Appendix D

Descriptions of Mathematics Items at Each Benchmark
Lower Quarter Benchmark Items

Fractions and Number Sense

H09 Rounds to estimate the sum of two three-digit numbers.

R07 Subtracts a three-decimal-place number from another with multiple regrouping.

R13 Subtracts a four-digit number from another involving zeroes.

Data Representation, Analysis, and Probability

A06 Calculates and compares the averages of two sets of data.

P16 Reads a thermometer and locates the reading in a table.

Algebra

P09 Selects an expression in exponential notation for repeated multiplication.

Median Benchmark Items

Fractions and Number Sense

B08 Solves a word problem by finding the missing term in a proportion.

C06 Determines which is the most unreasonable estimate for two 3-digit numbers.

D12 Estimates the value, to one decimal place, of a point on a number line marked at whole number intervals.

E04 Arranges four given digits in descending and ascending order and finds the difference between those two numbers.

H08 Selects a figure with shaded parts that represents a familiar fraction.

I05 Solves a word problem involving subtraction of a two-place decimal number from another.

K01 Identifies a circular model of a fraction that best approximates a given rectangular model of the same fraction.
Fractions and Number Sense continued

K02 Solves a word problem by adding numbers with up to three decimal places.

K06 Selects the approximate quantity remaining after an amount is decreased by a given percent.

L09 Given an object of one length, to one decimal place, estimates the length of a second object in a diagram.

L10 Identifies the numerical equivalent of a decimal number given in words.

M04 Selects the smallest fraction from a set of familiar fractions.

N11 Rounds a number less than 100,000 to the nearest hundred.

P13 In a word problem, uses rounding to identify the number sentence that gives the best estimate for the product.

Measurement

D11 Selects appropriate metric unit to measure weight (mass).

G02 Identifies an unlabeled midway point on a number line marked in tenths.

L13 Recognizes the inverse relation between length of nonstandard units and the number of those units required to cover a distance.

Data Representation, Analysis, and Probability

B07 Given two line graphs, identifies the relevant one and determines the interval showing the greatest increase.

C02 Reads and interprets information from a pie graph.

E01 Solves problem by interpreting information from a graph of two intersecting lines.

H07 Reads data from a bar graph to solve a word problem.

J13 Determines how many items are represented by one symbol in a pictogram.

M03 Recognizes that the probability of an outcome of a single event is inversely related to the number of elements in the population of events.
Data Representation, Analysis, and Probability continued

M09 Given a table of values for two variables, selects the graph that could represent the given data.

Q04 Solves a comparison problem by associating elements of a bar graph with a verbal description.

Geometry

C03 Identifies corresponding parts of congruent trapezoids.

J15 Selects the pair of similar triangles from a set of triangles.

J16 Locates the point on a grid with 5-unit divisions when the point lies between the grid lines.

K03 Identifies the diagrammatic representation of a three-dimensional object after rotation.

Algebra

A02 Using properties of a balance, reasons to find an unknown weight (mass).

B12 Identifies the linear equation corresponding to a given verbal statement involving a variable.

D08 Solves for missing number in a proportion.

G04 Solves equation for missing number in a proportion.

H12 Selects the expression that represents a situation involving multiplication.

J17 Finds a missing $y$ value in a table relating $x$ and $y$ values.

V04A Given a sequence of diagrams growing in one-dimension and a partially completed table, finds the next two terms in the table.
Upper Quarter Benchmark Items

Fractions and Number Sense

A01  Finds 4/5 of a region divided into 10 equal parts.
A04  Solves a word problem by finding the missing term in a proportion.
B09  Given two equivalent fractions, identifies the pictorial representation showing they are equivalent.
B10  Selects the smallest of a set of numbers with differing numbers of decimal places.
D09  Selects the smallest fraction from a set of familiar fractions.
E03  Identifies the fraction of an hour representing a time interval.
F09  Identifies a decimal number given in thousandths between two decimal numbers given in hundredths.
F12  Identifies the interval containing the fraction that represents the shaded part of a circle.
G05  Selects a fraction representing the comparison of part to whole, given each of two parts in a word-problem setting.
I02  Solves a multi-step word problem involving multiplication of whole numbers by fractions.
I06  Writes a fraction less than a given fraction.
J12  Divides one fraction by another with unlike denominator.
J18  Uses a map scale to find the approximate distance between two towns.
K09  Adds three fractions with denominators less than 10.
L18  Subtracts fractions with unlike denominators.
N14  Selects a set of equivalent fractions.
N19  Shades squares in a rectangular grid to represent a given fraction.
O04  Rounds a four-place decimal to the nearest hundredth.
O09  Solves a one-step word problem involving division of a whole number by a unit fraction.
Fractions and Number Sense continued

