Mathematics

Overview

Western Northern Canadian Protocol for Mathematics

The NWT government mandates that teachers use the mathematics curriculum outlined by the Western Northern Canadian Protocol (www.wncp.ca). This document categorizes mathematics learning outcomes into four main strands:

- **Number**
  - Number Concepts
    - The students will:
      - Use numbers to describe quantities.
      - Represent numbers in multiple ways.
  - Number Operations
    - The students will:
      - Demonstrate an understanding of and proficiency with calculations.
      - Decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

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- **Patterns and Relations**
  - Patterns
    - The students will:
      - Use patterns to describe the world and to solve problems.
  - Variables and Equations
    - The students will:
      - Represent algebraic expressions in multiple ways.
  - Relations and functions (applies to grades 10 –12)

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- **Shape and Space**
  - Measurement
    - The students will:
      - Describe and compare everyday phenomena, using either direct or indirect measurement.
  - 3-D Objects and 2-D Shapes
    - The students will:
      - Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.
  - Transformations
    - The students will:
      - Perform, analyze and create transformations.

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- **Statistics and Probability**
  - Data Analysis
    - The students will:
      - Collect, display and analyze data to make predictions about a population.
  - Chance and Uncertainty
    - The students will:
      - Use experimental or theoretical probability to represent and solve problems involving uncertainty.

Mathematical Processes

There are critical components that students must encounter in a mathematics program in order to achieve the goals of mathematics education and to encourage lifelong learning in mathematics.

- Communication
  - Communicate mathematically

- Connections
  - Connect mathematical ideas to other concepts in mathematics, to everyday experiences and to other disciplines

- Estimation and Mental Mathematics
  - Use estimation and mental mathematics where appropriate

- Problem solving
  - Relate and apply new mathematical knowledge through problem solving

- Reasoning
  - Reason and justify their thinking

- Technology
  - Select and use appropriate technologies as tools to solve problems

- Visualization
  - Use visualization to assist in processing information, making connections and solving problems

These seven interrelated mathematical processes are intended to permeate teaching and learning

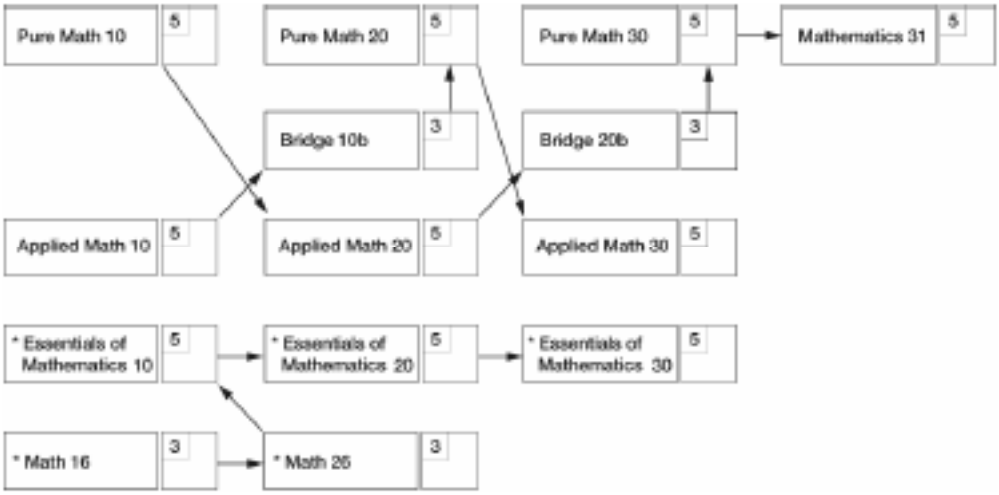
Courses sequences and numbering

Course Sequences and Numbering

RECOMMENDED TRANSFER POINTS

Curriculum is designed to accommodate transfer between course sequences at particular points. The following transfer points are recommended. However, special circumstances may warrant student transfer at other points in the sequence. The local school/District Education Authority/Divisional Education Council shall have a policy that states clearly the criteria to be met by a student who wishes to change course sequence. Students can receive "double" credits (for example, Science 15 and Science 10) when they take a higher course. However, only 5 of these count as science credits. The other 5 are part of the 26 unspecified credits required for graduation.

Mathematics Program Recommended Transfer Points



* Transfer between courses is at the discretion of the Principal.

Strategies
MATHEMATICS—PROBLEM SOLVING

Problem solving is the real life use of mathematics. Knowing the basic facts, but not being able to use these facts to solve problems, means that a student only understands half of the mathematics program. Students must be taught to problem solve by teaching the vocabulary, the problem solving methods, and thinking skills.

Some ideas for teaching problem solving:

• Do one problem solving activity each math lesson

•Use a calculator to do the calculations for word problems so that you can teach the process, not calculations

•Begin with oral problem solving

•Use pictures with word problems

•Use Rhebus sentences

•Use graphs

•Relate the problems to the objectives being taught

•Use computer programs such as:

- The Factory
- Puzzle Tanks
- King's Rule
- Memory
- Math Blaster
- See additional in technology links section

•Use Interactions for examples of problems.

