Credit Humber Association for Mathematics Promotion

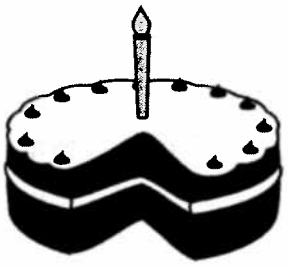
CHAMP NEWS

Volume #2 Issue #1
Fall 1997

CHAMP is an association for Mathematics Teachers of Halton, Halton Separate, Peel and Dufferin Peel Separate.

CHAMP News is 1 YEAR OLD!

CHAMP News is now in it's second year! After 3 successful issues last year, CHAMP continues to provide its members, and every school in the four affiliate boards, with this resource, as a means of sharing and communicating across the region. Special thanks go to the contributors for this issue for taking the time to write articles despite the hectic pace of a new school year and the added stress of our current political climate. CHAMP will endeavor to provide a forum for you in which it is just as valuable to give as it is to receive. We would appreciate contributions from across the four associated boards, from both elementary and secondary levels. Please consider sharing an idea, a success, a concern, an opinion, a joke, a cartoon or. . . whatever you wish. Your colleagues in Math Education will benefit from your contribution.



A huge **THANK YOU** goes to Jeff Irvine at Brampton Centennial Secondary School (Peel) who took on the position of Chief Editor of the CHAMP News in its pilot year in 1996-97. His vision, creativity, organization and his genuine belief in this communication opportunity made the publication so successful. Assisted by the BPA 4AG students at Brampton Centennial S.S., who are responsible for the Layout and Typeset, Jeff managed to put the first issue into the hands of every math teacher in this region. Currently, issues are sent to CHAMP members as a benefit of their membership. In addition, each school in the region receives a copy, in the CHAMP spirit of sharing. Congratulations to Jeff, the BPA 4AG students and all contributors on the success of the first three issues.

So...enjoy this current issue...use whatever you can...and PLEASE consider making your contribution to one of our next two issues!

Please send your contributions to:

Marlene Dewey
Clarkson Secondary School
2524 Bromsgrove Rd.
Mississauga, ON L5J 1L8

or fax to (905) 822-6896. Please include your name, school, board, grade level, and your school telephone and fax numbers with your contribution.

I will now be your CHAMP News Editor, having been Jeff's Assistant Editor last year. I look forward to hearing from you and to another year of CHAMP News!

Marlene Dewey

Editor and CHAMP Executive

In This Issue:

Credits:

This issue of the Champ News was created by a team of students in the BPA-4AG-A class of Brampton Centennial Secondary School. Members of this team are: Jason Campbell (Team Leader), Kawsi Kindra, Shivana Singh, Reena Raj, Jason Hunt, Sara Lennox, Fiona Allison, Amanda Pinkerton, Richie Robomas, and Venice Phillips. Thanks to the entire team who worked together to bring you another fine issue of The Champ News. Special thanks to Mrs. White, the team's teacher and professional consultant.

Book and Software Review

While browsing through the books on computer-related topics over the summer, I was struck by the thought that there truly was a Computer sub-culture out there in virtual reality land. The sociologists have landed. Many of the books are now examining Cyberia as if it was a lost tribe of strange people with stranger habits. It makes interesting reading and certainly can enrich one's presentations to various computer studies classes. Three books about Cybercrime deserve some attention:

① Masters of Deception, by Michelle Slatalla and Joshua Quittner, from Harper Collins. $17.50.

The book discusses the phenomenon of cybergangs. The Masters of Deception (MOD) and Legion of Doom (LOD) are two groups of teenage hackers, involved in organized software piracy, unauthorized network entry and sabotage and cyberjokes on each other. The subculture of a street gang has invaded "Cyberia". Turf wars and a machismo associate with "Cybermastery" seems to be a main focus of these groups.

② Cyberia: Life in the Trenches of Hyberspace, by Douglas Rushkoff, Harper Collins. $15.50

A dip into the seamier side of the virtual world discloses a fascination with information as addiction. A variety of personalities are introduced. All of these people appear to be techno-obsessed and many are involved in legal applications of the technology that appears to be redefining our world.

③ Cyberpunks: Outlaws and Hackers on the Computer Frontier, by Kate Hafner and John Markoff, from Simon & Schuster. $17.50

The book contains three separate stories about serious and big time hacking. If you ever needed something more to worry about you will find it here. Enjoy!

by: Peter Cox
North Park S.S.
Peel Board of Education

SOME FUN "FILLERS"

(See answers below)

1. I went to Tim Horton's and bought some donuts. All but two were cinnamon, all but two were plain and all but two were jelly-filled. How many donuts did I buy?

