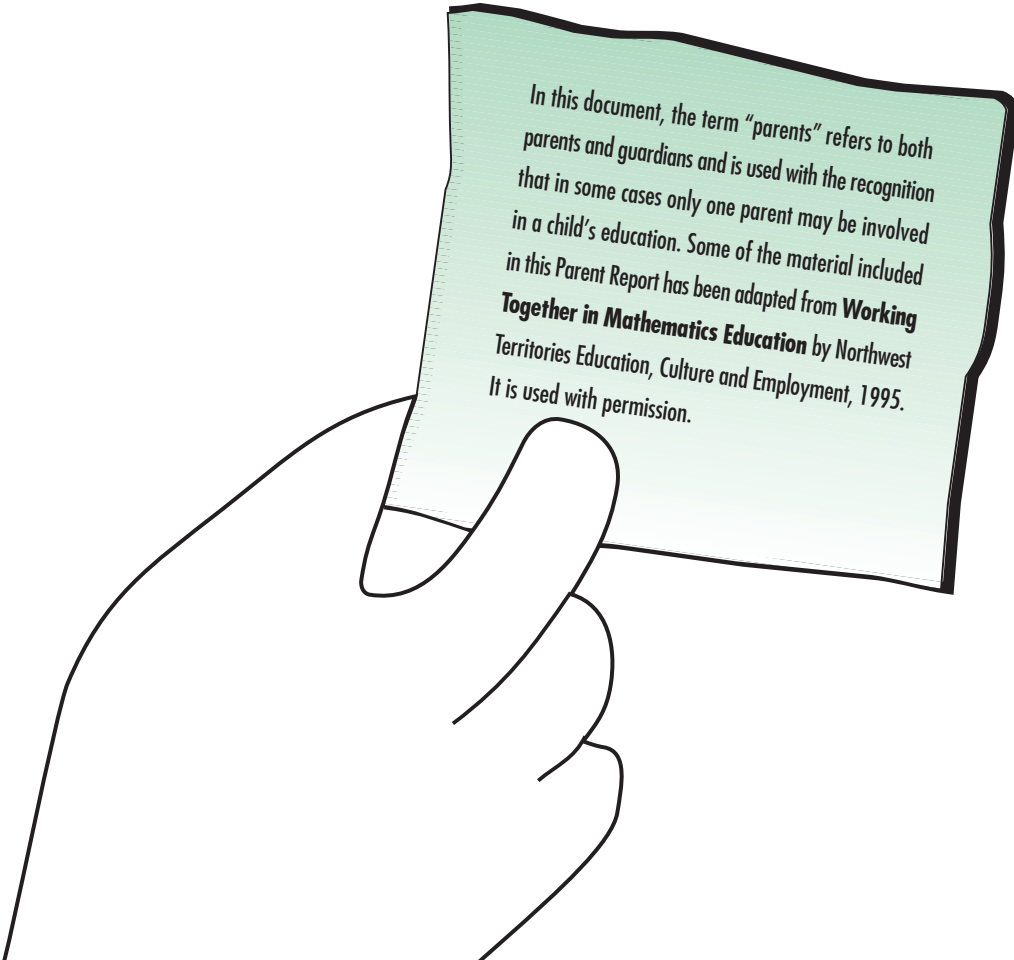


Working Together in Mathematics Education

MATH MATTERS



A Parent Report on What's New in Math



In this document, the term "parents" refers to both parents and guardians and is used with the recognition that in some cases only one parent may be involved in a child's education. Some of the material included in this Parent Report has been adapted from **Working Together in Mathematics Education** by Northwest Territories Education, Culture and Employment, 1995. It is used with permission.

DEAR PARENTS:

This Parent Report is designed to share important new developments in mathematics.

The first is the way the new curriculum for math has been developed. The new curriculum framework is based on outcomes defined in a project called the Western Canadian Protocol for Collaboration in Basic Education, K-12.

This ongoing project has brought together the four western provinces and two territories as partners to identify the knowledge, skills and attitudes students should have at the end of each grade. Work is complete for mathematics and language arts and is continuing on other subjects.

We believe that the common curriculum frameworks developed under the Western Canadian Protocol and the Manitoba curriculum frameworks based on them will greatly improve the quality of teaching, learning and assessing in our schools.

