

## **201 Math Problem Solving**

**Source:** Charles, Randall, Lester, Frank and O'Daffer, Phares. *How to Evaluate Progress in Problem Solving*. Reston, VA: National Council of Teachers of Mathematics, 1987. In Stenmark, Jean, *Mathematics Assessment: Myths, Models, Good Questions and Practical Suggestions*. Reston, VA: National Council of Teachers of Mathematics, 1991.

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<b>3</b>
<b>Grade(s)</b>	<i>Not specified</i>	<b>Scale length</b>	<b>3</b>

### **Scale I: Understanding the Problem**

- 2** Complete understanding of the problem
- 1** Part of the problem misunderstood or misinterpreted
- 0** Complete misunderstanding of the problem

### **Scale II: Planning a Solution**

- 2** Plan could have led to a correct solution if implemented properly
- 1** Partially correct plan based on part of the problem being interpreted correctly
- 0** No attempt, or totally inappropriate plan

### **Scale III: Getting an Answer**

- 2** Correct answer and correct label for the answer
- 1** Copying error; computational error; partial answer for a problem with multiple answers
- 0** No answer, or wrong answer based on an inappropriate plan

## 202 California Generalized Rubric for Math

*Source:* California State Department of Education, *A Question of Thinking*. Sacramento, CA: California State Department of Education, 1989

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	1
<b>Grade(s)</b>	<i>Not specified</i>	<b>Scale length</b>	6

### Holistic Scale

- 6 Exemplary response. Gives a complete response with a clear, coherent, unambiguous and elegant explanation; includes a clear and simplified diagram; communicates effectively to the identified audience; shows understanding of the open-ended problem's mathematical ideas and processes; identifies all the important elements of the problem; may include examples and counterexamples; presents strong supporting arguments.
- 5 Competent response. Gives a fairly complete response with reasonably clear explanations; may include an appropriate diagram; communicates effectively to the identified audience; shows understanding of the problem's mathematical ideas and processes; identifies the most important elements of the problem; presents solid supporting arguments.
- 4 Minor Flaws But Satisfactory. Completes the problem satisfactorily, but the explanation may be muddled; argumentation may be incomplete; diagram may be inappropriate or unclear; understands the underlying mathematical ideas; uses mathematical ideas effectively.
- 3 Serious Flaws But Nearly Satisfactory. Begins the problem appropriately but may fail to complete or may omit significant parts of the problem; may fail to show full understanding of mathematical ideas and processes; may make major computational errors; may misuse or fail to use mathematical terms; response may reflect an inappropriate strategy for solving the problem.
- 2 Begins, But Fails to Complete Problem. Explanation is not understandable; diagram may be unclear; shows no understanding of the problem situation; may make major computational errors.
- 1 Unable to Begin Effectively. Words do not reflect the problem; drawings misrepresent the problem situation; copies parts of the problem but without attempting a solution; fails to indicate which information is appropriate to the problem.

## **203 Analytical Scale for Problem Solving**

*Source:* Szetela, Walter and Nicol, Cynthia. Evaluating Problem Solving in Mathematics. *Educational Leadership*, May 1992, pp. 42-45.

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<b>3</b>
<b>Grade(s)</b>	<i>Not specified</i>	<b>Scale length</b>	<b>3-5</b>

### **Scale I: Understanding the Problem**

- 4** Complete understanding of the problem
- 3** Misinterprets minor part of the problem
- 2** Misinterprets major part of the problem
- 1** Completely misinterprets the problem
- 0** No attempt

### **Scale II: Solving the Problem**

- 4** A plan that could lead to a correct solution with no arithmetic errors
- 3** Substantially correct procedure with minor omission or procedural error
- 2** Partially correct procedure but with major fault
- 1** Totally inappropriate plan
- 0** No attempt

### **Scale III: Answering the Problem**

- 2** Correct solution
- 1** Copying error; computational error, partial answer for problem with multiple answers; no answer statement; answer labeled incorrectly
- 0** No answer or wrong answer based upon an inappropriate plan

**Note:** This rubric is based on rubric 201.

## **204 North Carolina Math Rubric I**

*Source:* North Carolina Department of Public Instruction

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<i>1</i>
<b>Grade(s)</b>	<i>Elementary</i>	<b>Scale length</b>	<i>4</i>

### **Holistic Scale**

- 3** All parts of the question are answered accurately and completely. All directions are followed.
- 2** Answer deals correctly with most aspects of the question, but something is missing. May deal with all aspects but have minor errors.
- 1** Addresses item but only partially correct; something correct related to the question.
- 0** Does not address task, unresponsive, unrelated or inappropriate. Nothing correct.

