

Engaging in the Mathematical Practices (Look-fors)

Mathematics Practices		Students:	Teachers:
Overarching habits of mind of a productive math thinker	1. Make sense of problems and persevere in solving them	<input type="checkbox"/> Understand the meaning of the problem and look for entry points to its solution <input type="checkbox"/> Analyze information (givens, constraints, relationships, goals) <input type="checkbox"/> Make conjectures and plan a solution pathway <input type="checkbox"/> Monitor and evaluate the progress and change course as necessary <input type="checkbox"/> Check answers to problems and ask, "Does this make sense?" Comments:	<input type="checkbox"/> Involve students in rich problem-based tasks that encourage them to persevere in order to reach a solution <input type="checkbox"/> Provide opportunities for students to solve problems that have multiple solutions <input type="checkbox"/> Encourage students to represent their thinking while problem solving Comments:
	6. Attend to precision	<input type="checkbox"/> Communicate precisely using clear definitions <input type="checkbox"/> State the meaning of symbols, carefully specifying units of measure, and providing accurate labels <input type="checkbox"/> Calculate accurately and efficiently, expressing numerical answers with a degree of precision <input type="checkbox"/> Provide carefully formulated explanations <input type="checkbox"/> Label accurately when measuring and graphing Comments:	<input type="checkbox"/> Emphasize the importance of precise communication by encouraging students to focus on clarity of the definitions, notation, and vocabulary used to convey their reasoning <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 Comments:
Reasoning and Explaining	2. Reason abstractly and quantitatively	<input type="checkbox"/> Make sense of quantities and relationships in problem situations <input type="checkbox"/> Represent abstract situations symbolically and understand the meaning of quantities <input type="checkbox"/> Create a coherent representation of the problem at hand <input type="checkbox"/> Consider the units involved <input type="checkbox"/> Flexibly use properties of operations Comments:	<input type="checkbox"/> Facilitate opportunities for students to discuss or use representations to make sense of quantities and their relationships <input type="checkbox"/> Encourage the flexible use of properties of operations, objects, and solution strategies when solving problems <input type="checkbox"/> Provide opportunities for students to decontextualize (abstract a situation) and/or contextualize (identify referents for symbols involved) the mathematics they are learning Comments:
	3. Construct viable arguments and critique the reasoning of others	<input type="checkbox"/> Use definitions and previously established causes/effects (results) in constructing arguments <input type="checkbox"/> Make conjectures and use counterexamples to build a logical progression of statements to explore and support ideas <input type="checkbox"/> Communicate and defend mathematical reasoning using objects, drawings, diagrams, and/or actions <input type="checkbox"/> Listen to or read the arguments of others <input type="checkbox"/> Decide if the arguments of others make sense and ask probing questions to clarify or improve the arguments Comments:	<input type="checkbox"/> Provide and orchestrate opportunities for students to listen to the solution strategies of others, discuss alternative solutions, and defend their ideas <input type="checkbox"/> Ask higher-order questions which encourage students to defend their ideas <input type="checkbox"/> Provide prompts that encourage students to think critically about the mathematics they are learning Comments:

ems&tl Project, 2012 * All indicators are not necessary for providing full evidence of practice(s). Each practice may not be evident during every lesson.

Fennell, Francis (Skip) Beth Kobett, & Jon Wray Elementary Mathematics Specialists and Teacher Leaders Project (ems&tl) <http://www.mathspecialists.org>, Used with permission.

Mathematics Practices		Students:	Teacher(s):
Modeling and Using Tools	4. Model with mathematics	<input type="checkbox"/> Apply prior knowledge to solve real world problems <input type="checkbox"/> Identify important quantities and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts, and/or formulas <input type="checkbox"/> Use assumptions and approximations to make a problem simpler <input type="checkbox"/> Check to see if an answer makes sense within the context of a situation and change a model when necessary Comments:	<input type="checkbox"/> Use mathematical models appropriate for the focus of the lesson <input type="checkbox"/> Encourage student use of developmentally and content-appropriate mathematical models (e.g., variables, equations, coordinate grids) <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 Comments:
	5. Use appropriate tools strategically	<input type="checkbox"/> Make sound decisions about the use of specific tools (Examples might include: calculator, concrete models, digital technologies, pencil/paper, ruler, compass, protractor) <input type="checkbox"/> Use technological tools to visualize the results of assumptions, explore consequences, and compare predications with data <input type="checkbox"/> Identify relevant external math resources (digital content on a website) and use them to pose or solve problems <input type="checkbox"/> Use technological tools to explore and deepen understanding of concepts Comments:	<input type="checkbox"/> Use appropriate physical and/or digital tools to represent, explore and deepen student understanding <input type="checkbox"/> Help students make sound decisions concerning the use of specific tools appropriate for the grade level and content focus of the lesson <input type="checkbox"/> Provide access to materials, models, tools and/or technology-based resources that assist students in making conjectures necessary for solving problems Comments:
Seeing structure and generalizing	7. Look for and make use of structure	<input type="checkbox"/> Look for patterns or structure, recognizing that quantities can be represented in different ways <input type="checkbox"/> Recognize the significance in concepts and models and use the patterns or structure for solving related problems <input type="checkbox"/> View complicated quantities both as single objects or compositions of several objects and use operations to make sense of problems Comments:	<input type="checkbox"/> Engage students in discussions emphasizing relationships between particular topics within a content domain or across content domains <input type="checkbox"/> Recognize that quantitative relationships modeled by operations and their properties remain important regardless of the operational focus of a lesson <input type="checkbox"/> Provide activities in which students demonstrate their flexibility in representing mathematics in a number of ways e.g., $76 = (7 \times 10) + 6$; discussing types of quadrilaterals, etc. Comments:
	8. Look for and express regularity in repeated reasoning	<input type="checkbox"/> Notice repeated calculations and look for general methods and shortcuts <input type="checkbox"/> Continually evaluate the reasonableness of intermediate results (comparing estimates), while attending to details, and make generalizations based on findings Comments:	<input type="checkbox"/> Engage students in discussion related to repeated reasoning that may occur in a problem's solution <input type="checkbox"/> Draw attention to the prerequisite steps necessary to consider when solving a problem <input type="checkbox"/> Urge students to continually evaluate the reasonableness of their results Comments: