

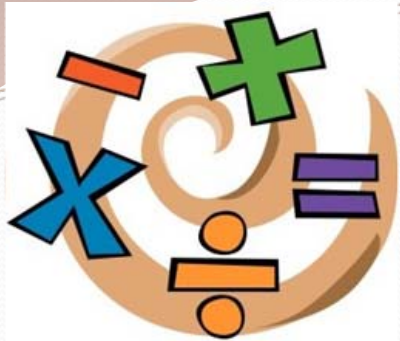
Education 4161: Mathematical Curriculum Models

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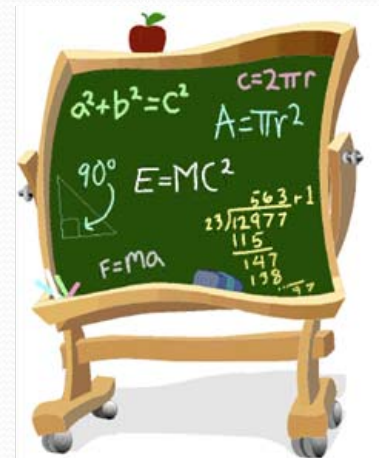


What is Mathematics?

- ❑ It is a powerful way of expressing relationships and ideas in numerical, graphical, symbolic and verbal forms.
- ❑ It is the classification and study of all possible patterns.
- ❑ It is a study of numbers using formula's, laws, patterns and measurement.

*"The essence of mathematics is not to make simple things complicated, but to make complicated things simple".
~S. Gudder*

<http://www.quote garden.com/math.html>





Mathematics From a Student's Perspective

- ☐ **Abstract representation system used in the study of numbers, shapes, structure and change.**
- ☐ **A person's ability to count, calculate and use different systems of mathematics.**
- ☐ **It is a system of numbers we use to figure out solutions to everyday problems.**
- ☐ **Understanding the connections between numbers and their symbols.**

Image: <http://www.freewebs.com/sdccc/>

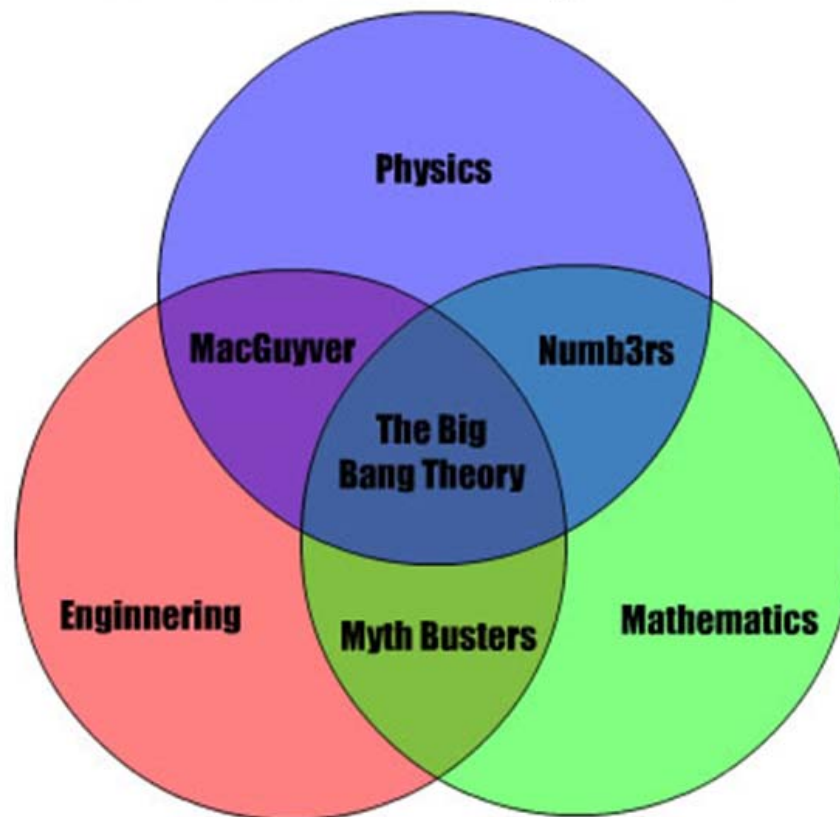


Mathematics of the World

- ❑ Many schools misrepresent mathematics. This aversion to math is also reflected in our popular culture as well.
- ❑ Mathematics has the potential to be appealing as shown in movies, books and puzzles.
- ❑ Trends suggest that school mathematics is widely hated but the mathematics of life, work and leisure is intriguing and much more enjoyable.
- ❑ Today's society has shifted from an industrial age to an information age driven by computers, calculators and other technology.

