



BRITISH
COLUMBIA

The Best Place on Earth

Ministry of
Education

Introduction to Mathematics 10-12 Pathways

January 12, 2010

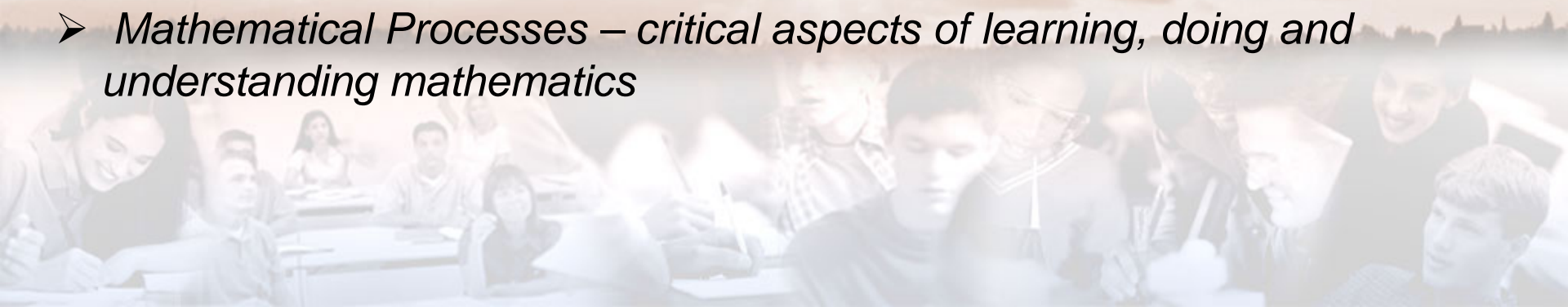
Richard V. DeMerchant

- *Key Terms*
- *Current Situation*
- *Revised WNCP CCF for 10-12 Mathematics*
- *Overview of Pathways*
- *Document Structure*
- *Sources of additional information*



Key Terms

- *WNCP – Western and Northern Canadian Protocol*
- *CCF – Common Curriculum Framework: basis for K-12 mathematics in BC, YT, AB, NT, SK, NU, MB, NB, PEI, NF*
- *Pathways – series of courses students take in high school*
- *PLO – Prescribed Learning Outcomes: specific knowledge, skills and understandings that students are required to attain by the end of a given course*
- *Als – Achievement Indicators: how students may demonstrate their achievement of the goals of a specific outcome*
- *Mathematical Processes – critical aspects of learning, doing and understanding mathematics*



➤ *Teachers*

- *Too much content for the instructional time*
- *Want to provide a deeper understanding of mathematics*
- *Students are in the “wrong” pathway*

➤ *Post Secondary*

- *Students are not prepared well enough*
- *Need a better understanding of “the basics”*

➤ *Parents*

- *Students are struggling*
- *Do not want to “close doors”*



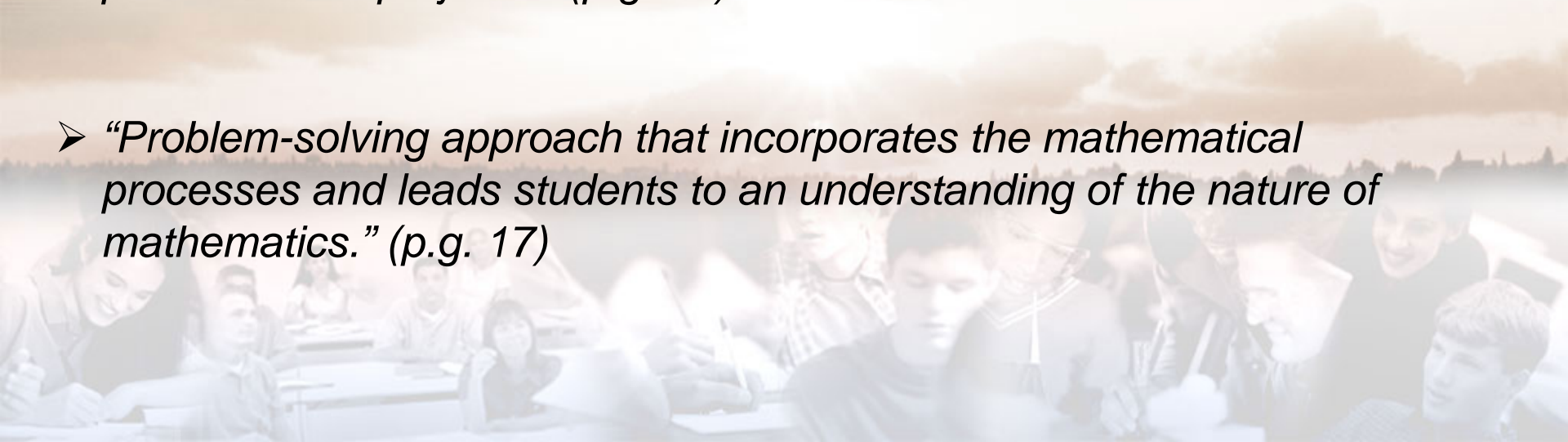
- *Overlap between Applications of Mathematics and Principles of Mathematics by design*
- *Courses differ by instructional focus*
 - *AM - practical, contextual focus*
 - *EM - practical and contextual numeracy skills and concepts*
 - *PM – more formal and theoretical*
- *Mathematical Processes included within WNCP but not explicit in BC curriculum*



