# Appendix 14C: TIMSS 2015 Eighth Grade Mathematics Item Descriptions Developed During the TIMSS 2015 Benchmarking

## Items at Low International Benchmark (400)

**Number**

| | |
|---|---|
| M04_01 | Recognizes a 7-digit number given in words |
| M07_01 | Evaluates the power of a whole number |

**Data and Chance**

| | |
|---|---|
| M01_13 | Uses information in a table to complete a bar graph |
| M06_13 | Identifies the table that matches the information shown in a pictograph |

## Items at Intermediate International Benchmark (475)

**Number**

| | |
|---|---|
| M01_04 | Identifies equivalent ratios |
| M02_01 | Recognizes the commutative property |
| M03_01 | Identifies the decimal number closest in size to a given fraction |
| M05_01 | Identifies the divisor by moving the decimal point |
| M07_03 | Uses knowledge of the whole being 100 percent to solve a simple word problem |
| M07_04A | Completes a table of equivalent proportions |
| M08_04 | Shades a percent of a figure |
| M09_01 | Evaluates an expression involving negative whole numbers and parentheses |
| M09_02 | Solves a word problem involving subtraction of negative numbers |
| M10_01 | Solves a word problem involving subtraction of negative numbers |
| M11_03 | Solves a two-step word problem involving whole numbers |
| M11_04 | Determines what fraction of a 10×10 grid is shaded |
| M13_02A | Solves a word problem involving addition of time |

**IEA**

**TIMSS & PIRLS**
International Study Center
Lynch School of Education, Boston College

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015      14.27

**Algebra**

| M11_06 | Evaluates the power of an expression given its value |
|---|---|
| M12_08 | Uses values for a linear function to determine an extrapolated value |
| M14_05 | Solves a linear equation in two-variables given the value of one variable |

**Geometry**

| M02_08 | Identifies opposite faces of a cube given its net |
|---|---|
| M04_09 | Recognizes congruent quadrilaterals |
| M05_12 | Identifies a true statement based on the properties of parallel and perpendicular lines |
| M12_09 | Identifies the reflection of a partly shaded shape |
| M12_11 | Determines the total number of stacked unit cubes |

**Data and Chance**

| M05_15 | Given a table of percentages, selects the pie chart that could represent the given data |
|---|---|
| M06_12A | Compares the chances of two outcomes shown pictorially |
| M07_12 | Reads values from two line graphs to solve a problem |
| M07_14 | Given a situation, judges the chance of an outcome as unlikely |
| M08_14A | Estimates an expected value given an observed sample |
| M09_12 | Finds and compares the unit prices of four objects |
| M09_14 | Identifies the bar graph that matches the information shown in a table |
| M11_12A | Reads data from a line graph |
| M11_12B | Compares data from two line graphs to solve a problem |
| M13_12 | Solves a problem given the chance of an outcome |

## Items at High International Benchmark (550)

**Number**

| M01_01 | Solves a word problem involving multiplication of a fraction and a decimal |
|---|---|
| M01_06B | Selects and combines information from two sources to solve a multi-step word problem (2 of 2 points) |
| M02_02 | Solves a two-step word problem involving subtraction of whole numbers and multiplication of a fraction |

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015     14.28

TIMSS & PIRLS
International Study Center
Lynch School of Education, Boston College

IEA

| | |
|---|---|
| M02_03A | Determines the percentage for a section of a pie chart |
| M03_04 | Orders decimals with different numbers of decimal places |
| M03_05 | Solves a proportion problem involving decimals |
| M05_02 | Recognizes the fraction equivalent to a percentage |
| M05_03 | Approximates the sum of five three-digit numbers to the nearest hundred |
| M05_04 | Identifies the larger of two fractions with different numerators and different denominators and explains why it is larger |
| M06_01 | Uses the distributive law to identify an expression equivalent to a given one |
| M06_04 | Determines fractions equivalent to a given fraction |
| M07_04B | Finds the unknown term in a proportion in a given situation |
| M08_01 | Identifies an expression equivalent to a given division expression |
| M08_03 | Finds the missing value in an addition problem with both fractions and decimals |
| M09_04 | Given the two parts of a whole in a word problem, identifies the fraction which represents one part |
| M09_05A | Solves a word problem involving multiplication and addition of whole numbers |
| M10_02 | Identifies equivalent ratios |
| M10_04 | Uses four different digits to write two two-digit numbers with the smallest product |
| M11_01 | Solves a word problem involving ratios |
| M11_02 | Identifies a prime number |
| M12_01 | Solves a word problem involving a fraction of a whole |
| M12_02 | Solves a word problem involving division of whole numbers with a remainder |
| M13_01 | Identifies the representation of a fraction equivalent to a given representation of a fraction |
| M13_03 | Understands a property of adding multiples |
| M13_04 | Writes a decimal with three places as a fraction |
| M14_01 | Identifies an expression equivalent to a given multiplicative expression |
| M14_02 | Solves a two-step word problem involving subtraction of whole numbers and multiplication of a fraction |
| M14_04 | Solves a word problem involving ratios and decimals |

