

Summary of Results and Strategies for Teachers, 2009–2010

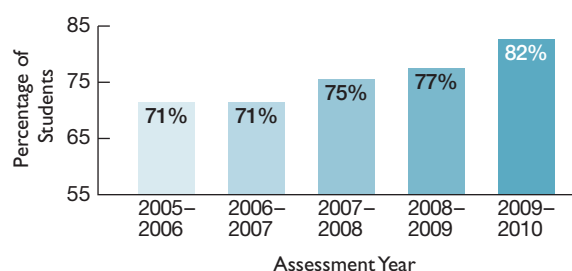
GRADE 9 ASSESSMENT OF MATHEMATICS

ACADEMIC COURSE Comparison of Provincial Results over Time*

	2005–2006	2006–2007	2007–2008	2008–2009	2009–2010
Number of Students	103 412	103 011	100 823	100 992	101 268
Level 4	6%	6%	8%	8%	10%
Level 3	65%	64%	68%	69%	72%
Level 2	17%	18%	16%	15%	12%
Level 1	9%	9%	7%	6%	5%
Below Level 1	1%	1%	1%	<1%	<1%
No Data	1%	2%	1%	1%	1%
Exempt†	<1%	N/A‡	N/A	N/A	N/A
At or Above the Provincial Standard§	71%	71%	75%	77%	82%

- There were 101 268 Grade 9 students enrolled in the academic course at the time of the 2009–2010 assessment.
- The Grade 9 assessment is based on *The Ontario Curriculum, Grades 9 and 10: Mathematics* (revised 2005).

PERCENTAGE OF ALL STUDENTS AT OR ABOVE THE PROVINCIAL STANDARD (LEVELS 3 AND 4) OVER TIME



Observations

- Over the past five years, the percentage of students taking academic mathematics who performed at or above the provincial standard has increased by 11 percentage points, from 71% to 82%.
- There has been an increase of five percentage points (to 82%) since last year in the percentage of students taking academic mathematics who performed at or above the provincial standard.

* Because percentages in tables and graphs are rounded, percentages may not add up to 100.

† After 2006–2007, exemptions have not been permitted.

‡ In 2006–2007, students who were coded “exempt” were placed in the “no data” category.

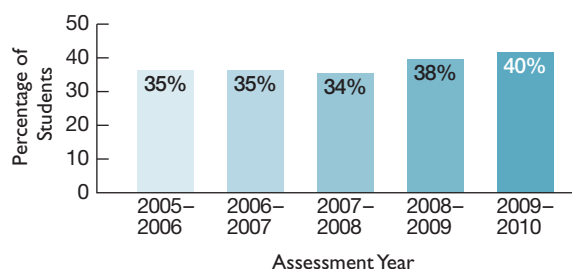
§ These percentages are based on the actual number of students and cannot be calculated simply by adding the rounded percentages of students at Levels 3 and 4.

APPLIED COURSE Comparison of Provincial Results over Time*

	2005–2006 [†]	2006–2007	2007–2008	2008–2009	2009–2010
Number of Students	50 687	49 056	47 817	48 482	47 566
Level 4	5%	5%	5%	5%	7%
Level 3	31%	30%	29%	33%	34%
Level 2	34%	36%	36%	35%	35%
Level 1	14%	14%	15%	14%	14%
Below Level 1	7%	7%	8%	7%	6%
No Data	8%	9%	7%	6%	5%
Exempt[‡]	2%	N/A [§]	N/A	N/A	N/A
At or Above the Provincial Standard^{**}	35%	35%	34%	38%	40%

- There were 47 566 Grade 9 students enrolled in the applied course at the time of the 2009–2010 assessment.
- The Grade 9 assessment is based on *The Ontario Curriculum, Grades 9 and 10: Mathematics* (revised 2005).

PERCENTAGE OF ALL STUDENTS AT OR ABOVE THE PROVINCIAL STANDARD (LEVELS 3 AND 4) OVER TIME



Observations

- Over the past five years, the percentage of students taking applied mathematics who performed at or above the provincial standard has increased by five percentage points, from 35% to 40%.
- There has been an increase of two percentage points (to 40%) since last year in the percentage of students taking applied mathematics performing at or above the provincial standard.

* Because percentages in tables and graphs are rounded, percentages may not add up to 100.

[†] Note that significant revisions were made to applied program courses in 2005, as reflected in *The Ontario Curriculum, Grades 9 and 10: Mathematics* (revised 2005).