The new frameworks set high expectations for teachers and students of mathematics. They cover more material and at greater depth than earlier curricula. Most importantly, they make the development of thinking skills the central focus of all learning experiences.

In practical terms, these newly developed curriculum frameworks will make it easier for students to move from school to school without jeopardizing their progress. Expectations will be consistent from province to territory, school to school, classroom to classroom.

This Parent Report will highlight some features of the new mathematics frameworks and discuss ways parents can help their child learn. By working together, we can help ensure that every child can enjoy and experience success in mathematics.

- Visit the Education, Training and Youth Web site at: <http://www.edu.gov.mb.ca>



SIGNING OF AN AGREEMENT FOR WESTERN EDUCATION COLLABORATION

The signing of the Western Canadian Protocol for Collaboration in Basic Education, Kindergarten to Grade 12, in December of 1993 marked the beginning of joint development projects in education for the four western provinces and two territories.

Projects completed under this agreement include **The Common Curriculum Framework for K - 12 Mathematics**.

The common curriculum framework for mathematics identifies what the four provinces and two territories believe students should know and be able to do at the end of each grade. It is then up to each jurisdiction to decide how the framework is to be used for their students. In Manitoba, the western framework has been used to develop our own curriculum framework documents for mathematics.

These curriculum frameworks help ensure that our expectations for Manitoba students are as high as those for students anywhere in Western Canada. They increase students' opportunities for self-fulfilment and for their roles as leaders who will take Manitoba into the 21st century.

WHY

IS IT IMPORTANT TO STUDY MATHEMATICS?

Mathematics is much more than arithmetic ($= + - \times \div$).

Mathematics is

- a useful tool in everyday life
- a language
- the study of patterns and relations
- a way of thinking
- an art

Students who are successful in mathematics

- are “numerate” in arithmetic and possess a wide variety of mathematics skills
- have more self-confidence in problem-solving situations
- are better prepared to make informed decisions
- are more capable of processing information
- are more competent at understanding the world around them
- have more career opportunities open to them
- can apply mathematical processes to many areas of their life and work
- appreciate the value of math as a useful tool in everyday living
- are better prepared to live in a world of changing technology



TAKING OFF INTO THE 21st CENTURY



To be ready for the 21st century, a student needs to

appreciate and
value math

commit to
lifelong
learning



communicate
and reason
mathematically

use mathematics
confidently
to solve problems

be able to use
mathematics
to contribute
to our society



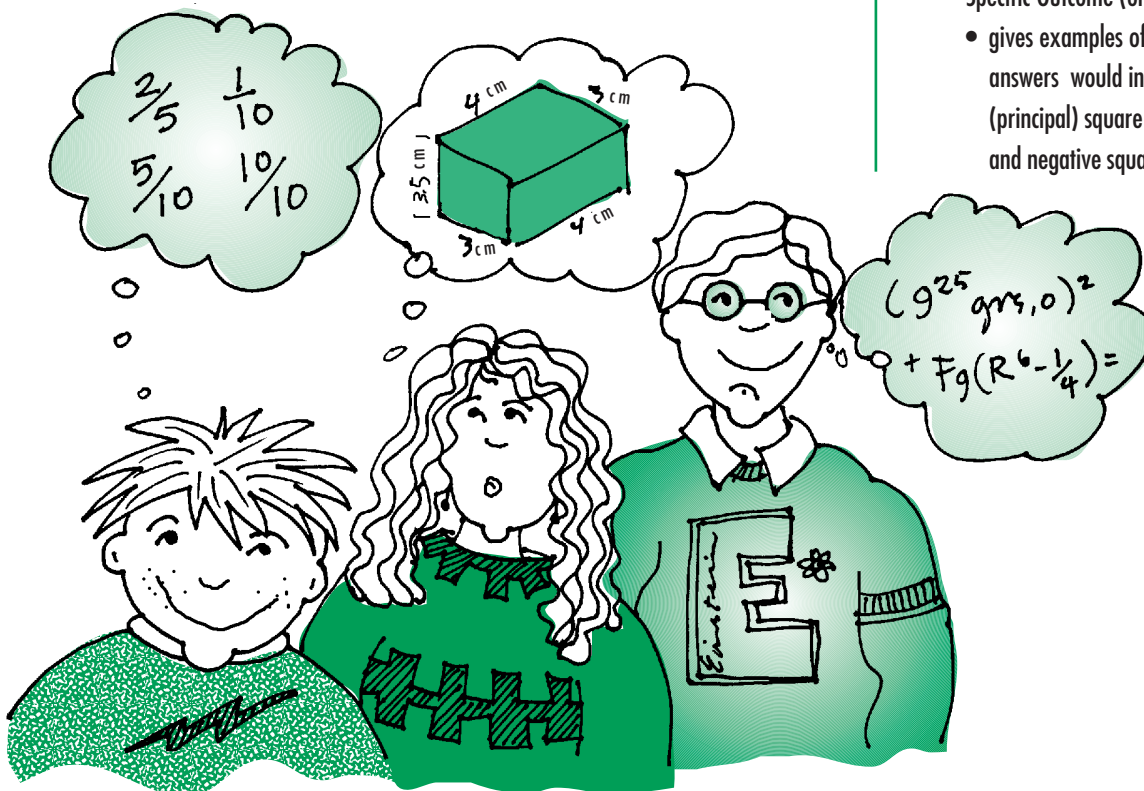
WHAT ARE STUDENT LEARNING OUTCOMES?