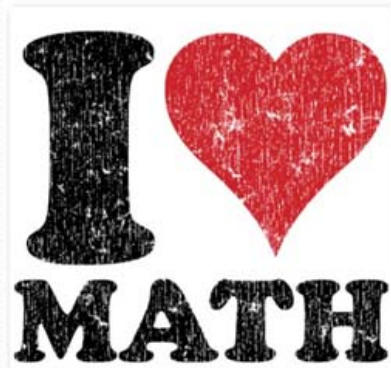
Image: <http://faculty.wiu.edu/JR-Olsen/wiu/>

Sharing the TV between Math-based Diciplines



GraphJam.com

<http://graphjam.files.wordpress.com/2009/04/song-chart-memes-tv-math.jpg>



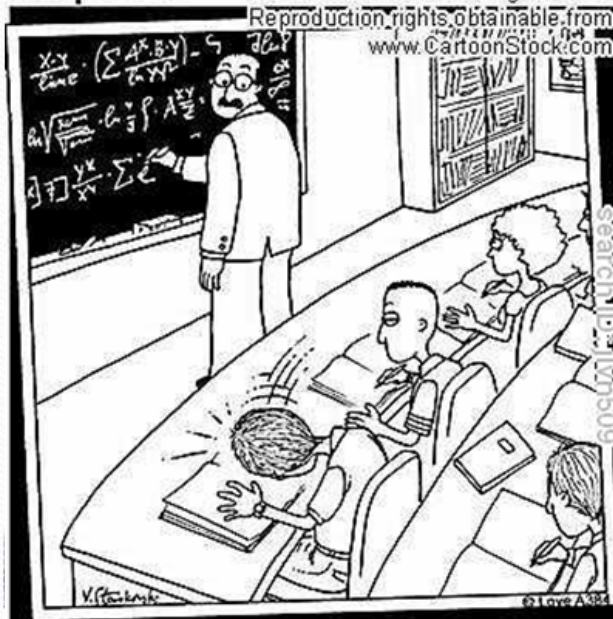
❑ There are two versions of math in the lives of many people:

- ❑ The strange and boring subject
- ❑ The interesting set of ideas

*** Our task as new teachers is to introduce the second version to today's students, get them excited about math and prepare them for the future.**

Snapshots

© Original Artist



Professor Herman paused when he heard that unmistakable thud – another brain had imploded.

"The mathematician's patterns, like the painter's or poet's, must be beautiful. The ideas, like the colors or the words, must fit together in a harmonious way. Beauty is the first test: There is no permanent place in the world for ugly mathematics."-- G. H. Hardy

<http://www.onlinemathlearning.com/math-quotes.html>

Image: <http://sillysidilly.wordpress.com/page/13/>

What's Math Got To Do With It?

- ☐ It has a lot to do with children having low self esteem.
- ☐ Children not enjoying school as they are made to sit through uninspiring lessons.
- ☐ Many more students could become successful in mathematics if they learned to approach math differently.



<http://www.onlinemathlearning.com/math-trivia.html>

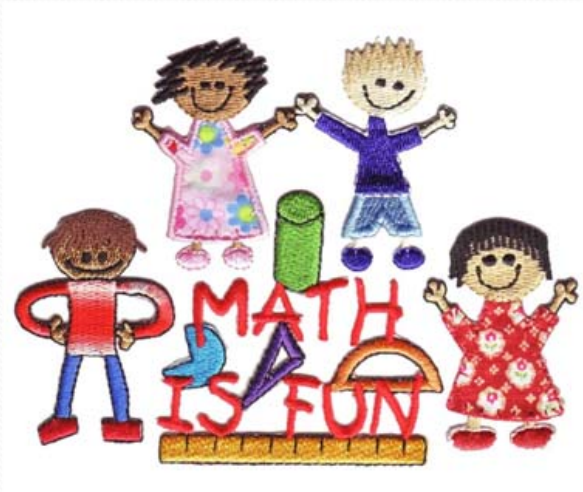
What did one math book say to the other math book?

Answer: Wow, have I got problems!

It happens once in a minute, twice in a week, and once in a year. What is it?

Answer: The letter e

Why Should Students Learn Math?



- ❑ There are four main reasons why students need to possess mathematical competence:
 - ❑ Mathematics for life.
 - ❑ Mathematics as a part of cultural heritage.
 - ❑ Mathematics for workplace.
 - ❑ Mathematics for scientific and technical community.