**Algebra**

| | |
|---|---|
| M01_03 | Recognizes the distributive property in evaluating an algebraic expression |
| M01_05 | Identifies the algebraic expression that represents a fraction of a variable |
| M01_07 | Identifies the ordered pair of numbers that satisfies a given linear equation |
| M01_08 | Identifies the equation that models a situation given in a word problem |
| M01_09 | Identifies values of two variables, each satisfying a simple inequality |
| M03_06 | Evaluates an algebraic expression involving a fraction |
| M03_08 | Identifies the solution to an equation involving a square root |
| M03_09 | Identifies the formula that represents a situation involving area |
| M05_06 | Solves a simple linear equation in one variable with a mixed number solution |
| M05_07 | Finds a missing term in a non-arithmetic and non-geometric number sequence |
| M05_08 | Identifies the linear equation satisfied by two given values |
| M05_11A | Adds two algebraic expressions and simplifies |
| M06_08A | Extends a pattern to find the area of a square |
| M07_07 | Finds the value of an algebraic expression involving parentheses and negative terms |
| M08_07 | Identifies an algebraic expression that represents the perimeter of an irregular shape |
| M08_08 | Determines a missing coordinate for a linear relationship given in a table |
| M09_07 | Evaluates an algebraic expression involving fractions and integers |
| M09_08 | Uses a given formula involving fractions to solve a word problem |
| M10_05 | Identifies an expression that represents a situation |
| M12_06 | Identifies an equation that models a situation |
| M12_07 | Identifies an expression for the area of part of a geometric figure |
| M13_06 | Identifies the equivalent algebraic expression involving exponents and multiplication |
| M13_07A | Extends a given geometric pattern to find the value of the 10th term |
| M14_07 | Identifies the true statement about a linear relationship given in a graph |

IEA   **TIMSS&PIRLS**
International Study Center
Lynch School of Education, Boston College

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
**METHODS AND PROCEDURES IN TIMSS 2015**      14.30

**Geometry**

| | |
|---|---|
| M01_11 | Identifies the number of remaining unit cubes |
| M02_07 | Draws the reflection of a shape over a diagonal line on a grid |
| M03_11 | Identifies a net of a rectangular solid |
| M03_12 | Solves a problem involving angles of a triangle and parallel lines |
| M05_13 | Uses the angle properties of triangles and rectangles to find a missing angle |
| M06_09 | Uses the Pythagorean theorem to solve a word problem |
| M06_10 | Solves a problem involving angles of a triangle |
| M07_09 | Draws a symmetrical shape given half of it and its line of symmetry |
| M08_10 | Finds the coordinates of a midpoint given two points in the Cartesian plane |
| M09_10 | Identifies the value of an angle involving properties of corresponding and supplementary angles |
| M09_11 | Draws an angle of a given measure on a square grid |
| M11_10 | Solves a problem involving similar triangles |
| M13_11 | Solves a problem involving angles of a triangle |
| M14_08A | Solves a word problem involving the length around a hexagonal prism |

**Data and Chance**

| | |
|---|---|
| M01_14 | Explains why a conclusion drawn from a given bar graph is incorrect |
| M02_13 | Identifies the probability of an event |
| M05_16 | Interpolates from a line graph to provide an estimated value |
| M06_12B | Compares the chances of two outcomes |
| M07_02 | Reads the value indicated by an unlabeled mark on a speedometer |
| M07_13 | Identifies a possible description of a part of a time-speed graph |
| M10_13A | Computes the mean of four given values |
| M11_13 | Interprets data in a pictograph to solve a multi-step problem |
| M11_14 | Justifies a conclusion resulting from comparing two distributions |