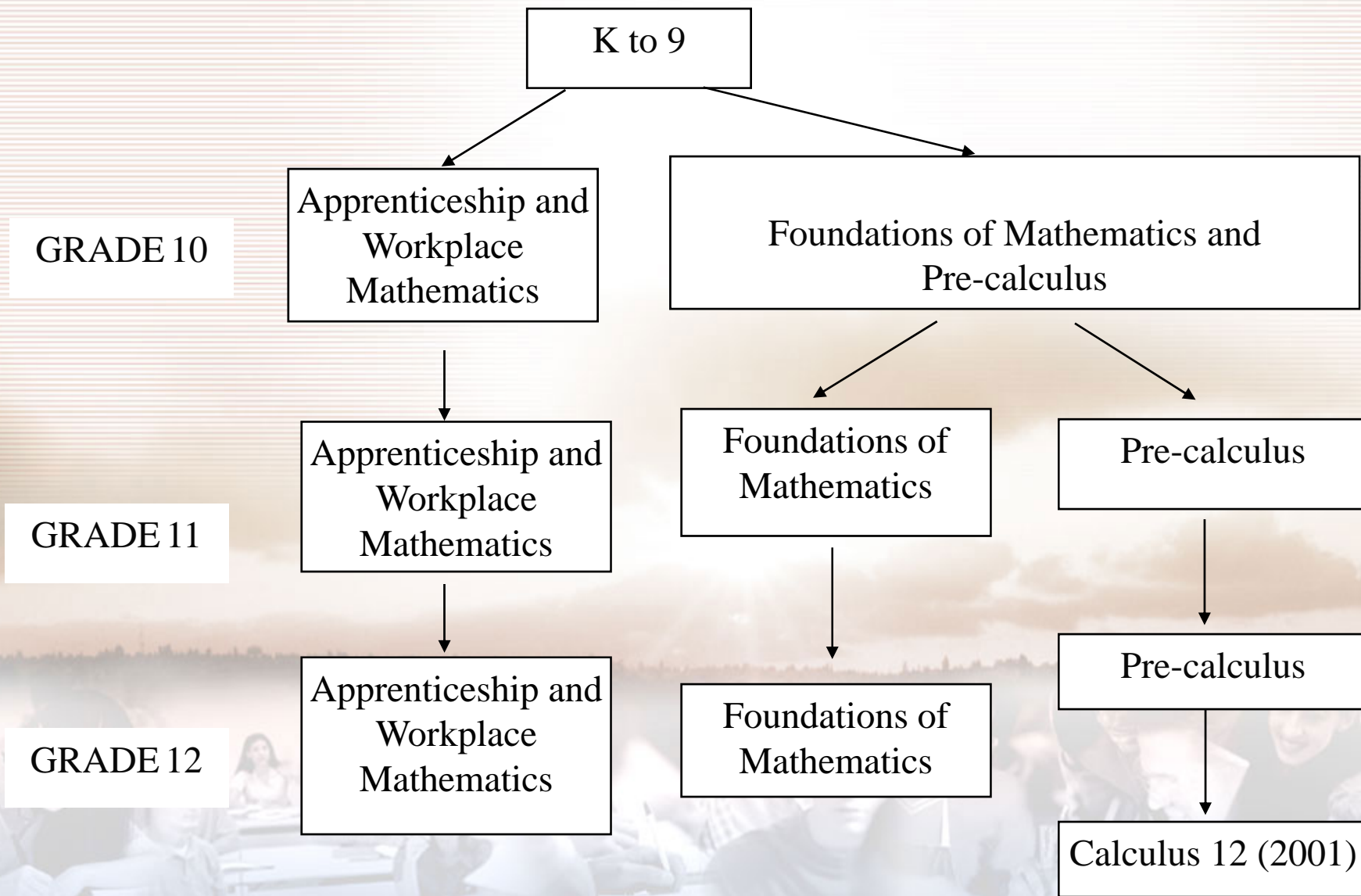
Revised WNPCP 10-12

- *Reduced overlap based on “need” of intended destination*
- *Some topics covered in previous K-9 have been moved to grades 10-12 to allow for more in-depth learning*
- *Instructional focus of all courses is to provide time for in-depth learning including the use of*
 - *Problem based learning*
 - *Contextual learning*
 - *Projects*
- *Mathematical Processes are explicit within the curriculum*
- *Address mathematical competencies needed after high school*
- *Desire to keep “both doors open”*
 - *Post secondary and career opportunities*