[‡] After 2006–2007, exemptions have not been permitted.

[§] In 2006–2007, students who were coded “exempt” were placed in the “no data” category.

** These percentages are based on the actual number of students and cannot be calculated simply by adding the rounded percentages of students at Levels 3 and 4.

Tracking Student Progress from Assessment to Assessment

EQAO has compared students' Grade 9 mathematics assessment results in 2010 with their results on the mathematics components of the primary- and junior-division assessments when they were in Grade 3 in 2004 and Grade 6 in 2007.

The progress of students as they moved from Grade 3 to Grade 6 has been illustrated by a pie chart that is divided into four categories to reflect the four possible ways students can progress from one assessment to the next:

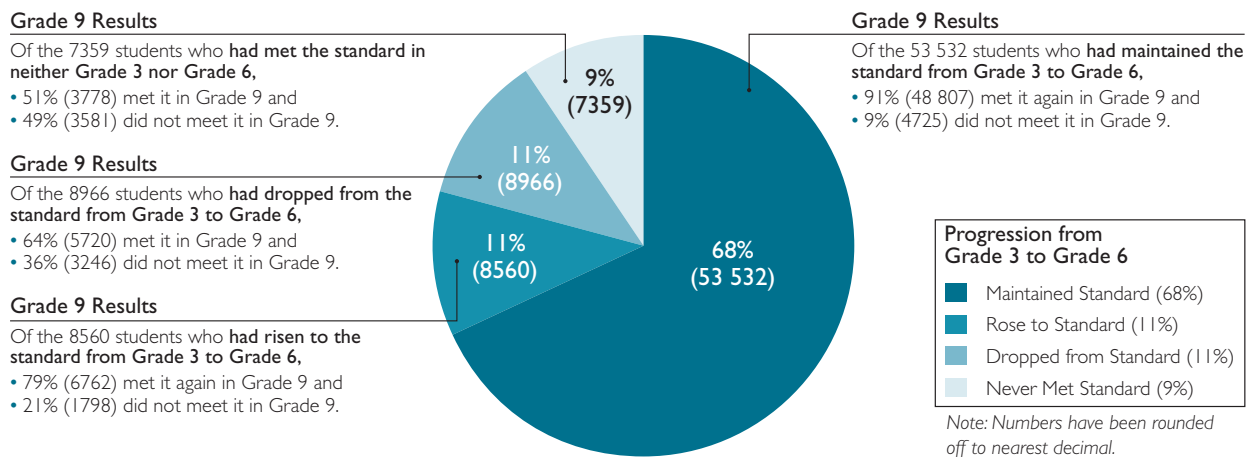
- **Maintained Standard**—Met the provincial standard in both Grade 3 and Grade 6
- **Rose to Standard**—Did not meet the standard in Grade 3 but met it in Grade 6
- **Dropped from Standard**—Met the standard in Grade 3 but did not meet it in Grade 6
- **Never Met Standard**—Met the standard in neither Grade 3 nor Grade 6

Tracking Progress in Mathematics from Grade 3 Through Grade 6 to Grade 9

The chart below is first divided into four slices, which represent the four possible ways students could have progressed from the Grade 3 to the Grade 6 assessment. Each slice then shows the number and percentage of students who met or did not meet the provincial standard in Grade 9.

The percentages in the chart are based on all students who could be tracked, including those who participated, were exempted or did not provide enough work to be scored. Specifically, of the 101 268 students enrolled in the Grade 9 academic mathematics course in 2010, 78 417 had also written the mathematics component of the provincial assessment in both Grade 3 and Grade 6.

Student Mathematics Progress from Grade 3 to Grade 6 to Grade 9, Academic Mathematics Course



Key Findings

- **Students who meet the provincial standard early in their schooling are most likely to maintain that high achievement in secondary school.** Of the students who had met the provincial standard in both Grade 3 and Grade 6, 91% met it again in Grade 9 in the academic mathematics course.
- **Students who do not meet the provincial standard early in their schooling are most likely to struggle in later grades.** Of the students who had met the provincial standard in neither Grade 3 nor Grade 6, only 51% met the standard in Grade 9 in the academic mathematics course.
- **Identifying struggling students early and providing support makes a difference.** Students who had not met the standard in Grade 3 but had improved to meet it in Grade 6 were considerably more likely to carry that success forward into Grade 9 than students who had not met the standard in Grade 6. Of the students who had not met the provincial standard in Grade 3 but had met it in Grade 6, 79% met it in Grade 9 in the academic mathematics course.

