

## Missouri Assessment Program

### Mathematics Achievement Level Descriptors

In July 1997, a five-step scale of achievement levels was established to classify students' performance in the area of Mathematics. The levels were **“Step 1”** (lowest), **“Progressing,”** **“Nearing Proficiency,”** **“Proficient,”** and **“Advanced.”** Each level, beginning with Step 1, identifies a progression of students' skills, knowledge, and abilities; that is, each level is inclusive of the skills identified in the preceding level(s). Associated with each level is a specific range of numerical scores that determines students' rankings. These five levels have been approved by the State Board of Education.

The Missouri Assessment Program (MAP) was designed to measure students' progress in meeting the Show-Me Standards, a set of academic goals adopted by the State Board of Education in January 1996, as part of the board's goal to raise the bar for academic achievement and student performance in Missouri's public schools. Throughout the process of developing the Show-Me Standards and the MAP, teachers, business leaders, and parents have strongly supported the need for high academic standards and for assessments in which students are able to apply their knowledge and skills.

Teachers, parents, legislators, and business leaders across the state met to determine what students should be expected to know and be able to do, at grade levels 4, 8, and 10, in order to be considered “proficient” in Mathematics. The “proficient” category, which is the cornerstone of the Mathematics achievement levels, reflects this emphasis. Although rigorous levels were established, educators and citizens believe proficiency can be achieved through hard work by teachers, students, and parents.

The achievement levels represent what teachers, parents, and employers should expect students to know and be able to do at each grade level. Perhaps most importantly, the levels represent what Missouri teachers and citizens think should be demanded from students today. Missouri teachers, parents, legislators, and business leaders carefully drafted descriptors for the Mathematics achievement levels to help educators understand what each level represents and what additional skills are required by students to improve their levels of performance. The descriptors should be studied carefully because they illustrate the connection of the Missouri Show-Me Standards to the MAP by specifying the skills, knowledge, and abilities that students should have at each achievement level.

The following are descriptors for each of the Mathematics achievement levels at grades 4, 8, and 10.

## MAP MATHEMATICS ACHIEVEMENT LEVEL DESCRIPTORS

### GRADE 4

#### **Step 1:**

Students

- add and subtract one- or two-digit whole numbers without regrouping
- identify congruent shapes
- read simple tables and graphs to locate information
- identify and complete simple geometric, pictorial, and/or numeric patterns
- order positive integers in a specified order
- know and apply concepts of comparison (greater than, less than, shorter, and taller)

#### **Progressing:**

Students

- attempt an appropriate strategy for solving real-world problems
- identify fractions using physical models, both as parts of a whole and parts of a set
- identify coin values
- find a combination of coins that equals a given value
- add whole numbers with regrouping
- set up monetary problems related to real-life situations
- identify attributes of polygons up to six sides
- visually rotate geometric figures
- read Fahrenheit thermometers with various gradations
- use information from graphs to solve problems
- use the concept of frequency of an occurrence
- determine and apply the probability of a simple event
- identify and complete numeric patterns using a constant interval
- recognize evens, odds, ordinals, and multiples
- use given information to make logical decisions

#### **Nearing Proficiency:**

Students

- determine the appropriate process and identify missing information to solve a problem
- determine missing information needed to solve problems
- multiply with a one-digit multiplier
- find multiple combinations of coins for a given monetary value
- solve monetary problems based on real-life situations
- determine a number sentence for a given model
- use models to relate fractions to other equivalent fractions
- identify two- and three-dimensional figures and their attributes
- recognize geometric figures in various rotations

- read analog and digital displays of time
- recognize position in a coordinate system
- use terms relevant to predicate, interpret, and organize data
- compare information from graphs and tables
- make decisions based on equally likely events
- recognize and extend numerical, geometric, and pictorial patterns through several intervals
- write an expression or open sentence to describe a mathematical situation
- relate basic operations to one another
- read Venn diagrams and use deductive reasoning to come to a logical solution