2. A number ends in the digit 2. When the 2 is moved from the right hand end to the front of the number, the new number is twice the original number. Find the smallest positive number with this property.

Special thanks to Peter Marmorek, a Math and English teacher at Clarkson S.S., for finding the two problems above on the internet.

3. From a recent CNML Contest:
Solve for x:

$$\log_2(9-2^x)=3-x$$

4. From somewhere in my past:
Solve:

$$(x^2-5x+5)^{x^2-9x+20}=1$$

Hope you enjoyed these!

from Marlene Dewey

P.S. Q. What did the ZERO say to the eight?
A. Nice belt!!

Answers:
1. 3 donuts
2. 105263157894736842
3. $x = 0, 3$
4. $x = 1, 2, 3, 4, 5$

Graphing Trig Functions On The TI-83

by Fred Ferneyhough, Bramalea S. S. (PEEL)

In MAT 4A0, we spend a fair amount of time asking questions to graph functions of Sine and Cosine. My experience in this area has always had mixed results until the past few years. Part of the problem was that I was always asking students to graph the base function, say f(x) = Sin(x), over the domain $x \in [-2\pi, 2\pi]$ and then asking them to graph a transformation of this function over the same domain. On a graphical calculator, this would be a poor use of technology as the student simply enters the equation and the domain and shows no understanding of the function.

Two years ago, I had a superb 4A0 class who suggested that it might be just as good to graph a number of cycles of the transformed function rather than specifying a domain for the graph. To set this up, I went back and emphasized the concepts of period, amplitude and phase shift, relating them to the basic transformations which we do in MAT 3A0 and repeat at the beginning of MAT 4A0. Using this approach, we generalized that, if we were going to show two cycles of the function, the first cycle will begin at x =(phase angle - period) and will end at x = phase angle. Likewise, the second cycle will begin at x = phase angle and end at x = (phase angle + period). As an example, try the function

$$y = -2\ Sin\left(3\left(x - \frac{\pi}{4}\right)\right)$$

Before we start the graph, the class should determine that the amplitude is 2, the period is $2\pi/3$ and the phase shift is $\pi/4$ units to the right. Then determine the endpoints of two cycles by writing the following information at the board:

First cycle

ends at x = $\pi/4$

begins at x = $\pi/4 - 2\pi/3$

Second cycle

begins at x = $\pi/4$

ends at x = $\pi/4 + 2\pi/3$

Now, we can take all of this information to the calculator.

First, press the y= button at the top left corner of the machine and enter the equation. Your screen should be the same as diagram 1.

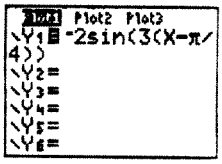


Diagram 1

Next, we fix the domain and range by pressing the WINDOW button. Mel Tintpulver at TLK showed me this summer that you can enter an expression into the WINDOW diagram.

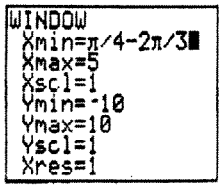


Diagram 2

After you hit ENTER, this line will change to a decimal as shown in diagram 3.

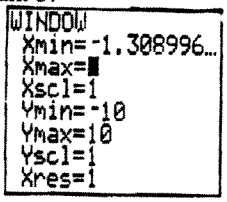


Diagram 3

In the same way, enter the expression for Xmax as the right endpoint of the second cycle as shown in diagram 4.

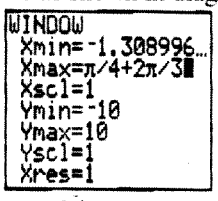


Diagram 4

Once again, the value is converted to decimal form. Finally, correct the range. My students suggested using a range on the calculator which would leave a gap of one unit between the top and bottom of the screen and the graph itself (see diagram 5).

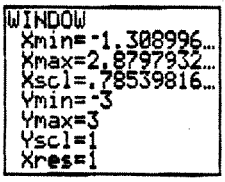


Diagram 5

At this point, we can call up the graph (diagram 6).

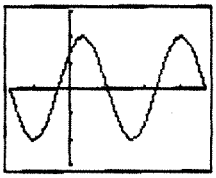


Diagram 6- The final result

If everything has been done correctly, we should see exactly two cycles of this function. Having the students fix the domain and range on the calculator to show a fixed number of cycles of the wave forces the students to think about the transformations involved in such graphs and gets us around the approach of using the graphical calculator as a magic box.

