1-2 | 542 | **4.NBT.5** |
| Unit 5, Lesson 8, Activities 1-3 | 550 | **4.NBT.5** |
| Unit 5, Lesson 11, Activities 1-2 | 574 | **4.NBT.5** |
| Unit 5, Lesson 12, Activities 1-2 | 580 | **4.NBT.5** |
| Unit 5, Lesson 13, Activities 1-3 | 590 | **4.NBT.5** |
| Unit 5, Lesson 14, Activities 1-2 | 598 | **4.NBT.5** |
| Unit 5, Lesson 15, Activities 1-2 | 606 | **4.NBT.5,** 4.NBT.1 |
| Unit 5, Lesson 16, Activities 1-2 | 612 | **4.NBT.5** |

| ***Math Expressions Activities***  **(use as centers, re-teaching/extension support, etc.)** | | ***Partner Games Activities***  **(use as centers)** | |
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| **Activity** | **Standards** | **Activity** | **Standards** |
| Activity Card 1-1 On-Level | 4.MD.1 | Multiplication Fill In p. 16 | **4.NBT.5** |
| Activity Card 1-4 On-Level | 4.OA.1, 4.OA.2 | Multiplication Arrays p. 22 | **4.NBT.5** |
| Activity Card 1-5 On-Level | 4.OA.2 | Counting Tape Game p. 26 | **4.NBT.5** |
| Activity Card 1-7 On-Level | **4.OA.3** | Big Double Trouble p. 28 | **4.NBT.5** |
| Activity Card 5-1 On-Level | **4.NBT.5** | Multiple Marker p. 30 | **4.NBT.5** |
| Activity Card 5-3 Intervention | **4.NBT.5** | Figuring Factors p. 40 | **4.NBT.5** |
| Activity Card 5-6 Intervention | **4.NBT.5** | Go For It…I’ve Got It! p. 44 | **4.NBT.5** |
| Activity Card 5-7 On-Level | **4.NBT.5** | Product Comparing p. 50 | **4.NBT.5** |
| Activity Card 5-11 Intervention, On-Level, Challenge | **4.NBT.5** |  |  |
| Activity Card 5-12 Intervention | **4.NBT.5** |  |  |
| Activity Card 5-13 On-Level | **4.NBT.5** |  |  |
| Activity Card 5-14 On-Level | **4.NBT.5** |  |  |
| Activity Card 5-15 Intervention, On-Level | **4.NBT.5**, 4.NBT.1 |  |  |
| Activity Card 5-16 Intervention | **4.NBT.5** |  |  |

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| ***District Created Activitites***  ***(from 2010-2011)***  **These are in a file on the math wiki** | |
| Fishing for Multiplying Multiples | Multiplication Rounding Challenge (3-digit x 1-digit) |
| Multiplication Pictionary (2-digit x 1-digit) | Roll a Problem (3-digit x 1 digit) |
| Multiplication Rounding Challenge (2-digit x 1-digit) | Multiplication Rounding Challenge (4-digit x 1-digit) |
| Multiplication Evaluates Reasonableness Activity Bank | Roll a Problem (4-digit x 1-digit) |
| Multiplication Methods (2-digit x 1-digit) | Multiplication Pictionary (2-digit x 2-digit) |
| Multiplication Pictionary (3-digit x 1-digit) | Multiplication Rounding Challenge (2-digit x 2-digit) |
|  | Roll a Problem (2-digit x 2-digit) |

