



Competencies and Characteristics

Mathematics

Cycle 3
2001-2002

Extracted from

The Québec Education Program

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Legend

I have used the following conventions to help identify when a characteristic of a competency is/was introduced.

First, if a competency/characteristic was introduced in Cycle 1 but is no longer shown in the listings of Cycle 2 you will see

C 1[competency/characteristic description]

The competency/characteristic has not been removed but has been identified with a C 1 (for Cycle 1) in front of the listing and square brackets around the description so that you are able to see what was introduced previously.

Second, a competency/characteristic that was listed in Cycle 1 and is still listed in Cycle 2 will be entered without any extra symbols.

Third, a new competency/characteristic to the Cycle 2 listing will have a plus sign + in front of it.

Fourth, a new competency/characteristic to the Cycle 3 listing will have two plus signs ++ in front of it.

COMPETENCY 1 • TO SOLVE A SITUATIONAL PROBLEM RELATED TO MATHEMATICS				
	Evaluation Criteria			
	Production of a correct solution (procedure and final answer)			
	Oral or written explanation of the main aspects of the solution			
	+ Appropriate oral or written explanation of how the solution was validated			
COMPETENCY 2 • TO REASON USING MATHEMATICAL CONCEPTS AND PROCESSES				
	Evaluation Criteria			
	Appropriate analysis of a situation involving applications			
	Choice of mathematical concepts and processes appropriate to the given situation involving applications			
	Appropriate application of the chosen processes			
	Correct justification of actions or statements by referring to mathematical concepts and processes			
COMPETENCY 3 • TO COMMUNICATE BY USING MATHEMATICAL LANGUAGE				
	Evaluation Criteria			
	Correct interpretation of a message (oral or written) using mathematical language			
	Correct production of a message (oral or written) using mathematical language			

LEARNING AND STRATEGY				
ARITHMETIC: UNDERSTANDING AND WRITING NUMBERS	• Natural numbers			
	C 1 { natural numbers less than 1000 (units, tens, hundreds): reading, writing, digit, number, counting, one-to-one correspondence, representation, comparison, classification, order, equivalent expressions, writing numbers in expanded form, patterns, properties (even numbers, odd numbers), number line]			
	+ natural numbers less than 100 000 (thousands, ten thousands): reading, writing, representation, comparison, classification, order, equivalent expressions, writing numbers in expanded form, patterns, properties (squares, prime and compound numbers), number line			
	++ natural numbers less than 1 000 000 (hundred thousands): reading, writing, representation, comparison, classification, order, equivalent expressions, writing numbers in expanded form, patterns, number line			
	++ power, exponent			
	approximation			
	• Fractions			
	C 1 [fractions related to the student's everyday life]			
	+ fractions based on a whole or a collection of objects: reading, writing, numerator, denominator, various representations (using objects or pictures), equivalent parts, comparison with 0, $\frac{1}{2}$ and 1			
	++ fractions: reading, writing, numerator, denominator, various representations, order, comparison, equivalent expressions, equivalent fractions			
	++ percentages			

LEARNING AND STRATEGY (cont)			
ARITHMETIC: UNDERSTANDING AND WRITING NUMBERS (cont)	+ • Decimals		
	C 2 [up to two decimal places (tenths, hundredths): reading, writing, various representations, order, equivalent expressions, writing numbers in expanded form]		
	++ up to three decimal places (tenths, hundredths, thousandths): reading, writing, various representations, order, equivalent expressions, writing numbers in expanded form		
	+ approximation		
	++ • Using numbers		
	++ converting from one type of notation to another: writing fractions, decimal numbers or percentages		
	++ choosing the most suitable notation for a given context		
	++ • Integers		
	++ reading, writing, comparison, order, representation		
	ARITHMETIC: MEANING OF OPERATIONS INVOLVING NUMBERS	• Natural numbers	
C1 [operation, operation sense: addition (adding, uniting, comparing), sum, subtraction (taking away, complement, comparing), difference, term, missing term, number line, multiplication (repeated addition, Cartesian product) and division (repeated subtraction, sharing, number of times x goes into y)]			
C 1 [choice of operation: addition, subtraction]			
+ operation sense: multiplication (e.g. repeated addition, Cartesian product), product, factor, multiples of a natural number, division (repeated subtraction, sharing, number of times x goes into y), quotient, remainder, dividend, divisor, set of divisors of a natural number, properties of divisibility			
+ choice of operation: multiplication, division			
meaning of an equality relation (equation), meaning of an equivalence relation			
relationships between the operations			
C1 [property of operations: commutative law]			

