

BAA Mathematics Explorations 10

District Name: Kamloops/North Thompson

District Number: 73

Developed by: Tracy Buck

Date Developed: June 2006

School Name: Clearwater Secondary School

Principal's Name: Rick Kienlein

Board/Authority Approval Date:

Board/Authority Signature:

Course Name: Mathematics Explorations 10

Grade Level of Course: Grade 10

Number of Course Credits: 4

Number of Hours of Instruction: 110

Prerequisite(s): Math 9

Special Training, Facilities or Equipment Required: Computer/Internet access, Geometer's Sketchpad, many Math resource books

Rationale:

Most students learn Mathematics by memorizing and replicating algorithms because their Mathematics course curriculums do not allow time for the exploration of ideas. As a result, many students soon lose interest in the subject or quickly decide "Math is hard".

This course will allow students to investigate, explore, and develop interesting and relevant topics within Mathematics. It will offer students a view of Mathematics that they do not see in the regular Mathematics courses offered. Students will look at the beauty of Mathematics by exploring many unique concepts. They will develop problem solving skills as they work both individually and collaboratively to explore these concepts. They will write about Mathematics, create art with Mathematics, discuss Mathematics, research Mathematics, and, of course, practice Mathematics.

Course Synopsis:

Students will look at the fundamental processes of problem solving and game strategy. These processes will be developed from theoretical to practical as the course progresses.

Students will explore the history of Mathematics, Mathematicians and their contributions, number patterns, geometric theorems and proofs, statistical analysis, graph theory, Mathematics in art and life, and Mathematics in careers.

Student progress will be assessed through projects, problems, group work, journals, research papers, and quizzes.

Organizational Structure:

Unit/Topic	Title	Time	% of Final Mark
Unit A	Problem Solving (throughout the course)	20	18
Unit B	Game and Puzzle Strategies (throughout the course)	20	18
Unit 1	History of Mathematics and Mathematicians	7	6
Unit 2	Number Patterns	20	18
Unit 3	Geometric Theorems, Proofs, and Patterns	7	6
Unit 4	Statistical Analysis	10	9
Unit 5	Graph Theory	7	6
Unit 6	Mathematics in Art and Life	15	15
Unit 7	Mathematics in Careers	4	4
Total		110	100

Unit/Topic/Module Descriptions:

Unit A: Problem Solving

Overview:

Students will learn the problem solving process and use this process with the many problem solving strategies introduced.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Use the problem solving process throughout the course
- Employ various problem solving strategies throughout the course
- Solve a variety of problems, theoretical and real

Instructional Component: (20 hours throughout the course)

5 step problem solving process	1 hour
10 problem solving strategies	5 hours
Practice problems: As a class	2 hours
Collaboratively in groups	8 hours
Individually	4 hours

Assessment Component: (% of unit)

Class participation	10%
Group problems sets	40%
Individual problem solving journals	50%

Learning Resources:

Problem Solving, Tips for Teachers by Phares G. O'Daffer

The Heart of Mathematics - An invitation to effective thinking by Edward B. Burger and Michael Starbird

The Liar Paradox and the Towers of Hanoi - The Ten Greatest Math Puzzles of All Time

by Marcel Danesi

American Math league contest problems

Canadian Mathematics Competitions Problems, Problems, Problems, Volume 1

Cariboo College High School Mathematics Contest Problems 1973-1992 by Jim Totten, ed.