## **205 North Carolina Math Rubric II**

*Source:* North Carolina Department of Public Instruction

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<i>1</i>
<b>Grade(s)</b>	<i>Elementary</i>	<b>Scale length</b>	<i>53</i>

### **Holistic Scale**

- 2** Answer is complete and correct; all parts of the question are addressed.
- 1** Student gives a partially correct answer, or task is incomplete (i.e., one of two parts answered correctly).
- 0** Does not address task, unresponsive, unrelated or inappropriate.

## 206 *Maine Holistic Rubric for Mathematics Open-Ended Items*

*Source:* Maine Department of Education

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<i>1</i>
<b>Grade(s)</b>	<i>Not specified</i>	<b>Scale length</b>	<i>5</i>

### **Holistic Scale**

**4** A correct solution and an appropriate strategy are shown or explained and the solution is shown with correct label or description if necessary.

**3** A complete, appropriate strategy is show or explained but:

- an incorrect solution is given due to a simple computational or other error or
- no solution is given.

A correct solution is given with no solution strategy or explanation shown.

A correct solution and appropriate strategy is shown or explained, but not labeled correctly when necessary.

**2** Some parts of an appropriate strategy are shown or explained, but some key elements are missing.

Some parts of an appropriate strategy are shown or explained, along with some inappropriate parts.

Appropriate strategy shown or explained, but implemented incorrectly.

**1** Some work or explanation beyond re-copying data, but work would not lead to a correct solution.

One or more incorrect approaches attempted or explained.

**0** No work or solution shown or explained.

Incorrect solution and no work shown or explained.

Some data from the problem copied over, but no evidence of any strategy is shown or explained.

## 207 Vermont Math Problem Solving Criteria

Source: Vermont Department of Education

<b>Subjects:</b>	Mathematics	<b># of scales</b>	4
<b>Grade(s)</b>	8	<b>Scale length</b>	4

### **Scale I: Understanding the Problem**

- 4 Identified special factors that influenced the approach before starting the problem.
- 3 Understood the problem.
- 2 Understood enough to solve part of the problem or to get part of the solution.
- 1 Didn't understand enough to get started or make progress.

### **Scale II: How Student Solved Problem**

- 4 Approach was efficient or sophisticated.
- 3 Approach would work for the problem.
- 2 Approach would only lead to solving part of the problem.
- 1 Approach didn't work.

### **Scale III: Decisions Along the Way**

- 4 Clearly explained the reasons for the correct decisions made throughout the problem.
- 3 Didn't clearly explain the reasons for decisions, but work suggests correct reasoning used for only part of the problem.
- 2 Only partly correct reasoning, or correct reasoning used for only part of the problem.
- 1 No reasoning is evident from the work or reasoning is incorrect.

### **Scale IV: Outcomes of Activities**

- 4 Solved the problem and made general rule about the solution or extended the solution to a more complicated situation.
- 3 Solved the problem and connected the solution to other math or described a use for what was learned in the "real world."
- 2 Only partly correct reasoning, or correct reasoning used for only part of the problem.
- 1 Solved the problem and stopped.

## 208 QUASAR General Rubric (page 1 of 2)

*Source:* Lane, Suzanne, The Conceptual Framework for the Development of a Mathematics Performance Assessment Instrument. *Educational Measurement: Issues and Practice*, Summer 1993, 16-23.

<b>Subjects:</b>	Mathematics	<b># of scales</b>	1
<b>Grade(s)</b>	Not specified	<b>Scale length</b>	5

### Holistic Scale

- 4** Mathematical knowledge: Shows understanding of the problem's mathematical concepts and principles; uses appropriate mathematical terminology and notations; and executes algorithms completely and correctly.

Strategic knowledge: May use relevant outside information of a formal or informal nature; identifies all the important elements of the problem and shows understanding of the relationships between them; reflects an appropriate and systematic strategy for solving the problem; and gives clear evidence of a solution process, and solution process is complete and systematic.