 - *Further study in mathematics*

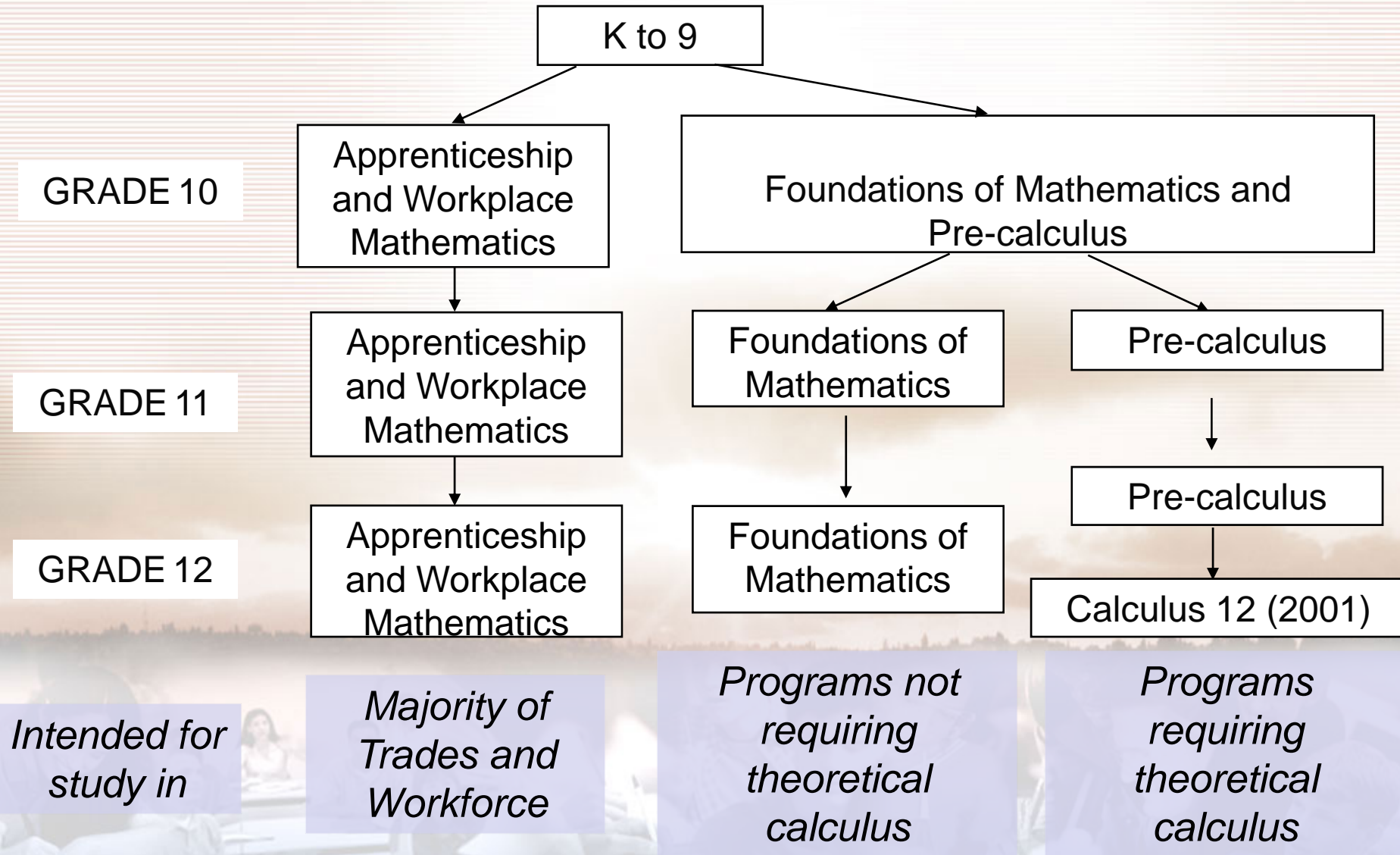
- *Reduced overlap between pathways where “each pathway is designed to provide students with the mathematical understandings, rigour and critical-thinking skills that have been identified for specific post-secondary programs of study and for direct entry into the work force.” (p.g. 16)*
- *“Wherever possible, meaningful contexts should be used in examples, problems and projects.” (p.g. 18)*
- *“Problem-solving approach that incorporates the mathematical processes and leads students to an understanding of the nature of mathematics.” (p.g. 17)*