•Use Mental Math Activities

•Refer to Math Curriculum for ideas and more examples***!***

Problem Solving Strategies

- Identify key words – What does the problem say?
  - Discuss and explain any words students do not know
  - Read it aloud
  - Underline key words
  - Restate the problem in different words

- Identify wanted, given and needed information.
  - Knowledge of unstated facts may be necessary

- Interpret pictures.
  - Bridge the gap between the concrete level and the abstract or symbolic level
  - Students tell what happened before, during and after the picture
  - Symbols or objects in pictures could represent something

- Identify extraneous information.
  - Tell students some problems can contain information that is not needed to solve the problem
  - Circle information needed

- Act it out.
  - Could involve the student physically themselves, or student can use manipulative to represent people or any other information that will make a problem more relevant
  - Helpful for kinesthetic learners
  - Helps to develop visual images of data

- Ask relevant questions.
  - Understand what the problem is saying

- Restate the problem in your own words.
  - Restate verbally – the problem situation is most important. Actual numbers need not be retold (use 'some').

- Guess – Check- Refine.
  - Guessing is estimating, not wild prediction based on no information
  - Guesses can be refined as the process is carried out
  - Can lead to the solution of complex problems

- Collect and organize information
  - Tally sheets, tables, lists or pictographs are useful
  - Sort and classify by discovering attributes of the information

- Use or look for a pattern.
  - Analyze, duplicate and extend patterns visually, auditorially, orally and physically
  - Don't assume students can identify what a pattern is
  - Could create a table to further extend the pattern
  - Problem solver can predict "what will come next" or what will happen again and again

- Make diagrams and models.
    - Enables students to easily identify the parts of the problem

- Use manipulatives
    - Focuses on the concrete level of thinking
    - Particularly useful for younger students
    - Good for introducing new concepts
    - Manipulatives can represent things in the problem
    - Helps to focus on essential elements
    - Can be used to represent things that cannot be brought into the classroom

- Use a simpler problem.
    - Some problems can appear too complex
    - Restating and understanding in simpler terms first can help before attempting to solve the original problem
    - A similar simpler problem can often be solved and a complicated procedure simplified using tables, lists or diagrams

- Construct flow charts.
    - Excellent way of representing a set of instructions
    - All steps are shown, as well as what choices there are, and in what order the instructions must be done
    - Symbols to use:
        - Circle: start or stop (beginning or end)
        - Rectangle: processing (an action to be done or what to do)
        - Diamond: decision (where a yes or no choice must be made. Often more than one alternative.)
    - No dead ends in a flow chart

- Always an arrow(s) showing what to do and where to go next
- Working backwards
    - Effective if the problem tells the final result and asks students to find the steps used to get there
    - Visualize or record the order of events described in the problem

- Write and solve a number sequence.
    - For some problems it is necessary to understand the problem and translate the valid information into a mathematical equation or sentence
    - Students need to identify the appropriate operation
    - Different but related number sentences may also be correct.

- Choose and apply the appropriate operation.
    - Students need to identify key words which will help them determine the required operation

- Use logic or reason.
    - Information could be displayed in a chart of matrix
    - Some problems can be solved by more than one approach
    - Logic or reason can be used in these types of problems
    - Any logical way could be considered an appropriate way

- Some may use phrases like “if. . .then”, “if something is true then. . .”

- Restate the problem with the answer.
  - If the students can restate the problem, it is likely that they have a sound understanding of what has occurred

- Check the answer.
  - An important part of the problem solving process
  - For instance, in problems with patterns, always check back to see that the pattern follows the one given

- Consider the possibility of other answers.
  - Other approaches should be tried if the first one does not work
  - Some problems may have more than one solution.

- Review the solution process.
  - Provide opportunities to verbalize understanding of the problem solved, the plans developed as well as the solution
  - Discuss how one problem may be similar to others they have solved

- Identify and apply relationships.
  - In some problems, data can be interpreted, and a formula devised to arrive at a solution
  - Formulas can be learned for later similar problems

- Work with a partner or a group.
  - Students will fell more confident than working alone and may develop strategies they learn form one another

Reference: Problem Solving Strategies. Math to the Max. Edmonton Public Schools. 2000.

Math Journals

How can writing in math class improve student achievement?

- Because the process of writing requires organization and clarification of thoughts, students are actively involved in thinking and learning about mathematics
- It helps students to make sense of mathematics
- It provides teachers with valuable information not available from right/wrong tests that can help drive instructional decisions
- It helps students deepen and extend their understanding

Formats:
Scribbler with wide lines as space for drawing ideas
Duo tang
Scrapbook
A file folder

Personalizing: To personalize the journals, it is suggested that each student decorate his math journal in a mathematical way – an easy first introduction to the math journal with the students.

Scheduling
Journal writing could be done daily, once or twice a week or at the end of each unit. The more opportunities there are for writing, the better able students will be able to write. It is suggested that the math journals remain in the classroom at all times. The journal can be integrated into language arts.

Prompts:
Today I learned. . .
Today I learned. . .
I am wondering about. . .
This is what I like about math. . .
My strategy for_____ is. . .
Something interesting about _____ is. . .
The answer is _____ and I think this because _____
Write about what _____ is. . .
Write all you know about _____
What is _____?
Math is important because _____
Write a letter to your partner to explain how to. . .
What about what it takes to be a good partner.
How does working in groups help you with math?

Tips:
Keep your expectations high for your students but don't be too disappointed with their math journal writing in the beginning.
Encourage students to use words, numbers, symbols and pictures in their writing
Before writing, take time for a class discussion or meet with those students who don't know what to write
Make your feedback specific and encouraging - not merely praise – and if you make suggestions, allow rewrites

Math Journals. Math to the Max. Edmonton Public Schools. 2000