# Evaluating Mathematical Development Across Curriculum

## The Chart of Descriptions

The descriptions on the reference set chart provide a broad framework to look at three aspects of students' mathematical development: attitudes, mathematical thinking, and communication.

### Attitudes

This section of the chart describes the students' motivation, willingness to take risks in their mathematical thinking, and their tolerance of ambiguity.

### Mathematical Thinking

This section of the chart is divided into four subcategories: strategies and approaches, knowledge and concepts, relationships and patterns, and application and relevance.

#### Strategies, Approaches

This subcategory deals with how students approach mathematical tasks, monitor their progress, seek support, reflect on their thinking, and use manipulatives and symbols to deal with concrete and abstract mathematical ideas.

#### Knowledge, Concepts

This subcategory describes how students learn mathematical concepts and procedures, develop number and spatial sense, use logical and proportional reasoning, make connections, and grow in their ability to deal with complexity and abstractness.

#### Relationships, Patterns

This subcategory deals with students' recognition, understanding, and use of patterns and relationships, and their ability to describe, explain, and interpret them.

#### Application, Relevance

This subcategory describes student development in seeing and valuing mathematical connections within the discipline of Mathematics, in other disciplines, and in their everyday lives.

### Communication

This section describes student development in explaining and representing their mathematical thinking in language or through other means, and using mathematical representations as a form of communication.

### Using the Chart of Descriptions

In using the descriptions, teachers should keep in mind that:

*The development of mathematics is not necessarily linear, sequential, and universal.*
Students progress at different rates, in different ways, and may demonstrate quite different levels of skill and competence in different situations.

*The descriptions are tied to mathematical activities rather than to students.*
Any given student is likely to display behaviours from a number of descriptions depending on various factors including: the task, the student's interest and experience, and the support provided.

*The chart offers generalized descriptions of features that often go together as a student moves from one reference point to another.*
Any mathematical activity is likely to involve elements from more than one description.

*Information from various sources is required to describe students' performance.*
In most cases, information is gathered through observation, conferencing or discussion, and examination of the student's work.

**Province of British Columbia**
Ministry of Education

# The Chart of Descriptions

<table>
<tr><th>Attitudes</th><th>Level 1</th><th>Level 2</th><th></th></tr>
<tr>
<td></td>
<td>
<ul>
<li>shows no outward signs of interest; may say "I don't like math"</li>
<li>sees a purpose for mathematical activity when it relates to his or her immediate experiences</li>
<li>may be tentative about his or her abilities to do mathematical tasks</li>
</ul>
</td>
<td>
<ul>
<li>may need encouragement to participates in the task</li>
<li>may question the value of mathematics</li>
<li>is driven to get an answer; may have an uniformed optimism about ability to do mathematics</li>
<li>may need hints, suggestions or other support to engage in mathematical tasks</li>
</ul>
</td>
<td>
<ul>
<li>shows …</li>
<li>tasks, …</li>
<li>is begi… as a us…</li>
<li>is conf…</li>
<li>perseve…</li>
</ul>
</td>
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</table>

## Mathematical Thinking

<table>
<tr><th></th><th>Level 1</th><th>Level 2</th><th></th></tr>
<tr>
<td>*Strategies, approaches*</td>
<td>
<ul>
<li>uses random approaches</li>
<li>needs support</li>
<li>will monitor own thinking when guided</li>
</ul>
</td>
<td>
<ul>
<li>may look to others for a strategy to use</li>
<li>may need assistance to get started and support throughout</li>
<li>may be unsure how to proceed, if initial approach does not seem to work</li>
</ul>
</td>
<td>
<ul>
<li>uses a…</li>
<li>seeks r…</li>
<li>is some… a strate…</li>
</ul>
</td>
</tr>
<tr>
<td>*Knowledge, concepts*</td>
<td>
<ul>
<li>attempts to use computational skills and processes accurately; may invent symbols</li>
<li>tries to mentally calculate/estimate</li>
<li>randomly plays with manipulatives</li>
</ul>
</td>
<td>
<ul>
<li>can use an algorithm or procedure with some accuracy when supported</li>
<li>uses some mental mathematics strategies to estimate or to visualize spatial relationships</li>
<li>needs to use manipulatives to understand concepts</li>
<li>understands some basic conceptual connections, if drawn to his or her attention</li>
</ul>
</td>
<td>
<ul>
<li>applies… structu…</li>
<li>is conc… may re…</li>
<li>uses m… represe…</li>
<li>is begi… are cor…</li>
</ul>
</td>
</tr>
<tr>
<td>*Relationships, patterns*</td>
<td>
<ul>
<li>is beginning to recognize simple patterns in shape, colour, number, size, and direction</li>
<li>understands concepts of magnitude of number in a numerical situation, if presented in a simple concrete form</li>
</ul>
</td>
<td>
<ul>
<li>recognizes, extends, and creates basic patterns with support</li>
<li>understands concept of magnitude by simple ordering and comparing</li>
</ul>
</td>
<td>
<ul>
<li>recogn… mather…</li>
<li>underst… recogn… and oth…</li>
</ul>
</td>
</tr>
<tr>
<td>*Application, relevance*</td>
<td>
<ul>
<li>may apply mathematical knowledge when prompted</li>
<li>makes connections between mathematics and immediate personal interest</li>
</ul>
</td>
<td>
<ul>
<li>sees the application of numbers in the context of money, counting, games, time</li>
<li>sees some connections between mathematics and activities at hand</li>
</ul>
</td>
<td>
<ul>
<li>needs a… mather… solving…</li>
<li>recogn… variety…</li>
</ul>
</td>
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</table>