Communication: Gives a complete response with a clear, unambiguous explanation and/or description; may include an appropriate and complete diagram; communicates effectively to the identified audience; presents strong supporting arguments which are logically sound and complete; may include examples and counter-examples.

- 3** Mathematical knowledge: Shows nearly complete understanding of the problem's mathematical concepts and principles; uses nearly correct mathematical terminology and notations; executes algorithms completely; and computations are generally correct but may contain minor errors.

Strategic knowledge: May use relevant outside information of a formal or informal nature; identifies the most important elements of the problems and shows general understanding of the relationships between them; and gives clear evidence of a solution process, and solution process is complete or nearly complete, and systematic.

Communication: Gives a fairly complete response with reasonably clear explanations or descriptions; may include a nearly complete, appropriate diagram; generally communicates effectively to the identified audience; presents supporting arguments which are logically sound but may contain some minor gaps.

(cont'd.)

## 208 QUASAR General Rubric (page 2 of 2)

- 2** Mathematical knowledge: Shows understanding of some of the problem's mathematical concepts, and principles; and may contain serious computational errors.

Strategic knowledge: Identifies some important elements of the problems, but shows only limited understanding of the relationships between them; and gives some evidence of a solution process, but solution process may be incomplete or somewhat unsystematic.

Communication: Makes significant progress towards completion of the problem, but the explanation or description may be somewhat ambiguous or unclear; may include a diagram which is flawed or unclear; communication may be somewhat vague or difficult to interpret; and arguments may be incomplete or may be based on a logically unsound premise.

- 1** Mathematical knowledge: Shows very limited understanding of the problem's mathematical concepts, and principles; may misuse or fail to use mathematical terms; and may make major computational errors.

Strategic knowledge: May attempt to use irrelevant outside information; fails to identify important elements or places too much emphasis on unimportant elements; may reflect an inappropriate strategy for solving the problem; gives incomplete evidence of a solution process; solution process may be missing, difficult to identify, or completely unsystematic.

Communication: Has some satisfactory elements but may fail to complete or may omit significant parts of the problem; explanation or description may be missing or difficult to follow; may include a diagram which incorrectly represents the problem situation, or diagram may be unclear and difficult to interpret.

- 0** Mathematical knowledge: Shows no understanding of the problem's mathematical concepts and principles.

Strategic knowledge: May attempt to use irrelevant outside information; fails to indicate which elements of the problem are appropriate; copies part of the problem, but without attempting a solution.

Communication: Communicates ineffectively; words do not reflect the problem; may include drawings which completely misrepresent the problem situation.

## 209 **Maryland Math Communication Rubric**

*Source:* Maryland State Department of Education, *Sample activities, student responses and Maryland teachers' comments on a sample task: Mathematics Grade 8*, February 1991.

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<i>1</i>
<b>Grade(s)</b>	<i>8</i>	<b>Scale length</b>	<i>5</i>

### **Holistic Scale**

- 4** Uses mathematical language (terms, symbols, signs, and/or representations) that is highly effective, accurate, and thorough, to describe operations, concepts, and processes.
- 3** Uses mathematical language (terms, symbols, signs, and/or representations) that is partially effective, accurate, and thorough to describe operations, concepts and processes.
- 2** Uses mathematical language (terms, symbols, signs and/or representations) that is minimally effective and accurate, to describe operations, concepts, and processes.
- 1** An incorrect response—attempt is made.
- 0** Off task, off topic, illegible, blank or insufficient to score.

## 210 California Performance Standards for Student Work

Source: California Department of Education, *A Sampler of Mathematics Assessment*, 1991.