Learning outcomes are statements that describe what students are expected to know and be able to do in a specific subject area by the end of a course or grade.

Each general learning outcome includes specific learning outcomes. Students are expected to show that they have attained the specific learning outcomes for a particular course or grade while building on and maintaining previous outcomes.

A Representative Sample of Mathematics Outcomes

Grade 3	Grade 6	Senior 1 (formerly Grade 9)
<p>General Outcome The student develops a number sense for whole numbers 0 to 1000 and explores fractions (fifths and tenths).</p> <p>Specific Outcome (one of many)</p> <ul style="list-style-type: none"> counts by 2s, 5s, 10s, and 100 to 1000, using random starting points. 	<p>General Outcome The student solves problems involving perimeter, area, surface area, volume and angle measurement.</p> <p>Specific Outcome (one of many)</p> <ul style="list-style-type: none"> designs and constructs rectangles of a given area, using natural numbers. 	<p>General Outcome The student explains and illustrates the structure and the interrelationship of the sets of numbers within the rational number system and develops a number sense of powers with integral exponents and rational bases.</p> <p>Specific Outcome (one of many)</p> <ul style="list-style-type: none"> gives examples of situations where answers would involve the positive (principal) square root, or both positive and negative square roots of a number.



HOW CAN YOU SUPPORT YOUR CHILD IN SCHOOL?

Numeracy learning is a shared responsibility.

1. Work with your child to set up a study area in the home that is comfortable and away from too many distractions.



2. Be available to provide help and support if it is needed. If you are unable to help, assist your child in finding someone who can.



3. Make it a habit to talk with your child about school work. Even if you aren't familiar with the topic, you can still be an interested listener.



4. Keep in touch with your child's teacher. Stay informed about your child's progress (notes, phone calls, visits). Encourage the teacher to contact you about successes and achievements, not just problems.



5. Make sure your child has access to scraps, junk and art materials for building and making things.



6. Establish a regular study time when homework assignments, review work or reading are to be done.

Negotiate a time that is flexible enough to fit your child's extracurricular schedule.



7. Attend parent orientation nights, open houses, special events, parent-teacher interviews. Read school newsletters. Discuss all of these with your child.



8. Make sure your child has a good night's sleep, eats breakfast and gets to school on time every day.

9. Invite your child to watch or assist you whenever possible. It is an excellent way for a child to gain background experience and to develop self-confidence in trying new things.



10. Have fun with problem solving on an ongoing basis at home. Use your child's experiences and everyday situations to create and solve problems.



WHAT WILL STUDENTS LEARN IN MATHEMATICS?

The new mathematics curriculum frameworks contain four strands - number, patterns and relations, shape and space, statistics and probability. In many mathematics classes, it was traditional practice to spend much of the time on knowledge and skills in the number strand. Students learned numbers and how to compute them by adding, subtracting, multiplying and dividing.

In the Manitoba curriculum frameworks, all four strands are of equal importance. Every student, regardless of ability, can find an area of mathematics learning in which to shine. For example, a teacher describes a student for whom number work is a real struggle, but who finds great joy in working with 3-D solids and is now the class expert on them. Students have an opportunity to work in areas of strength and also in areas where their skills need to improve.

In planning the year, teachers include content from all four strands. That way each student has an opportunity to experience success in a well-rounded mathematics education.