P14    Estimates the product of two whole numbers in a word problem.
Q05    Selects the statement that describes the effect of adding the same amount to both terms of a ratio.
Q06    Estimates the product of a multiple of 1000 and a two-digit number in a word problem involving knowledge of units of time.
Q09    Multiplies and adds fractions with different denominators in the correct order.
R15    Solves a multi-step word problem that involves dividing a quantity in a given ratio.
T04    Solves a word problem that involves multiplying a decimal in thousandth by a multiple of a hundred.
V01    Provides an example of a measure that would round to a given value.
V03    Determines the ratio of part to total in a word problem.

Measurement

A03    Given a length rounded to the nearest centimeter, identifies what the actual length could have been in centimeters to one decimal place.
C01    Compares volume by visualizing and counting cubes.
I07    Finds the area between two rectangles when one is inside the other and their sides are parallel.
M01    Reads the value indicated by an unlabeled tick mark on a circular scale.
N15    Identifies an angle of a given size in a diagram.
O06    Given the start time, and the duration of an event expressed as a fraction of an hour, determines the end time.
S02A   Finds a fraction of a given area of an irregular figure composed of squares of equal sides.
T03    Finds the area of a rectangle contained in a parallelogram of given dimensions.
Data Representation, Analysis, and Probability

F08 Understands independence in a probability setting.

H11 In a word problem, finds the missing number in a proportion.

I09 Given the set of possible outcomes expressed as fractions of all outcomes, recognizes that probability is associated with the size of a fraction.

K07 In a word problem, when given the possible number of outcomes and the probability of successful outcomes, solves for the number of successful outcomes.

L11 Determines the number of values on the horizontal axis of a line graph that correspond with a given value on the vertical axis.

N18 Identifies the number of successful outcomes of a simple experiment and calculates the probability of success.

O01 On a given graph, interpolates to find a value between graduations on one axis matching a given value on the other axis.

O05 In a word problem, when given the possible number of outcomes and the probability of successful outcomes, solves for the number of successful outcomes.

R09 Solves a word problem by extrapolating a graph of a non-linear relationship.

Geometry

A05 Identifies pairs of congruent triangles.

B11 Visualizes the arrangement of the faces of a cube given its net.

D07 Applies knowledge of symmetry to select the measure of an angle.

E02 Uses properties of congruent triangles to find the measure of an angle.

G03 Solves a problem involving adjacent and vertical angles.

J11 Identifies a false statement about the properties of rectangles.

M07 Uses knowledge of a straight angle to find the measure of an angle.

O03 Given two parallel lines cut by a transversal, selects a pair of supplementary angles.

O08 Selects the center of rotation when shown a diagram of a triangle and its image under a quarter turn.
Geometry continued

R11 Determines the number of triangles of given dimensions needed to cover a given rectangle.

Algebra

C05 Finds a specified term in a sequence given the first three terms pictorially.

D10 Identifies algebraic equation (formula) corresponding to a verbal description involving a constant and two variables.

E05 Identifies the linear relationship between the first and second terms in a set of ordered pairs.

F11 Solves a two-step problem involving multiplication and division of whole numbers and fractions.

G06 Finds the value of an algebraic expression involving multiplication of negative integers.

H10 Identifies the linear equation that describes the relationship between two variables given a table of values.

L12 Translates a word problem into a short finite arithmetic sequence and sum the sequence.

L14 Identifies the linear equation that describes the relationship between two variables given a table of values.

L17 Solves a linear equation involving transposing.

N13 Evaluates a rational expression in one variable for a given value of the variable.

O07 Solves a linear equation involving parentheses.

P11 Selects a multiplicative expression for repeated addition.

Q02 Subtracts algebraic fractions with the same numeric denominator.

Q07 Selects the formula satisfied by the given values of the variables.

R12 Selects a simple, multiplicative expression in one variable that is positive for all negative values of that variable.