“I advise my students to listen carefully the moment they decide to take no more mathematics courses. They might be able to hear the sound of closing doors.” -- James Caballero

<http://www.onlinemathlearning.com/math-quotes.html>

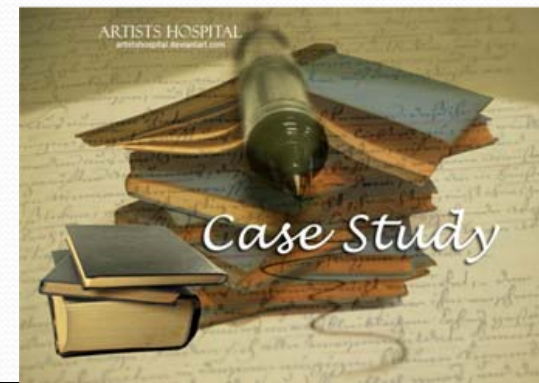
Images: http://www.aplusimages.com/dept.cfm?DEPT_ID=96

Congratulations! You have been hired to teach 7th grade mathematics at a high school. It is your first teaching position and you walk into the department chair's classroom excited about your new job, 2 weeks prior to the start of the school year.

- **You:** So, what am I supposed to teach the 7th graders?
- **Chair:** Well, its up to you. Teach them whatever you think they need to know. Oh and feel free to teach and emphasize the things you're interested in. Thats how I make my decisions.
- **You:** You mean if I don't enjoy a topic like probability or three dimensional geometry, I can just choose not to deal with it in my classes?
- **Chair:** Yeah, thats correct. I mean, why not? If you've made it this far in your life without knowing much about a certain area of the math curriculum, they probably don't need to know much about it either. Teach what's in the book but leave our the stuff you don't want to do. Like I said, its up to you.

Image: <http://artistshospital.deviantart.com/art/Case-Study-Too-Many-Ideas-61029670>

- Brahier, Daniel. Teaching Secondary and Middle School Mathematics. Pearson Education Inc, Toronto, 2005



What is a Curriculum?

- Government document concerning different units and topics that teachers educate students on.
- Different curriculums for different mathematical grades/levels
- Effective teaching guide that help teachers in their planning process.



NL Program Design (Senior High)

Program Level	Course 1	Course 2	Course 3	Course 4
Advanced	Math 1204	Math 2205	Math 3205	Math 3207
Academic	Math 1204	Math 2204	Math 3204	Math 3103
Practical	Math 1206	Math 2206	Math 3206	

Curriculum Models:

There are three major types:

- **Crossover:** college bound and non-college bound tracks.
 - Practical vs Academic vs Advanced.
- **Enrichment:** students are assigned some enrichment topics to explore.
 - Give students extra problems.
- **Differentiated:** different learning teams that address the same topic at a variety of levels in the same classroom.
 - Every student learns at a different rate.

Curriculum Perspectives:

- ***Intended Curriculum:*** Materials and units developed by the curriculum designers. Consists of all the units that teachers should teach their students.
- ***Implemented Curriculum:*** Materials and units that teachers reach in the classroom. Consists of all the units that teachers educate students on.
- ***Attained Curriculum:*** Materials and units that students understand. Consists of all the units that students learn and can solve problems on.

History of Math Curriculum

- **In the 1800s, social class dictated what students learned**
- **Lower class students learned the four operations, fractions, proportions and the applications of these**
- **Upper class students learned formal algebra & Euclidean geometry**



So What Changed?

- **Classically, learning aimed towards reproduction of facts and procedures**
- **Sputnik changed everything in 1957**
- **“The New Math”**
- **Redefined math in terms of abstract notions of sets, functions & formal logic**



The New New Math?

- **By the 1970s, teachers & students alike were having difficult with “the new math”**
- **In the late 70s & early 80s, curriculums were redefined, with an attempt at equity between abstract objectives & applicable math skills**
- **In 1989, the National Council of Teachers of Math in the United States (NCTM) developed a more current framework**

Here & Now

- **NCTM framework was implemented in NL between 1999 & 2005**
- **K-12 Mathematics Curriculum Review published in 2007**
- **Suggests adopting Western & Northern Canadian Protocol (WNCP) Standards**
- **Suggested because...**



Math Understanding Index

<u>2001</u>	
<u>Province</u>	<u>Aptitude</u>
PQ	550
AB	547
BC	534
MAN	533
SK	525
ON	524
NS	513
PEI	512
NL	509
NB	506
National	533

<u>2006</u>	
<u>Province</u>	<u>Aptitude</u>
PQ	540
AB	530
ON	526
BC	523
MAN	521
NL	507
SK	507
NB	506
NS	506
PEI	501
National	527

Source: Measuring Up: Canadian Results of the OECD PISA Study
(Stats Canada, 2008)

Stakeholders

- A stakeholder is any individual or organization, internal or external, that has some stake in the success of the institution
- How many people really have a say in what goes in the math curriculum?