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	1
<b>Grade(s)</b>	<i>Not specified</i>	<b>Scale length</b>	6

### Holistic Scale

- 6** Fully achieves the purpose of the task, while insightfully interpreting, extending beyond the task, or raising provocative questions.
- Demonstrates an in-depth understanding of concepts and content.  
Communicates effectively and clearly to various audiences, using dynamic and diverse means.
- 5** Accomplishes the purposes of the task.
- Shows clear understandings of concepts.  
Communicates effectively.
- 4** Substantially completes purposes of the task.
- Displays understanding of major concepts, even though some less important ideas may be missing.  
Communicates successfully.
- 3** Purpose of the task not fully achieved; needs elaboration; some strategies may be ineffectual or not appropriate; assumptions about the purposes may be flawed.
- Gaps in conceptual understanding are evident.  
Limits communication to some important ideas; results may be incomplete or not clearly presented.
- 2** Important purposes of the task not achieved; work may need redirection; approach to task may lead away from its completion.
- Presents fragmented understanding of concepts; results may be incomplete or arguments may be weak.  
Attempts communication.
- 1** Purpose of the task not accomplished.
- Shows little evidence of appropriate reasoning.  
Does not successfully communicate relevant ideas; presents extraneous information.

## 211 Kentucky Holistic Scoring Rubric for Grade 12 Math

**Source:** Kentucky Department of Education *Open-Response Released Items and Scoring Rubrics: Grade 12 1991-92*

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	1
<b>Grade(s)</b>	12	<b>Scale length</b>	5

### Holistic Scale

**5** The student completes all important components of the task and communicates ideas clearly.

The student demonstrates in-depth understanding of the relevant concepts and/or processes.

Where appropriate, the student chooses more efficient and/or sophisticated processes.

Where appropriate, the student offers insightful interpretations or extensions (generalizations, applications, analogies).

**4** The student completes most important components of the task and communicates clearly.

The student demonstrates understanding of major concepts even though she/he overlooks or misunderstands some less important ideas or details.

**3** The student completes some important components of the task and communicates those clearly.

The student demonstrates that there are gaps in his/her conceptual understanding.

**2** Student shows minimal understanding.

Student unable to generate strategy or answer may display only recall effect. Answer lacks clear communication.

Answer may be totally incorrect or irrelevant.

**1** Blank/no response.

## 212 California General Rubric for Mathematics (page 1 of 2)

**Source:** California Department of Education, *A Sampler of Mathematics Assessment: Addendum, Preliminary Edition*, 1993.

<b>Subjects:</b>	Mathematics	<b># of scales</b>	1
<b>Grade(s)</b>	4, 8, 10	<b>Scale length</b>	6

### Holistic Scale

**6 Solid work that may go beyond the requirements of the task(s), showing for example:**

- complete understanding of the task's mathematical concepts and processes.
- clear identification of all of the important elements of the task(s).
- where appropriate, clear evidence of doing purposeful mathematics, including investigating, experimenting, modeling, designing, interpreting, analyzing, or solving.
- excellent prose and mathematical supporting arguments that may include examples or counter-examples.
- creativity and thoughtfulness in communicating the results and the interpretations of those results, to an identified audience, using dynamic and diverse means.
- multiple solutions based upon different assumptions about or interpretations of the task(s).
- unusual insights into the nature of and the resolution of problems encountered in the task(s).
- a high level of mathematical thinking that includes, where appropriate, making comparisons, conjectures, interpretations, predictions, or generalizations.
- exceptional skill in choosing appropriate mathematical tools and techniques in the resolution of problems in task(s).

**5 Fully achieves the requirements of the task(s), showing for example:**

- good understanding of the task's mathematical concepts and processes.
- identification of most, if not all, of the important elements of the task(s).
- evidence of doing purposeful mathematics, including where appropriate, investigating, experimenting, modeling, designing, interpreting, analyzing, or solving.
- clear, successful communications with an identified audience.
- one solution and interpretation of those results.
- evidence of mathematical thinking that includes, where appropriate, making comparisons, conjectures, interpretations, predictions, or generalizations.
- use of variety of tools and techniques appropriate to the form of the task(s) and the requirements of the task.

**4 Substantially completes the requirements of the task(s), showing for example:**

- an understanding of most of the task's mathematical concepts and processes.
- identification of the important elements of the task(s), but some less important ideas are missing.

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## 212 California General Rubric for Mathematics (page 2 of 2)

**Source:** California Department of Education, *A Sampler of Mathematics Assessment: Addendum, Preliminary Edition*, 1993.

- some aspects of investigations, experiments, model building, designs, interpretations, analysis, solutions require by the task(s) may be missing,
- adequate communication with an identified audience, but with limited clarity and variety.
- occasional evidence of mathematical thinking involving comparisons, conjectures, interpretations, predictions, or generalizations.
- a limited variety of tools and techniques used to resolve the situation presented in the task(s).