**TIMSS & PIRLS**
International Study Center
Lynch School of Education, Boston College

IEA

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015      14.31

| M12_13 | Interprets a histogram to identify a proportion |
| M12_14 | Draws a spinner that has given probabilities |
| M13_13B | Uses and interprets data sets in pie charts to solve a problem involving percentages |
| M14_11 | Evaluates information given by a time/distance graph |
| M14_13 | Identifies the probability of an event |

## Items at Advanced International Benchmark (625)

### Number

| M01_02 | Uses knowledge of place value to express a sum as a decimal |
| M01_06A | Selects and combines information from two sources to solve a multi-step word problem (2 of 2 points) |
| M02_03B | Determines the whole given the amount of a percentage |
| M03_02 | Solves a non-routine problem involving whole numbers |
| M03_03 | Reasons about divisibility in an algebraic expression |
| M04_02 | Given the volume of a fraction of a container, determines the total volume for multiple containers of the same size |
| M04_03 | Solves a word problem involving price per unit and explains reasoning |
| M04_04 | Given four different containers, identifies the container with the greatest fraction filled |
| M06_02 | Solves a word problem involving comparison of fractions and percentages and explains answer |
| M06_03 | Solves a non-routine word problem involving reasoning with whole numbers (2 of 2 points) |
| M06_05 | Reasons about fractional parts of a whole in a word problem and explains answer |
| M08_02 | Solves a two-step word problem involving whole numbers |
| M09_03 | Solves a two-step word problem involving percentages |
| M09_05B | Solves a non-routine word problem involving whole numbers |
| M10_03 | Determines the dimensions of a rectangle that is similar to a given rectangle |
| M11_05 | Identifies a true statements about percentages of given numbers |
| M12_03 | Completes a table of equivalent proportions and percentages (2 of 2 points) |
| M12_04 | Solves a word problem involving ratios |

**TIMSS & PIRLS**
International Study Center
Lynch School of Education, Boston College

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015     14.32

| | |
|---|---|
| M13_02B | Solves a word problem involving percentages and elapsed time |
| M14_03 | Identifies a percentage using a given ratio |
| **Algebra** | |
| M01_10 | Uses a given formula to solve a word problem |
| M02_04 | Solves a pair of simultaneous linear equations in two variables |
| M02_05 | Computes values of a function given values of the variable |
| M02_06 | Identifies a linear equation given the y-intercept |
| M04_05 | Simplifies an algebraic expression |
| M04_06 | Retrieves coordinate points from a graph of a function |
| M04_08 | Constructs a linear equation for the perimeter of a triangle and solves for the length of one side |
| M05_05 | Writes a rule for a multiplicative number pattern involving negative numbers |
| M05_09 | Solves a proportion expressed algebraically |
| M05_10 | Constructs and uses the solution of a linear equation to solve a word problem (2 of 2 points) |
| M05_11B | Subtracts one algebraic expression from another and simplifies |
| M06_06 | Identifies an equivalent equation |
| M06_07 | Identifies a pair of simultaneous linear equations that model a given situation |
| M07_05 | Identifies the equation of a line that passes through points shown on a graph |
| M07_06 | Identifies the equation that models a situation involving distance, speed, and time |
| M07_08A | Finds a specific term in a pattern presented numerically and geometrically |
| M07_08B | Explains how to find a specific term in a pattern presented numerically and geometrically |
| M07_08C | Expresses the general term algebraically in a pattern presented numerically and geometrically |
| M08_06 | Identifies a line with positive slope |
| M09_06 | Identifies an equivalent algebraic expression |
| M09_09 | Demonstrates an understanding of slope by relating graphs and their equations |
| M10_06 | Constructs a linear equation to represent a situation |

