# Appendix 15A: Grade 4 Mathematics Item Descriptions Developed During the TIMSS 2019 Benchmarking

| Items at Low International Benchmark (400) | |
|---|---|
| **Number** | |
| N01_02 | Solves a word problem involving subtraction of a one-digit number from a two-digit number |
| N01_05 | Multiplies a one-digit number by a two-digit number |
| N03_01 | Orders four three-digit numbers |
| N03_02 | Solves a word problem involving division of a two-digit number by a one-digit number |
| N03_03A | Identifies the largest of four three-digit numbers in context |
| N05_01 | Identifies a four-digit number represented in words |
| N07_03 | Solves a word problem involving subtraction of a one-digit number from a three-digit number |
| N07_04 | Writes a number between two two-digit numbers |
| N09_02 | Solves a word problem involving addition of two two-digit numbers |
| N11_02 | Solves a word problem involving addition of two- and three-digit numbers |
| N11_04 | Multiplies a three-digit number by a one-digit number |
| N12_01 | Identifies the smallest of four four-digit numbers |
| N12_02 | Identifies a multiple of a one-digit number |
| N13_01 | Adds two two-digit numbers |
| N13_02 | Divides a two-digit number by a one-digit number |
| N14_01 | Supplies one factor of a two-digit number (1 of 2 points) |

Items beginning with "N" are items unique to less difficult mathematics.

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| N04_02 | Divides a two-digit number by a one-digit number with a remainder |
|--------|-------------------------------------------------------------------|
| N07_02 | Multiplies a one-digit number by a two-digit number |
| N04_04 | Implements a one-step rule to generate the next number in a pattern |
| N07_07 | Finds the missing term in an addition number sentence |
| N12_05 | Identifies the missing term in an addition sentence |
| N12_06 | Implements a one-step rule forward and in reverse to partially complete a table (1 of 2 points) |
| N14_04 | Solves for the missing number in a multiplication sentence |
| N14_05 | Identifies the operation for an expression that represents a situation |
| N01_07 | Writes a fraction larger than a given unit fraction |
| N03_06 | Recognizes a unit fraction represented pictorially |
| N04_07 | Solves a word problem involving addition of one-place decimals |
| N09_08 | Recognizes a non-unit fraction represented pictorially |

**Measurement and Geometry**

| N03_09 | Solves a word problem involving addition of three one-digit numbers |
|--------|---------------------------------------------------------------------|
| M03_10 | Relates a specified face of a cube to its net |
| N01_08 | Identifies a cylinder |
| N03_08 | Writes the names of four common two-dimensional shapes |
| N05_10 | Completes a rectangle on a square grid |
| N11_11A | Identifies the tallest of four rectangular prisms represented pictorially |

Items beginning with "N" are items unique to less difficult mathematics.

| | |
|---|---|
| N12_10 | Completes a symmetric figure on a square grid given half the shape and the line of symmetry |
| N14_09 | Determines the number of  lateral faces of a given rectangular prism |
| N09_10 | Identifies a cube |
| N11_11B | Identifies the greatest volume of four rectangular prisms represented pictorially |

**Data**

| | |
|---|---|
| M08_12 | Labels bars on a bar graph to represent data given in a table |
| M10_11 | Represents data from a table in a bar graph |
| N01_04A | Reads data from a bar graph |
| N04_13 | Represents data from a table in a bar graph (1 of 2 points) |
| N04_14 | Evaluates statements about data in a pictograph (1 of 2 points) |
| N05_05A | Reads data from a table |
| N05_05B | Compares data presented in a table |
| N07_05 | Uses data from a table to complete a bar graph (2 of 2 points) |
| N07_05 | Uses data from a table to partially complete a bar graph (1 of 2 points) |
| N13_04A | Reads data from a bar graph |
| N14_13A | Reads data from a table |
| N13_04B | Compares data presented on a bar graph |

Items beginning with "N" are items unique to less difficult mathematics.