ARITHMETIC: MEANING OF OPERATIONS INVOLVING NUMBERS (cont)	C2 [+ property of operations: associative law]			
	++ property of operations: distributive law			
	++ order of operations (series of operations involving natural numbers)			
	+ • Decimals			
	C 2 [+ operation sense: addition and subtraction]			
	++ operation sense: multiplication and division			
	++• Fractions			
	++ operation sense (using objects and diagrams):addition, subtraction and multiplication by a natural number			
ARITHMETIC: OPERATIONS INVOLVING NUMBERS	+ • Natural Numbers			
	C 1[approximating the result of an operation: addition, subtraction]			
	+ approximating the result of an operation: addition, subtraction, multiplication, division			
	C 1[own processes for mental computation: addition, subtraction]			
	+ own processes for mental computation: addition, subtraction, multiplication, division			
	operations to be memorized:			
	C 1[additions (0 + 0 to 10 + 10) related to the corresponding subtractions]			
	C2 [+ multiplications (0 · 0 to 10 · 10) related to the corresponding divisions]			
	C 1[own processes for written computation: addition, subtraction]			
	C1 [+ own processes for written computation: multiplying a three-digit number by a one-digit number]			
	C1 [+ own processes for written computation: dividing a three-digit number by a one-digit number]			
	C2 [+ conventional processes for written computation: adding two four-digit numbers]			
	C2 [+ conventional processes for written computation: subtracting a four-digit number from a four-digit number such that the difference is greater than 0]			

ARITHMETIC: OPERATIONS INVOLVING NUMBERS (cont)	++ conventional processes for written computation: multiplying a three-digit number by a two-digit number			
	++ conventional processes for written computation: dividing a four-digit number by a two-digit number, expressing the remainder as a decimal that does not go beyond the second decimal place			
	++ series of operations in accordance with the order of operations			
	patterns: series of numbers, family of operations			
	+ finding prime factors			
	++ divisibility by 2, 3, 4, 5, 6, 8, 9, 10			
	+ • Decimals			
	+ approximating the result of an operation			
	C2 [+ mental computation: addition, subtraction]			
	++ mental computation: addition, subtraction, multiplication, division			
	C2 [+ written computation: addition, subtraction; the result must not go beyond the second decimal place]			
	++ written computation: multiplication whose product does not go beyond the second decimal place, division by a natural number less than 11			
	++ mental computation: multiplication and division of decimals by 10, 100, 1000			
	++ • Fractions			
	++ establishing equivalent fractions			
	++ reducing fractions, irreducible fractions			
	++ adding fractions using objects and diagrams, when the denominator of one fraction is a multiple of the denominator of the other fraction			
	++ subtracting fractions using objects and diagrams, when the denominator of one fraction is a multiple of the denominator of the other fraction			
	++ multiplying a natural number by a fraction, using objects and diagrams			

GEOMETRY: GEOMETRIC FIGURES AND SPATIAL SENSE

• Space			
C 1 [locating objects and getting one's bearings in space, spatial relationships (e.g. in front, on, to the left)]			
locating objects on an axis			
C1,2 [locating objects in a plane]			
+ locating objects in a Cartesian plane			
• Solids			
C 1 [comparing and constructing prisms, pyramids, spheres, cylinders, cones]			
C 1 [comparing objects in the environment with solids]			
C 1 [attributes (number of faces, base): prisms, pyramids]			
+ describing prisms and pyramids in terms of faces, vertices and edges			
C2 [+ nets for prisms and pyramids]			
C2 [+ classification of prisms and pyramids]			
++ recognizing nets for convex polyhedrons			
++ testing Euler's theorem (relationship between faces, vertices and edges of a convex polyhedron)			
• Plane figures			
C 1 [comparing and constructing figures made with closed curved lines or closed straight lines]			
C 1 [identifying a square, rectangle, triangle, circle and rhombus]			
C 1 [describing a square, rectangle, triangle and rhombus]			
C2 [+ describing convex and nonconvex polygons]			
C2 [+ describing quadrilaterals, including trapezoids and parallelograms: parallel segments, perpendicular segments, right angles, acute angles, obtuse angles]			
C2 [+ classifying quadrilaterals]			
C2 [+ constructing parallel lines and perpendicular lines]			
++ describing triangles: right triangles, isosceles triangles, scalene triangles, equilateral triangles			

