

Mathematical Problem Solving: A Three-Trait Model, Adult Version (Grades 3–12)

Mathematical Concepts and Procedures

5 A strong performance occurs when the student demonstrates extensive understanding of the mathematical concepts and related procedures and uses them correctly. The student:

- Understands mathematical concepts and related procedures.
- Uses all necessary information from the problem.
- Performs computation(s) accurately or with only minor errors.

3 A developing performance occurs when the student demonstrates general understanding of the mathematical concepts and related procedures, but there may be some gaps or misapplication. The student:

- Partially understands mathematical concepts and related procedures.
- Uses some necessary information from the problem.
- May make some computational errors.

1 A weak performance occurs when the student demonstrates little or no understanding of mathematical concepts and related procedures. Application, if attempted, is incorrect. The student:

- Does not appear to understand mathematical concepts and related procedures.
- Does not use information from the problem or uses irrelevant information.
- Does no computation; or does computation that is unrelated to the problem.

Problem Solving

5 A strong performance occurs when the student selects or devises and uses an efficient, elegant, or sophisticated strategy to solve the problem.

- The student translates the problem into a useful mathematical form.
- The student applies the selected plan(s) or strategy(ies) through to completion; no pieces are missing.
- The plan or strategy may incorporate multiple approaches.
- Pictures, models, diagrams, and symbols, if used, enhance the strategy.
- The solution is reasonable and consistent with the context of the problem.

3 A developing performance occurs when the student selects or devises a plan or strategy, but it is partially unworkable.

- The student leaves gaps in framing or carrying out the strategy.
- The strategy may work in some parts of the problem, but not in others.
- The strategy is appropriate but incomplete in development or application.
- Results of computation, even if correct, may not fit the context of the problem.

1 A weak performance occurs when the student shows no evidence of a strategy or has attempted to use a completely inappropriate strategy.

- The student shows no attempt to frame the problem or translates the problem into an unrelated mathematical form.
- The strategy is inappropriate, misapplied, or disconnected.
- Pictures, models, diagrams, and symbols, if used, may bear some relationship to the problem.
- The solution is not reasonable and/or does not fit the context of the problem.

Mathematical Communication

5 A strong performance occurs when a student clearly explains in words, numbers, and/or diagrams the strategy used to solve the problem and the solution itself.

- The problem could be solved following the explanation. It is clearly explained and organized.
- The explanation is coherent and complete. There are no gaps in reasoning. Nothing is left out.
- The student presents logical arguments to justify strategy or solution.
- The explanations may include examples and/or counterexamples.
- Charts, pictures, symbols, and diagrams, when used, enhance the reader's understanding of what was done and why it was done.
- Few inferences are required to figure out what the student did and why.
- Correct mathematical language is used.

3 A developing performance occurs when the student's problem-solving process is partially explained, but requires some inferences in order to figure it out completely.

- The student attempts to use mathematical language, but may not have used all terms correctly.
- Some key elements are included in the explanation.
- The student explains the answer, but not the reasoning or explains the process, but not the solution.
- Charts, pictures, symbols, and diagrams, if used, provide some explanation of the major elements of the solution process.

1 A weak performance occurs when the student's explanation does not describe the process used or the solution to the problem.

- Charts, pictures, symbols, and diagrams, when used, interfere with the reader's understanding of what was done and why it was done.
- The explanation appears to be unrelated to the problem.
- The reader cannot follow the student's explanation.
- Little or no explanation of the thinking/reasoning is shown.
- The explanation only restates the problem.
- Many inferences are required to follow the student's work.
- Incorrect or misapplied mathematical language interferes with the reader's ability to understand the explanation.