<http://epchc.com/>

Stakeholders in NL



<http://www.ed.gov.nl.ca/edu/departement/minister.html>



Stakeholders in NL



http://simpsons.wikia.com/wiki/Seymour_Skinner

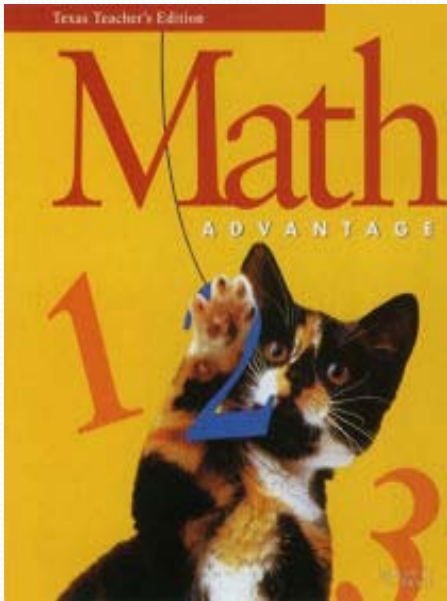


<http://can.org.nz/image/edna-krobboppel>



http://stkarnick.com/blog2/2007/07/the_simpsons_movie.html

Stakeholders in NL



http://designarchives.aiga.org/entry.cfm/eid_1370



<http://www.mun.ca/math/people/ppl-faculty/>

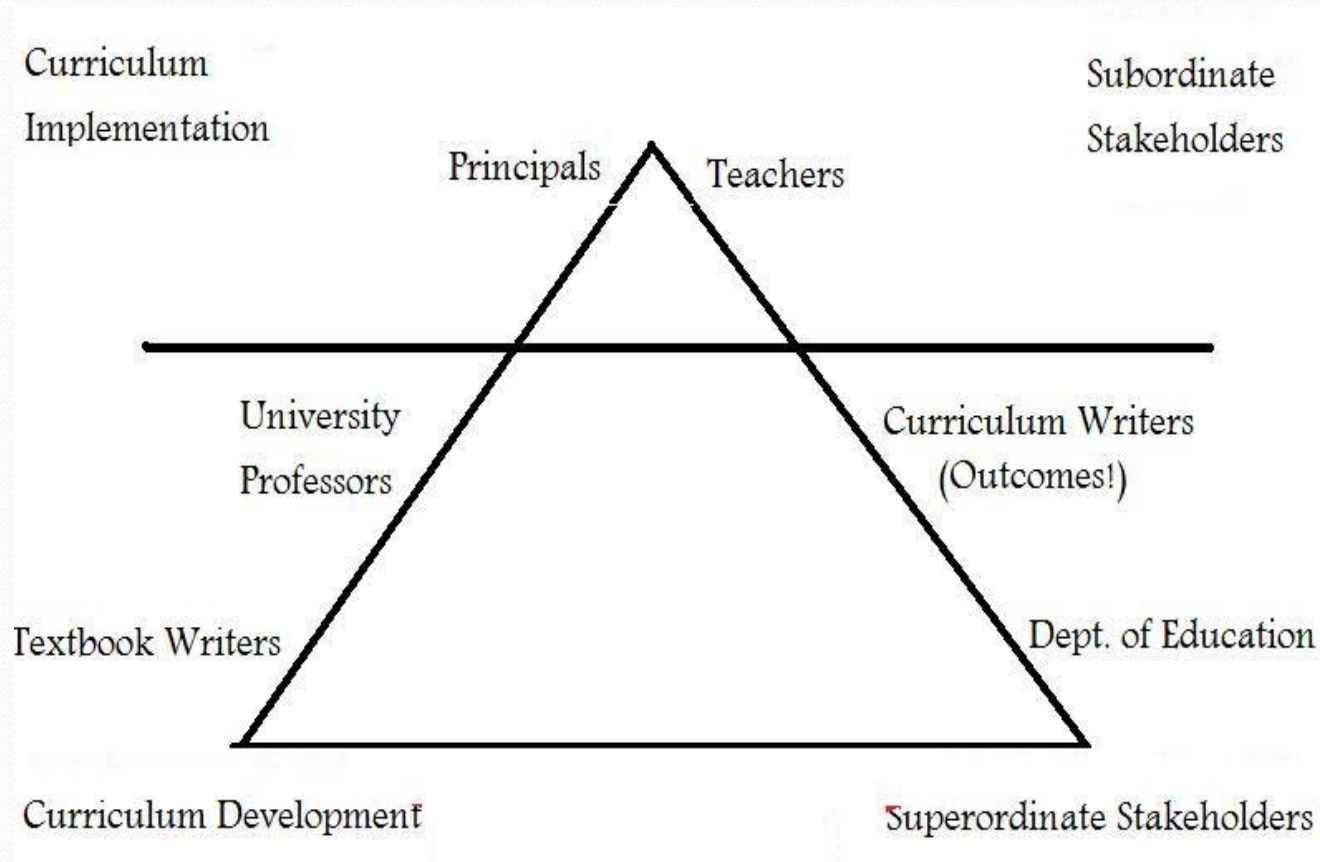


www.cbc.ca/hereandnownl/crew.html

Stakeholders in NL

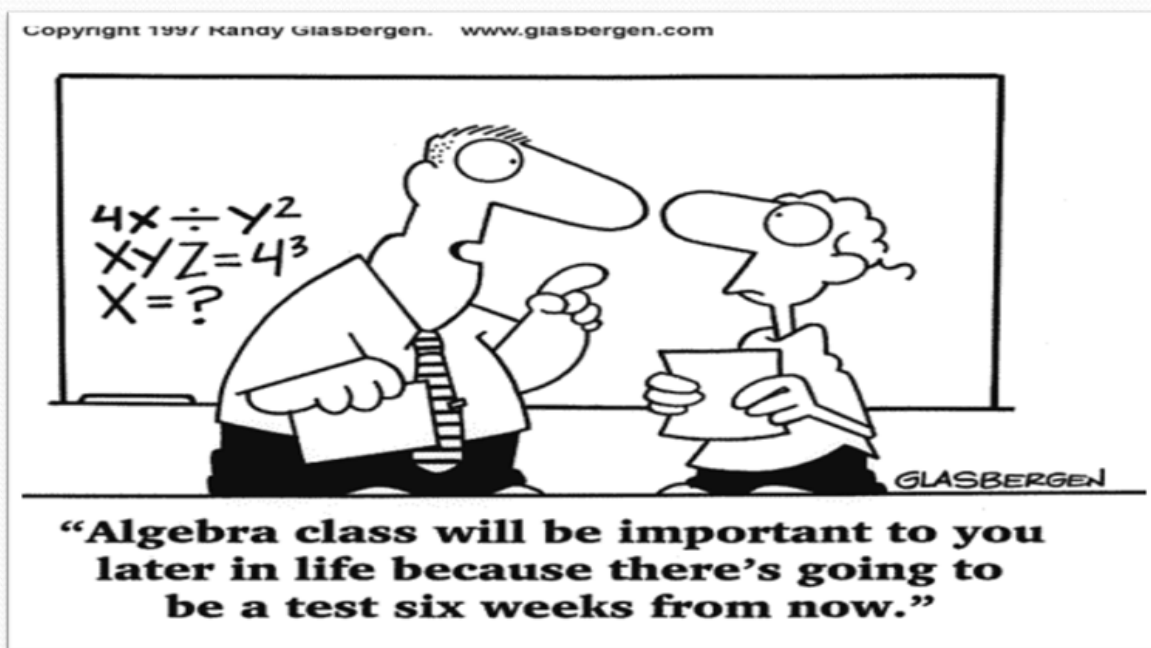
- **Parent organizations**
- **Employers/Business organizations**
- **Mathematics Teacher organizations**
- **Education consultants**
- **Lobby groups**

Stakeholders



Curriculum Components:

- ***Rationale:*** Reasons why students should learn the desired material.



Curriculum Components:

- ***Aims and Objectives:*** Goals that students should develop in learning Mathematics.



<http://www.clipartguide.com/pages/0511-0908-2515-5709.html>



Curriculum Components:

- ***Content:*** Units that students are going to learn.

Example: Grade 7 Mathematic material

Unit 1:
Patterns
and
Relations

Unit 2:
Integers

Unit 3:
Fractions,
Decimals
and
Percents

Unit 4:
Circles
and
Area

Unit 5:
Operations
with
Fractions

Unit 6:
Equations

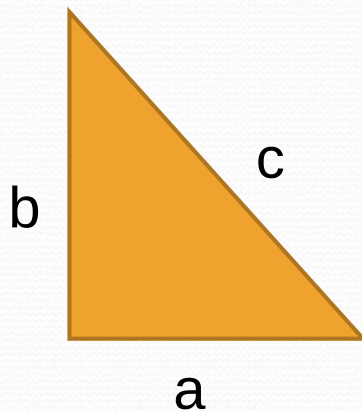
Unit 7:
Data Analysis

Unit 8:
Geometry

Curriculum Components:

- ***Outcomes:*** Topics in the units that students are required to learn.