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| Items at Intermediate International Benchmark (475) | |
|---|---|
| **Number** | |
| M02_01 | Identifies a three-digit number given the place values of two of its digits |
| M05_01 | Adds a four-digit and a three-digit number |
| M06_02 | Divides a three-digit number by a one-digit number |
| M09_02 | Determines a four-digit number given the place values of the digits |
| M11_03 | Multiplies a one-digit number by a three-digit number |
| M12_01 | Identifies a four-digit number given in words in expanded form |
| N01_01 | Subtracts a two-digit number from a three-digit number |
| N01_03 | Determines a four-digit number given the values of two of its digits |
| N03_03B | Justifies the greatest number if one of four numbers is increased by 100 |
| N05_02 | Solves a two-step word problem involving subtraction of one- and two-digit numbers |
| N05_03 | Solves a word problem involving division of a two-digit number by a one-digit number |
| N07_06 | Finds the missing term in an addition word problem |
| N09_04 | Determines the smallest 3-digit number with three given digits |
| N12_04 | Solves a multi-step word problem involving multiplication of one-digit numbers and comparison of two-digit numbers |
| N13_03 | Compares representations of a value in numbers and in words and explains answer |
| N13_05 | Solves a multi-step word problem involving addition and subtraction of one- and two-digit numbers and explains answer |
| M03_01 | Identifies a four-digit number given in expanded form |

Items beginning with "N" are items unique to less difficult mathematics.

| M04_01 | Subtracts a three-digit number from a four-digit number |
| --- | --- |
| N11_06 | Solves a multi-step word problem involving multiplication of one-digit numbers and addition of two-digit numbers |
| M09_01 | Adds a four-digit, three-digit, and two-digit number |
| N03_05 | Solves a word problem involving subtraction of one- and two-digit numbers |
| N04_01 | Solves a word problem involving subtraction of two three-digit numbers |
| N07_01 | Solves a word problem involving multiplication of one- and two-digit numbers |
| N09_01 | Subtracts a two-digit number from a three-digit number |
| N09_03 | Solves a word problem involving multiplication of one- and two-digit numbers |
| N11_01 | Identifies a four-digit number given the digits in two places |
| N11_03 | Divides a two-digit number by a one-digit number with a remainder |
| M04_03 | Identifies the missing number in two number sentences with inequalities |
| M13_05 | Solves for the missing number in a subtraction sentence |
| N04_06 | Identifies an expression with addition and subtraction that represents a situation |
| N09_06 | Determines the missing number in a well defined number pattern |
| N12_06 | Implements a one-step rule forward and in reverse to complete a table (2 of 2 points) |
| M11_06 | Determines the operation to complete a number sentence |
| N05_04 | Identifies an arithmetic operation that represents a situation |
| N11_05 | Identifies an expression that represents a situation |
| N05_07 | Supplies a fraction larger than one half |

Items beginning with "N" are items unique to less difficult mathematics.

| N05_08 | Orders two decimals and a whole number |
| --- | --- |
| N13_07 | Solves a word problem involving addition of decimals |
| M01_02 | Identifies the representation of a non-unit fraction |

**Measurement and Geometry**

| M08_06 | Measures the vertical height of an object with a ruler |
| --- | --- |
| N04_08 | Solves a multi-step word problem involving multiplication and addition of mass |
| N05_11 | Determines the number of unit cubes to fill a rectangular prism |
| N05_12 | Solves a word problem involving addition of hours and minutes |
| N13_10 | Determines the perimeter of a triangle given the side lengths |
| N13_11 | Solves a word problem involving addition of hours and minutes |
| N14_08 | Identifies the appropriate metric unit of volume for an object |
| N03_10 | Solves a word problem involving subtraction of hours and minutes |
| N09_09 | Identifies the appropriate metric unit of measurement for an object |
| M01_07 | Identifies the number of triangular faces in a given three-dimensional shape |
| M02_09 | Completes a symmetric figure on a square grid given half the shape and the line of symmetry |
| N13_08 | Identifies a square |
| M01_06B | Identifies a street perpendicular to a given street |
| N05_09 | Identifies a shape with equal angles |
| N07_10 | Identifies a common shape inside another common shape |

Items beginning with "N" are items unique to less difficult mathematics.