S01A Given a sequence of diagrams growing in two dimensions and a partially completed table, finds the next two terms in the table.

V04B Knowing the first five terms of a sequence growing in one dimension, finds the seventh term.
Top 10% Benchmark Items

Fractions and Number Sense

C04 Identifies the pair of numbers satisfying given conditions involving ordering integers, decimals, and common fractions.

F07 Solves a time-distance-rate problem that involves division of decimals and conversion of minutes to seconds.

J14 Identifies the correct position for the decimal point in the quotient in a division of a decimal written in hundredths by a decimal written in thousandths.

M06 Given the total number and the ratio of the two parts, finds the value of one part.

M08 Multiplies a two-place decimal by a three-place decimal.

N16 Solves multi-step problem with fractions requiring analysis of the verbal relations described.

N17 Solves a word problem involving multiplication of two-digit one-place decimals and subtraction of decimals.

O02 Finds the percent change given the original and the new quantities.

P15 Solves a word problem involving both addition and subtraction of familiar fractions.

P17 Writes a decimal expressed in hundredths as a fraction in lowest terms.

Q08 Orders a set of decimals of up to three decimal places.

R08 In a word problem, finds an average by dividing a decimal by a multiple of 100.

R14 Solves a two-step problem involving multiplication of a whole number by a fraction.

T02A In a multi-step word problem, finds how many of each of two groups of different sizes are required to produce a given number.
Measurements

E06 Identifies the length of a rectangle given its perimeter and width.
F10 Recognizes that precision of measurement is related to the size of the unit of measurement.
I03 Applies knowledge of number of milliliters in a liter to solve a word problem.
J10 Finds the area between two rectangles when one is inside the other and their sides are parallel.
K05 Finds the perimeter of a square given that its area is a square number less than 150.
P12 Estimates the length of a curved piece of string adjacent to a ruler.
Q03 From a set of times expressed variously in days, hours, minutes, and seconds, determines which is least.
S02B Finds the length of a side of a square, given that its area is a square number.
U02A Uses computation with fractions to find the length and width of a rectangle and draws and labels that rectangle on a grid.
U02B Given the dimensions of two rectangles, expresses the ratio of their areas.
U03 Finds the area of a triangle, on the same base and with the same height as a square, when the length of a side of the square is known.

Data Representation, Analysis, and Probability

G01 Reads data from a frequency table to solve a problem.

Geometry

I08 Given only the coordinates of two points on the line, selects the coordinates of a third point on that line.
K08 Uses properties of congruent triangles and the sum of the angles of a triangle to find the measure of an angle.
L16 Identifies the measure of an angle of a quadrilateral given the measures of the other three angles.
Geometry continued

M05 Identifies the image of a triangle under a rotation about a point in the plane.

N12 Locates a point on a number line given its distance from two given points.

P10 Uses properties of similar triangles to find the length of a corresponding side.

Q10 Solves a problem involving measures of overlapping angles.

Algebra

K04 Solves a linear inequality involving a fraction.

L15 Uses proportion to find missing values in a table.

R10 Recognizes properties of operations on real numbers represented in symbolic form.

S01B Knowing the first five terms of a sequence growing in one dimension, finds the seventh term.

T01 Solves a multi-step word problem in which there are two unknowns and displays the method of solution.

V04C Given the initial terms in a sequence and, for example, the 50th term of that sequence, generalizes to find the next term.
# Items Above the Top 10% Benchmark

## Fractions and Number Sense

**S03** Solves a word problem involving multiplication and subtraction of decimals.

**T02B** Uses information in a word problem to determine numerator and denominator and writes the relevant common fraction.

**U01** Estimates the total time in minutes for an event made up of a series of events, each given in minutes and seconds.

## Measurement

**P08** Finds the ratio of width to perimeter for a rectangle when given the ratio of length to width of a rectangle.

**S02C** Finds the perimeter of a figure made up of squares with known length of sides.

## Data Representation, Analysis, and Probability

**V02** Selects relevant information from two advertisements to solve a complex word problem involving decimals.

## Algebra

**I01** Identifies what the variable represents in an equation for a given situation.

**I04** Identifies numbers common to two different arithmetic sequences.

**Q01** Selects an algebraic expression to answer a question about a set of linked verbal statements.

**S01C** Generalizing from the first several terms of a sequence growing in two dimensions, explains a way to find a specified term, e.g. the 50th.