AN AMAZING OCTO-GON (?!)

More Paper - folding by Marlene Dewey
Clarkson Secondary School (Peel)

You Need:

8 squares, each 20cm by 20cm, of coloured paper; xerox weight is fine (for stunning results use 2 each of 4 different colours or 4 each of 2 different colours - the brighter the colours, the better.)

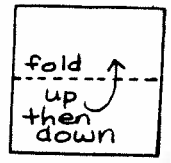
Instructions:

For this versatile magic OCTO-GON follow these steps very *carefully.* Practice makes perfect and you will find it easier to make your second or third or.... Experiment with colours and size of the original squares when you are a pro at making both your OCTO-GON and your "OCTO-GON" ! It is really a nifty construction!

Hint:

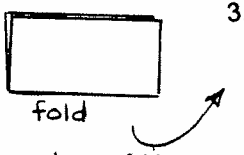
Make all folds tight and smooth and flat!

1.



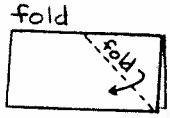
to front and back to make a 2-way fold

2.

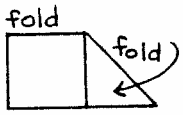


turn so fold is at top now

3.

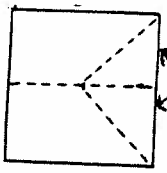


4.



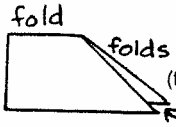
fold towards then backwards along same fold line (a 2-way fold)

5. OPEN lightly:



6. fold top half down again but push these 2 triangles inside the figure now.

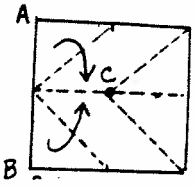
7.



(triangles inside now)

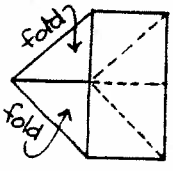
8. End - view:

9.



OPEN again lightly fold corners A & B to meet on centre fold line at point C

10.



fold here again, top half over bottom half pushing these two triangles inside again on the right hand side of the figure

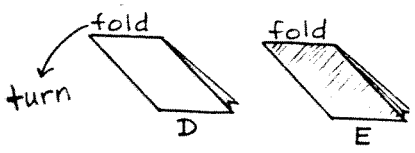
11. It should look like this now:

2 seperate triangles are inside here, on the left

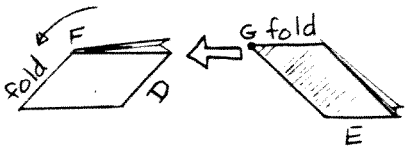
2 triangles joined at a fold are pushed inside here, on the RIGHT

12. Make 7 more of these figures in #11, following steps #1 to #11 each time.... and then....

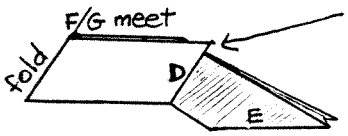
13. Now to form an OCTOGON: start with 2 figures of different coulors:



14. Turn D on to its side but leave E as it was

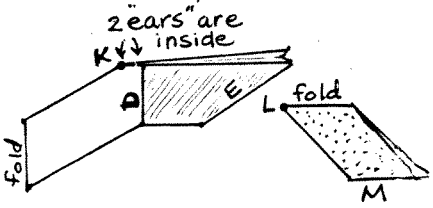


15. slide figure E to the left so G is INSIDE figure D. The upper folded edges must match exactly:



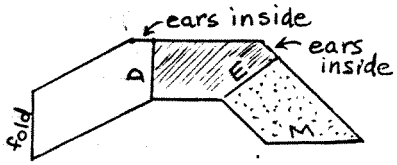
2 little "ears" stick out here. Fold these "ears" to the inside of figure E

16. Turn object left until edge E is on the far RIGHT and the pushed-in "ears" have their folds at the top now



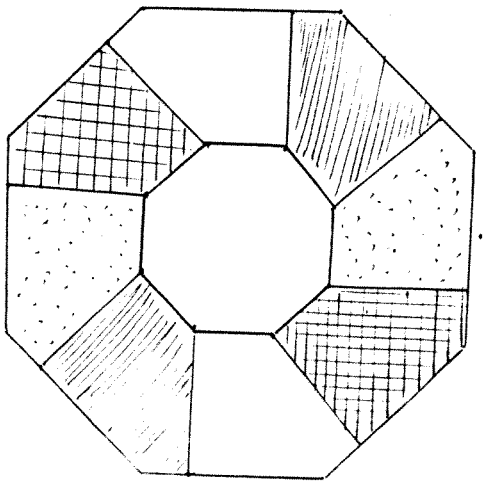
17. bring the 3rd of your 8 identical parallelograms up and into figure E. As before, there will be 2 little "ears" to fold inside of figure M. (M can be the same colour as D or a 3rd colour completely different from the colours of D and E.)