### 3 **Limited completion of the requirements of the task(s), showing for example:**

- an understanding of some of the task's mathematical concepts and processes, but with evidence of gaps in those understanding.
- identification of some of the important elements of the task(s), but assumptions about some of the elements may be flawed.
- communication of some ideas, but generally makes inadequate attempts to communicate, often failing to address the identified audience, and difficulty in expressing mathematical ideas.
- inadequate mathematical thinking that includes ineffective analysis procedures, limited solution strategies, unclear mathematical arguments, and inappropriate interpretation of results.
- a selection of some inappropriate tools and techniques used to resolve the situation presented in the task(s).

### 2 **Requirements of the task(s) not completed, showing for example:**

- only fragmented understanding of the task's mathematical concepts and processes, accompanied by disorganized, incomplete results.
- identification of only a few, usually superficial elements of the task(s).
- attempts to address the intended audience that may be incoherent, muddled, or incomplete.
- attempts to explain or justify results that are convoluted, illogical, circular, or unrelated to the results shown.

### 1 **Does not achieve any requirements of the task(s), showing for example:**

- an irrelevant, nonsensical, or illegible response that has no valid relationship to the task(s).
- no understanding of the task's mathematical concepts and processes.
- unsuccessful attempt, if any, to communicate with the intended audience. Usually communication is not attempted.
- no attempt to explain or justify results. If attempt is made, it is often unrelated to the task, illegible, or incoherent.

## 213 Temple ISD Math Rubric

*Source:* Temple Independent School District, Temple, Texas

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	<i>1</i>
<b>Grade(s)</b>	<i>Not specified</i>	<b>Scale length</b>	<i>4</i>

### Holistic Scale

- 3** Response is exemplary, detailed and clear
- 2** Response is generally correct
- 1** Response is partially correct, but lacks clarity
- 0** No response or response is incorrect

## 214 Illinois Rubric for Mathematics (page 1 of 2)

Source: Illinois State Board of Education

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	3
<b>Grade(s)</b>	3-12	<b>Scale length</b>	5

### **Scale 1 Mathematical Knowledge**

- 4 Shows complete understanding of the problem's mathematical concepts and principles. Uses appropriate mathematical terminology and notation (e.g., labels as appropriate\*). Executes algorithms completely and correctly.
- 3 Shows nearly complete understanding of the problem's mathematical concepts and principles. Uses nearly correct mathematical terminology and notation. Executes algorithms completely. Computations are generally correct, but may contain minor errors.
- 2 Shows understanding of some of the problem's mathematical concepts and principles. May contain serious computational errors.
- 1 Shows very limited understanding of the problem's mathematical concepts, and principles. May misuse or fail to use mathematical terms. May contain major computational errors.
- 0 Shows no understanding of the problem's mathematical concepts and principles.

### **Scale II: Strategic Knowledge**

- 4 Identifies all important elements of the problem and shows understanding of the relationship between them. Reflects and appropriate and systematic strategy for solving the problem. Gives clear evidence of a solution process, and solution process is complete and systematic.
- 3 May use relevant outside information of a formal or informal nature. Identifies the most important elements of problem and shows general understanding of the relationships between them. Solution process is nearly complete.
- 2 Identifies some important elements of the problem but shows only limited understanding of the relationships between them. Gives some evidence of a solution process.
- 1 May attempt to use irrelevant outside information. Fails to identify important elements or places too much emphasis on unimportant elements. May reflect an inappropriate strategy for solving the problem. Gives minimal evidence of a solution process. Process may be difficult to identify.
- 0 Attempts to use irrelevant outside information. Fails to indicate elements of the problem. Copies part of the problem, but without attempting a solution.

\*:"As appropriate" or "if appropriate" relate to whether or not the specific element is called for in the stem of the item.