Pathway Structure When Fully Implemented



Overview of Pathways



WNCP 10-12 Overview

	Apprenticeship and Workplace 10	Foundations of Mathematics and Pre-calculus 10	Apprenticeship and Workplace 11	Foundations of Mathematics 11	Pre-calculus 11	Apprenticeship and Workplace 12	Foundations of Mathematics 12	Pre-calculus 12
Algebra and Number	<ul style="list-style-type: none"> Proportional reasoning including unit pricing Formula manipulation and application 	<ul style="list-style-type: none"> Factors of whole numbers Irrational numbers Powers with integral and rational exponents Multiplication of polynomial expressions Common and trinomial factors 	<ul style="list-style-type: none"> Proportional reasoning including unit analysis Formula manipulation and application Numerical puzzles and games 	<ul style="list-style-type: none"> Application of rates 	<ul style="list-style-type: none"> Absolute value Radicals and radical expressions Rational expressions and equations 		<ul style="list-style-type: none"> Numerical puzzles and games 	
Financial Mathematics	<ul style="list-style-type: none"> Types of income 		<ul style="list-style-type: none"> Personal budgets Compound interest Financial services including credit cards and loans 			<ul style="list-style-type: none"> Purchasing and leasing a vehicles Viability of a small business 	<ul style="list-style-type: none"> Compound interest Analysis of renting, leasing or buying Investment portfolio 	
Geometry	<ul style="list-style-type: none"> Spatial puzzles and games Pythagorean theorem Similarity of convex polygons 		<ul style="list-style-type: none"> Two and three right triangle problems Scale Representation of 3-D objects Exploded views and component parts of 3-D objects 	<ul style="list-style-type: none"> Scale factors, areas, surface area, volume Proofs for the properties of angles and triangles Spatial puzzles and games 		<ul style="list-style-type: none"> Triangles, quadrilaterals and regular polygons Transformation of 2-D shapes and 3-D objects 		
Logic				<ul style="list-style-type: none"> Inductive and deductive reasoning 		<ul style="list-style-type: none"> Logical reasoning puzzles and games 	<ul style="list-style-type: none"> Logic puzzles and games Application of set theory Conditional statements 	
Measurement	<ul style="list-style-type: none"> SI and Imperial units and conversions Linear, area, volume, capacity, mass and temperature 	<ul style="list-style-type: none"> SI and Imperial units and conversions Surface area and volume of 3-D objects 	<ul style="list-style-type: none"> Surface area, volume and capacity in SI and Imperial 			<ul style="list-style-type: none"> Precision, accuracy, uncertainty and tolerance of instruments 		
Permutations, Combinations and Binomial Theorem							<ul style="list-style-type: none"> Fundamental counting principle Permutations and combinations 	<ul style="list-style-type: none"> Fundamental Counting Principle Permutations and combinations Binomial expansion

