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| Why are Mathematics Tasks worth looking at?  “There is no other decision that teachers make that has a greater impact on students’ *opportunity to learn* and on their *perceptions* about what mathematics is than the selection or creation of tasks with which the teacher engages the students in studying mathematics.” (Lappan & Briars, 1995, p. 138)  “One of the purposes of using a variety of task types is to offer students a *breadth* of perspectives on mathematics and numeracy and a *variety of ways to learn*.” (Sullivan et al., 2013, p. 8)  When mathematics teaching attends to all four components of the pedagogical system (see Anthony and Walshaw citation below), then students develop the following mathematical proficiencies :   1. Conceptual understanding – comprehension of mathematical concepts, operations and relations 2. Mathematical fluency – skill in carrying out procedures flexibly, accurately, efficiently, and appropriately, and in addition to these procedures, factual knowledge and concepts that come to mind readily 3. Strategic competence – ability to formulate, represent and solve mathematical problems 4. Adaptive reasoning – capacity for logical thought, reflection, explanation and justification 5. Productive disposition – habitual inclination to see mathematics as sensible, useful and worthwhile, coupled with a belief in diligence and one’s own efficacy (growth mindset)   Sullivan et al. (2013), argued that a balance of various types of mathematical tasks, along with the components of effective mathematics pedagogy, are needed:   * [ 1 ] Purposeful representative tasks (i.e. chocolate bar task) * [3, 4] Tasks arising from contexts (i.e. signpost task) * [3, 4] Content specific tasks (i.e. if the perimeter of a rectangle is 32 m, what is the area?) * [2 ] Practice and consolidation tasks (i.e. find the value of ½ + ¾)   Any analysis of a *collection* of tasks, in addition to examining the attributes of a particular task, should consider the **balance** of task types. Often, a task develops more than one proficiency; however, some types (see above) are more closely aligned with specific mathematical proficiencies. See the [numbers] above; i.e. purposeful representative aligns with conceptual understanding. |  | **Conversation Tool for Reflection on Mathematical Tasks**  “On its own, a rich task is not rich – it is only what is made of it that allows it to fulfil its potential. In essence, rich tasks encourage children to think creatively, work logically, communicate ideas, synthesize their results, analyse different viewpoints, look for commonalities and evaluate findings.” (Jennifer Piggott, Retrieved from <http://nrich.maths.org/5662>)  **What is it?** This is an emerging tool for understanding and reflecting on the potential of a mathematical learning task. It identifies some of the important features and attributes of a task. It can be used for planning, developing, selecting, analyzing and refining a student learning task.  ***C:\Users\BlackKi\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\86SA396D\MC900441428[1].png*** The **intention** is that school and system leaders could use this tool to:   * C:\Users\BlackKi\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\U1KQHMUE\MC900437079[1].pngIncrease their understanding of the features and attributes of mathematical tasks * Analyze the potential impact of various tasks, in particular how they might enable the development of students’ mathematical proficiencies * Inform professional learning to deepen understanding of the features and types of mathematical tasks * Co-learn and co-reflect for the purposes of developing and/or improving a mathematical task * Monitor school and system improvement efforts through the analysis of mathematical tasks as one source of information   **Additional considerations in the use of this tool:**   * C:\Users\BlackKi\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\86SA396D\MC900442002[1].pngThis conversation tool is not meant to be an evaluation checklist but rather a springboard for conversation and reflection * It is crucial to consider the context and purpose of all classroom tasks, which are dependent on multiple factors * A surface analysis of any task will not yield a definitive answer regarding how well it meets students’ learning needs |

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| *“Effective mathematical pedagogy is a coherent system rather than a set of discrete, interchangeable strategies. This pedagogical system encompasses a non-threatening classroom environment, instructional tasks, tools and representations, and classroom discourse. These four aspects of effective pedagogy constitute a system, for example, the way instructional tasks are realized in the classroom and experienced by students depends on the classroom atmosphere, the tools and representations available for them to use and the nature and focus of classroom discourse.”* – Anthony and Walshaw, 2007, page x | | | | |
| **Task Features** | **Attributes** *Note: As tasks vary according to purpose and type, tasks will vary in attributes. The goal*  **The task…** *is to have a balance of tasks that as a collection develop all the mathematical proficiencies.* | **Leadership Implications** |
| **Mathematical Focus**  *What is the mathematical learning that students will achieve with this task?* | * has a clear connection to the curriculum – for both content and processes * enables students to develop a deeper understanding of mathematical concepts, skills and processes * broadens students’ skills and mathematical proficiencies |  |
| **Connection to Prior Knowledge**  *How does the task build on students’ prior knowledge and experience?* | * is developmentally connected to earlier mathematical concepts * addresses a clear student learning need within the zone of proximal development * may connect to known contexts or life experiences of the students * if contextual, the context is not overly complicated or distracting from the mathematics |  |
| **Problem Solving**  *Is the task problematic for students?*  *(i.e. something they need to think about, not simply a disguised way of practising already demonstrated algorithms)* | * necessitates the use of a range of higher-level thinking skills in mathematical processes * allows students to develop, select and apply problem solving strategies * requires explanation, justification or proof, and thinking time * allows for developing and applying reasoning, hypothesis making and the testing of various strategies * provides students opportunities to reflect on and demonstrate that they are monitoring their thinking to help clarify their understanding |  |
| **High Cognitive Demand and Understanding**  *Does the task provide opportunities to “press for understanding”?* | * requires students to explore and understand the nature of mathematical concepts, processes, or relationships * has the potential to develop students’ mathematical processes (see below) and/or their proficiencies (see overleaf) * provides appropriate level of challenge for every student, encouraging students to address their misconceptions * has an element of complexity and academic press, encouraging students to see mathematics as sense making * is visually structured so as not to obscure the inherent mathematical thinking and reasoning required |  |
| **Tools and Representations**  *Does the task allow for the use of multiple tools and representations?* | * allows students to select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems * promotes the creation of a variety of representations of mathematical ideas * encourages the communication of thinking either orally, visually, or in writing |  |
| **Entry Points**  *Does the task allow for multiple entry points for students?* | * is open, encouraging multiple approaches to its solution * has a low floor for entry and a high ceiling for exit; thus is accessible to a wide range of learners * provides opportunity for “mathematical play”, i.e. involves investigation, conjecturing and problem extensions |  |
| **Intellectual and Social Engagement**  *Does the task have the potential to engage students in mathematical thinking?* | * has the potential to spark students’ curiosity (there is an element of perplexity) * considers the use of concise questions, visuals, video and other approaches that appeal to the intended audience * allows for student choice and voice; students must make decisions about what to do and how to do it * can be solved in a reasonable amount of time * provides opportunities for students to have their thinking valued, share their thinking, inquire, build on the ideas of others and reconstruct or confirm their thinking |  |
| **Additional Input**  *What other features could be considered?* |  |  |
| **Task Type**  *Which type of task is this?* | Tasks can be classified as one of four types: purposeful representative, contextual, content specific, or practice/consolidation. How does this task contribute to a balance of mathematical tasks and thus one or more of the mathematical proficiencies? |  |

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| The **mathematical process expectations** in the Ontario Curriculum are embedded within the attributes above | | | | | | |
| Problem Solving | Reasoning and Proving | Reflecting | Selecting Tools and Computational Strategies | Connecting | Representing | Communicating |