## **214 Illinois Rubric for Mathematics (page 2 of 2)**

*Source:* Illinois State Board of Education

- 4 Gives a complete written explanation of the solution process employed. Includes appropriate and complete diagram with explanation of elements. May provide examples and counter examples if appropriate.
- 3 Gives a fairly complete written explanation of the solution process employed. May contain some minor gaps. May include a nearly complete diagram with some explanation.
- 2 Gives some explanation of the solution process employed, but communication is vague or difficult to interpret. May include diagram that is flawed, unclear, or not explained.
- 1 Provides minimal explanations of solution process. May fail to complete or may omit significant parts of the problem. Explanation missing or difficult to follow. May include a diagram which incorrectly represents the problem situation or diagram may be unclear and difficult to interpret.
- 0 Words do not reflect the problem or no written explanation given. May include drawings which completely misrepresent the problem situation

Note: This rubric was adapted from the QUASAR mathematics rubric (#208)

## 215 Ann Arbor Kindergarten Report Card -- Math

Source: Ann Arbor Public Schools, Ann Arbor, Michigan

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	1
<b>Grade(s)</b>	<i>Kindergarten</i>	<b>Scale length</b>	5

### Holistic Scale

**Note:** Scale points 2 and 4 are not explicitly defined. A score of 2 would be assigned to work that exceeded criteria for a score of 1, but did not meet criteria for a score of 2. Similarly a score of 4 would be assigned to work that exceeded criteria for a score of 3, but did not meet criteria for a score of 5.

**5** Achieving

**3** Developing

**1** Not yet

**Note:** Scale points are defined in more detail for each outcome. For example, the outcome "Count to 20" is scored as follows:

**5** Achieving. Counts from 1 to 20.

**3** Developing. Counts from 1 to 10. Cannot count from 11 to 19.

**1** Not yet. Counts to 5 or less.

The outcome "Extending patterns" is scored this way:

**5** Extends pattern 3 times.

**3** Same attributes but not correct order.

**1** Randomly adds on.

For a copy of the entire Ann Arbor report card, contact the Chicago Public Schools Bureau of Student Assessment.

## 216 Ann Arbor First Grade Report Card -- Math

Source: Ann Arbor Public Schools, Ann Arbor, Michigan

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	1
<b>Grade(s)</b>	1	<b>Scale length</b>	5

### Holistic Scale

**Note:** Scale points 2 and 4 are not explicitly defined. A score of 2 would be assigned to work that exceeded criteria for a score of 1, but did not meet criteria for a score of 2. Similarly a score of 4 would be assigned to work that exceeded criteria for a score of 3, but did not meet criteria for a score of 5.

- 5 Achieving
- 3 Developing
- 1 Emerging

**Note:** Scale points are defined in more detail for each outcome. For example, the outcome "Tells time to the nearest hour and half hour" is scored as follows:

- 5 Achieving. Tells time correctly for all six hour and half hour times given.
- 3 Developing. Misses one to two of the six times given. Tells time to hour, but not half hour. Needs prompt to get times correct.
- 1 Not yet. Provides no response or gives three or more incorrect responses.

For a copy of the entire Ann Arbor report card, contact the Chicago Public Schools Bureau of Student Assessment.

## 217 Kentucky Open-Ended Scoring Guide for Grade 8 Mathematics, Social Studies and Science

Source: Kentucky Department of Education

<b>Subjects:</b>	Science, mathematics, social studies	<b># of scales</b>	1
<b>Grade(s)</b>	8	<b>Scale length</b>	5

### Holistic Scale

- 4** ■ The student completes all important components of the task and communicates ideas clearly.
- The student demonstrates in-depth understanding of the relevant concepts and/or processes.
  - Where appropriate, the student chooses more efficient and/or sophisticated processes.
  - Where appropriate, the student offers interpretations or extensions (generalizations, applications, analogies).
- 3** ■ The student completes most important components of the task and communicates clearly.
- The student demonstrates understanding of major concepts even though he/she overlooks or misunderstands less important ideas or details.
- 2** ■ The student completes some important components of the task and communicates those clearly.
- The student demonstrates that there are gaps in his/her conceptual understanding.
- 1** ■ Student shows minimal understanding.
- Student unable to generate strategy or answer may display only recall. Answer lacks clear communication.
  - Answer may be totally incorrect or irrelevant.
- 0** ■ Blank/no response

**Note:** Scale points are defined in greater detail for each test question.

## **218 Norwood Park Draft Math Problem Solving Rubric (page 1 of 2)**

*Source:* Faculty of Norwood Park Elementary School, Chicago, Illinois

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	5
<b>Grade(s)</b>	<i>K-8</i>	<b>Scale length</b>	4