WNCP 10-12 Overview

Probability						<ul style="list-style-type: none"> • Interpretation of probability 	<ul style="list-style-type: none"> • Odds and probability statements • Mutually exclusive and non-exclusive events • Probability of two events 	
Relations and Functions		<ul style="list-style-type: none"> • Relationship between data, graphs and situations • Slope • Linear relations and characteristics of their graphs • Function notation • Systems of linear equations 	<ul style="list-style-type: none"> • Slope 	<ul style="list-style-type: none"> • Systems of linear equalities in two variables • Quadratic functions 	<ul style="list-style-type: none"> • Polynomial factoring • Graphs of absolute value functions • Quadratic functions • Linear-quadratics and quadratic-quadratic equations • Linear and quadratic inequalities • Arithmetic sequences • Geometric sequences • Reciprocal functions 	<ul style="list-style-type: none"> • Linear relations 	<ul style="list-style-type: none"> • Polynomials of degree less than or equal to three • Exponential and logarithmic functions • Sinusoidal functions 	<ul style="list-style-type: none"> • Operations and compositions of functions • Stretches and translations of functions • Reflections of functions • Inverse of relations • Exponential and logarithmic functions • Polynomial factoring • Graphs of polynomials of degree less than or equal to five • Radical functions • Rational functions
Research Project				<ul style="list-style-type: none"> • Historical event or area of interest involving mathematics 			<ul style="list-style-type: none"> • Current event or area of interest involving mathematics 	
Statistics			<ul style="list-style-type: none"> • Bar graphs, histograms, line graphs and circle graphs 	<ul style="list-style-type: none"> • Normal distribution, standard deviation and z-scores • Confidence intervals, confidence levels and margin of error 		<ul style="list-style-type: none"> • Measures of central tendency • Percentiles 		
Trigonometry	<ul style="list-style-type: none"> • Primary trigonometry ratios 	<ul style="list-style-type: none"> • Primary trigonometry ratios 	<ul style="list-style-type: none"> • Cosine Law and Sine Law excluding the ambiguous case 		<ul style="list-style-type: none"> • Primary trigonometry ratios • Sine Law and Cosine Law including the ambiguous case 	<ul style="list-style-type: none"> • Cosine Law and Sine Law including the ambiguous case 		<ul style="list-style-type: none"> • Angles in degrees and radians • Unit circle • Six trigonometric ratios • Sine, cosine and tangent functions • First and second degree trigonometric equations • Trigonometric identity proofs

Measurement

- *SI and Imperial (length, area, volume, capacity, mass, temperature)*
- *Regular and irregular 2-D shapes and 3-D objects*

Geometry

- *Pythagorean theorem, primary trig ratios*
- *Parallel, perpendicular and transversal lines and angles*
- *Similarity of polygons*
- *Spatial reasoning puzzles and games*

Number

- *Proportional reasoning (unit pricing, currency exchange)*
- *Gross and net pay (wages, salary, contracts, commissions, piecework)*

Algebra

- *Formula manipulation*



Measurement

- *SI and Imperial (surface area, volume, capacity)*

Geometry

- *Right triangles*
- *Scale*
- *Perspective views of 3-D objects including exploded views and component parts*

Number

- *Personal budgets*
- *Compound interest*
- *Financial services, credit options*
- *Numerical reasoning puzzles and game*

Algebra

- *Formula manipulation*
- *Slope*
- *Proportional reasoning and unit analysis*

Measurement

- Measuring instruments (precision, accuracy, uncertainty, tolerance)

Geometry

- Sine Law and Cosine Law
- Polygons
- Transformations of 2-D shapes and 3-D objects

Number

- Buying and leasing vehicles and small business analysis
- Logical reasoning puzzles and game