The Four Strands of Mathematics

Number

- number concept
- number operations

Patterns and Relations

- patterns
- variables & equations
- relations & functions

Shape and Space

- measurement
- 3-D objects and 2-D shapes
- transformations

Statistic and Probability

- data analysis
- chance & uncertainty



LEARNING BRIDGES

To help children achieve success in mathematics, it is important to create learning bridges. These are activities designed to help students make connections between real-life experiences and the use of concrete materials and abstract, symbolic thinking. Concrete materials are those that can be touched or handled.

Mathematics is more meaningful and much easier to understand when many connections are made between the two types of thinking (concrete and abstract). Learning bridges are essential. They are crossed back and forth many times throughout the grades. The challenge for teachers is to provide many opportunities for students to make these crucial connections.

Bridging

**Concrete Thinking, Students' Life Experiences,
Symbolic Experiences and New Mathematical Concepts**

Connecting

Concrete/Simple

Abstract/Complex

active learning
sharing
visualizing
reflecting
integrating
manipulative materials
pictures
graphs
symbols
real-world applications
models



HOW WILL STUDENTS LEARN MATHEMATICS?

All teaching and learning of mathematics in the new curriculum frameworks involve students using mathematical processes, which are interrelated.

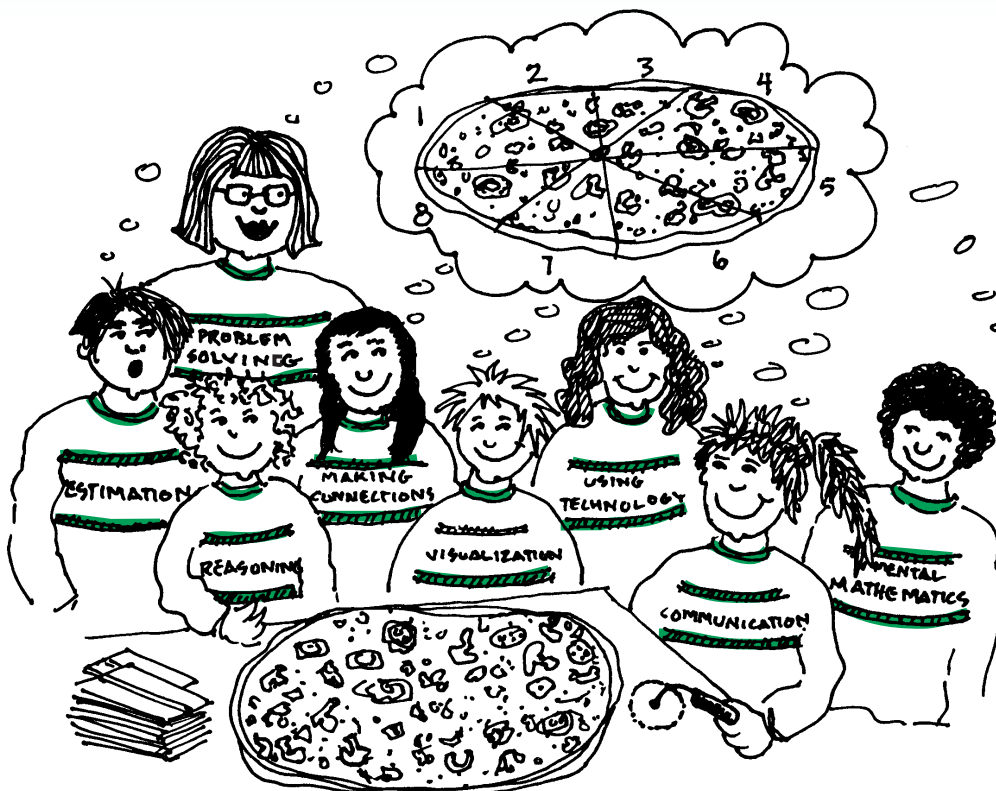
There is less emphasis on memorization and rote learning of facts and formulae, although mental math continues to be important. Students will learn how to learn. They will learn how to think. This should improve understanding of mathematical concepts and reduce frustration and anxiety.

These process thinking skills will serve them well in all areas of their lives. They are life skills.

Problem solving is the focus of mathematics at all grades. It provides an opportunity for children to be active in constructing mathematical meaning, to learn problem-solving strategies, to practise a variety of concepts and skills in a meaningful context and to communicate mathematical ideas.

