NTN Knowledge and Thinking Rubric for Math Problem Solving, Grade 12

The ability to reason, problem-solve, develop sound arguments or decisions, and create new ideas by using appropriate sources and applying the knowledge and skills of a discipline.

	EMERGING	E/D	DEVELOPING	D/P	PROFICIENT College Ready	P/A	ADVANCED College Level
PROBLEM SOLVING *What is the evidence that the student understands the problem and the mathematical strategies that can be used to arrive at a solution?*	• Does not provide a model • Ignores given constraints • Uses few, if any, problem solving strategies		• Creates a limited model to simplify a complicated situation • Attends to some of the given constraints • Uses inappropriate or inefficient problem solving strategies		• Creates a model to simplify a complicated situation • Analyzes all given constraints, goals and definitions • Uses appropriate problem solving strategies		• Creates a model to simplify a complicated situation and identifies limitations of model • Analyzes all given constraints, goals and definitions and implied assumptions • Uses novel problem solving strategies and/or strategic use of tools
REASONING AND PROOF *What is the evidence that the student can apply mathematical reasoning/procedures in an accurate and complete manner?*	• Provides incorrect solutions without justifications • No evidence of monitoring for reasonableness • Results are not interpreted in terms of context		• Provides partially correct solutions or correct solution without logic or justification • Monitors for reasonableness in final answer • Results are interpreted partially or incorrectly in terms of context		• Constructs logical, correct, complete solution • Monitors for reasonableness in final answer and adapts appropriately • Results are interpreted correctly in terms of context		• Constructs logical, correct, complete solution with justifications • Monitors for reasonableness, identifies sources of error, and adapts appropriately • Interprets results correctly in terms of context, indicating the domain to which a solution applies
CONNECTIONS *What is the evidence that the student understands the relationships between the concepts, procedures, and/or real-world applications inherent in the problem?*	• Does not identify the underlying mathematical structures of the given problem • Little or no evidence of applying previous math knowledge to given problem		• Identifies the underlying mathematical structures of the given problem • Applies previous math knowledge to given problem but may include reasoning or procedural errors		• Identifies the underlying mathematical structures and makes connections to similar problems set in different contexts • Applies and extends math previous knowledge correctly to given problem		• Identifies and generalizes the underlying mathematical structures of the given problem to other seemingly unrelated problems or applications • Applies and extends previous knowledge correctly to given problem; makes appropriate use of derived results
COMMUNICATION AND REPRESENTATION *What is the evidence that the student can communicate mathematical ideas to others?*	• Uses representations (diagrams, tables, graphs, formulas) in ways that confuse the audience • Uses incorrect definitions or inaccurate representations		• Uses representations (diagrams, tables, graphs, formulas), though correct, do not help the audience follow the chain of reasoning; extraneous representations may be included • Uses imprecise definitions or incomplete representations with missing units of measure or labeled axes		• Uses multiple representations (diagrams, tables, graphs, formulas) to help the audience follow the chain of reasoning • With few exceptions, uses precise definitions and accurate representations including units of measure and labeled axes		• Uses multiple representations (diagrams, tables, graphs, formula) and key explanations to enhance the audience's understanding of the solution; only relevant representations are included • Uses precise definitions and accurate representations including units of measure and labeled axes; uses formal notation

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