GEOMETRY: GEOMETRIC FIGURES AND SPATIAL SENSE (cont)			
• Plane figures (cont)			
++ classifying triangles			
++ measuring angles in degrees using a protractor			
++ studying the features of a circle: radius, diameter, circumference, central angle of measure			
• Frieze patterns and tessellations			
C2 [+ observing and producing patterns using geometric figures]			
C 1 [congruent figures]			
C2 [+ observing and producing (grids, tracing paper) frieze patterns by means of reflections: reflection, line of reflection]			
C2 [+ observing and producing tessellations by means of reflections]			
++ observing and producing (grids, tracing paper) frieze patterns by means of translations: translation, translation arrow (length, direction, sense)			
++ observing and producing tessellations by means of translations			
MEASUREMENT			
• Lengths: estimating and measuring			
C 1 [dimensions of an object]			
C 1 [unconventional units: comparison, construction of rulers]			
C 1 [conventional units (m, dm, cm)]			
C2 [+ conventional units (m, dm, cm, mm)]			
++ conventional units (km, m, dm, cm, mm)			
+ relationships between units of measure			
C2 [+ perimeter, calculating the perimeter]			
• Angles: estimating and measuring			
C2 [+ comparing angles (right, acute, obtuse)]			
++ degree			
+ • Surface areas: estimating and measuring			
C2 [+ unconventional units]			
++ conventional units (m^2, dm^2, cm^2), relationships between the units of measure			

GEOMETRY: GEOMETRIC FIGURES AND SPATIAL SENSE (cont)			
+ • Volumes: estimating and measuring			
C2 [+ unconventional units]			
++ conventional units (m ³ , dm ³ , cm ³), relationships between the units of measure			
++ • Capacities: estimating and measuring			
++ unconventional units			
++ conventional units (L, mL), relationships between the units of measure			
• Masses: estimating and measuring			
++ unconventional units			
++ conventional units (kg, g), relationships between the units of measure			
• Time: estimating and measuring			
C1,2 [conventional units, duration (day, hour, minute, second, daily cycle, weekly cycle, yearly cycle)]			
++ relationships between the units of measure			
++ • Temperatures: estimating and measuring			
++ conventional units (°C)			
STATISTICS			
Formulating questions for a survey			
Collecting, describing and organizing data using tables			
C 1 [Interpreting data using a bar graph, a pictograph and a data table]			
C 1 [Displaying data using a bar graph, a pictograph and a data table]			
C2 [+ Interpreting data using a broken-line graph]			
C2 [+ Displaying data using a broken-line graph]			
++ Interpreting data using a circle graph			
++ Arithmetic mean (meaning, calculation)			
PROBABILITY			
Experimentation with activities involving chance			
Predicting the likelihood of an event (certainty, possibility or impossibility)			

GEOMETRY: GEOMETRIC FIGURES AND SPATIAL SENSE (cont)

PROBABILITY				
	C 1[Enumerating the possible outcomes of a simple random experiment]			
	+ Probability that a simple event will occur (more likely, just as likely, less likely)			
	+ Enumerating the possible outcomes of a random experiment using a table, a tree diagram			
	++ Comparing the outcomes of a random experiment with known theoretical probabilities			
	+ Doing simulations with or without a computer			

Cultural References			
• Numbers			
C 1 [origin and creation of numbers]			
C 1 [development of systems for writing numbers]			
+ number systems (e.g. Arabic, Roman, Babylonian, Mayan): characteristics, advantages and disadvantages			
social context (e.g. price, date, telephone, address, age, quantity: mass, size)			
• Operations			
own or conventional computation processes: development, limitations, advantages and disadvantages			
technology: development (e.g. sticks, strokes, abacus, calculator, software), limitations, advantages and disadvantages			
C 1 [symbols (origin, development, need, mathematicians involved): +, -, >, <, =]			
C 2 [+ symbols (origin, development, need, mathematicians involved): ∞, \div, \neq]			
interdisciplinary or social context (e.g. history, geography, science and technology)			
Geometric figures			
interdisciplinary or social context (e.g. architecture, maps, arts, decoration)			
+ symbols (origin, development, need, mathematicians involved): $\angle, //, \perp$			
• Measurement			
systems of measurement (historical aspect)			
+ units of measure: development according to society's needs (e.g. agrarian measurements, astronomy, standard measurement, precision), instruments (rudimentary approach for measuring time, hourglass, clock)			
C 1 [symbols (origin, development, need): m, dm, cm]			
C 2 [+ symbols (origin, development, need): m, dm, cm, mm]			
++ symbols (origin, development, need): km, m, dm, cm, mm			
++ symbols (origin, development, need): kg, g, L, mL			