Mathematical Processes

- problem solving
- estimation
- making connections
- visualization
- using technology
- communication
- reasoning
- mental mathematics



USING THE **NEW** MANITOBA CURRICULUM FRAMEWORKS FOR MATHEMATICS

- **problem situations** might be used to introduce new topics.
- **problem solving** becomes a thread woven through all instruction, in every strand.
- **problem situations** might also be used to check if the student is successful in applying what has been learned to solve problems.

A goal for classrooms is to try to encourage a problem-solving "spirit" in all that is done. Teachers take risks and learn along with students. Together, they can experience the joy and satisfaction of trying hard and solving a problem. Together, they can become "hooked" on thinking.

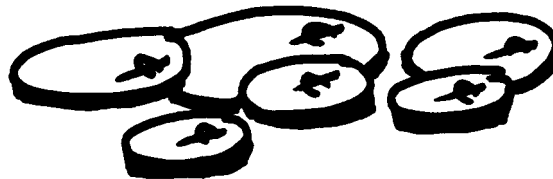
Many word problems in textbooks are not true problems. They are often just factual math exercises surrounded by words. The only thinking involved is deciding which number operation (+ - x ÷) is needed to solve it, then calculating the answer.

A problem is when you are stuck and don't know what to do. You don't know what the solution is. It is not obvious to you. **Problem solving** is what you do in that situation.

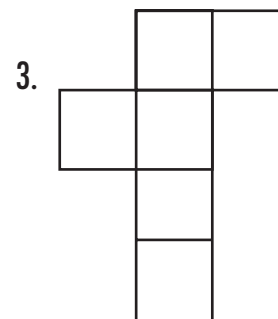
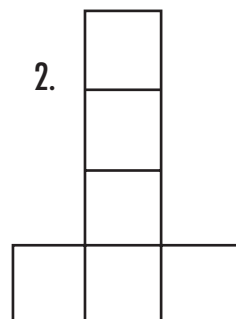
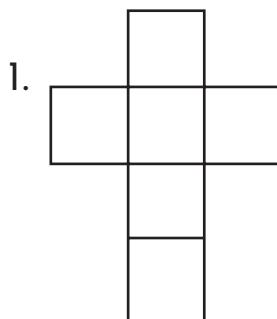
For example: Bob had \$2.00. He bought a bottle of Tahiti Treat for \$1.25. How much change will Bob get?



Two examples of problems that involve more complex and higher-level thinking are:
I have six coins worth \$0.42. What coins do you think I have? There is more than one correct answer.



Cut out each of the following. Fold each one to make an object. What object does each make?
Create a different arrangement for the same object.

