

## Assessments

“Assessment should guide teaching and must be decided before teaching” (Ortiz 2004).

To assess accurately what students know and can do mathematically, teachers should understand the mathematics content of the current grade level curriculum and the mathematical thinking, attitudes, and beliefs possessed by students within a specific grade level.

This guide will provide sample rubrics and task analysis by grade level to use for pre-assessments, on-going assessments and post-assessments. Assessments used as pre-assessments are generally utilized to gather baseline data and to assess the student’s prior knowledge. Pre-assessment results help teachers determine instructional needs of their students. Teachers should use assessments to obtain on-going data to determine if students are mastering what is being taught. This information should be utilized to target struggling learners and provide interventions to assist students in being successful learners in algebra. Lastly, assessments used as post assessment are utilized to measure if students have mastered the required benchmarks provided within the Sunshine State Standards (SSS) and (National Council for Teachers of Mathematics) requirements. Once teachers have successfully gathered all assessment data, they can utilize this data to determine student gains or target problematic areas.

Some students within special programs may be eligible for accommodations during instruction and during formal assessments. There are many guidelines and requirements within the different assessments to assist in providing equity between students. An updated and complete list of approved accommodations for standardized testing can be found in the Individual Administrator’s Manual. The Florida Comprehensive Assessment Test (FCAT) also allows accommodations to be administered to some students who are in (Exceptional Student Education) and (English Language Learners) programs as well as on 504 plans. A complete listing of permitted accommodations can be obtained at

[www.myflorida.com](http://www.myflorida.com). Additional information on assessments can be obtained through the clearinghouse at <http://www.firn.edu/doe/commhome/clerhome.htm>.

The Assessment Standards for School Mathematics (NCTM 1995) presented six standards about exemplary mathematics assessment. Assessments should:

- ✓ Reflect the mathematics that students should know and be able to do;
- ✓ Enhance mathematics learning;
- ✓ Promote equity;
- ✓ Be an open process;
- ✓ Promote valid inference; and
- ✓ Be a coherent process.

According to the Assessment Standards for School Mathematics (NCTM 1995) classroom assessments should:

- ✓ Provide a rich variety of mathematical topics and problem situations;
- ✓ Give students opportunities to investigate problems in many ways;
- ✓ Question and listen to students;
- ✓ Look for evidence of learning from many sources; and
- ✓ Expect students to use concepts and procedures effectively in solving problems.

The Assessment Standards for School Mathematics (NCTM 1995) offers many samples of Assessments in their series of publications on assessments by grade levels. Some assessments useful to teachers include open-ended questions, discussions, portfolios, journal logs, quizzes, tests, observations, rubrics, standardized assessments, computerized assessment, checklists, student surveys, and textbook developed assessments. This guide will provide samples of the use of rubrics in assessing algebraic thinking.

## Rubrics

Rubrics are scales that define levels of performance for tasks or collections of tasks (NCTM, 2003a, 2003b, 2003c, 2003d). Rubrics are primarily used to inform the teacher and student of their performance. Rubrics also help describe expectations, strategies and methods that students may use. There are many resources available to help develop rubrics. The NCTM Assessment publications [www.nctm.org](http://www.nctm.org) provide explanations and samples. Also, the website [www.rubrics.com](http://www.rubrics.com) and the Florida Department of Education Website [www.fldoe.org](http://www.fldoe.org) provide sample FCAT rubrics and scoring rubrics.

Two types of rubrics discussed in this guide are the holistic rubric and the analytic rubric.

The holistic rubric provides a “big picture” assessment of the understanding of a concept. Students receive a single score determined by the level they have reached and the overall quality of the work is judged (NCTM, 2003a). One example of a holistic approach is used in scoring the FCAT <http://www.firn.edu/doe/sas/fcat/pdf/rubrcmat.pdf> (Appendix A). Another example of a holistic rubric:

### Holistic Scoring Rubric

#### Sample

Points			
4	3	2	1
Finished the entire task	Completed most of the task	Did not complete most of the task.	Did not complete task
Used the problem solving strategy demonstrated in class	Used some of the strategy demonstrated in class	Used very little of the strategy demonstrated in class.	Did not use the strategy demonstrated in class
Communicated the answer clearly by showing all work and using a representation	Either showed all work and used a representation but not both	Showed incomplete attempt to work problem	Did not attempt to work the problem

The analytic rubric assigns partial scores to the components of the task (NCTM, 2003). This type of rubric defines more clearly the criteria for assigning points on student work samples. Two examples are included to demonstrate K-2 & 3-12

### Scoring Rubric

#### Strand 1 /Grades K-2

#### Analytical

Levels of Understanding	Scoring Criteria	Points
Concrete	0 pts.      Completely misunderstands the task	
	1 pt.        Partial misunderstanding of the task	
	2 pts.        Complete understanding of the task	
Representational	0 pts.        No attempt to sort	
	1 pt.        Partial completion of sorting with some understanding	
	2 pts.        Completed sorting with understanding task	
Abstract	0 pts.        Cannot classify with understanding	
	1 pt.        Can classify, but unable to explain	
	2 pts.        Can classify and explain process	
	Total Points	

**Scoring Rubric  
Strand 1/Grades 3-12  
Analytical**

Levels of Understanding	Scoring Criteria	Points
Concrete	0 pts. Completely misunderstands the task	
	1 pt. Partial misunderstanding of the task	
	2 pts. Complete understanding of the task	
Representational	0 pts. No attempt to graph	
	1 pt. Partial completion of graph with some understanding	
	2 pts. Completed graph with understanding	
Abstract	0 pts. Cannot solve for unknown	
	1 pt. Can solve for unknown, but unable to explain	
	2 pts. Can solve for unknown number and explain reasoning	
	<b>Total Points</b>	

This guide contains a task analysis that may help you develop rubrics. **The Task Analysis For Algebraic Thinking By Grade Level** as follows contains major skills and concepts that help develop algebraic thinking. The skills are listed by grade level. Within grade levels, there are indicators to show whether the skill is concrete, representational, or abstract. Each skill can be observed by either communicating it or by doing the skill. This is a valuable resource to have in determining mastery of skills and concepts and may help teachers decide on re-teaching or moving to the next concept or skill.

## **Task Analysis for Algebraic Thinking by Grade Level**

The following contains the major skills and concepts that support and help develop algebraic thinking for each grade level (K-12). Depending on the grade level, these skills and concepts were subdivided in some or all of the following major areas: pre-number concepts, numeration, measurement, addition concept and skills, addition computation, subtraction concepts and skills, subtraction computation, properties, variables, expressions, equations and functions, tables and graphs, fraction concepts, decimal concepts, multiplication concepts, multiplication computation, division concepts, and division computation. Furthermore, each of the tables contains the following areas: which representation level should be included (concrete, representational and/or abstract), type of validation the student should provide, indication of student's mastery or non-mastery of the skill or concept after proper instruction and assessment, and students' retention or non-retention of the skill or concept after proper instruction and assessment.