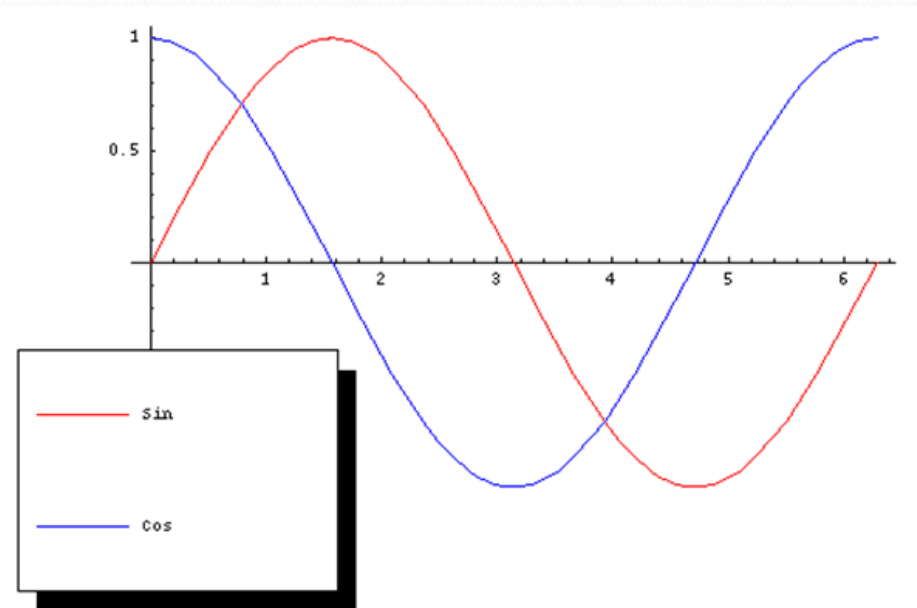
Pythagorean Theorem:



$$A^2 + B^2 = C^2$$

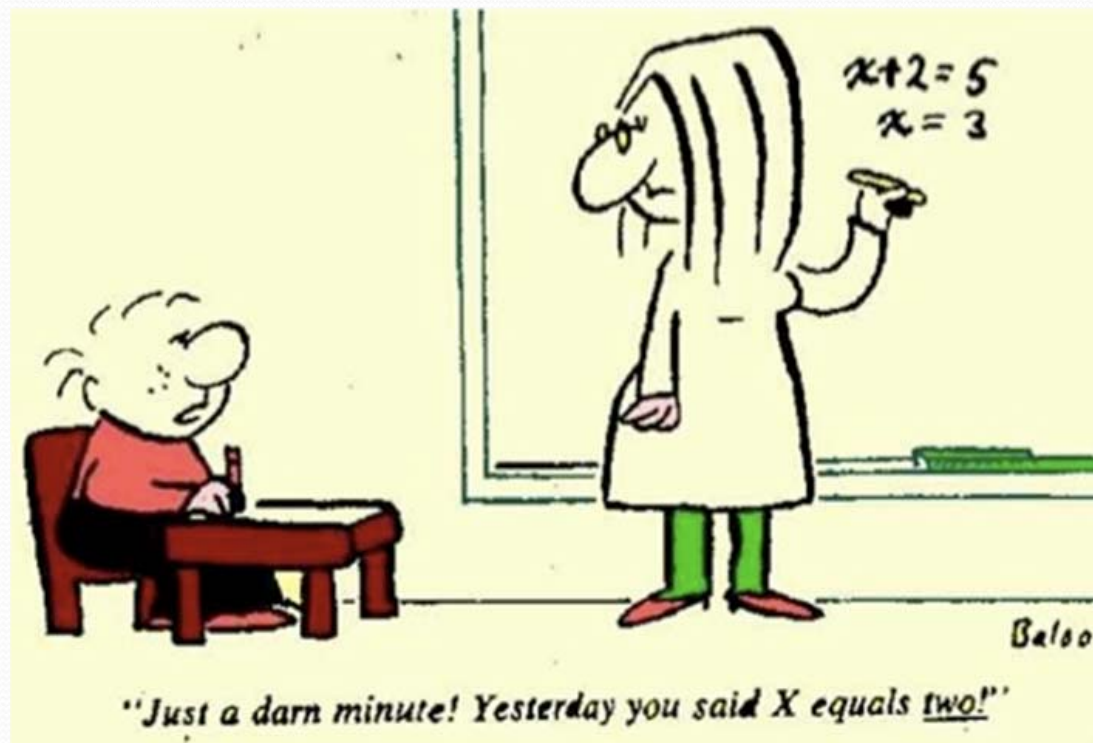


Sin vs. Cos functions



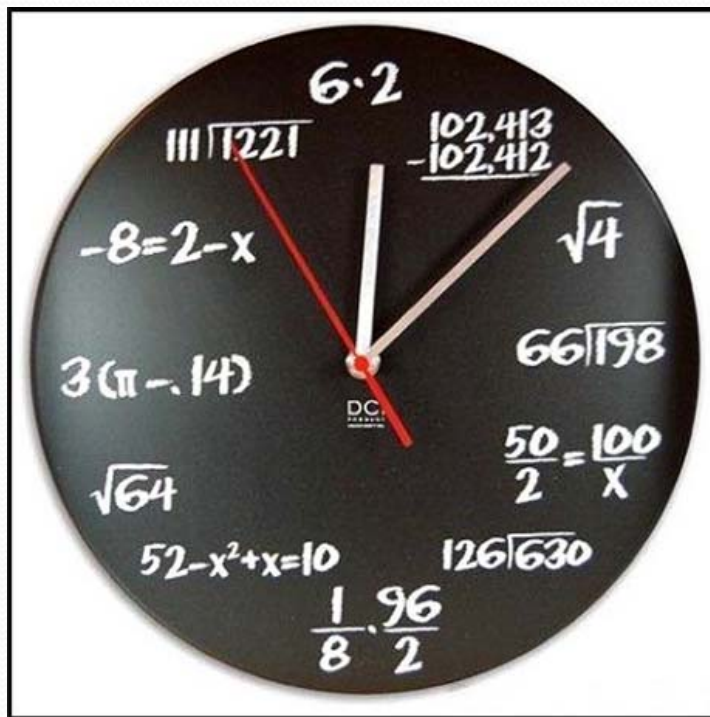
Curriculum Components:

- ***Teacher role:*** Teaching strategies that teacher may use to help students understand the material.



Curriculum Components:

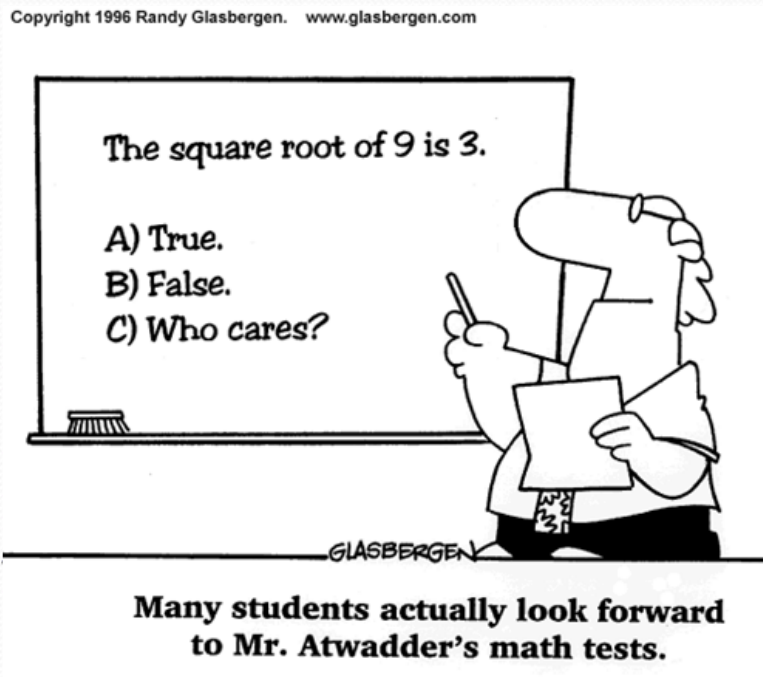
- ***Time:*** Time suggested for a teacher to teach a given unit.



Curriculum Components:

- **Assessment:** suggest ways in which you can evaluate students understandings.

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<http://mrart.wikispaces.com/Math+Cartoons>





How is the Curriculum Organized?

Essential Graduation Learnings (EGLs)



Essential Graduation Learnings (EGLs)

- **Statements describing the knowledge, skills, and attitudes expected of all students who graduate from high school.**





Essential Graduation Learnings (EGLs)

Aesthetic Expression

Citizenship

Communication

Personal Development

Problem Solving

Technological Competence



Unifying Ideas

Problem Solving

Communication

Reasoning

Connections

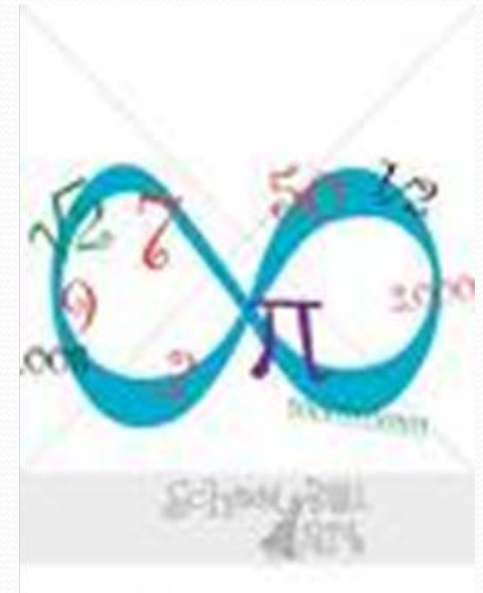
Strands

**Number concepts/number and
relationship operations**

Patterns and relations

Shape and space

Data management and probability



<http://www.schoolbellart.com/image/infinity-and-math-symbols.html>

General Curriculum Outcomes

- **Statements which identify what students are expected to know and be able to do upon completion of study in a curriculum area.**