Cultural References (cont)				
	symbols (origin, development, need): h, min, s			
	++ symbols (origin, development, need): °C			
	++ symbols (origin, development, need, mathematicians involved): (), %			
	In each cycle, students in a given class carry out at least one individual or group project or activity related to cultural references.			
• SYMBOLS				
	C 1 [0 to 9, +, -, >, <, =]			
	C2 [+ 0 to 9, +, -, ×, ÷, >, <, =, ≠]			
	++ 0 to 9, +, -, ×, ÷, >, <, =, ≠, (), %]			
	Calculator keys [keys: 0 to 9, +, -, ×, ÷, =, ON, OFF, AC, C, CE (all clear, clear, clear last entry)]			
	++ Certain commonly used calculator functions [memories (M+, M-, MR, MC), change of sign (+/-)]			
	Numbers written using digits			
	Writing fractions (a/b)			
	+ Writing decimals using a period as the decimal marker			
	++ Exponential notation			
	+ ∠, //, ⊥			
	C 1 [m, dm, cm]			
	C2 [+ m, dm, cm, mm]			
	++ km, m, dm, cm, mm			
	++ kg, g, L, mL			
	h, min, s (representation of time of day: 02:00, 2:00 a.m; representation of elapsed time: 2 h 10 min, 2:10)			
	++ °C			
	+ \$, ¢			
• VOCABULARY				
	C 1 [addition]			
	C 1 [as many as]			
	C 1 [as much as]			
	C 1 [bar graph]			
	C 1 [base of a solid]			
	C 1 [centimeter]			
	C 1 [certain event]			
	C 1 [chance]			
	C 1 [circle]			

Cultural References (cont)

VOCABULARY (cont)			
C 1[cone]			
C 1[cube]			
C 1[curved line]			
C 1[cylinder]			
C 1[day]			
C 1[decimeter]			
C 1[decreasing order]			
C 1[depth]			
C 1[difference]			
C 1[digit]			
C 1[even number]			
C 1[face]			
C 1[fewer]			
C 1[fraction]			
C 1[grouping]			
C 1[half]			
C 1[height]			
C 1[hour]			
C 1[hundreds place]			
C 1[impossible event]			
C 1[increasing order]			
C 1[...is bigger than...]			
C 1[...is equal to...]			
C 1[...is smaller than...]			
C 1[length]			
C 1[less]			
C 1[metre]			
C 1[minus]			
C 1[minute]			
C 1[more]			
C 1[natural number]			
C 1[none]			
C ![number]			
C 1[number line]			
C 1[odd number]			
C 1[one third]			
C 1[one-to-one correspondence]			
C 1[pictograph]			
C 1[plane figure]			
C 1[plus]			
C 1[possible event]			
C 1[prism]			
C 1[probable outcome]			

Cultural References (cont)

Cultural References (cont)			
VOCABULARY (cont)			
C 1[pyramid]			
C 1[quarter]			
C 1[rectangle]			
C 1[rhombus]			
C 1[second]			
C 1[series]			
C 1[side]			
C 1[solid]			
C 1[sphere]			
C 1[square]			
C 1[straight line]			
C 1[subtraction]			
C 1[sum]			
C 1[survey]			
C 1[table]			
C 1[tens place]			
C 1[triangle]			
C 1[unit]			
C 1[unit of measure]			
C 1[width]			
C2[+ acute angle]			
C2[+ angle]			
C2[+ area]			
C2[+ at least]			
C2[+ at most]			
C2[+ base ten]			
C2[+ broken-line graph]			
C2[+ Cartesian plane]			
C2[+ chance (statistics)]			
C2[+ compound number]			
C2[+ convex polygon]			
C2[+ curved body]			
C2[+ curved surface]			
C2[+ daily cycle]			
C2[+ decimal]			
C2[+ denominator]			
C2[+ dividend]			
C2[+ dividing up]			
C2[+ division]			
C2[+ divisor]			
C2[+ edge]			
C2[+ equality]			