### **Scale I: Shows Evidence That Problem Was Understood**

<b>Distinguished</b>	Shows rigorous understanding of the problem
<b>Proficient</b>	Shows substantial understanding of the problem
<b>Apprentice</b>	Shows limited understanding of the problem
<b>Novice</b>	Shows little or no understanding of the problem

### **Scale II: Uses Information Appropriately**

<b>Distinguished</b>	Explains why certain information is essential to the solution
<b>Proficient</b>	Uses all appropriate information correctly
<b>Apprentice</b>	Uses some appropriate information correctly
<b>Novice</b>	Uses inappropriate information

### **Scale III: Applies Appropriate Procedures**

<b>Distinguished</b>	Explains why procedures are appropriate for the problem
<b>Proficient</b>	Applies completely appropriate procedures
<b>Apprentice</b>	Applies some appropriate procedures
<b>Novice</b>	Applies inappropriate procedures

(cont'd.)

## **218 Norwood Park Draft Math Problem Solving Rubric (page 2 of 2)**

*Source:* Faculty of Norwood Park Elementary School, Chicago, Illinois

### **Scale IV: Uses Representations, e.g., Diagrams, Graphs, Pictures, Manipulatives, Equations**

<b>Distinguished</b>	Uses a representation that is unusual in its aesthetic value or mathematical precision
<b>Proficient</b>	Uses a representation that clearly depicts the problem
<b>Apprentice</b>	Uses a representation that gives some important information about the problem
<b>Novice</b>	Uses a representation that gives little or no significant information about the problem

### **Scale V: Shows Competent Use of Mathematics**

<b>Distinguished</b>	Makes a general rule about the solution that can be applied to another problem
<b>Proficient</b>	Shows complete competence in using mathematics
<b>Apprentice</b>	Shows some competence in using mathematics, skips some important steps, or omits some important information
<b>Novice</b>	Shows incompetent use of mathematics

## 219 Oregon Mathematics Problem Solving (page 1 of 3)

Source: Oregon Department of Education

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	4
<b>Grade(s)</b>	3, 5, 8, 11	<b>Scale length</b>	5

**Note:** Scale points 2 and 4 are not explicitly defined. A score of 2 would be assigned to work that exceeded criteria for a score of 1, but did not meet criteria for a score of 2. Similarly, a score of 4 would be assigned to work that exceeded criteria for a score of 3, but did not meet criteria for a score of 5.

### **Scale I: Conceptual Understanding**

Conceptual Understanding includes the ability to interpret the problem and select appropriate information to apply a strategy for solution. Evidence is communicated through making connections between the problem situation, relevant information, appropriate mathematical concepts and logical/reasonable responses.

- 5** Full Conceptual Understanding: The student uses all relevant information to solve the problem.
- The student's answer is consistent with the question/problem.
  - The student is able to translate the problem into appropriate mathematical language.
- 3** Partial Conceptual Understanding: The student extracts the "essence" of the problem, but is unable to use this information to solve the problem.
- The student is only partially able to make connections between/among the concepts.
  - The student's solution is not fully related to the question.
  - The student understands one portion of the task, but not the complete task.
- 1** Lack of Conceptual Understanding: The student's solution is inconsistent or unrelated to the question.
- The student translates the problem into inappropriate mathematical concepts.
  - The student uses incorrect procedures without understanding the concepts related to the task.

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## **219 Oregon Mathematics Problem Solving (page 2 of 3)**

**Source:** Oregon Department of Education

### **Scale II: Procedural Knowledge**

Procedural Knowledge deals with the student's ability to demonstrate appropriate use of concepts. Evidence includes the verifying and justifying of a procedure using concrete models, or the modifying of procedures to deal with factors inherent in the problem.

- 5** Full Use of Appropriate Procedures: The student uses principles efficiently while justifying the solution.
- The student uses appropriate mathematical terms and strategies.
  - The student solves and verifies the problem.
  - The student uses mathematical principles and language precisely.
- 3** Partial Use of Appropriate Procedures: The student is not precise in using mathematical terms, principles, or procedures.
- The student is unable to carry out a procedure completely.
  - The process the student uses to verify the solution is incorrect.
- 1** Lacks Use of Appropriate Procedures: The student uses unsuitable methods or simple manipulation of data in his/her attempted solution.
- The student fails to eliminate unsuitable methods or solutions.
  - The student misuses principles or translates the problem into inappropriate procedures.
  - The student fails to verify the solution.