Key Stage Curriculum Outcomes

- ▣ **Statements which identify what students are expected to know and be able to do by the end of grades 3, 6, 9, and 12, as a result of their cumulative learning experience in a curriculum area.**

Strands



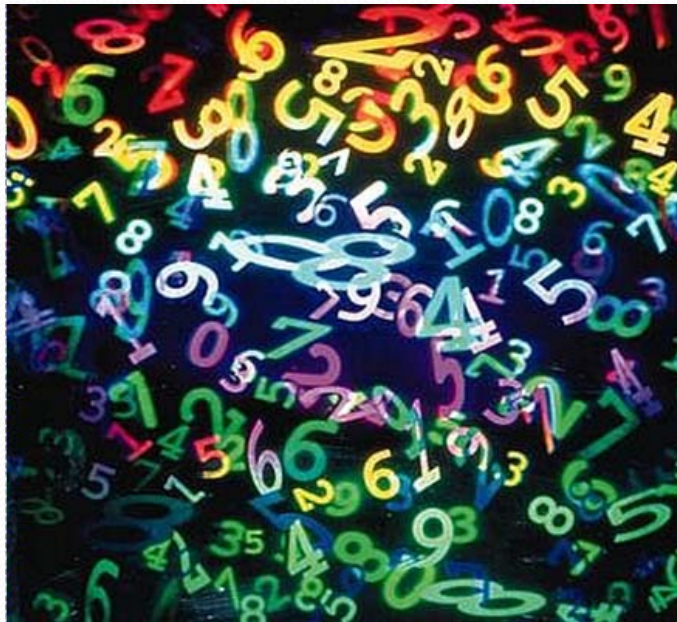
Unifying Ideas



Key Stage Outcomes

Example

GCO: Students will demonstrate number sense and apply number theory concepts.



By the end of grade 3, students will be expected to:

- **Construct and communicate number meanings, and explore and apply estimation strategies, with respect to whole numbers.**
- **Concretely explore common fractions and decimals in meaningful situations.**
- **Read and write whole numbers and demonstrate an understanding of place value (to four places).**
- **Order whole numbers and represent them in multiple ways.**
- **Apply number theory concepts (e.g., place value pattern) in meaningful contexts with respect to whole numbers and commonly used fractions and decimals.**

By the end of grade 6, students will be expected to:

- **Demonstrate an understanding of number meanings with respect to whole numbers, fractions and decimals.**
- **Explore integers, ratios and percents in common meaningful situations.**
- **Read and write whole numbers and decimals and demonstrate an understanding of place value (to millions and thousandths).**
- **Order whole numbers, fractions and decimals and represent them in multiple ways.**
- **Apply number theory concepts (e.g., prime numbers, factors) in relevant situations with respect to whole numbers, fractions and decimals.**

By the end of grade 9, students will be expected to:

- Demonstrate an understanding of number meanings with respect to integers and rational and irrational numbers, and explore their use in meaningful situations.**
- Read, write and order integers, rational numbers and common irrational numbers.**
- Represent numbers in multiple ways (including via exponents, ratios, percents and proportions) and apply appropriate representations to solve problems.**
- Apply number theory concepts in relevant situations and explain the interrelated structure of whole numbers, integers and rational numbers.**

By the end of grade 12, students will be expected to:

- **Demonstrate an understanding of number meanings with respect to the real numbers.**
- **Order real numbers, represent them in multiple ways (including scientific notation) and apply appropriate representations to solve problems.**
- **Demonstrate an understanding of the real number system and its subsystems by applying a variety of number theory concepts in relevant situations.**

GCOs

- **Students will demonstrate operation sense and apply operation principles and procedures in both numeric and algebraic situations.**
- **Students will explore, recognize, represent and apply patterns and relationships, both informally and formally.**

GCOs

- **Students will demonstrate an understanding of and apply concepts and skills associated with measurement.**
- **Students will demonstrate spatial sense and apply geometric concepts, properties and relationships.**

GCOs

- **Students will solve problems involving the collection, display and analysis of data.**
- **Students will represent and solve problems involving uncertainty.**