Entertaining Mathematical Puzzles by Martin Gardner

The First 7th and 8th Grade Math League Problem Book by Steven R. Conrad, Daniel Flegler

Flatland by Edwin A. Abbott

My Best Mathematical and Logic Puzzles by Martin Gardner

Problem-mathics by Carole E. Greenes, Rika Spungin, Justine M. Dombrowski

Test Your Logic by George J. Summers

Algebra Problems by Reuben Schadler

Unit B: Game and Puzzle Strategies

Overview:

Games and puzzles require a higher level of problem solving. This unit will allow students to work on more involved problems where sophisticated strategies are required.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Develop strategies in both simple and complex games
- Develop strategies in completing various types of puzzles

Instructional Component: (20 hours throughout the course)

Puzzle Strategy	2 hours
Game Strategy	2 hours
Tournament strategy	1 hour
Chess	3 hours
Go	3 hours
Card games	4 hours
Puzzles	5 hours

Assessment Component: (% of unit)

Game rule summaries	30%
Strategies summaries	30%
Class participation	10%
Individual Journal	30%

Learning Resources:

The Mathematics of Games by John D. Beasley

Projects to Enrich School Mathematics, Level 3 by Leroy Sachs, ed.

Projects to Enrich School Mathematics, Level 2 by Leroy Sachs, ed.

Chess

Go

Cards

Puzzles

Unit 1: History of Mathematics and Mathematicians

Overview:

Students will develop a timeline of the highlights of events and people in Mathematics.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Recognize several important Mathematicians and their contributions
- Create a timeline of important events and people in Mathematics
- Research and report on one Mathematician

Instructional Component: (7 hours)

Develop a Math timeline	3 hours
Review research methods	1 hour
Research a Mathematician	3 hours

Assessment Component: (% of unit)

Group work – timeline	40%
Research paper -- Mathematician	60%

Learning Resources:

Historical Connections in Mathematics by Wilbert Reimer, Luetta Reimer

The Story of Mathematics by Lloys Motz and Jefferson Hane Weaver

A Short Account of The History of Mathematics by W.W.R. Ball

Writing Math Research Papers by Robert Gerver

Famous Problems and Their Mathematicians by Art Johnson

Historical Connections in Mathematics, Volume II

Historical Connections in Mathematics, Volume III

Agnesi to Zeno by Sanderson Smith

Internet

Library

Unit 2: Number Patterns

Overview:

Students will explore various number base systems including binary, number divisibility, Pascal's triangle, Fibonacci and the Golden Ratio, prime and composite numbers, Pythagorean triples, and more.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Count a group of items and do basic arithmetic operations in various base systems
- Determine the divisibility of a number without actually dividing
- Predict numbers on Pascal's triangle using the patterns they observed
- Demonstrate examples of Fibonacci numbers in real life
- Demonstrate the Golden Ratio in life
- Distinguish between prime and composite numbers
- Factor composite numbers using various methods
- Recognize and create Pythagorean triples
- Identify infinite patterns and limits

Instructional Component: (20 hours)

Base systems	3 hours
Number divisibility	2 hour
Pascal's triangle	3 hours
Fibonacci and the Golden Ratio	4 hours
Prime and composite numbers	3 hours
Pythagorean triples	3 hours
Infinite patterns and limits	2 hours

Assessment Component: (% of unit)

Base systems	10%
Number divisibility	10%
Pascal's triangle	10%
Fibonacci and the Golden Ratio	10%
Prime and composite numbers	10%
Pythagorean triples	10%
Infinite patterns and limits	10%
Quizzes	30%

Learning Resources:

Amusements in Mathematics by H.E. Dudeney

The Book of Think by Marilyn Burns

Images of Infinity by Ray Hemmings, Dick Tahta

Mathemagic by Royal Vale Heath

Math for Smarty Pants by Marilyn Burns

Number Mysteries by Cyril Hayes, Dympna Hayes

Divine Proportion Phi in Art, Nature, and Science by Priya Hemenway

The Heart of Mathematics - An invitation to effective thinking by Edward B. Burger and Michael Starbird

The Book of Numbers

Internet

Unit 3: Geometric Theorems, Proofs and Patterns

Overview:

Students will be introduced to the basics of geometric theorems and their proofs and the patterns of polygons and polyhedra.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Be able to establish a proof with a firm foundation and a logical sequence
- Explore geometric patterns using Geometer’s Sketchpad

Instructional Component: (7 hours)

Basic theorems for points, lines and planes	2 hours
Writing proofs	2 hours
Using Geometer’s Sketchpad	1 hour
Polygons and Polyhedra	2 hours