Algebra

- Linear relations

Statistics

- Measures of central tendency
- Percentiles

Probability

- Applications of probability

Foundations of Mathematics and Pre-calculus 10

Measurement

- SI and imperial measurement (linear, surface area and volume)
- Primary trigonometric ratios

Algebra and Number

- Irrational numbers
- Powers with integral and rational exponents
- Multiplication of polynomial expressions
- Common and trinomial factoring

Relations and Functions

- Relationships between data, graphs and situations
- Representations of linear relations
- Characteristics of graphs of linear relations including slope
- Equations of linear relations
- Function notation
- Systems of linear equations in two variables

Measurement

- Proportional reasoning (rates, scale diagrams, scale factors)

Geometry

- Properties of angles and triangles (proofs and problems), sine law and cosine law

Logical Reasoning

- Inductive and deductive reasoning
- Spatial reasoning puzzles and games

Statistics

- Normal distribution (standard deviation, z-scores)
- Confidence intervals, confidence levels and margin of error

Relations and Functions

- Systems of linear inequalities in two variables
- Characteristics of quadratic functions

Mathematics Research Project

- Historical event or area of interest involving mathematics

Financial Mathematics

- Costs and benefits of renting, leasing and buying
- Investment portfolios

Logical Reasoning

- Numerical and logical reasoning puzzles and games
- Applications of set theory
- Conditional statements

Probability

- Odds and probability
- Mutually exclusive and non-mutually exclusive events
- Fundamental counting principle, permutations and combinations

Relations and Functions

- Polynomial, exponential, logarithmic and sinusoidal representations of data

Mathematics Research Project

- Historical event or area of interest involving mathematics

Algebra and Number

- Absolute value
- Radicals and radical expressions
- Rational Expressions (permissible and non-permissible values, operations, simplify)

Trigonometry

- Primary trigonometric ratios, sine law and cosine law

Relations and Functions

- Polynomial factoring
- Absolute value graphs
- Quadratic functions (standard form, general form, characteristics)
- Quadratic equations
- Systems of linear–quadratic and quadratic-quadratic equations
- Linear and quadratic inequalities
- Arithmetic and geometric sequences and series
- Reciprocal linear and quadratic functions

Trigonometry

- Angles in standard position (degrees and radians)
- Equation of unit circle
- Six trigonometric ratios
- Trigonometric functions (sine, cosine, tangent) and equations (1st and 2nd degree)
- Trigonometric identities

Relations and Functions

- Composition of functions
- Translation and stretches of functions (graphic and algebraic)
- Inverses of relations
- Exponential and logarithmic functions and equations
- Polynomials of degree greater than two (factoring, graphing, analyzing)
- Radical and rational functions

Permutations, Combinations and Binomial Theorem

- Fundamental counting principle, permutations, combinations and binomial theorem

Overview of 10-12 Courses – The Blankets

AWM 10
Measurement
Geometry
Number
Algebra

AWM 11
Measurement
Geometry
Number
Algebra
Statistics

AWM 12
Measurement
Geometry
Number
Algebra
Statistics
Probability

Foundations 11
Measurement
Geometry
Logical Reasoning
Statistics
Relations and Functions
Mathematics Research Project