Tracking Student Progress from Assessment to Assessment

EQAO has compared students' Grade 9 mathematics assessment results in 2010 with their results on the mathematics components of the primary- and junior-division assessments when they were in Grade 3 in 2004 and Grade 6 in 2007.

The progress of students as they moved from Grade 3 to Grade 6 has been illustrated by a pie chart that is divided into four categories to reflect the four possible ways students can progress from one assessment to the next:

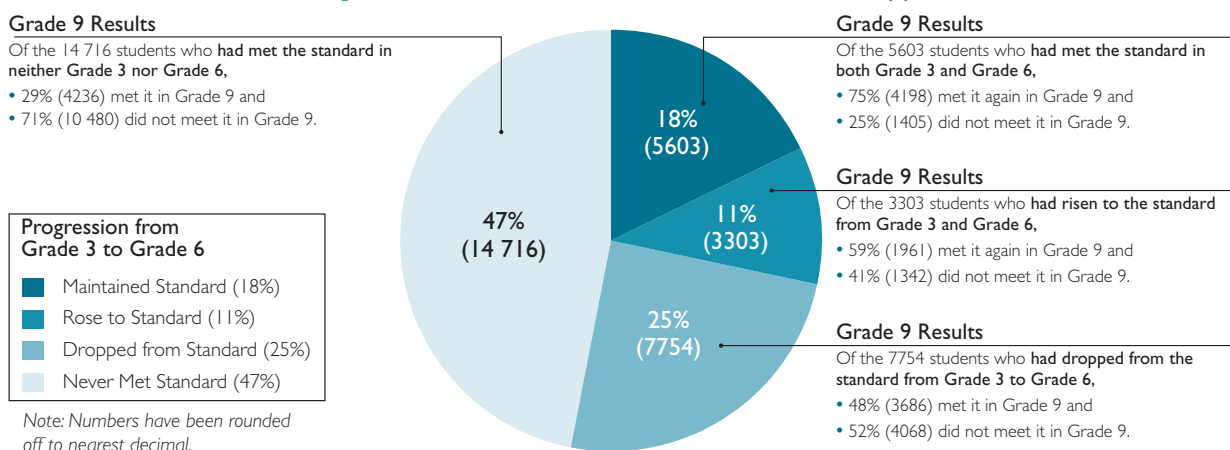
- **Maintained Standard**—Met the provincial standard in both Grade 3 and Grade 6
- **Rose to Standard**—Did not meet the standard in Grade 3 but met it in Grade 6
- **Dropped from Standard**—Met the standard in Grade 3 but did not meet it in Grade 6
- **Never Met Standard**—Met the standard in neither Grade 3 nor Grade 6

Tracking Progress in Mathematics from Grade 3 Through Grade 6 to Grade 9

The chart below is first divided into four slices, which represent the four possible ways students could have progressed from the Grade 3 to the Grade 6 assessment. Each slice then shows the number and percentage of students who met or did not meet the provincial standard in Grade 9.

The percentages in the chart are based on all students who could be tracked, including those who participated, were exempted or did not provide enough work to be scored. Specifically, of the 47 566 students enrolled in the Grade 9 applied course in 2010, 31 376 had also written the mathematics component of the provincial assessment in both Grade 3 and Grade 6.

Student Mathematics Progress from Grade 3 to Grade 6 to Grade 9, Applied Mathematics Course



Key Findings

- **Students who meet the provincial standard early in their schooling are most likely to maintain that high achievement in secondary school.** Of the students who had met the provincial standard in both Grade 3 and Grade 6, 75% met it again in Grade 9 in the applied mathematics course.
- **Students who do not meet the provincial standard early in their schooling are most likely to struggle in later grades.** Of the students who had met the provincial standard in neither Grade 3 nor Grade 6, only 29% met the standard in Grade 9 in the applied mathematics course.
- **Identifying struggling students early and providing support makes a difference.** Students who had not met the standard in Grade 3 but had improved to meet it in Grade 6 were considerably more likely to carry that success forward into Grade 9 than students who had not met the standard in Grade 6. Of the students who had not met the provincial standard in Grade 3 but had met it in Grade 6, 59% met the standard in Grade 9 in the applied mathematics course.

Informing Professional Practice

The following observations and suggested strategies for improvement are meant to assist educators in helping students develop and demonstrate their knowledge and skills in mathematics. The suggestions are based on an analysis of students' performance on the Grade 9 Assessment of Mathematics, Winter and Spring 2010, for both the academic and the applied courses, and on feedback from teachers who scored the assessment.