After step #17 it should look like this:

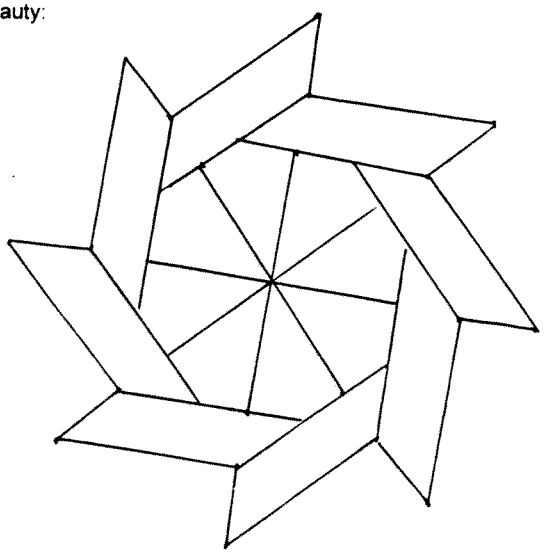


<u>Continue</u> joining the other pieces, one at a time until the 8th piece fits into the 1st piece

18. Voila! you have a really cool looking OCTOGONAL "ring" looking like this: BUT the best is yet to come!!!

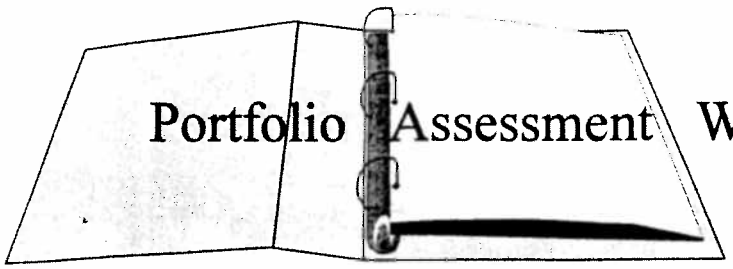


19. You will find that the "arms" of the ring will slide along inside each other. Gently push from RIGHT to LEFT as you slowly turn the ring counterclockwise. Continue pushing and turning until you get this beauty:



If it tries to give you the "gears" - look, thats good. Practice sliding it back out to the OCTOGONAL RING and then into this pretty"gear-like-star". Do this several times until you can do it

20. You did it! Hurrah! Try making another one using steps #1 to #19 again



Portfolio Assessment What's All the Fuss About?

by Christine Suurtamn, Lorne Park Secondary School (Peel)

It would be unusual to be in an educational setting today and not hear the word portfolio mentioned. Portfolios, portfolios, portfolios . . . professional portfolios, teacher portfolios, showcase portfolios, working portfolios, reflective portfolios. The list goes on and on and it appears that portfolios are part of the cargo which on the educational bandwagons usually stream the teaching profession into at least two distinct communities, those who jump on no matter where they are going and those that like to stay where they are and don't even look at the journey's itinerary. But there are also discerning teachers who investigate new innovations and based on the innovation's merits decide whether to add the new novelty to their professional "bag of tricks".

The use of portfolios is one of the components that I have decided to include in my repertoire in a mathematics class. I feel that portfolios address important issues that are not easily addressed in other ways. Portfolios help students become aware of and accept responsibility for their development in mathematics. I have used portfolios in grades 9 and 10 as a means of having students reflect on their work to see their growth in mathematics and to see how math fits into their lives. Students are asked to choose at least one sample from their work for each of the following categories:

- Problem Solving Ability
- Determination to stick with difficult task
- Most valuable experience in math
- Why math is important to learn
- What math means to you
- Something you are proud of

Students are given reflection sheets for each category which they use to write their reflections and then they staple the sheet to their work. Due dates are assigned as to when 2 samples or work should be in their portfolio, 4 samples of work and so on. As a teacher, I respond to each student's reflection with a comment

I am amazed at the responses I receive from students in their portfolios. I discover things about students that I may not have noticed without portfolios. Students consistently surprise me with their capacity to think about their own learning.