### **Proficient:**

#### Students

- communicate mathematical processes
- determine the reasonableness of an answer
- apply problem-solving strategies to solve multi-step problems
- investigate relationships between fractions and decimals
- use basic operations to solve word problems
- create models to communicate addition, subtraction, and multiplication processes and the relationships between those processes
- recognize/compare attributes of two- and three-dimensional shapes (congruency, similarity, and symmetry)
- use standard and metric tools to accurately measure length (to the nearest centimeter or half-inch) and temperature
- develop spatial sense
- read, interpret, compare, and analyze data using graphs, tables, and charts to solve problems
- recognize, extend, and describe number, pictorial, and geometric patterns representing mathematical relationships
- extend pictorial patterns using multiple attributes
- understand and use number theory concepts (factors, multiples, odd/evens, and doubling)
- identify or develop algorithms
- use number operations and order relations for decimals and fractions with like denominators
- use strategies that include systematic listings, counting, and reasoning
- construct graphs, tree diagrams, and charts
- solve simple logic problems

### **Advanced:**

#### Students

- interpret and make inferences from visual models (maps, charts, tables, and graphs) used in representing real-life problems
- explore concepts of division
- demonstrate relationships between counting, grouping, and place value concepts

- use a variety of mental computation and estimation strategies to solve problems
- demonstrate a high degree of accuracy in the application of spatial relationships
- investigate and predict the outcome of combining, subdividing, and changing shapes
- apply concepts of similarity, congruency, and symmetry to two-dimensional figures
- demonstrate accuracy in construction and interpretation of display of data (graphs, tables, and charts)
- determine probability based on real-life situations
- create, complete, explain, and generalize geometric, pictorial, and numeric patterns
- develop strategies to represent and explain number theory relationships, such as multiples and factors
- solve problems using networks (paths) and Venn diagrams
- illustrate and/or explain comparison of subsets to each other and to the whole set
- explain the process used to solve simple logic problems

**MAP MATHEMATICS ACHIEVEMENT LEVEL DESCRIPTORS  
GRADE 8**

**Step 1:**

Students

- perform basic operations with whole numbers
- begin to solve simple word problems
- identify, describe, compare, and classify geometric figures
- use information from tables and graphs
- recognize and extend simple numeric patterns
- order integers
- continue a pattern using inductive reasoning

**Progressing:**

Students

- apply place value concepts
- solve simple word problems using whole numbers or numbers in decimal form
- accurately use appropriate geometric tools of measurement, such as a protractor or ruler
- identify lines of symmetry for geometric figures
- read and interpret tables, bar graphs, line graphs, and pictographs
- begin to find measures of central tendency (mean, median, and mode)
- extend patterns to a given term
- solve equations using a replacement set
- order rational numbers
- interpret simple Venn diagrams

**Nearing Proficiency:**

Students

- perform basic operations with various forms of fractions
- solve basic problems involving percent
- determine when pairs of figures are congruent or similar
- determine elapsed time in order to solve simple real-life problems
- utilize unit conversion within a measurement system
- use data from tables and graphs to make simple predictions and recommendations
- find simple probabilities
- choose an appropriate random sampling method
- accurately show the process of finding measures of central tendency
- identify and extend patterns using simple computations
- solve equations given a real-life situation
- apply order of operations

- find and order equivalent forms of fractions and decimals
- construct simple tree diagrams
- generalize a pattern using inductive reasoning
- determine solutions using logical reasoning

**Proficient:**

Students

- communicate math processes
- understand and apply ratios, proportions, and percents in a wide variety of situations
- apply relationships of congruent and similar figures
- demonstrate transformational concepts of geometric shapes through rotations, reflections, and translations
- compute and apply perimeter, area, and volume using the appropriate units
- investigate sample space to determine simple and conditional probabilities
- demonstrate the ability to interpret data from multiple representations, including graphs and tables
- use measures of central tendency to interpret mathematical real-life models
- use algebraic expressions to extend and describe patterns and relationships
- know and apply commutative, associative, distributive properties and properties of zero and one
- identify number theory concepts including primes, multiples, factors, and exponents
- use deductive and inductive reasoning to solve problems