Cultural References (cont)

Cultural References (cont)			
VOCABULARY (cont)			
C2[+ equation]			
C2[+ equivalent part]			
C2[+ event]			
C2[+ factor]			
C2[+ flat surface]			
C2[+ frieze pattern]			
C2[+ gram]			
C2[+ hundredth]			
C2[+ inequality]			
C2[+ inverse operation]			
C2[+ parallelogram]			
C2[+ ...is greater than...]			
C2[+ ...is less than...]			
C2[+ ...is not equal to...]			
C2[+ ...is parallel to...]			
C2[+ ...is perpendicular to...]			
C2[+ just as likely]			
C2[+ kilogram]			
C2[+ less likely]			
C2[+ line of reflection]			
C2[+ measuring instrument]			
C2[+ millimeter]			
C2[+ missing term]			
C2[+ more likely]			
C2[+ multiple]			
C2[+ multiplication]			
C2[+ net of a solid]			
C2[+nonconvex polygon]			
C2[+ number squared]			
C2[+ numerator]			
C2[+ obtuse angle]			
C2[+ ordered pair]			
C2[+ perimeter]			
C2[+ place value]			
C2[+ plane]			
C2[+ polygon]			
C2[+ prime number]			
C2[+ product]			
C2[+ quadrilateral]			
C2[+ quotient]			
C2[+ reference system]			

Cultural References (cont)

VOCABULARY (cont)				
C2[+ reflection]				
C2[+ remainder]				
C2[+ right angle]				
C2[+ segment]				
C2[+ surface]				
C2[+ symmetric figure]				
C2[+ ten thousands place]				
C2[+ tenth]				
C2[+ term]				
C2[+ tessellation]				
C2[+ thousand]				
C2[+ thousands place]				
C2[+ trapezoid]				
C2[+ tree diagram]				
C2[+ vertex]				
C2[+ volume]				
C2[+ weekly cycle]				
C2[+ whole]				
C2[+ yearly cycle]				
++ arithmetic mean				
++ capacity				
++ central angle				
++ circle graph				
++ circumference				
++ convex polyhedron				
++ cube of (the)				
++ degree (angle)				
++ degree Celsius				
++ diameter				
++ equilateral triangle				
++ equivalent fraction				
++ Euler's theorem				
++ exponent				
++ hundred thousands place				
++ integer				
++ irreducible fraction				
++ isosceles triangle				
++ kilometre				
++ litre				
++ mass				
++ millilitre				
++ million				

Cultural References (cont)

Cultural References (cont)				
	VOCABULARY (cont)			
	++ negative number			
	++ parenthesis			
	++ percentage			
	++ polyhedron			
	++ positive number			
	++ power			
	++ protractor			
	++ radius			
	++ right triangle			
	++ scalene triangle			
	++ square of (the)			
	++ thousandth			
	++ translation			
++ translation arrow				

Suggestions for Using Information and Communications Technologies

	Becoming familiar with the basic operations of a calculator [keys: 0 to 9, +, -, ×, ÷, =, ON, OFF, AC, C, CE (all clear, clear, clear last entry), functions: recursive with the = key]			
	++ Becoming familiar with certain commonly used calculator functions [memories (M+, M-, MR, MC), change of sign (+/-)]			
	Using technology for operations involving numbers that go beyond the scope of the material covered in these cycles			
	Using technology to present proofs related to operations			
	Using a calculator in applying different problem-solving strategies			
	Using a calculator and a computer to explore natural numbers and operations			
	+ Using a calculator and a computer to explore decimals, fractions and operations			
	Using a computer (graphics and spreadsheet software as well as simulations) in applying different problem-solving strategies			
	Using a computer (word-processing, graphics and spreadsheet software) to present information related to the solution			
	Producing a drawing (solids, plane figures, frieze patterns and tessellations) using graphics software			
	+ Using a computer to look for information			
	+ Learning to collect data using spreadsheet software			
	+ Learning to produce a graphic representation of data using spreadsheet software			
	+ Learning to do a computer simulation of a random experiment			
	+ Using the Internet to find historical accounts related to concepts studied in class			
	+ Consulting Internet Web sites on mathematics as well as glossaries and databases			
	++ Using interactive mathematics sites			