The released questions can be found in the 2009–2010 Sample Assessment Questions on the EQAO Web site, www.eqao.com.

For more information on the knowledge of content and the cognitive processes that students are required to demonstrate on the assessment, see the Grade 9 Assessment of Mathematics *Framework*, on the EQAO Web site.

For more information on the terms in bold print, refer to the list of resources at the end of this section.

Academic Course	Observations:	Strategies for Improvement:
Number Sense and Algebra	Students performed better on questions mapped to the skill Knowledge and Understanding than on questions mapped to Application or Thinking. Scorers of the open-response questions observed that many students made errors converting 6% into decimal form.	Continue to provide students with opportunities to practise converting percentages into decimals in a variety of contexts (e.g., commission, sales tax and other rates). Continue to provide students with problems that involve using algebraic skills in a variety of contexts. Instruct students in how to use manipulatives, and allow their use to aid in the visualization of abstract concepts.
Linear Relations	Students performed well on simple questions involving linear equations. Students had difficulty with questions whose answers are more open-ended. Students had more difficulty answering the open-response questions in this strand than they did those in the other strands. Scorers of the open-response questions observed that students had difficulty with the mathematical terminology “direct” or “partial variation” and “initial value.” Many students considered initial value to be the value for one unit.	Provide students with opportunities to solve open-ended problems and discuss the strategies used and differences in the answers. Use the reading and writing strategies outlined in <i>Think Literacy: Cross-Curricular Approaches, Grades 7–12: Mathematics, Grades 7–9</i> to teach students to organize the information in problems and solve them. Encourage students to use mathematical terminology during class discussions and when working with peers.
Analytic Geometry (Academic Only)	Students performed well on the open-response questions in this strand. Students performed fairly well on questions that required them to determine the slopes and y-intercepts of lines. Students were not as successful on the question that required them to calculate speeds given a graph with two different scales.	Provide students with opportunities to graph relationships using different scales and to calculate slopes using these graphs. Continue to provide opportunities for students to make connections between ordered pairs, points on a graph and the corresponding equation.

Academic Course	Observations:	Strategies for Improvement:
Measurement and Geometry	Students performed well on the open-response questions in this strand. Students performed well on multiple-choice and open-response questions that required them to determine the measures of angles. Scorers of the open-response questions noted that students made assumptions about angle measures without considering geometric properties. Students performed the least well on the question about the perimeter of a composite 2-D shape that involved semicircles.	Continue to provide students with problems that require them to consider composite shapes with circular parts (e.g., a circle inscribed in a square) and to determine the unlabelled dimensions of one shape using the dimensions of the other shapes. Require students to write justifications for angle measures that include relevant geometric properties. Continue to review timelines to ensure that the expectations in this strand receive an appropriate amount of instructional time.
General Observations on the Mathematics Data	Overall, students were the least successful on multiple-choice and open-response questions mapped to the skill Thinking. They were most successful on questions mapped to the skill Knowledge and Understanding. Students continue to miss important details and make incorrect assumptions when answering all types of mathematics questions.	Continue to provide students with opportunities to solve multi-step problems in various contexts across all strands. Reinforce the Four-Step Problem-Solving Model. Provide opportunities for students to discuss different problem-solving strategies and present different solutions through group strategies such as math congress. Provide students with exemplars to demonstrate work at various levels of performance. Continue to model working backward as a tool to verify a solution.
Students with Special Education Needs (Excluding Gifted)	Students with special education needs continue to perform less well than the general population and less well than English language learners. Overall, students with special education needs demonstrated a similar pattern of relative strengths and weaknesses to that of the general population.	Continue to differentiate instruction using the Universal Design for Learning for all students, but particularly for those with special education needs. Review the allowed accommodations in the <i>Guide for Accommodations and Special Provisions, Winter and Spring 2010</i> and assign them to students individually. Provide the same accommodations regularly for classroom assessments.
English Language Learners	English language learners performed well on open-response questions in the strand Measurement and Geometry. Although English language learners continue to perform less well than the general population, the gap in overall performance continues to decrease.	Continue to provide multiple opportunities for English language learners to solve problems in contexts using a variety of tools, such as manipulatives and graphic organizers. Reinforce mathematical terminology through small-group presentations.
Gender	Overall, compared to last year, there was greater similarity between the performances of male and female students.	Continue to provide opportunities for mixed-gender group work. Rotate roles in the groups to give opportunities for all members to lead.

