

# Mathematics Standards of Learning for Virginia Public Schools, 2009

## Goals

Students today require more rigorous mathematical knowledge and skills to pursue higher education, to compete in a technologically sophisticated work force, and to be informed citizens. Students must gain an understanding of fundamental ideas in arithmetic, measurement, geometry, probability, data analysis and statistics, and algebra and functions, and they must develop proficiency in mathematical skills. In addition, students must learn to use a variety of methods and tools to compute, including paper and pencil, mental arithmetic, estimation, and calculators. Graphing utilities, spreadsheets, calculators, computers, and other forms of electronic information technology are now standard tools for mathematical problem solving in science, engineering, business and industry, government, and practical affairs. Hence, the use of technology must be an integral part of teaching, learning, and assessment. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. The teaching of computer/technology skills should be the shared responsibility of teachers of all disciplines.

The content of the mathematics standards is intended to support the following five goals for students: becoming mathematical problem solvers, communicating mathematically, reasoning mathematically, making mathematical connections, and using mathematical representations to model and interpret practical situations.

## Mathematical Problem Solving

Students will apply mathematical concepts and skills and the relationships among them to solve problem situations of varying complexities. Students also will recognize and create problems from real-life data and situations within and outside mathematics and then apply appropriate strategies to find acceptable solutions. To accomplish this goal, students will need to develop a repertoire of skills and strategies for solving a variety of problem types. A major goal of the mathematics program is to help students become competent mathematical problem solvers.

## Mathematical Communication

Students will use the language of mathematics, including specialized vocabulary and symbols, to express mathematical ideas precisely. Representing, discussing, reading, writing, and listening to mathematics will help students to clarify their thinking and deepen their understanding of the mathematics being studied.

## Mathematical Reasoning

Students will recognize reasoning and proof as fundamental aspects of mathematics. Students will learn and apply inductive and deductive reasoning skills to make, test, and evaluate mathematical statements and to justify steps in mathematical procedures. Students will use logical reasoning to analyze an argument and to determine whether conclusions are valid. In addition, students will learn to apply proportional and spatial reasoning and to reason from a variety of representations such as graphs, tables, and charts.

## Mathematical Connections

Students will relate concepts and procedures from different topics in mathematics to one another and see mathematics as an integrated field of study. Through the application of content and process skills, students will make connections between different areas of mathematics and between mathematics and other disciplines, especially science. Science and mathematics teachers and curriculum writers are encouraged to develop mathematics and science curricula that reinforce each other.

## Mathematical Representations

Students will represent and describe mathematical ideas, generalizations, and relationships with a variety of methods. Students will understand that representations of mathematical ideas are an essential part of learning, doing, and communicating mathematics. Students should move easily among different representations—graphical, numerical, algebraic, verbal, and physical—and recognize that representation is both a process and a product.

## Mathematical Process Goals for Students

Process Goal	Notes
<p><b><u>Mathematical Problem Solving</u></b></p> <ul style="list-style-type: none"> <li>• Build new mathematical knowledge through problem solving.</li> <li>• Solve problems that arise in mathematics and in other contexts.</li> <li>• Apply and adapt a variety of appropriate strategies to solve problems.</li> <li>• Monitor and reflect on the process of mathematical problem solving.</li> </ul>	
<p><b><u>Mathematical Communication</u></b></p> <ul style="list-style-type: none"> <li>• Organize and consolidate their mathematical thinking through communication.</li> <li>• Communicate their mathematical thinking coherently and clearly to peers, teachers and others.</li> <li>• Analyze and evaluate the mathematical thinking and strategies of others.</li> <li>• Use the language of mathematics to express mathematical ideas precisely.</li> </ul>	
<p><b><u>Mathematical Reasoning</u></b></p> <ul style="list-style-type: none"> <li>• Recognize reasoning and proof as fundamental aspects of mathematics.</li> <li>• Make and investigate mathematical conjectures.</li> <li>• Develop and evaluate mathematical arguments and proofs.</li> <li>• Select and use various types of reasoning and methods of proof.</li> </ul>	
<p><b><u>Mathematical Connections</u></b></p> <ul style="list-style-type: none"> <li>• Recognize and use connections among mathematical ideas.</li> <li>• Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.</li> <li>• Recognize and apply mathematics in contexts outside of mathematics.</li> </ul>	
<p><b><u>Mathematical Representations</u></b></p> <ul style="list-style-type: none"> <li>• Create and use representations to organize, record, and communicate mathematical ideas.</li> <li>• Select, apply and translate among mathematical representations to solve problems.</li> <li>• Use representations to model and interpret physical, social and mathematical phenomena.</li> </ul>	