

Coordinating the **mathematical topics** in **JavaMathBits** with **General Mathematics Standards**.

As a mathematics teacher teaching Computer Programming, you quickly see the connection between the skills needed to organize and create computer code and the skills needed for analyzing and solving mathematical problems. In addition, there is a profound correlation between developing computer code and preparing a high school geometrical proof. Students that are good at geometrical proofs are also good at coding. If your computer science students have not yet encountered geometrical proofs, the experiences gained from coding will enhance their abilities to reason through proofs.

Standards for Mathematical Practice:

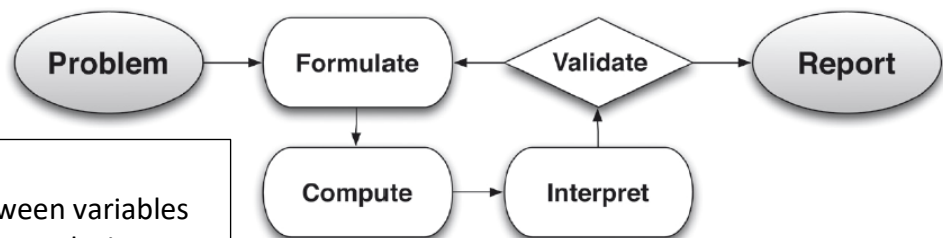
The National Council of Teachers of Mathematics (NCTM) list “mathematical process standards” as being **problem solving, reasoning and proof, communication, representation, and connections**. Below are eight varieties of expertise that mathematics educators seek to develop in their students.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

All of these skills are also needed to analyze, construct, and deliver a workable computer program.

Modeling:

Mathematicians and computer programmers share a “basic modeling process” for problem solving. The “flowchart” below has been used to illustrate a basic mathematics modeling cycle for mathematics, and can also be applied when developing a computer program.



1. identify and select variables
2. formulate relationships between variables
3. perform operations to draw conclusions
4. interpret results of the situation
5. determine if the results are valid
6. report the conclusions

If you are familiar with computer coding (in any coding language), you know that these six specifications are also descriptive of the programming process.

The following section will show which mathematical concepts and/or topics are included in the Units of **JavaMathBits** (*Grade levels of mathematical skills range from Grade 7 to Grade 12+)

Unit 1 – Introduction

- Number base conversions - Bases 10, 2, 8, 16
→ working w/ integer exponents
- Writing Explicit Directions.
- Interpreting Descriptions and Directions
- Problem Solving ...

Unit 2 – Data Basics

- Integers and Rational Numbers
- Scientific Notation
- Number Properties
- Order of Operations
- Modulus (Remainder)
- Equations Computer vs Math
- Use of Variables
- Number Digits
- Circles Area Circumference
- Triangle Area
- Money & Coins
- Volume
- Pythagorean Triples
- Measurement Conversions
- Rounding
- Division by Zero
- Organization (Pseudocode)
- Problem Solving ...

Unit 3 – Conditionals

- Trichotomy ($a=b$, $a<b$, $a>b$)
- And/Or/Not Logic
- Truth Tables
- DeMorgan's Laws
- Operator Precedence
- Logical comparison to graphing calculators
- Determining Costs
- Determine odd/even
- Types of Triangles
- Sides of Triangles
- Measurement Conversions
- Sudoku reasoning
- Problem Solving ...

Unit 4 – Looping

- Representing odd/even
- Factorial
- Prime numbers
- Quadratic Formula
- Fibonacci Sequence
- Code Binary to Decimal
- Powers of 2
- Sum of Digits
- Division by Zero
- Modulus Operator
- Averaging
- Repetitive Process
- Incremental Counting
- Nesting Process
- Problem Solving ...

Unit 5 – Methods

- Square Feet
- Triangular Numbers
- Harmonic Means
- Squares, Cubes
- Determining Cost & Tax
- Circle Area
- Function Input/Output
- Linear Regression
- Discriminant
- Logical Operators
- Determining Minimum Value
- Geometric Designs
- Right Triangles, Isosceles Triangles, Rectangles
- Problem Solving ...

Unit 6 – Library Methods

- Rounding Techniques
- Absolute Value
- Square Roots
- Exponents
- Maximum/Minimum Values
- Circle Area & Circumference
- Exponential Growth
- Rolling Dice
- Experimental Probability
- Dealing with Percentages
- Right Triangles
- Pythagorean Theorem
- Trigonometry
- Find angle in right triangle
- Convert Radians to degrees
- Random Generation Formulas
- Problem Solving ...

Unit 7 – Files

- Random number formulas
- Average
- Gross Pay
- Determining Odd/Even
- Division by Zero
- Statistical Analysis
- Mean
- Sum of Differences Squared
- Variance
- Standard Deviation
- Problem Solving ...

Unit 9 – Graphics Drawing

- Algebraic Expressions
- Properties of Geometric Figures
- Working on Coordinate Axes
- Mathematics of Color
- Similar Figures
- Central angles and Arcs
- Unit Circle
- Random Number Generation
- Formula Development in Animation
- Recursive Reasoning
- Problem Solving ...

Unit 8 – Arrays

- Designation of zero as odd/even/neither/positive/negative
- Proper Subscripting
- Showing odd/even
- Average
- Cost
- Rounding
- Reverse thinking
- Number comparisons
- Percentage
- Sequential searching
- Binary searching
- Matrices
- Magic squares
- Random numbers
- Numerical analysis
- Maximum/minimum
- Range
- Median
- Variance
- Standard deviation
- Data manipulation
- Histograms
- GPAs
- Processing Fees
- Palindromes
- Problem Solving ...

Unit 10 – Graphical User Interface

- Perfect Squares
- Prime Numbers
- Working with GPA
- Determining Sides of Triangle
- Pythagorean Th^m to test Rt. Triangle
- Determining BMI
- Random Number Generation
- Probability Die
- Divisibility by 3
- Unit Conversions
- Sigma Notation for Series
- Types of Triangles
- Problem Solving ...