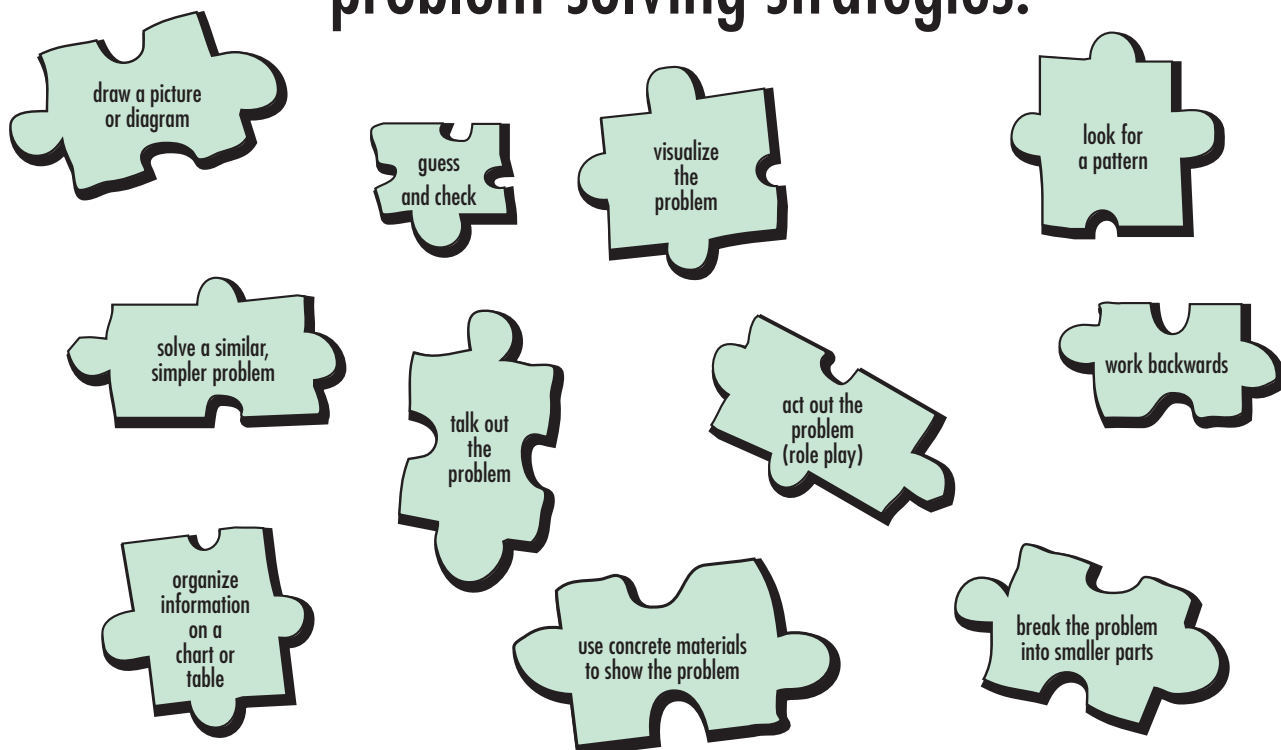


Students learn steps to solving problems that help them to organize their thinking:

- Make sense of the problem (understand what you need to find out).
- Attempt several strategies (find possible ways of solving the problem).
- Try to solve (decide on the best strategy, make a plan, carry it out).
- How did you do? (look back, think, discuss how the problem was solved).



Students create their own set of problem-solving strategies:



MATH TALK

Most of us remember our own math classes as being a very quiet time of the school day. Teachers did most of the talking: explaining a concept, asking questions and giving instructions. Students worked independently and silently at their seats. There was little opportunity for “math talk” and student interaction.

The new curriculum frameworks recognize that mathematics is a way of communicating. Communication is an important mathematical process that should be encouraged in all teaching and learning activities.

Students need opportunities to talk to each other about math. They need to feel free to ask questions of the teacher and of their peers. As children are busy doing their math activities, they need to talk about what they are doing, why they are doing it, how they are thinking and what they are learning. When children put their thinking into words, it helps them understand concepts more successfully.

Talking about math is not just giving answers to questions like $8 + 6 = ?$. It's students using their own language to make sense of what they are learning. It helps them to clarify their ideas. It helps them to connect new concepts to what they already know.

Teachers and parents can encourage math talk by being good listeners. When we listen to a child talk about how he or she figured out a particular answer, we get a picture of how the child is thinking and at what level of understanding. We can encourage children to explain their ideas clearly. We can help them organize their ideas by asking questions that focus their thinking. We can ask open-ended questions that promote math talk.

MATH TALK

Students, Parents and Teachers

COMMUNICATING



talking through the thinking involved in solving a problem helps to clarify and improve thinking



demonstrating with concrete materials



listening to and respecting the ideas of others



discussing how to go about solving a problem: - what should be done? - what would be a reasonable answer?



asking questions

thinking aloud, talking to oneself



sharing ideas, explaining clearly their thinking in solving a problem



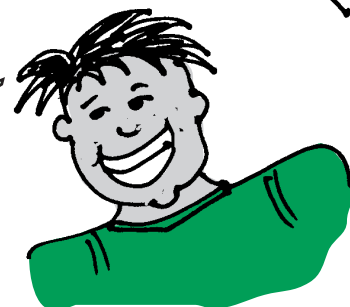
talking about what they are doing during a math task gives the teacher a clearer picture of students' thinking and understanding of the activity



discussing math activities helps develop thinking and broaden understanding



sharing writing and records (diagrams, graphs) used in solving a problem



WHAT MIGHT YOU EXPECT TO SEE IN A MATHEMATICS CLASS?