## Communication

<table>
<tr><th></th><th>Level 1</th><th>Level 2</th><th></th></tr>
<tr>
<td></td>
<td>
<ul>
<li>may imitate forms they see around them; the work "looks like" mathematical notation</li>
<li>uses everyday language or may invent own language to convey mathematical ideas</li>
<li>attempts to explain or record their thinking</li>
<li>provides some reasons for response/answer, if prompted</li>
</ul>
</td>
<td>
<ul>
<li>can use simple pictures, models, and concrete objects to show thinking</li>
<li>tries mathematical language; uses some symbols and terms accurately</li>
<li>gives explanations that tend to repeat or copy</li>
<li>makes attempts to explain reasoning</li>
</ul>
</td>
<td>
<ul>
<li>represe…</li>
<li>uses sc… increas…</li>
<li>provide…</li>
<li>partially…</li>
</ul>
</td>
</tr>
</table>

| Level 3 | Level 4 | Level 5 |
|---|---|---|
| • shows interest, participates in mathematical tasks, may volunteer responses<br>• is beginning to see the value of mathematics as a useful life skill<br>• is confident if receiving ongoing support<br>• perseveres on short term tasks | • is both self-motivated and motivated by others<br>• makes connections between real life and mathematics<br>• is willing to take risks and is flexible in dealing with challenges<br>• perseveres on open-ended and complex tasks | • is motivated to go beyond expectations<br>• values mathematics as a way of understanding the world<br>• takes risks and questions mathematical data and conclusions<br>• seeks out mathematical tasks |
| • uses appropriate strategies for routine tasks<br>• seeks reassurance to check their progress<br>• is somewhat flexible in approach; will abandon a strategy and try another if prompted | • knows when and how to use appropriate strategies; strategy may not be efficient<br>• is generally able to work independently<br>• considers various approaches; may predict consequences and make choices | • creates or sythesizes own strategy and approaches as the need arises<br>• works independently; may ask questions that lead to further investigation<br>• evaluates approach for effectiveness, appropriateness and efficiency |
| • applies correct mathematical procedures in structured situations<br>• is concerned with accuracy of estimations; may recognize an unreasonable answer<br>• uses manipulatives and other forms of representation to demonstrate concepts<br>• is beginning to see how mathematics concepts are connected | • applies correct algorithms and mathematical procedures in new or complex situations<br>• regularly uses mental mathematics to determine reasonableness of a solution; manipulates some complex visual shapes<br>• can represent concepts symbolically, but may use manipulatives to explore new ideas<br>• demonstrates clear understanding of mathematical concepts; discovers new connections | • may develop new algorithms and procedures to solve problems<br>• automatically estimates; continually "ball parks" numbers when applying knowledge<br>• solves complex mathematical tasks symbolically<br>• sees mathematics topics and concepts as a connected whole |
| • recognizes, extends, and creates simple mathematical patterns<br>• understands concept of magnitude of number; recognizes some equivalent forms of number and other mathematical ideas | • recognizes, extends, and creates complex number patterns<br>• recognizes and uses multiple forms of mathematical symbols | • seeks, creates and interprets patterns to solve problems<br>• readily sees relationships between complex mathematical forms |
| • needs a "walk through" to see how mathematics can be applied in routine problem solving situations<br>• recognizes how mathematics is relevant to a variety of daily activities | • applies mathematics in unfamiliar situations<br>• knows mathematics has relevance in work or technical environments | • readily makes mathematical interpretations to support predictions and decision making<br>• uses mathematical forms as a means of interpreting the world |
| • represents learning in symbolic form<br>• uses some mathematical terminology with increasing accuracy<br>• provides mechanical or rule-bound explanations<br>• partially explains reasoning; may be repetitious | • usually chooses the most appropriate form of representation<br>• accurately uses language and symbols of mathematics<br>• gives clear explanations that are easy to follow<br>• gives explanations that are logical and clearly presented | • chooses appropriate representation of mathematical data and can critically appraise the choice<br>• uses technical language with precision<br>• presents unique, elegant expressions of thinking<br>• communicates mathematical reasoning to persuade, teach, help or influence |