**Advanced:**

Students

- recognize and justify reasonableness of a solution
- utilize and apply knowledge of geometric terms and concepts, such as area, perimeter, and scale drawings
- apply transformational concepts of geometric shapes in a coordinate setting
- compare and analyze experimental and theoretical probability
- make, read, and interpret multiple representations of data, including graphs and tables
- analyze information and defend predictions based on given data
- recognize relationships between dependent and independent variables
- extend and describe patterns and/or relationships using algebraic equations and inequalities
- develop or use diagrams, patterns, and functions to solve problems in real-life situations
- apply number theory concepts including primes, factors, multiples, and exponents to solve problems
- analyze problems and select and apply an appropriate method, model, or tool (including the counting principle, tree diagram, Venn diagrams, and student-developed diagrams) in solving problems



# MAP MATHEMATICS ACHIEVEMENT LEVEL DESCRIPTORS

## GRADE 10

### Step 1:

Students

- perform basic operations on whole numbers
- solve simple word problems using positive rational numbers
- identify, describe, and draw basic geometric figures
- use information from more than one table or graph to solve problems
- find measures of central tendency
- determine simple probability of given situations
- solve simple equations using a replacement set
- know and apply commutative, associative, distributive properties and properties of zero, one, and closure
- apply simple counting techniques

### Progressing:

Students

- express and apply numbers in various forms, including commonly used fractions ( $\frac{\_}{\_}$ ), percents, decimals, scientific notation, words, and standard form
- simplify exponential expressions involving whole numbers
- identify similarity and congruence in plane (two-dimensional) figures
- determine perimeter, area, volume, and angle measures in simple applications
- apply measures of central tendency
- apply simple probability to given situations
- organize and display data in graphical forms
- locate relevant data in a table or chart and identify trends in the data
- apply patterns and relationships in problem solving
- find factors or multiples of rational numbers
- demonstrate the concept of recursion
- perform basic operations with matrices

### Nearing Proficiency:

Students

- distinguish between significant and extraneous data
- identify and perform basic operations with integers
- translate word problems into single- or multi-step problems using basic arithmetic operations
- recognize correct transformations
- apply synthetic and coordinate geometric representations
- use and convert basic measurement units

- identify the effects of parameter changes on graphs
- determine the appropriate statistical measures for a given situation
- utilize the concept of random variable
- determine whether a graph correctly represents a given set of data
- identify an equation that describes given data
- determine, extend, and describe a pattern
- apply least common multiple and greatest common factor
- solve problems involving simple networking (paths)
- solve simple problems with combinations or permutations using lists of possibilities, tree diagrams, or the counting principle

### **Proficient:**

#### Students

- communicate mathematical processes
- use formulas to solve problems
- recognize reasonable answers in the context of the problem
- demonstrate use of approximations and estimations
- apply understanding of perimeter, area, volume, angle measure, capacity, weight, and mass
- from given assumptions, deduce properties of and relationships between figures
- solve real-life problems using scale drawings, similarity, congruence relationships, and transformations (reflections, translations, and rotation)
- interpret and summarize data from tables and graphs
- determine simple and conditional probabilities to make predictions
- apply appropriate statistical measures to make a decision in problem-solving situation
- represent and/or solve real-life problems using mathematical expressions, equations, or inequalities
- apply basic algebraic procedures to solve a system of equation
- extend understanding and apply appropriate properties of real numbers and number theory concepts to solve real-life problems
- apply recursion principle to solve application problems
- solve application problems using networks and counting techniques
- use tree and Venn diagrams to analyze and interpret data

### **Advanced:**

#### Students

- explain solutions in terms of language, diagrams, equations, and graphs
- comprehend and evaluate visual representations in order to correctly solve problems
- analyze complex problems that require the selection and use of appropriate geometric concepts
- use appropriate geometric concepts to analyze complex problem situations
- apply theoretical probability to real-world problems

- analyze data and make a hypothesis using various statistical processes
- interpret and analyze patterns and relationships represented in charts or tables
- compare and contrast the real numbers and its properties with its various subsystems
- form conclusions based on valid inductive and deductive reasoning
- use appropriate measures of comparisons to analyze and describe the effects of parameter changes