**Data**

| | |
|---|---|
| M01_09A | Identifies the greatest value in a bar graph |
| M02_10A | Reads data from a line graph |
| M10_12A | Represents data in a table |
| M12_10 | Identifies a title and axis labels for a bar graph |
| M13_10A | Reads data from a graph |
| N04_12 | Reads data from a tally chart |
| N04_13 | Represents data from a table in a bar graph (2 of 2 points) |
| N14_12 | Labels a bar on a bar graph given data in a tally chart |
| M14_10 | Solves a word problem involving reading data from a table |
| N12_11 | Reads data from a table |
| N12_12A | Identifies the label for a bar in a bar graph given the data in a table |
| N14_11 | Reads data from a table |
| M04_12 | Determines one or two out of three missing values in a table given conditions for the data (1 of 2 points) |
| N09_05 | Uses data from a bar graph to solve a problem |

Items beginning with "N" are items unique to less difficult mathematics.

| Items at High International Benchmark (550) | |
| --- | --- |

**Number**

| | |
| --- | --- |
| M01_01 | Identifies the set of numbers having a given number as a factor |
| M02_02 | Solves a word problem involving division of a two-digit number by a one-digit number |
| M03_02 | Multiplies a two-digit number by a two-digit number |
| M05_02 | Identifies the number closest in size to a given four-digit number |
| M05_03 | Solves a word problem involving division |
| M06_01 | Classifies two- and three-digit numbers as even or odd |
| M06_03 | Devises one way of grouping objects that satisfy two conditions (1 of 2 points) |
| M07_01 | Solves a multi-step word problem involving multiplication and addition of whole numbers |
| M07_03 | Solves a word problem involving multiplication of two-digit numbers |
| M08_01 | Solves a word problem involving division of a two-digit number by a one-digit number with a remainder |
| M08_02 | Solves a word problem involving subtraction of a two-digit number from a four-digit number |
| M09_03 | Devises one way to allocate money in a given context (1 of 2 points) |
| M10_02 | Solves a word problem involving multiplication of a three-digit number by a one-digit number |
| M11_01 | Rounds a four-digit number to the thousands place |
| M11_04 | Solves a problem set in a novel situation involving addition and comparison of whole numbers and justifies the solution |
| M11_09 | Given two positions on a curved path, follows specified moves and labels another position (1 of 2 points) |
| M12_02 | Solves a word problem involving addition of one-, two-, and three-digit numbers |

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| | |
|---|---|
| M13_03 | Identifies a true statement about comparison of two- and three-digit numbers |
| M03_09 | Finds the distance between two positions on a number line |
| M11_02 | Identifies a number that satisfies two conditions of multiples |
| M09_08 | Finds the halfway point between two positions on a number line |
| M14_02 | Solves a word problem involving subtraction of two three-digit numbers |
| M01_05 | Follows a two-step rule to extend a number pattern |
| M03_06 | Solves for a repeated missing number in a subtraction sentence |
| M06_06 | Determines the operation to complete a number sentence with operations on both sides |
| M06_07 | Identifies an expression that represents a situation |
| M07_05 | Solves a number sentence involving division |
| M08_03 | Determines the place of three numbers in a number sentence with operations on both sides |
| M09_06 | Identifies an expression that represents a situation |
| M12_04A | Implements a two-step arithmetic rule to a given number |
| M13_02 | Determines whether three pairs of numbers follow a given two-step rule |
| M13_07 | Follows a two-step rule to generate the next number in a pattern |
| M14_03 | Identifies an expression with multiplication and subtraction that represents a situation |
| M14_04 | Determines the one-step rule that relates five numbers in a pattern |
| M02_04 | Identifies the operation for an expression that represents a situation |
| M03_07 | Identifies an expression that represents a situation |

| M01_04A | Solves a word problem involving rectangular representations of fractions |
| M01_04B | Solves a word problem involving rectangular representations of fractions |
| M06_04 | Solves a word problem involving subtraction of a non-unit fraction from 1 |
| M07_06 | Adds a whole number and a two-place decimal |
| M09_05 | Solves a word problem involving subtracting one-place decimals |
| M14_05 | Solves a word problem involving addition of three two-place decimals |