### **Scale III: Problem Solving Skills and Strategies**

Problem Solving requires the use of many skills, often in certain combinations, before the problem is solved. Students demonstrate problem solving strategies with clearly focused, good reasoning that leads to a successful resolution of the problem.

- 5** Evidence of Thorough/Insightful Use of Skills/Strategies: The skills and strategies show some evidence of insightful thinking to explore the problem.
- The student's work is clear and focused.
  - The skills/strategies are appropriate and demonstrate some insightful thinking.
  - The student gives possible extensions or generalizations to the solution or the problem.

(cont'd.)

## **219 Oregon Mathematics Problem Solving (page 3 of 3)**

*Source:* Oregon Department of Education

- 3 Evidence of Routine or Partial Use of Skills/Strategies:** The skills and strategies have some focus, but clarity is limited.
- The student applies a strategy which is only partially useful.
  - The student's strategy is not fully executed.
  - The student starts the problem appropriately, but changes to an incorrect focus.
  - The student recognizes the pattern or relationship, but expands it incorrectly.
- 1 Limited Evidence of Skills/Strategies:** The skills and strategies lack a central focus and the details are sketchy or not present.
- The procedures are not recorded (i.e., only the solution is present).
  - Strategies are random.
  - The student does not fully explore the problem, looking for concepts, patterns or relationships.
  - The student fails to see alternative solutions that the problem requires.

### **Scale IV: Communication**

In assessing the student's ability to communicate, particular attention should be paid to both the meanings he/she attaches to the concepts and procedures and also to his/her fluency in explaining, understanding, and evaluating the ideas expressed.

- 5 Clear, Complete Communication:** The student gives a complete response with clear, coherent, unambiguous, and elegant explanations.
- The student communicates his/her thinking effectively to the audience.
  - The details fit and make sense.
  - One step flows to the next and shows organization.
  - The student presents strong supporting arguments.
- 3 Partial or Incomplete Communication:** The student's explanation is unclear, inconsistent or not complete.
- The student uses terminology incorrectly or inconsistently.
  - The student's visual aids (graphs, tables, diagrams, etc.) are inappropriate or not directly related.
  - The student's explanation centers on his/her solution, not on his/her thinking.
- 1 Limited or Lack of Communication:** The student's explanation is not understandable or not present.
- The student either does not use or misuses appropriate mathematical terminology.
  - The student does not use essential visual aids to enhance or clarify the explanation.
  - The student's explanation lacks focus.\

## 220 Arizona Mathematics Rubric

**Source:** Arizona Department of Education

<b>Subjects:</b>	<i>Mathematics</i>	<b># of scales</b>	3
<b>Grade(s)</b>	3-12	<b>Scale length</b>	5

### Holistic Scale

- 4** A 4 response represents an effective solution. It shows complete understanding of the problem, thoroughly addresses all points relevant to the solution, shows logical reasoning and valid conclusions, communicates effectively and clearly through writing and/or diagrams, and includes adequate and correct computations and/or setup. It may contain insignificant errors that do not interfere with the completeness or reasonableness of the student's response.
- 3** A 3 response contains minor flaws. Although it shows an understanding of the problem, communicates adequately through writing and/or diagrams, and generally reaches reasonable conclusions, it shows minor flaws in reasoning and/or computation or neglects to address some aspect of the problem.
- 2** A 2 response shows gaps in understanding and/or execution. It shows one or some combination of the following flaws: an incomplete understanding of the problem, failure to address some aspects of the problem, faulty reasoning, weak conclusions, unclear communication in writing and/or diagrams, or a poor understanding of relevant mathematical procedures or concepts.
- 1** A 1 response shows some effort beyond restating the problem or copying given data. It shows some combination of the following flaws: little understanding of the problem, failure to address most aspects of the problem, major flaws in reasoning that lead to invalid conclusions, or a lack of understanding of relevant mathematical procedures or concepts.
- 0** Response shows no mathematical understanding of the problem or the student has failed to respond to the item.