Scoring Open-Ended Items in Mathematics:
According to the National Council of Teachers of Mathematics’ (NCTM) publication *EMRF: Everyday Rubric Grading*, rubrics are valuable tools in a mathematics classroom as they “narrow the feedback focus” helping students to know if their completed work meets an acceptable standard (Stutzman & Race, 2004, p. 34). Teachers who utilize rich, open-ended problems with their students can benefit from a rubric in that it “creates opportunities for assessments with questions that are fewer in quantity but higher in quality” (p. 34). This means that with just one quality problem-solving question, teachers can learn to provide helpful feedback to students without having to create and administer an excess of additional items.

There are two guiding questions teachers must ask themselves when reviewing students’ work:
1) “Does this work demonstrate understanding of the concept?” and
2) “Does this work meet the expectations outlined in the assignment?” (p. 35)

Answering “yes” to both of these questions will lead teachers to consider a score of 4 or 3, as outlined by the rubric on the next page. If a “yes” is recorded for the two questions above, the next question the teacher must ask is:

- “Is [the student work] complete and well communicated?”
  - If answered with a “yes,” the student earns a score of a 4—which indicates the student has a solid understanding, meets (or exceeds) expectations, and communicated clearly and completely.
  - If answered with a “no,” the student earns a score of a 3—which indicates understanding is evident and no additional teaching is needed, but that some revision or expansion of work is required. Here, the student needs just a written comment from the teacher indicating where the work is slightly incomplete or lacking in communication (p. 35).

Answering “no” to either of the guiding questions posed above will lead teachers to consider a score of 2, 1, or 0, as outlined by the rubric on the next page. If a “no” is recorded for the two questions above, the next question the teacher must ask is:

- “Is there evidence of partial understanding?”
  - If answered with a “yes,” the student earns a score of a 2—which indicates that revisions to the work are needed. A score of a 2 denotes students have significant gaps in their understanding.
  - If answered with a “no,” the students earns a score of a 1 if the work is fragmented and shows clear misunderstanding, or a score of a 0 if no attempt was made to solve the problem (p. 35).

Utilizing a rubric according to best practice would include an opportunity for students scoring a 2 to complete revisions to their work. A score of a 1 indicates a complete re-working of the problem is required. Both a score of 2 or 1 indicates the need for re-teaching and/or further communication about the misunderstandings present.

When utilizing rubrics with students, they should be taught to understand the criteria required to obtain a given score, and they should be taught how to interpret their score in order to understand whether or not their work “met the standard.”

The rubric on the next page includes components of the Mathematical Process Standards and can be used as a guide in helping teachers evaluate open-ended items, such as those found in the HISD Problem Solving Journals.

Reference:
### Elementary Mathematics Open-Ended Question Scoring Rubric

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<tr>
<td>4</td>
<td>The student provides a correct solution to the problem and demonstrates understanding of the concept. The student uses a problem-solving model to find the correct solution to the problem and meets the expectations of the assigned task. Student work provides detailed evidence of planning and follow through. Evidence of modifying the initial strategy or switching to a more efficient strategy may be present. Student work clearly communicates mathematical ideas using multiple representations, including symbols, diagrams, graphs, and language. The student explicitly communicates the solution to the problem using correct mathematical language and may provide additional justification in support of their solution (e.g., writes the solution in context, connecting back to the question asked).</td>
<td>2</td>
<td>The student provides a solution to the problem (correct or incorrect), and there is evidence of partial understanding. The student uses a problem-solving model to find the solution to the problem, but might make mistakes using the model. The student selects a strategy that results in an incorrect solution. Student work provides evidence that there is an understanding about the use of multiple representations when solving problems. However, the representation is incomplete or illustrates a misconception.</td>
<td>1</td>
<td>The student provides an incorrect solution to the problem or a correct solution without showing any work. Student work does not demonstrate the use of a problem-solving model, communication is fragmented, and work shows clear misunderstandings. Student work does not provide evidence of understanding of the problem or the steps necessary to find a solution.</td>
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**Reference:**