**Table 2.**Common multiplication and division situations.1

Iowa Core Mathematics, 2010, p. 92; www.corecurriculum.iowa.gov

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|  | **Unknown Product** | **Group Size Unknown**  **("How many in each group?"**  **Division)** | **Number of Groups Unknown**  **("How many groups?" Division)** |
|  | **3 × 6 = ?** | **3 × ? = 18, and 18 ÷ 3 = ?** | **? × 6 = 18, and 18 ÷ 6 = ?** |
| **Equal**  **Groups** | There are 3 bags with 6 plums in each bag. How many plums are there in all?  Measurement example. You need 3 lengths of string, each 6 inches long. How much string will you need altogether? | If 18 plums are shared equally into 3 bags, then how many plums will be in each bag?  Measurement example. You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be? | If 18 plums are to be packed 6 to a bag, then how many bags are needed?  Measurement example. You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have? |
| **Arrays,2**  **Area3** | There are 3 rows of apples with 6 apples in each row. How many apples are there?  Area example. What is the area of a 3 cm by 6 cm rectangle? | If 18 apples are arranged into 3 equal rows, how many apples will be in each row?  Area example. A rectangle has area 18 square centimeters. If one side is 3 cm long, how long  is a side next to it? | If 18 apples are arranged into equal rows of 6 apples, how many rows will there be?  Area example. A rectangle has area 18 square centimeters. If one side is 6 cm long, how long  is a side next to it? |
| **Compare** | A blue hat costs $6. A red hat blue hat. How much does the red hat cost?  Measurement example. A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long? | A red hat costs $18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost?  Measurement example. A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first? | A red hat costs $18 and a blue hat costs $6. How many times as much does the red hat cost as the blue hat?  Measurement example. A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first? |
| **General** | a × b = ? | a × ? = p, and p ÷ a = ? | ? × b = p, and p ÷ b = ? |
| 1The first examples in each cell are examples of discrete things. These are easier for students and should be given before themeasurement examples.  2The language in the array examples shows the easiest form of array problems. A harder form is to use the terms rows and columns: The apples in the grocery window are in 3 rows and 6 columns. How many apples are in there? Both forms are valuable.  3Area involves arrays of squares that have been pushed together so that there are no gaps or overlaps, so array problems include these especially important measurement situations. | | | |

**Multiplication Problem Bank**

There are \_\_\_\_ pairs of shoes is Mrs. Baker’s closet. How many individual shoes are there all together?

Each child in Mrs. Baker’s class reads \_\_\_\_\_ pages in their book everyday. How many pages have they read after \_\_\_\_ days?

There are \_\_\_\_\_ snowmen on the playground. Each snowman is made with three big snowballs. How many snowballs were used to make all the snowmen?

Jonah has a lot of money in his piggy bank. All of the money is in five dollar bills. Jonah has \_\_\_\_\_ bills in his piggy bank. How much money does he have?

There are five days in a school week. We have \_\_\_\_\_ weeks until our next test. How many days until the next test?

Mrs. Baker is making cookies for the cookie exchange. She is making one dozen (12) of\_\_\_\_ different types of cookies. How many cookies is Mrs. Baker making?

Mr. Simmons was getting ready to decorate his Christmas tree. He carried up all of the ornament boxes from his basement. There were \_\_\_\_ boxes of ornaments. Each box had \_\_\_\_ ornaments in it. How many ornaments did Mr. Simmons have?

There were \_\_\_\_\_\_ children sitting at \_\_\_\_\_\_ tables. How many children were there sitting in the cafeteria?

There were \_\_\_\_ children in the room sitting in rows of \_\_\_\_\_\_\_. How many rows are there?

Mrs. Baker was baking cookies. Only \_\_\_\_\_ cookies would fit on each pan. She made \_\_\_\_ pans. How many cookies did she bake?

There were \_\_\_\_\_ towels in the closet. If mom puts them in piles of \_\_\_\_\_ how many piles will there be?

Michael went shopping for his friend’s birthday. He was buying baseball cards that cost 9 cents each. If he bought \_\_\_\_ cards, how much would he spend?

Jonah has a lot of money in his piggy bank. All of the money is in five dollar bills. Jonah has \_\_\_\_\_ bills in his piggy bank. How much money does he have?

There were \_\_\_\_\_groups of turkeys out in the farm field. There were \_\_\_ turkeys in each group. How many turkeys were in the field?

At the pet store there were \_\_\_\_\_cages of mice with \_\_\_\_\_mice in each cage. How many mice are in the pet store?

There are \_\_\_\_ pieces of gum in a pack. Mrs. Baker has \_\_\_\_ packs of gum. How many pieces of gum does Mrs. Baker have?

Morgan has \_\_\_\_ jars with \_\_\_\_ gumballs in each jar. How many gumballs does Morgan have all together?