

# Appendix A

## Mathematics Cognitive Domains

### Framework: TIMSS 2003

## Developmental Project Fourth and Eighth Grades

covers what the student needs to know, while the second, *applying knowledge and conceptual understanding* focuses on the ability of the student to apply what he or she knows to solve prob

lems or answer questions. The third domain, *reasoning*

depends on mathematical knowledge

developing mathematical understanding

Without access to a knowledge base that enables easy recall of the language and basic facts and conventions of number, symbolic representation, and spatial relations, students would find purposeful mathematical thinking impossible. *Facts* encompass the factual knowledge that provides the basic language of mathematics, and the essential mathematical facts and properties that form the foundation for mathematical thought.

*Procedures* form a bridge between more basic knowledge and the use of mathematics for solving routine problems, especially those encountered by many people in their daily lives. In essence a fluent use of procedures entails recall of sets of actions and how to carry them out. Students need to be efficient and accurate in using a variety of



standard in classroom exercises designed to provide practice in particular methods or techniques. Some of these problems will have been in words that set the problem situation in a quasi-real context. Though they range in difficulty, each of these types of “textbook” problems is expected to be sufficiently familiar to students that they will essentially involve selecting and applying learned procedures.

Problems may be set in real-life situations, or may be concerned with purely mathematical questions involving, for example, numeric or algebraic expressions, functions, equations, geometric figures, or statistical data sets. Therefore, problem solving is included not only in the *applying knowledge and conceptual understanding* domain, with emphasis on the more familiar and routine tasks, but also in the *reasoning* domain.

This cognitive domain covers the following behaviors:

<b>Select</b>	Select an efficient/appropriate operation, method or strategy for solving problems where there is a known algorithm or method of solution. Select simple algebraic expressions which represent straightforward situations (fourth grade). Select the nets of simple geometric figures (fourth grade). Select appropriate algorithms or formulas.
<b>Represent</b>	Display mathematical information and data in diagrams, tables, charts, or graphs, and generate equivalent representations for a given mathematical entity or relationship.

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**Solve Routine Problems**

Solve routine problems (i.e., problems similar to those target students are likely to have encountered in class). For example, use geometric properties to solve problems; compare and match different representations of data (eighth grade) and use data from charts, tables, graphs, and maps to solve routine problems.

**Reasoning**

*Reasoning* mathematically involves the capacity for logical, systematic thinking. It includes intuitive and inductive reasoning based on patterns and regularities that can be used to arrive at solutions to non-routine problems. Non-routine problems are problems that are very likely to be unfamiliar to students. They make cognitive demands over and above those needed for solution of routine problems, even when the knowledge and skills requi e n sê huid lr k a e ge\$ a l i e