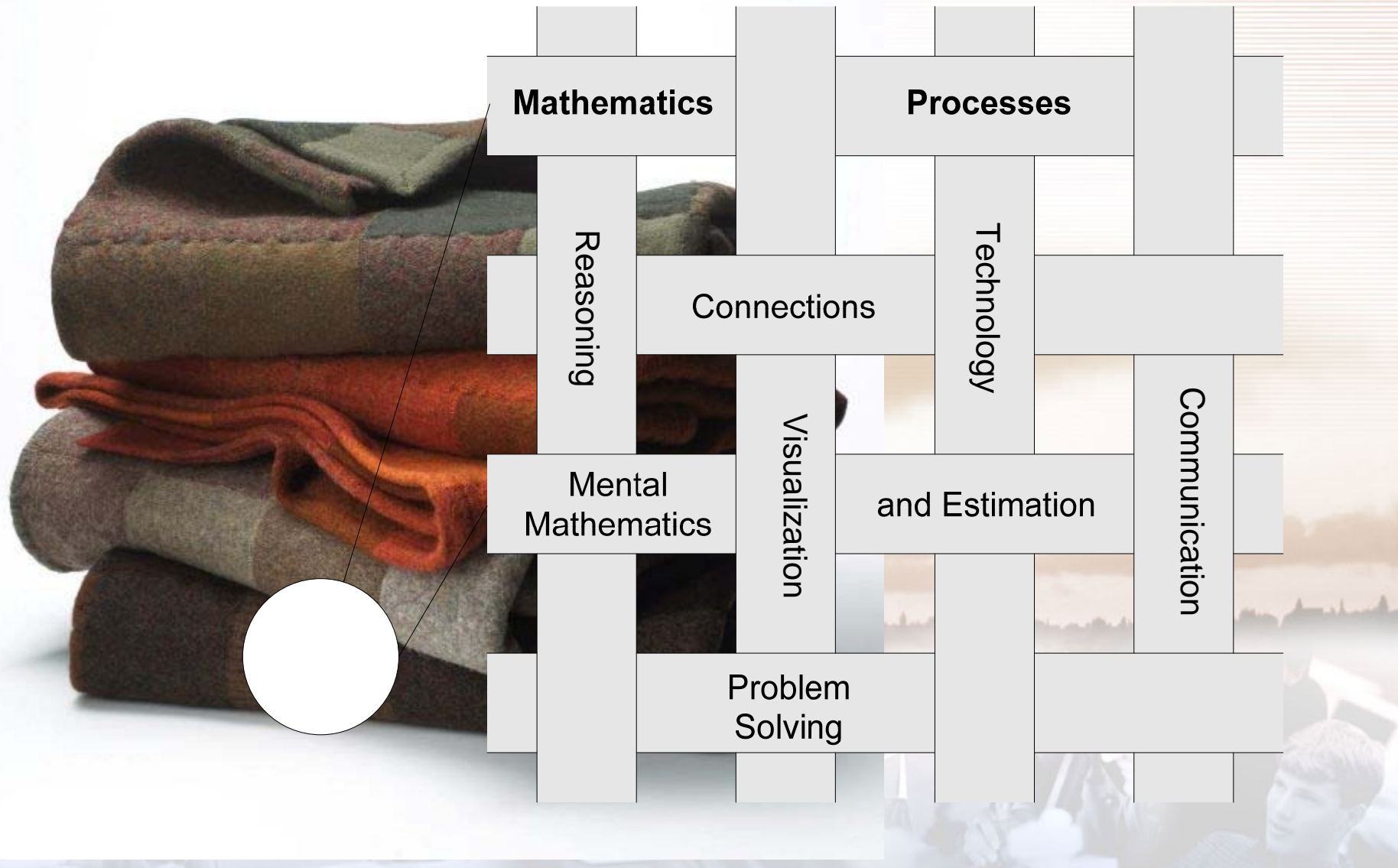
Foundations 12
Financial Mathematics
Logical Reasoning
Probability
Relations and Functions
Mathematics Research Project

“Common 10”
Measurement
Algebra and Number
Relations and Functions

Pre-calculus 11
Algebra and Number
Trigonometry
Relations and Functions

Pre-calculus 12
Trigonometry
Relations and Functions
Permutations, Combinations and Binomial Theorem

Mathematical Processes – The Threads



Mathematics Processes

Students are expected to:

- use **communication** in order to learn and express their understanding
- make **connections** among mathematical ideas, other concepts in mathematics, everyday experiences and other disciplines
- demonstrate fluency with **mental mathematics and estimation**
- develop and apply new mathematical knowledge through **problem solving**
- develop mathematical **reasoning**
- select and use **technology** as a tool for learning and solving problems
- develop **visualization** skills to assist in processing information, making connections and solving problems.

