



Look-Fors in Mathematics

(Adapted from the National Council for Teachers of Mathematics (NCTM) document and NCTM Principles to Action resource book)

Students and teachers should demonstrate a variety of these look-fors, not necessarily all of the descriptions that are listed.

When appropriate, connections to the mathematical practices (MP#) and #CUTOUT4CS lessons (L1-5) has been indicated.

	Mathematical Practices	Students	Teachers
Habits of mind of a computational thinker (math thinker)	Persevere in solving problems (MP1)	<ul style="list-style-type: none"> <input type="checkbox"/> Understand meaning of problem and look for entry points to solutions (L2, 3, 5) <input type="checkbox"/> Analyze information (givens, constraints, relationships, goals) (L1, L2, L4, L6) <input type="checkbox"/> Make conjectures and plan solution pathways (L4, L4) 	<ul style="list-style-type: none"> <input type="checkbox"/> Involve students in rich problem-based tasks that encourage them to persevere in order to reach solutions (L1-L5) <input type="checkbox"/> Provide opportunities for students to solve problems that have multiple solutions (L1, L2, L3, L5) <input type="checkbox"/> Encourage students to represent their thinking while problem solving (L3, L5)
	Attend to precision (MP6)	<ul style="list-style-type: none"> <input type="checkbox"/> Calculate accurately and efficiently, expressing numerical answers with a degree of precision (L3, L5) <input type="checkbox"/> Provide carefully formulated explanations (L3, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Encourage accuracy and efficiency in computation and problem-based solutions, expressing numerical answers, data, and/or measurements with a degree of precision appropriate for the context of the problem (L3, L5)
Reasoning & Explaining	Reason abstractly and quantitatively (MP2)	<ul style="list-style-type: none"> <input type="checkbox"/> Represent abstract situations symbolically and understand the meaning of quantities (L3, L5) <input type="checkbox"/> Create a coherent representation of the problem at hand (L3, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Facilitate opportunities for students to discuss or use representations to make sense of quantities and their relationships (L3, L5)
	Construct viable arguments and critique the reasoning of others (MP3)	<ul style="list-style-type: none"> <input type="checkbox"/> Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions (L2, L3, L4, L5) <input type="checkbox"/> Listen or read the arguments of others (L4 launch) <input type="checkbox"/> Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments (L3, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Provide and orchestrate opportunities for students to listen to the solution strategies of others, discuss alternative solutions, and defend their ideas (L2, L3, L4, L5)
Modeling & Using Tools	Model with Mathematics (MP4)	<ul style="list-style-type: none"> <input type="checkbox"/> Identify important quantities and map their relationship using tools as diagrams, two-way tables, graphs, flowcharts and/or formulas (L2, L3, L5) <input type="checkbox"/> Check to see if an answer makes sense within the context of a situation and change a model when necessary (L1, L3, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Remind students that a mathematical model used to represent a problem's solution is a "work in progress" and may be revised as needed (L3, L5)

	Use appropriate tools strategically (MP5)	<ul style="list-style-type: none"> <input type="checkbox"/> Make decisions about the use of specific tools (calculator, concrete model, digital technologies) (L2, L3, L5) <input type="checkbox"/> Use technological tools to visualize the results of assumptions, explore consequences, and compare predictions with data (L2, L4) 	<ul style="list-style-type: none"> <input type="checkbox"/> Provide access to materials, models, tools and/or technology-based materials that assist students in making conjectures (L1, L5)
Seeing structure and generalizing	Look for and make use of structure (MP7)	<ul style="list-style-type: none"> <input type="checkbox"/> Look for patterns or structure, recognizing that quantities can be represented in different ways (L1, L2, L3, L5) <input type="checkbox"/> Recognize the significance in concepts and models and use the patterns or structure for solving related problems (L3, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Engage students in discussions emphasizing relationships between particular topics within a content domain or across content domains (L1, L3, L4, L5)
	Look for and express regularity in repeated reasoning (MP8)	<ul style="list-style-type: none"> <input type="checkbox"/> Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings 	<ul style="list-style-type: none"> <input type="checkbox"/> Engage students in discussion related to repeated reasoning that may occur in a problem's solution (L1-5) <input type="checkbox"/> Urge students to continually evaluate the reasonableness of their results (L3, L5)



Look-Fors in Computer Science

(Adapted from the K-12 Computer Science Framework)

Students and teachers should demonstrate a variety of these look-fors, not necessarily all of the descriptions that are listed.

When appropriate, connections to the Practices Including Computational Thinking and #CUTOUT4CS lessons (L1-5) has been indicated.

	Practices including Computational Thinking	Students	Teachers
	<p>Recognizing and Defining Computational Problems (P3)</p> <p><i>Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to determine whether a computational solution is appropriate.</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Ask clarifying questions to understand whether a problem or part of a problem can be solved using a computational approach. (L2, L4, L5) <input type="checkbox"/> Identify and solve problems that involve multiple criteria and constraints. (L2, L4, L5) <input type="checkbox"/> Evaluate whether a computational solution is the most appropriate solution for a particular problem. 	<ul style="list-style-type: none"> <input type="checkbox"/> Provide opportunities for students to break complex problems into smaller parts. <input type="checkbox"/> Support students in evaluation parts to determine whether a computational solution is appropriate.
	<p>Developing and Using Abstractions (P4)</p> <p><i>Identifying patterns and extracting common features to create generalizations</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Recognize patterns within tasks and identify and describe related sequences in data or code (L1, L2, L4) <input type="checkbox"/> Identify common features in segments of code and substitute a single segment that uses variables to account for differences (L4) <input type="checkbox"/> Draw pictures to describe a simple patterns and/or represent patterns, processes, or phenomena. (L3, L4, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Involve students with opportunities to critically think about and explain segments of their code
	<p>Creating Computational Artifacts (P5)</p> <p><i>Examples of computational artifacts include programs, simulations, visualizations, digital amintaions, robotic systems, and apps.</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Participate in project planning and creation of brainstorming documents (L4) <input type="checkbox"/> Develop artifacts in response to a task or computational problem. (L4) <input type="checkbox"/> Attempt to use existing solutions to accomplish a desired goal (remix to develop something new). (L3, L5) 	<ul style="list-style-type: none"> <input type="checkbox"/> Facilitate computational tasks/problems with multiple solution pathways <input type="checkbox"/> Provide opportunitis for students to explore existing artifacts

	<p>Testing and Refining Computational Artifacts (P6)</p> <p><i>Testing and refinement is the deliberate and iterative process of improving a computational artifact.</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Compare results to intended outcomes and verify whether given criteria has been met (L3, L5) <input type="checkbox"/> Identify and fix errors in programs (debugging) and use strategies to solve problems with computing systems (troubleshooting) 	<ul style="list-style-type: none"> <input type="checkbox"/> Faciliate conversations and sharing opportunities related to meeting criteria <input type="checkbox"/> Engage in discussions related to sharing strategies for fixing errors in code
	<p>Communicating about Computing (P7)</p> <p><i>Communication invloces personal expression and exchanging ideas with others.</i></p>	<ul style="list-style-type: none"> <input type="checkbox"/> Present basic data through the use of visual representations (storyboards, flowcharts, graphs. (L2, L3, L5) <input type="checkbox"/> Use precise language that articluates what they are doing <input type="checkbox"/> Give and receive feedback about artifacts. 	<ul style="list-style-type: none"> <input type="checkbox"/> Provide opportunities for students to write clear comments, document work, and communicate ideas.