A captivating topic is "What math means to me". One student mentions that math is everywhere:

"This assignment demonstrates what math means to me because it is about a real life situation (going to Florida), and using different math skills and problem solving to figure out answers to real life problems. Math is used everywhere, whether it is used to figure out how many toppings you can afford on a pizza, how many orders of fries you can get, or how many more kilometers you have to go. You use math everywhere."

I didn't realize that many students saw math as security but this student in MAT 2GO class wrote:

"To me, math means security, not being cheated, knowing where your money is going and problem solving. It is like a puzzle and you trying to fit all the pieces together."

Another student also saw math as problem solving:

"To me, math means that you work with other people to solve problems. That way you can get a few different methods on solving problems."

Occasionally, as teachers, we do not see whether a student is really trying or understand what determination is. Some of my grade 9 students have surprised me with their reflections on determination. One student compares her determination as an athlete with her determination with math problems:

"Being an athlete, determination is as much a part of my life as many of the other basic needs in life. If I didn't have determination then I wouldn't ever be able to make it through a practise, or a race. In order to become the best that you can possibly be at something you have to be determined. This particular piece of work took a lot of effort by a number of different students in our group. We were proud when we finally solved the problems we were given."

One student, Derek, stands out because when he started in my MAT2GO class he constantly needed to be reminded to stay on task and not to interrupt others. As the year progressed I noticed a great improvement in his behavior. His portfolio showed me that he not only noticed this as well but he was conscious of working at improving his behavior. He included a quiz as something that he was proud of and this is part of what he wrote in his reflection:

"I'm proud of my mark in math because from the very start I never was any good at math especially when I don't pay attention. But now I'm trying to boost my mark up more by paying more attention in class and to 'shut up' when the teacher talks."

As students choose work from their notebook or photos of group work or projects I gain a glimpse of what we have done in class that really matters to them. I find that often it is the projects that they worked on in groups, the assignments where they made an imaginary trip to Florida or the Family Math that they had to do with their parents that get picked to go in their portfolio. But also, items like exam review are chosen when students speak of their determination to do well. I find that the student reflections reassure me that students are gaining responsibility for their own learning and I trust that portfolios are helping them (and me) to see what really counts in math.

Performance A+ ssessment in Mathematics

Welcome to my first column about performance assessment. I'm far from an expert in "alternative assessment", but I hope to use this column to get you acquainted with some of the "non test" assessments happening in classrooms throughout the CHAMP region. Each issue I'd like to feature an interesting assessment technique, with a different teacher's work each column. So if you're using assessment techniques other than the good old test/exam (or if you've put a new slant on the good old test/exam), drop me a note at Brampton Centennial and you might see yourself in a future column.

Last semester I used Math Journals for the first time, in a destreamed Grade Nine. I was more than a bit hesitant to try them and I wasn't sure what more I would learn about my students than I couldn't find out using traditional techniques. I provided a small workbook for each student. I assigned no marks for journal writing, but it was an expected part of each Friday's class. I don't believe that everything we do in class needs to have a mark assigned to it, as some of our activities are simply expectations for students who are involved in their own learning. I did however undertake to read every journal entry by Monday, and provide a written reply to each student's entry each week. I marked no spelling or grammar, and in retrospect I probably should have specified "no obscenities". Live and learn.

The first week's journal task was to respond to the topic "My Life in Math Up To Today". Since we didn't know each other yet, I prefaced the assignment by reading to the class my own response to the topic. I was amazed by the responses, most of which were at least a full page in length and many of which told me about the crushing boredom and confusion of half-remembered "rules" for Mathematical techniques. A few of the students indicated that Math was "fun", "easy", "interesting" and "made me feel good when I got the right answer". I replied to each of the students and discovered the first lesson of Math Journals: For the students to get something out of this, I need to commit significant time to reading and responding.

Every Friday after the first one, a portion of class (usually about twenty minutes) was devoted to the journal. The usual format was a response to two questions. The first question was always the same: "This week in Math ...". This wasn't to be descriptive paragraph like "this week we did integers." but rather a chance to reflect on the week's work and the level of comprehension attained. Often I would get responses like "This week I understood everything except questions like _____" or " Most of the week was OK but I really don't understand about ____". I wrote detailed responses to these comments, sometimes inserting an additional practise sheet, or setting up an extra help session. Students who were reluctant to ask questions in class or admit that they were stuck were much freer to ask through the privacy of their journals. I felt that this part of the journal activity was very beneficial.