Classroom Climate

well-established routines

high expectations

positive attitudes

problem-solving "spirit"

a community of learners

students motivated on a task

friendly, relaxing non-threatening

Groupings

- independent activities
- whole-class instruction
- teacher-directed groups
- self-directed groups
- learning groups with another class
- small co-operative groups
- peer partners
- centre activities

Physical Environment

- students' math work on display
- interactive math bulletin boards where students are challenged to solve a problem or ask their own
- models, concrete materials that are used freely by students
- computers and calculators that students use frequently
- math displays in school hallways

Going Beyond the Classroom

- field trips to math in the real world (nature, places of work, construction sites, etc.)
- resource people invited into the classroom to talk about how they use math skills on the job

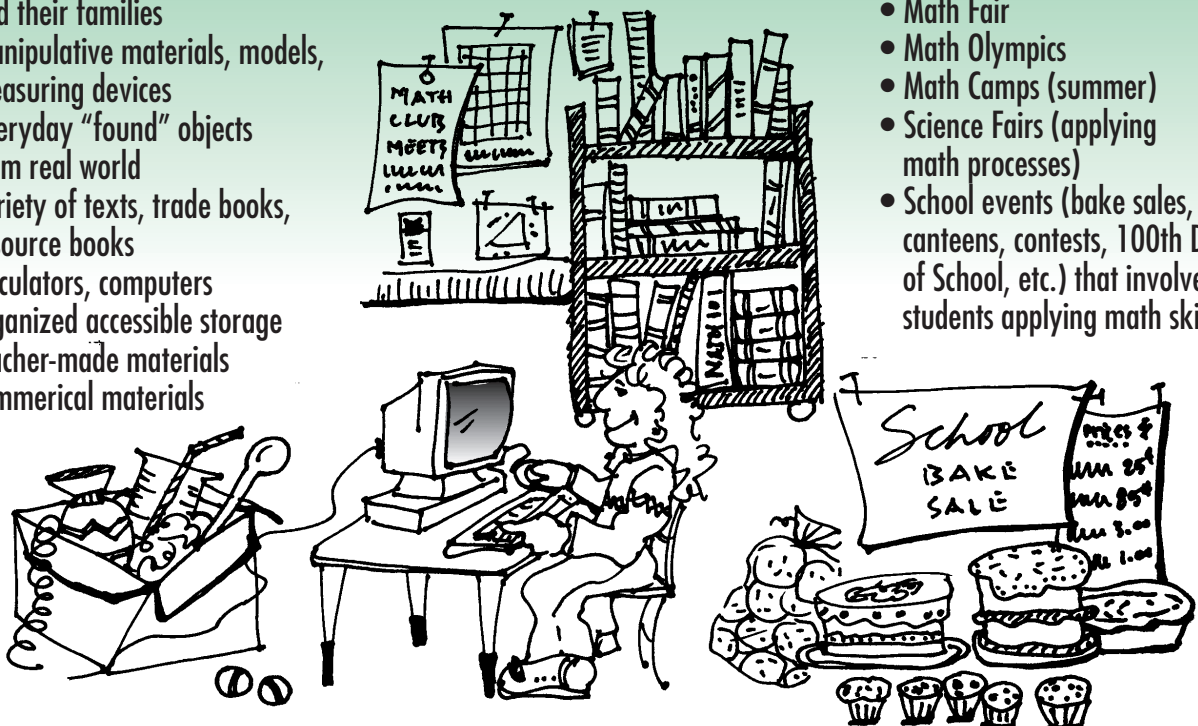
Learning Materials

- games, puzzles
- materials collected by kids and their families
- manipulative materials, models, measuring devices
- everyday "found" objects from real world
- variety of texts, trade books, resource books
- calculators, computers
- organized accessible storage
- teacher-made materials
- commercial materials

TECHNOLOGY

Special Events

- Family Math Nights
- Math Club
- Math Fair
- Math Olympics
- Math Camps (summer)
- Science Fairs (applying math processes)
- School events (bake sales, canteens, contests, 100th Day of School, etc.) that involve students applying math skills



Many times during parent-teacher interviews,
parents say things like:

- I never was much good at math myself, so I won't be surprised if my child doesn't do well either.
- I hated math when I was a kid.
- Once I got into high school, I couldn't understand math anymore. So I dropped it as soon as I could.
- I always found mathematics a very difficult subject, and I dreaded it.

HOW CAN PARENTS AND TEACHERS HELP CHILDREN DEVELOP A **POSITIVE ATTITUDE** TOWARDS MATHEMATICS?

I can do it.

Be positive and encouraging;
show you believe they can succeed.

Be enthusiastic.

Be an enthusiastic problem
solver yourself.