Applied Course	Observations:	Strategies for Improvement:
Number Sense and Algebra	Overall, students were not as successful on questions in this strand as on those in other strands. Students performed well on multiple-choice questions that required them to substitute into an algebraic equation and solve for an unknown value. Students had difficulty with multiple-choice questions requiring multiple steps. Scorers of open-response questions reported seeing an increase in highlighting, circling and underlining of important information in the question prompts.	To help students gain a conceptual understanding of algebra, continue to provide students with manipulatives and instruction on how to use them. Provide students with multiple opportunities to practise algebraic skills in all strands (e.g., solving for the unknown in a measurement problem or a linear equation) and for more complicated multi-step problems. Continue to teach organizational strategies for answering open-response questions (e.g., highlight important information, reread the prompt). Continue to encourage students to check the reasonableness of their answers and to reread the question to ensure they have answered it fully.
Linear Relations	As in previous years, students performed better on the questions in this strand than on those in the other strands. Students were successful on questions that required them to determine the value of a linear relationship given a graph or description of the relationship. Students were not as successful on multiple-choice questions that required them to determine other representations of a linear relationship (e.g., graphs, equations or tables of values) given one representation. Students performed well on the open-response questions in this strand. However, scorers of open-response questions noted that students had difficulty demonstrating an understanding of initial value and direct versus partial variations.	Continue to provide students with opportunities to explore the graphs of relationships in many contexts. Model how to create appropriate scales to accommodate given data with a many-to-one or many-to-many correspondence. Provide opportunities for students to make connections between the different representations of linear relationships (e.g., graphs, equations, tables of values). Encourage students to use mathematical terminology during class discussions and when working with peers.
Measurement and Geometry	Students performed well on simple questions that required them to determine measures of missing angles. Students had difficulty answering the open-response questions in this strand.	Continue to provide students with a variety of problems that require them to determine measures of missing angles and to justify their answers using geometric properties. Model the checking of answers by working backward to determine whether the solution is correct.

Applied Course	Observations:	Strategies for Improvement:
General Observations on the Mathematics Data	Overall, students were least successful on multiple-choice and open-response questions mapped to the skills Application and Thinking and most successful on those mapped to Knowledge and Understanding. Students continue to demonstrate difficulty solving multi-step problems. Similar to last year, students misinterpreted or missed important details in questions in all strands. Scorers noted that fewer students left open-response questions blank than in previous years.	Continue to provide students with opportunities to solve multi-step problems in various contexts across all strands. Reinforce the Four-Step Problem-Solving Model for students. Model various problem-solving strategies for students (e.g., look for a pattern, guess and check and make a table, picture or diagram) and present different solutions to problems through group strategies such as math congress. Support students by providing exemplars of various levels of performance. Encourage students to check their answer by considering its reasonableness and reviewing the question to ensure they have answered it fully. Continue to encourage students to attempt all questions in their course work.
Students with Special Education Needs (Excluding Gifted)	Students with special education needs continue to perform less well than the general population. Students with special education needs continue to exhibit the same pattern of relative strengths and weaknesses as does the general population.	Continue to differentiate instruction using the Universal Design for Learning for all students, but particularly for those with special education needs. Review the allowed accommodations in the <i>Guide for Accommodations and Special Provisions, Winter and Spring 2010</i> and assign them to students individually. Provide the same accommodations regularly for classroom assessments.
English Language Learners	English language learners performed less well than students with special education needs. Overall, English language learners exhibited the same pattern of relative strengths and weaknesses as did the general population. English language learners were more successful on questions that did not involve specific mathematical terminology.	Continue to provide multiple opportunities for English language learners to solve problems in contexts using a variety of tools, such as manipulatives and graphic organizers. Reinforce mathematical terminology through small-group presentations.
Gender	Overall, male students performed better than female students, especially on questions involving linear relationships.	Continue to provide opportunities for mixed-gender group work. Rotate roles in the groups to give opportunities for all members to lead.

If you are reading the version of this document found on the EQAO Web site, www.eqao.com, please use the hyperlinks to the listed resources.