*All seven processes should be used in the **teaching and learning** of mathematics. Each specific outcome includes a list of relevant mathematical processes. The **identified processes are to be used as a primary focus of instruction and assessment.***

CCF Document Structure: Content, Processes & Assessment

Organizer



Big Idea



Reminder



[C] Communication	[PS] Problem Solving
[CN] Connections	[R] Reasoning
[ME] Mental Mathematics and Estimation	[T] Technology
	[V] Visualization

Mathematics Research Project	General Outcome: Develop an appreciation of the role of mathematics in society.
Specific Outcomes <i>It is expected that students will:</i>	Achievement Indicators <i>The following set of indicators may be used to determine whether students have met the corresponding specific outcome.</i>
<p>1. Research and give a presentation on a historical event or an area of interest that involves mathematics. [C, CN, ME, PS, R, T, V]</p>	<p>1.1 Collect primary or secondary data (statistical or informational) related to the topic.</p> <p>1.2 Assess the accuracy, reliability and relevance of the primary or secondary data collected by:</p> <ul style="list-style-type: none"> identifying examples of bias and points of view identifying and describing the data collection methods determining if the data is relevant determining if the data is consistent with information obtained from other sources on the same topic. <p>1.3 Interpret data, using statistical methods if applicable.</p> <p>1.4 Identify controversial issues, if any, and present multiple sides of the issues with supporting data.</p> <p>1.5 Organize and present the research project, with or without technology.</p>

Student competency



• content

• processes



How you know a student has met the PLO

What is the bottom line?

The WNCP curriculum aims to:

- *promote a constructivist philosophy,*
- *develop BOTH conceptual and procedural understanding of mathematics,*
- *incorporate a problem solving approach to learning and teaching mathematics,*
- *provide knowledge, skills and understandings for post-secondary studies and the workforce, and*
- *develop a positive attitude toward mathematics.*

Your Questions

Q: How do the “new” courses align with the current curriculum?

A: The new WNPC courses have been restructured and the content is significantly different from the previous courses. As a result educators are encouraged to examine the content of each course.

Q: Will the course codes remain the same for the high school math courses?

A: No. Since the courses are significantly different new courses codes have been assigned for each course. Course codes will be:

Apprenticeship and Workplace Mathematics: AWM 10, AWM 11 and AWM 12

Foundations and Pre-calculus Mathematics 10: FMP 10

Foundations of Mathematics: FOM 11 and FOM 12

Pre-calculus Mathematics: PREC 11 and PREC 12

Q: Can students take more than one mathematics pathway?

A: Yes.

Q: When will the resources that match the new curriculum be available?

A: Conditional approval has been given for the grade 10 resources pending French translations. Final approval will be given in April 2010.

Your Questions

Q: Who is developing the resources for each course?

A: The new WNCP courses have been restructured and the content is significantly different from the previous courses. As a result educators are encouraged to examine the content of each course.

Course	Publisher
Apprenticeship and Workplace 10, 11 and 12	Pacific Educational Press
Foundations and Pre-calculus Mathematics 10	McGraw Hill Pearson Education
Foundations of Mathematics 11 and 12	Announcement Pending
Pre-calculus 11 and 12	Announcement Pending

Q: What will the post-secondary institutions require for general admission?

A: Post-secondary institutions are in the process of determining their admission requirements. Information on admission requirements will be discussed during the January 26 and 27 Eliminate session.

Where can I get more information?

Curriculum documents

- http://www.bced.gov.bc.ca/irp/irp_math.htm

Mathematics 10-12 FAQs

- www.bced.gov.bc.ca/irp/program_delivery/math1012_faq.pdf

WNCP CCF, background research, resources

- www.wncp.ca click on Subject Area/Projects then Mathematics

Four Additional Illuminate Sessions

Jan 26 @ 3:30pm	Choosing a High School Mathematics Pathway
Jan 27 @ 2:30 pm	Introduction to Mathematics 10-12 Pathways and Choosing a Mathematics Pathway
Feb 9 @ 3:30 pm	Grade 10 Provincial Mathematics Exams
Feb 23 @ 3:30 pm	Mathematical Processes in the High School Mathematics Curriculum

Further Questions

Additional questions can be sent by email to:

Richard V. DeMerchant
Coordinator
Education Standards Unit
BC Ministry of Education
richard.demerchant@gov.bc.ca

Dave Van Bergeyk
President
British Columbia Association of Mathematics
Teachers
davevanb@telus.net

Please include your email and phone number