**TIMSS & PIRLS**
International Study Center
Lynch School of Education, Boston College

IEA

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015      14.33

| M10_08 | Constructs a linear equation for the perimeter of a rectangle and finds the area (2 of 2 points) |
|---|---|
| M11_08 | Solves a pair of simultaneous linear equations |
| M13_05 | Identifies an algebraic expression that represents the area of a given rectangle |
| M13_07B | Gives a rule for the nth term of a geometric pattern |
| M13_08 | Identifies the graph of a linear equation |
| M14_06 | Identifies the slope of a line given its equation |
| **Geometry** | |
| M01_12 | Uses the Pythagorean theorem in finding the area of a triangle |
| M02_09 | Identifies two different arrangements of trapezoids with the same perimeter |
| M04_10 | Finds the coordinates of a vertex of a rectangle given the other three vertices |
| M05_14 | Uses properties of similar triangles to identify equal angles |
| M06_11 | Identifies the point equidistant from two given points in the Cartesian plane |
| M07_10 | Uses the Pythagorean theorem in finding the perimeter of a trapezoid |
| M07_11 | Identifies two shapes that make a square |
| M08_09 | Uses properties of triangles and quadrilaterals to solve for an angle |
| M08_12 | Draws a rectangle on square grid given area and perimeter (2 of 2 points) |
| M10_09 | Estimates area of an irregular shape on a square grid |
| M10_10 | Finds vertices of triangles created from trapezoids in the Cartesian plane (2 of 2 points) |
| M10_11 | Uses properties of supplementary angles to solve for an angle |
| M12_10 | Determines the number of faces of a regular solid with unit cubes removed |
| M13_10 | Determines the surface area of a prism given its net |
| M14_08B | Solves a word problem involving the lateral surface area of a hexagonal prism |
| **Data and Chance** | |
| M01_15 | Uses understanding of average to solve a problem |
| M02_11 | Identifies the statement that best describes a data set given in a table |

**TIMSS & PIRLS**
International Study Center
Lynch School of Education, Boston College

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015     14.34

| M02_12 | Estimates probability given an observed sample |
|--------|------------------------------------------------|
| M03_13 | Explains why a data representation could be misleading |
| M03_14 | Interprets data in a pie chart to solve a word problem |
| M03_15 | Uses understanding of mean and range to solve a problem |
| M04_12A | Calculates mean and median for two ordered lists of data (2 of 2 points) |
| M08_14B | Compares observed and expected values |
| M10_12 | Estimates the number of objects in a given probability sample |
| M10_13B | Determines the change in a mean given changes in individual scores |
| M12_12 | Solves a word problem involving averages |
| M13_13A | Uses and interprets data sets in pie charts to solve a problem involving percentages |

## Items Above the Advanced International Benchmark (625)

**Number**

| M01_06C | Compares results derived from two sources and provides a justification for the conclusion (2 of 2 points) |
|---------|------------------------------------------------------------------------------------------------------------|

**Algebra**

| M03_07 | Writes an expression for the area of part of a geometric figure |
|--------|------------------------------------------------------------------|
| M04_07 | Determines a collinear point given another point on the line and the slope |
| M06_08B | Writes the algebraic expression for the nth term in a series |
| M08_05 | Identifies the equivalent form of a linear inequality in one variable |
| M11_07 | Identifies an algebraic expression involving parentheses and negative terms |
| M12_05 | Identifies equivalent rational expressions |

**Geometry**

| M02_10 | Explains how to find the area of an irregular shape on a grid (2 of 2 points) |
|--------|--------------------------------------------------------------------------------|
| M03_10 | Solves a word problem using properties of similar triangles |
| M04_11 | Explains why two shaded areas of overlapping congruent triangles are equal |
| M08_11 | Solves for a missing side length given two similar triangles |
| M11_09 | Draws all lines of symmetry on a regular polygon |

**IEA** **TIMSS & PIRLS**
**International Study Center**
Lynch School of Education, Boston College

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
METHODS AND PROCEDURES IN TIMSS 2015    14.35

| M11_11 | Solves a multi-step word problem involving ratios between volumes |
| M13_09 | Identifies the image of a shape after rotation and reflection |
| M14_09 | Determines the number of exposed faces for unit-cubes that make up a larger cube (2 of 2 points) |
| M14_10 | Solves a word problem involving the Pythagorean theorem |

**Data and Chance**

| M04_13 | Solves a multi-step problem involving probability |
| M08_13 | Compares characteristics of two dot plots to justify a conclusion |
| M09_13 | Explains why a data representation could be misleading |

**IEA**

**TIMSS & PIRLS**
International Study Center
Lynch School of Education, Boston College

CHAPTER 14: USING SCALE ANCHORING TO
INTERPRET THE TIMSS 2015 ACHIEVEMENT SCALES
**METHODS AND PROCEDURES IN TIMSS 2015**        **14.36**