Conceptual understanding: Go to page 74 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* for a brief discussion of the link between procedural knowledge and conceptual understanding at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

Differentiated instruction: Go to

- pages 23 and 36–47 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM), Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy* for outlines of differentiation based on various student and learning factors at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMDevMathLit.pdf>
- “Professional Learning Guide: Differentiated Instruction” for what differentiated instruction means in the classroom and considerations relating to its implementation at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/differentiatedInstruction.pdf>
- pages 14–15 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* for an overview at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>
- the webcast *Differentiated Instruction: Continuing the Conversation* at <http://www.curriculum.org/secretariat/march29.shtml>
- the webcast *Differentiating Mathematics Instruction* at <http://www.curriculum.org/secretariat/may28.shtml>

English language learners: Go to

- *TIPS for English Language Learners in Mathematics, Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy for All* for support for teachers of English language learners in Grade 9 applied courses at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/ELLMath4All.pdf>
- *Many Roots, Many Voices: Supporting English Language Learners in Every Classroom: A Practical Guide for Ontario Educators* for insights on ways to assist English language learners at <http://www.edu.gov.on.ca/eng/document/manyroots/manyroots.pdf>

Exemplars: Go to

- *The Ontario Curriculum Exemplars, Grade 9* at <http://www.edu.gov.on.ca/eng/curriculum/secondary/math9ex/>
- EQAO’s sample assessment questions, which include scoring guides, item-specific rubrics and sample student responses at <http://www.eqao.com/Educators/Secondary/09/09.aspx?Lang=E&gr=09&Aud=Educators&App=Educators>

Four-Step Problem-Solving Model: Go to page 12 of *The Ontario Curriculum, Grades 1–8: Mathematics, 2005* at <http://www.edu.gov.on.ca/eng/curriculum/elementary/math18curr.pdf>

Graphic organizers: Go to

- page 25 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM), Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy* for an overview at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMDevMathLit.pdf>
- “Professional Learning Guide: Graphic Organizers” at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/graphicOrganizers.pdf>
- *Think Literacy: Cross-Curricular Approaches, Grades 7–12: Mathematics, Grades 7–9* for examples of graphic organizers at <http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/ThinkLitMath.pdf>

Manipulatives (concrete materials): Go to

- *Professional Learning Guide: Manipulatives* at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/manipulatives.pdf>
- page 22 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM), Grades 7, 8, 9 Applied and 10 Applied: Developing Mathematical Literacy* at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMDevMathLit.pdf>
- pages 48–50 and 58 of *Leading Math Success: Mathematical Literacy, Grades 7–12: The Report of the Expert Panel on Student Success in Ontario* for a list of essential manipulatives at <http://www.edu.gov.on.ca/eng/document/reports/numeracy/numeracyreport.pdf>
- the PowerPoint presentation *Family and Community Connections: Manipulatives and Technologies* for examples of the use of manipulatives at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/library.html#family>

Math congress: Go to *Teaching Mathematics Through Problem Solving* at [www.curriculum.org/LNS/coaching/files/ppt/july4/MathProblem Solving.ppt](http://www.curriculum.org/LNS/coaching/files/ppt/july4/MathProblemSolving.ppt)

Model: Go to pages 63–64 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* for suggestions on modelling at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

Problem-solving strategies: Go to

- page 2 of *Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM): Mathematical Processes* at <http://www.edu.gov.on.ca/eng/studentsuccess/lms/files/tips4rm/TIPS4RMProcesses.pdf>
- pages 12–13 of *TIPS: Mathematics 2* for information about the role of students and teachers in selecting and applying a problem-solving strategy at <http://www.curriculum.org/csc/library/tips/section2/ccmathprocess.pdf>
- pages 38–44 of *A Guide to Effective Instruction in Mathematics, Kindergarten to Grade 6: Volume Two, Problem Solving and Communication* at http://www.eworkshop.on.ca/edu/resources/guides/Guide_Math_K_6_Volume_2.pdf

Reading and writing strategies: Go to *Think Literacy: Cross-Curricular Approaches, Grades 7–12: Mathematics, Grades 7–9* at <http://www.edu.gov.on.ca/eng/studentsuccess/thinkliteracy/files/ThinkLitMath.pdf>

Students with special education needs: Go to

- the numeracy segments of the webcast *High-Yield Strategies to Improve Student Learning* at <http://www.curriculum.org/secretariat/may2.shtml>
- *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

Universal Design for Learning: Go to

- pages 10–13 of *Education for All: The Report of the Expert Panel on Literacy and Numeracy Instruction for Students with Special Education Needs, Kindergarten to Grade 6* at <http://www.edu.gov.on.ca/eng/document/reports/speced/panel/speced.pdf>

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