Be willing to try.

Help children see that they are
successful if they just make
progress toward a solution.

Be willing

to stick with it.

Reward perseverance; set
a good example yourself.



Be confident.

Encourage them to trust their own
abilities; don't solve the problem for them.

**Don't be afraid to make
mistakes.**

Help them see that mistakes are an
opportunity for further learning.

Be patient.

Compliment a child for taking time
to think through a problem.

**Find satisfaction in solving
a problem.**

Compliment a child for good
mathematics thinking.

MATH IS EVERYWHERE

You can help your child see the value of math as a way of understanding the world around us. You can help him or her to see that "math is everywhere!" You can provide experiences for your child to apply skills learned at school to real-life situations at home.

A sample of activities is included here to give you an idea of some of the possibilities. By extending their math learning from the classroom into the real world, children will come to appreciate math as meaningful and important in our world.



music

- learn to play an instrument, note rhythm patterns



newspapers and magazines

- do surveys, check computations in media (sports pages, ads, stock market) and how per cent is used in advertising



TV and radio

- estimate hours of TV watched last week, last month, last year



cooking

- figure time cooking, adjust recipe to yield a certain number, measure ingredients (fractions), oven temperature



books

- read books that have mathematical content (pattern in story, counting, etc.)



travel

- use maps, figure speeds, estimate distances, how many kilometres per litre, estimate time needed to get from A to B, duration of trip, estimate arrival & departure times



money

- go banking, calculate sales, make a budget, calculate allowance, figure the cost of one video game if three cost \$1.00 (ratio)



construction

- look at scale drawings, use construction toy sets, work together on a small building project or repair job

MATH IS EVERYWHERE



home decorating

- do estimating/measuring around the home (perimeter, area, angles), estimate/calculate how much material, estimate/calculate costs of projects



sewing

- estimate/measure material, calculate how much material would be needed for a project, estimate/calculate costs



shopping

- figure discounts, 3 kg for \$1.99 (ratio), sales tax (per cent), estimate items in package and then count them, estimate cost of groceries for week



sports

- figure rate of speed, win/loss percentages, games behind, estimate/measure lengths, heights, distances, understand and compute batting averages



weather

- figure hours of daylight, temperatures, rainfall, averages



time

- calendar talk, close eyes for estimated length of time, one-minute challenges (kitchen timer), estimate how many (?????) you could do in a minute



games

- play cribbage, card games, puzzles, logic games, board games



collections and hobbies

- look at junk collections, sort, sequence, compare, extend/create patterns, estimate number, estimate measurement (buttons, shells, rocks, stamps, cards, etc.)

It makes a great difference to the success of students when teachers clearly communicate to them and their parents what needs to be learned and what their expectations are.

This Parent Report is a first step in spelling out for parents what the goals for math education are in the new Manitoba curriculum frameworks. Throughout the school year, parents and teachers need to keep in touch. There should be regular school-home communication and homework assignments that encourage “family math.” There should be many special events throughout the year that will allow you to see what’s going on at school. Talk to educators at your child’s school about joining a math class!

WHY ??? CHANGE THE MATHEMATICS CURRICULUM

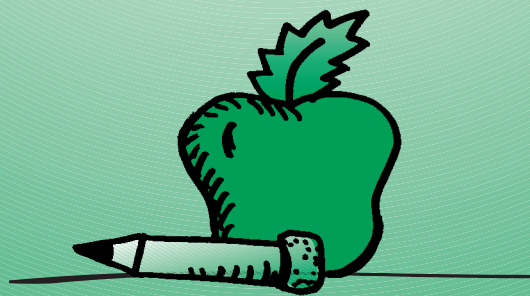
- Mathematics is an important language in the 21st century.
- Mathematics gives students an opportunity to use technology, which is another important tool of the 21st century.
- The workplace is changing.
- Workers need to solve problems in a variety of ways and work together co-operatively.

Mathematics is the study of relationships, the recognition of patterns and the building of structures.

The new mathematics curriculum frameworks

- Offer students a broad view of mathematics.
- Encourage them to see the part math plays in their lives.
- Present different courses for different purposes in Senior 2 - 4, such as Pre-Calculus Mathematics, Applied Mathematics and Consumer Mathematics.
- Offer Accounting Principles as a Senior 3 mathematics credit.
- Offer Accounting Systems as a Senior 4 mathematics credit.

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