The second question each week took the form of a response to statements like "I would like to learn more about ...", "Learning is fun when ... ", and so on. Many of these questions I borrowed or modified from an article in Home and School magazine (which I read in my chiropractor's office). The responses to these questions often gave me a more complete picture of my students, and sometimes helped me identify small ways I could reinforce their behaviour and/or self esteem. For example, when one student notified me he was an excellent golfer, we had a chance to discuss a real life application of integers (and the boy had a chance to brag a bit about his achievements on the golf course).

Near the end of the semester, the question of the week was "When I think about the Math final exam I... ". The following week, after the class had had a chance to obtain and work on a sample final exam, the question was "Now that I've seen a Math final exam I ...". both of these were great opportunities to help deal with Mathphobia, encourage some exam preparation, and allay some fears for students who may not have ever written an exam before.

I became a convert to Math Journals last year. The students' opportunities to reflect on their own learning, communicate privately with their teacher and give me a more three-dimensional picture of themselves more than outweighed the extra time I spent reading and responding. Next semester I plan to implement journals with two Grade Twelve Business Math classes, in a joint project with the Business English teacher. If it works, I'll tell you about it in a future column. If it doesn't work, I'll tell you about that too, and try to tell you why.

By: Jeff Irvine
Brampton Centennial Secondary School

MATH DAY in PEEL

Most schools in Peel celebrate MATH DAY once each year or once each semester. I am fortunate to be in a school which looks forward to Math Day and celebrates it with zeal! This day is dedicated to the recreational side of mathematics and has FUN as its greatest ingredient. Activities, contests, prizes and excitement abound! Students at Clarkson are already asking about when it will be Math Day. One young lady, who obviously loves math, called it, "The best day of the semester!"

At Clarkson, our Math Senior Scholars help plan and run the activities which take place in the cafeteria during all three of our lunch periods. They run the activity centers, distribute prizes and generally provide wonderful "PR" for our subject. The activities are open and free for all students, staff, and support personnel to participate in . We have received wonderful support from the student body. A few of the past activities chosen by the Senior Scholars include:

1. Match the correct nose to the correct teacher (in the past eyes, hands, feet, smiles or profiles have been used)
2. Guess the length of a cheerio string made from a full box of cheerios (we called them ZERIOS for fun!)
3. The RED DOT game (a Carnival Game with a large Red Dot to be covered completely by dropping 5 metal disks (circular) down upon the Red Dot).
4. Blackjack and Dice Games
5. Guess the number in a jar of popular candy with some math property.... eg. Life Saver Lollipops which look like Zeroes on sticks, or Rollo's (little cylinders), or numbered fruit snacks or...) or Guess the total length of all the ..... in a jar (string licorice or candy worms)
6. Sales of Math Cookies cut in the shape of π, ∞, $\sqrt{\ }$, or ϕ. (cookie cutters were hand-made)
7. π tosses —— tossing a sponge π as far as possible.

These and many other past "games" have been successful in drawing hundreds of participants into the action for Math Day!

As well, we run a Home Group Challenge in period 1 of Math Day which has been anything from an expression which must be evaluated (in which the variables represent quantities that must be counted in the school environment) to a set of clever (or silly) puzzles. Each is designed to be inviting to all classes, especially those that are not math classes. Our most successful H.G. Challenges have been ones where we give the teacher a passage to read aloud. The students must record any number they "hear" and afterwards perform several calculations with these numbers. Phrases in the reading might be like this one: Fortunately the gate was often too tight to open forcefully." Did you "hear" the 4, 8, 10, 2, 2, and 4?

Then there are Staff-Stumpers for the teachers, secretaries, administrators, and custodians to try, with prizes of course! So everyone feels welcome to participate and many staff do submit entries, keen to be winners. Everyone is a WINNER on Math Day!

In Math classes special math activities are chosen. We have a Peel Board Math Day Binder which contains student- ready worksheets for Review Relays, Wager Games, Poster Activities, Math Jeopardy, etc.

We can select from these or make up our own activity. Others chosen include the games of SET or READY OR NOTor MATH TRIVIA. We bring treats (usually edible) for our students and the excitement level is usually heard in the halls. Photos go in the Yearbook and often a whole page is devoted to the event!! A celebration of mathematics for all!

If you are interested in having a copy of the Peel Math Day Binder inserts please fax the form on the following page to **Jeff Irvine at Brampton Centennial S.S. at (905) 451 4756.** Peel offers this opportunity to any teacher in the CHAMP region at no charge.

