

Using Mathematics and Computational Thinking - Learning Progressions

Grades K-2	Grades 3-5	Grades 6-8	Grades 9-12
Mathematical and computational thinking in K-2 builds on prior experiences and progresses to recognizing that mathematics can be used to describe the natural and designed world(s).	Mathematical and computational thinking in 3-5 builds on K-2 experiences and progresses to extending quantitative measurements to a variety of physical properties and using computation and mathematics to analyze data and compare alternative design solutions.	Mathematical and computational thinking in 6-8 builds on K-5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.	Mathematical and computational thinking in 9-12 builds on K-5 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions, including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and use based on mathematical models of basic assumptions.
Decide when to use qualitative vs. quantitative data.	Describe if qualitative or quantitative data are best to determine whether a proposed object or tool meets criteria for success.		
Use counting and numbers to identify and describe patterns in the natural and designed world(s).	Organize simple data sets to reveal patterns that suggest relationships. (5.PS1.2)	Use digital tools (e.g., computers) to analyze very large data sets for patterns and trends.	Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. (PS.PS3.1 , PH.PS3.1 , EN.ESS3.3)
Describe measure, and/or compare quantitative attributes of different objects and display	Describe, measure, estimate, and/or graph quantities (e.g., area, volume, weight, time) to address scientific and	Use mathematical representations to describe and/or support scientific conclusions and design	Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions

the data using simple graphs.	engineering questions and problems. (5.ESS2.2)	solutions. (8.PS4.1 , 8.LS4.6 , B.LS2.2 , B.LS2.4 , EN.LS2.2 , EN.LS2.4)	to describe and/or support claims and/or explanations. (PS.PS1.7 , PS.PS2.2 , PS.PS4.1 , CH.PS1.7 , CH.PS4.1 , PH.PS2.2 , PH.PS2.4 , PH.PS4.1 , B.LS2.1 , EN.LS2.1 , ES.ESS1.4)
Use quantitative data to compare two alternative solutions to a problem.	Create and/or use graphs and/or charts generated from simple algorithms to compare alternative solutions to an engineering problem.	<p>Create algorithms (a series of ordered steps) to solve a problem.</p> <p>Apply mathematical concepts and/or processes (e.g., ratio, rate, percent, basic operations, simple algebra) to scientific and engineering questions and problems.</p> <p>Use digital tools and/or mathematical concepts and arguments to test and compare proposed solutions to an engineering design problem.</p>	<p>Apply techniques of algebra and functions to represent and solve scientific and engineering problems.</p> <p>Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world.</p> <p>Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived and compound units (e.g., mg/mL, kg/m³, acre-feet).</p>