**Measurement and Geometry**

| M02_06 | Identifies the appropriate metric unit of measurement for three objects |
| M04_06A | Solves a word problem involving multiplication of lengths |
| M05_04 | Solves a word problem involving addition of time |
| M05_11 | Solves a problem by filling a three-dimensional shape with rectangular solids |
| M14_07 | Solves a word problem involving conversion of minutes to hours |
| M10_06 | Estimates the total length of an object given the length of part of it |
| M12_06 | Estimates the length of an object given the length of another object |
| M11_08 | Classifies angle types in a figure |
| M12_05 | Identifies a pair of shapes that make a rectangle |
| M13_09 | Identifies a two-dimensional view of an irregular three-dimensional figure |
| M14_09 | Completes a shape on a square grid to satisfy four conditions |
| M05_08 | Identifies a shape with a right angle |

| M07_09 | Identifies the two-dimensional view of a three-dimensional object |
|--------|-------------------------------------------------------------------|
| M09_09 | Identifies a solid given two faces |

**Data**

| M02_11 | Represents data from a table in a pictograph |
|--------|----------------------------------------------|
| M04_10B | Compares data in a table |
| M05_12 | Completes a bar graph using information from a pictograph |
| M07_12 | Identifies a pie chart that has the same information as a bar graph |
| M08_11 | Determines whether questions can be answered with data in a table |
| M08_13 | Determines the key for a pictograph and uses it to complete the graph (1 of 2 points) |
| M10_10A | Reads data from a line graph |
| M11_11A | Uses a key to retrieve data from a pictograph |
| M12_09A | Uses a key to retrieve data from a pictograph |
| M12_11 | Labels sections of a pie chart given three conditions for the data |
| M14_11A | Evaluates statements about data in a bar graph |
| M14_13 | Completes a table for a given data series |
| M06_11 | Identifies a pie chart that represents given data |
| M07_11 | Uses information from a bar graph to solve a problem |
| M10_10B | Extrapolates a point on a line graph with constant slope |
| M10_12B | Interprets data in a table to solve a problem |
| M13_10B | Extrapolates from a graph to solve a problem |

| Items at Advanced International Benchmark (625) | |
| --- | --- |
| **Number** | |
| M01_03 | Solves a multi-step problem involving division and gives a reason for their answer |
| M03_03 | Solves a multi-step word problem involving addition and subtraction of two- and three-digit numbers |
| M04_02 | Determines a number that meets two conditions of multiples and one condition of order |
| M06_03 | Devises two ways of grouping objects that satisfy two conditions (2 of 2 points) |
| M09_03 | Devises two ways to allocate money in a given context (2 of 2 points) |
| M10_03 | Solves a multi-step word problem involving division of one- and two-digit numbers with remainders |
| M11_09 | Given two positions on a curved path, follows specified moves and labels another position (2 of 2 points) |
| M13_01 | Recognizes equivalent three-digit numbers written in expanded form |
| M14_01 | Divides a three-digit number by a one-digit number |
| M09_07 | Identifies the missing number in a number sentence with operations on both sides |
| M12_04B | Implements a two-step rule in reverse to generate the previous number in a pattern |
| M13_06 | Identifies an operation that represents a situation |
| M04_04 | Identifies an expression with division and addition that represents a situation |
| M10_04 | Solves a word problem by extending a pattern |
| M11_07 | Identifies number sentence that represents a situation |
| M02_03 | Identifies non-unit fractions greater than a given unit fraction |
| M03_04 | Solves a problem to identify a fraction that represents the shaded portion of a figure |

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| M03_05 | Solves a word problem involving division with a remainder (1 of 2 points) |
|--------|-------------------------------------------------------------------------|
| M05_05 | Identifies a fraction equivalent to a given fraction |
| M05_06 | Solves a multi-step problem involving fractions |
| M06_05 | Draws a complete shape on a grid given a picture of a fraction of the shape |
| M07_02 | Identifies a fraction equivalent to a one place decimal |
| M08_05 | Identifies a decimal given the place values of two of its digits |
| M10_05 | Identifies the larger number among pairs of one- and two-place decimals |
| M11_05 | Solves a word problem involving adding fractions with different denominators |
| M13_04 | Identifies a number between a one-place decimal and two-place decimal |
| M07_04 | Identifies a set of objects with a given fraction shaded |