Assessment Component: (% of unit)

Geometric problems	30%
Proofs	30%
Individual journals	20%
Polygon /Polyhedra project	20%

Learning Resources:

- 101 Puzzles in Thought and Logic by C. R. Wylie Jr.
- Fantastic Lateral Thinking Puzzles by Edward J. Harshman
- The Great Book of Math Teasers by Robert Muller
- The Heart of Mathematics - An invitation to effective thinking by Edward B. Burger and Michael Starbird
- Geoboard Teacher’s Manual by John Bradford
- The Write Tool to Teach Algebra by Virginia Gray
- Geometry 8-12 by Zoe Wakelin
- Mathematics 11 by Addison and Wesley
- Methods of Geometry by James T. Smith
- Geometer’s Sketchpad program

Unit 4: Statistical Analysis

Overview:

Students will develop and administer a survey then analyze the data using linear regression

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

Write an appropriate survey

Correctly administer a survey

Use a computer to plot graphs and analyze data from a survey

Instructional Component: (10 hours)

Writing surveys	2 hours
-----------------	---------

Administering surveys and collecting data	3 hours
---	---------

Using linear regression to analyze data	5 hours
---	---------

Assessment Component: (% of unit)

Project	80%
---------	-----

Group work	20%
------------	-----

Learning Resources:

The Heart of Mathematics - An invitation to effective thinking by Edward B. Burger and Michael Starbird

Applied Linear Regression by Sanford Weisberg

Computer program for linear regression

Unit 5: Graph Theory

Overview:

Students will be introduced to the basics of Graph Theory.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Recognize graphs and subgraphs
- Create and identify graph trees
- Create proper edge colourings
- Create proper vertex colourings
- Recognize and draw planar graphs
- Apply knot theory to problems

Instructional Component: (7 hours)

Graphs and subgraphs	1 hour
Graph trees	1 hour
Edge and vertex colourings	2 hours
Planar graphs	2 hours
Knot theory	1 hour

Assessment Component: (% of unit)

Graph Theory problems	50%
Quizzes	20%
Project	30%

Learning Resources:

Graph Theory With Applications by J.A. Bondy and U.S.R. Murty

Knots - Mathematics With a Twist by Alexei Sossinsky

Introduction to Graph Theory by Robin J. Wilson

Why Knot? By Colin Adams

Knots by Heather McLeay

Internet

Unit 6: Mathematics in Art and Life

Overview:

Students will be introduced to symmetry, patterns, and perspective in art and life.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

- Recognize the Golden Ratio
- Find symmetry in art and life
- Find patterns in art and life - tessellations, fractals, kaleidoscopes
- Identify perspective
- Use the above to create an original art piece

Instructional Component: (15 hours)

Symmetry – Scott Kim	3 hours
Patterns – tessellations, fractals, kaleidoscopes	3 hours
Perspective – Escher	3 hours
Golden Ratio – Fibonacci	3 hours
Consider the work of various other artists	3 hours

Assessment Component: (% of unit)

Projects	40%
Original art piece	40%
Individual journal	20%

Learning Resources:

Fractals by Jonathan Choate, Robert L. Devaney

Escher on Escher, Exploring the Infinite by M.C. Escher

Mathographics by Robert Dixon

The Life and Works of M.C. Escher (video)

The History Channel -- Engineering Disasters (video)

Library

Internet

Unit 7: Mathematics in Careers

Overview:

Students will investigate careers in the field of Mathematics.

Curriculum Organizers and Learning Outcomes:

It is expected that students will:

Research a Math career for:

Education

Skills

Pay

Job opportunities

Recognize that all careers use Mathematics in some way

Instructional Component: (4 hours)

Research a career for the Math used 2 hours

Research a Mathematics career 2 hours

Assessment Component: (% of unit)

Research projects 100%

Learning Resources:

Math... Who Needs It? by Province of British Columbia Ministry of Education (video)

Library

Internet

Career center