CHAMP recommends Math Day for every School and every board. It's a TOTALly aweSUM day!

By Marlene Dewey

To: Jeff Irvine **PHONE: (905) 451-2860**
FAX: (905) 451-4756

From:

NAME: _____

SCHOOL: _____ BOARD: _____

SCHOOL ADDRESS:

_____

_____

SCHOOL TEL. NO: _____

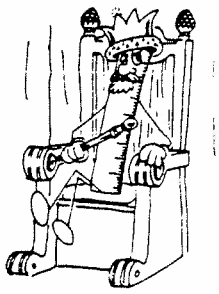
FAX. NO: _____

I am interested in getting a copy of the PEEL MATH DAY BINDER inserts for

Grades 4-6 ☐ Grades 7-8 ☐ Grades 9-OAC ☐

STAFF MATH DAY CHALLENGE

1. What do you get when you divide 30 by one half and add 10?
2. If one and one half hens lay one and one half eggs in one and one half days, how many eggs will three hens lay in eight days?
3. A fish weighs ten pounds plus half of its weight. How much does the fish weigh?
4. Waterlilies on a certain lake double in area every twenty-four hours. From the time the first Waterlily appears until the lake is completely covered takes 60 days. On what day is it half-covered?
5. A brick balances evenly with three quarters of a pound and three quarters of a brick. What does the whole brick weigh?
6. An egg salesman was asked how many eggs he had sold that day. He replied, "My first customer said, 'I'll buy half your eggs and half an egg more'. My second and third customers said the same thing. When I had filled all three orders I was sold out and I had not had to break a single egg all day." How many eggs did he sell altogether?
7. There are nine players on a baseball team. How many outs are there in an inning?
8. A car in Philadelphia starts toward New York City at 40 mph. Fifteen minutes later a car in New York City starts toward Philadelphia, 90 miles away, at 55 mph. Which car is nearest Philadelphia when they meet?
9. Thirteen percent of the people in a certain town have unlisted phone numbers. You select three hundred names at random from the phone book. What is the expected number of these people who will have unlisted numbers?
10. An author writes a book every two years. When his seventh book is published, the sum of the years in which they were all published is 13804. In which year was his fifth book published?
11. Find the missing number in the sequence: 65, 33, __, 9
12. If four days before tomorrow is Thursday, what is three days after yesterday?
13. Hobo Harvey can make a new cigar out of 5 cigar butts. He finds 25 cigar butts. How many cigars can he make?
14. What do you get if you multiply $(x\text{-}a)$ by $(x\text{-}b)$ by $(x\text{-}c)$ and so on, down to $(x\text{-}z)$?
15. Why is a metre stick such a stubborn ruler?



Answer: Because it won't give an ____ .

16. Alice told Ted a joke about decimals but he didn't get the _____.
17. Doing Mathematics can make you rich. For example, add 60 female pigs and 40 male deer. What to you get?
18. Translate this license plate into English.

ARE YOU A MEMBER OF CHAMP?

Membership Form

Name In Full: _____

School: _____ Board: _____

Position : _____

	Home Information	School Information
Address		
Tel. No.		
Fax No.		
E-Mail Address		

Application for Membership In:

O.A.M.E. (includes membership in your chapter affiliation, CHAMP) $40 for one year. Make cheque payable to O.A.M.E

- OR-

CHAMP membership only $9 for one year. Make cheque payable to CHAMP

Signature: _____ Date: _____

Please send completed application and cheque to:

Mrs. Donna Del Re
Applewood Heights S.S.
945 Bloor Street E.
Mississauga, ON L4Y 2M8

For new/returning CHAMP members:

Please tell us:

1. What do you personally get from your membership in CHAMP?
2. What would you LIKE to get as a member?
3. What would you like to see in our next issue of the CHAMP newsletter?
4. Would you like to make a contribution to a future issue? If so, please send your article, clearly identified with your name, address and phone number to:

Mrs. Marlene Dewey
Clarkson S.S.
2524 Bromsgrove Rd.
Mississauga, ON L5J 1L8
Fax No. (905) 822-6896
Phone No. (905) 822-6700 x 237

Thank you for your SUPPORT of CHAMP

Number Sequences from Bouncing Balls by Richard Dewey, IndEC South (PEEL)

The other day my daughter was playing with a small rubber ball called a "bouncy ball" that seemed to have an incredible amount of elasticity. A normal bouncing ball loses most of its energy when it strikes the ground. As a result, it usually bounces to less than half its original height.