### Measurement and Geometry

| M02_08 | Determines the number of three different shapes that cover the area of a square (2 of 2 points) |
|--------|-------------------------------------------------------------------------|
| M02_08 | Determines the number of two different shapes that cover the area of a square (1 of 2 points) |
| M04_06B | Solves a word problem involving division of lengths |
| M05_10 | Reads a ruler to find the length of one side of an equilateral triangle and finds its perimeter |
| M06_08 | Reads a ruler to find the length of a line segment beginning and ending at half-units |
| M07_07 | Reads a ruler to find the length of an object beginning at a half-unit |
| M08_07 | Solves a word problem involving subtraction of volumes |
| M08_10 | Determines two sides lengths of a hexagon given the other four side lengths and its perimeter |

| | |
|---|---|
| M10_07 | Draws a rectangle with a given perimeter on a square grid |
| M10_09 | Solves a multi-step word problem involving multiplication and division of lengths, with a remainder (1 of 2 points) |
| M12_07 | Determines the number of unit cubes to fill a rectangular prism and explains method (2 of 2 points) |
| M12_07 | Determines the number of unit cubes to fill a rectangular prism and explains method (1 of 2 points) |
| M12_08 | Measures a horizontal object with a ruler and applies a scale to determine its length |
| M14_06 | Identifies the speed shown on a speedometer |
| M02_07 | Solves a multi-step word problem involving multiplication and division of weights |
| M04_05 | Estimates the height of an object given the height of another object |
| M04_07 | Determines the weight of an object given a series of three balanced scales |
| M07_10 | Finds the area of a rectangle given its dimensions |
| M08_08 | Analyzes information in a time table to solve a word problem |
| M14_08 | Identifies the area of a rectangle drawn at an angle on a square grid |
| M03_08 | Identifies parallel lines on a geometric shape |
| M04_08 | Draws a line on a square grid that is parallel to a given line and passes through a specified point |
| M04_09 | Identifies properties of two pentagons |
| M06_09 | Recognizes acute angles in an irregular quadrilateral |
| M06_10 | Determines the number of square and triangular faces of three-dimensional shapes (2 of 2 points) |
| M06_10 | Determines the number of square and triangular faces of three-dimensional shapes (1 of 2 points) |
| M07_08 | Given a line, draws another line to form an angle less than a right angle |

| M09_10A | Draws a parallel line on a square grid given conditions |
|---|---|
| M13_08 | Draws an obtuse angle on a square grid given one side |
| M01_06A | Identifies a street parallel to a given street |
| M05_09 | Identifies a shape that has both line and rotational symmetry |
| M11_10 | Identifies a net of a hexagonal prism |

**Data**

| M02_12 | Determines the y-axis scale for a bar graph given the data in a table |
|---|---|
| M03_11 | Represents data from a table in a pie chart |
| M08_13 | Determines the key for a pictograph and uses it to complete the graph (2 of 2 points) |
| M14_12 | Identifies the optimal data display for data given in a table |
| M01_09B | Interprets a bar graph to solve a two-step problem |
| M04_12 | Determines three missing values in a table given conditions for the data (2 of 2 points) |
| M11_11B | Uses information in a pictograph to solve a problem |
| M12_09B | Uses data from a pictograph to solve a problem |
| M12_12 | Compares the slope of two lines on a graph for a specific period and explains answer |
| M14_11B | Uses data from a bar graph to determine whether a conclusion is true and explains answer. |

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## Items Above Advanced International Benchmark (625)

### Number

| | |
|---|---|
| M02_05 | Solves a multi-step word problem involving unit price (2 of 2 points) |
| M02_05 | Solves a multi-step word problem involving unit price (1 of 2 points) |
| M09_04 | Determines the missing digit for a two-digit number that satisfies two conditions |
| M08_04 | Solves a word problem by implementing a one-step rule to generate numbers in a pattern |
| M03_05 | Solves a word problem involving division with a remainder and justifies the solution (2 of 2 points) |
| M12_03 | Adds a one-place decimal and a two-place decimal |

### Measurement and Geometry

| | |
|---|---|
| M10_09 | Solves a multi-step word problem involving multiplication and division of lengths, with a remainder (2 of 2 points) |
| M01_08 | Identifies a net of a given object |
| M05_07 | Identifies a rule to sort shapes into two sets |
| M09_10B | Draws a perpendicular line on a square grid given conditions |
| M10_08 | Identifies properties of a parallelogram and a rectangle |

### Data

| | |
|---|---|
| M04_11 | Analyzes data in two bar graphs to refute a conclusion |
| M08_14 | Represents data from a table in a line graph (2 of 2 points) |
| M08_14 | Represents data from a table in a line graph (1 of 2 points) |