Here are some interesting questions about bouncing balls.
Feel free to share the questions with your students.

1. A bouncing ball is dropped from a height of one metre and loses 60% of its energy on each bounce. How high will it bounce after its third bounce?

2. A "bouncy ball" has a very high coefficient of elasticity and will bounce to about 80% of its original height. If there was a "super bouncy ball" that only lost 1% of its energy after each bounce and if it was dropped from a height of one metre, how high would it bounce after the 100th bounce? *(answer to 4 significant digits)*

3. How many bounces would the "super bouncy ball" have to make to reach the same height the ball in the first question reached after only 3 bounces?

4. Consider a "super super bouncy ball" which could bounce higher than its original height. Each bounce might increase its total height by exactly one half of the previous increase in height. If the original height of the ball was 10 metres and the first bounce took it to a height of 15 metres, how high would it bounce after five bounces? What would be its height after 20 bounces? How high would it bounce if it could bounce forever? *(answers to 7 significant digits)*

5. Consider the possibility of a "super super bouncy ball" with the property that the increase in height follows the pattern: $1+\frac{1}{2}+\frac{1}{3}+\frac{1}{4}+\frac{1}{5}+\frac{1}{6}+\cdots$. How high would this ball bounce if its original height was only one metre and it could bounce forever? How many bounces would it take this ball to reach a height of 100 metres?

ANSWERS TO BOUNCING BALLS QUESTIONS:

1. The first bounce B_1 is 40% of a metre of 40 cm.
   $B_2 = .4(40) = 16$ cm.
   $B_3 = .4(16) = 6.4$ cm.

2. $B_1 = .99\text{m}$
   $B_2 = .99(.99) = .99^2\text{m}$
   $B_3 = .99(.99\ ) = .99^3\text{m}$

   $B_{100} = .99^{100} = 0.3660$ m or 36.60 cm.

3. $(0.99) = 0.064$
   $n\log(0.99) = \log(0.064)$ $\quad n = \dfrac{\log(0.064)}{\log(0.99)} \approx 273.51$

   therefore, it would take 274 bounces to reach the same height.

4. $B_1 = 10 + \frac{1}{2}(10)$
   $B_2 = 10 + \frac{1}{2}(10) + \frac{1}{4}(10)$ $\qquad B_3 = 10 + \frac{1}{2}(10) + \frac{1}{4}(10) + \frac{1}{8}(10)$

therefore, the fifth bounce equals the sum of the first 6 terms in the above geometric series,

S_6, *where* $a = 10$ *and* $r = \frac{1}{2}$.

$$B_5 = S_6 = 10\left(\frac{1-\left(\frac{1}{2}\right)^6}{1-\left(\frac{1}{2}\right)}\right) \qquad B_{20} = S_{21} = 10\left(\frac{1-\left(\frac{1}{2}\right)^{21}}{1-\left(\frac{1}{2}\right)}\right) \qquad B_\infty = 10\left(\frac{1}{1-\frac{1}{2}}\right) = 20 \textit{ metres}$$

$= 20\left(1-\frac{1}{64}\right)$

$= 19.6875$ m $\qquad = 19.99999$ m

5. $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} + \frac{1}{9} + \cdots$

   The strategy for this problem is:
   1. with the exception of the first term, form groupings of successive terms that add up to at least 1/2
   2. look for a pattern which would describe the number of fractions in each grouping
   3. define a relationship between the last fraction in each grouping and the number of fractions required for the next grouping to add up to at least 1/2
   4. once a counting process has been established, decide whether the series converges or diverges

   Group 1 $= \frac{1}{2}$

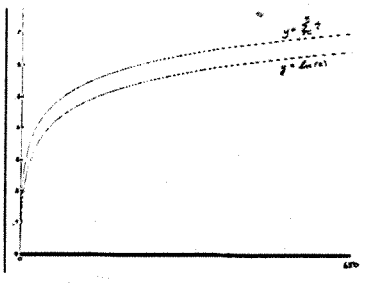
   Group 2 $= \frac{1}{3} + \frac{1}{4} \geq \frac{1}{2}$

   Group 3 $= \frac{1}{5} + \frac{1}{6} + \frac{1}{7} + \frac{1}{8} \geq \frac{1}{2}$

   Group 4 $= \frac{1}{9} + \frac{1}{10} + \frac{1}{11} + \cdots + \frac{1}{16} \geq \frac{1}{2}$

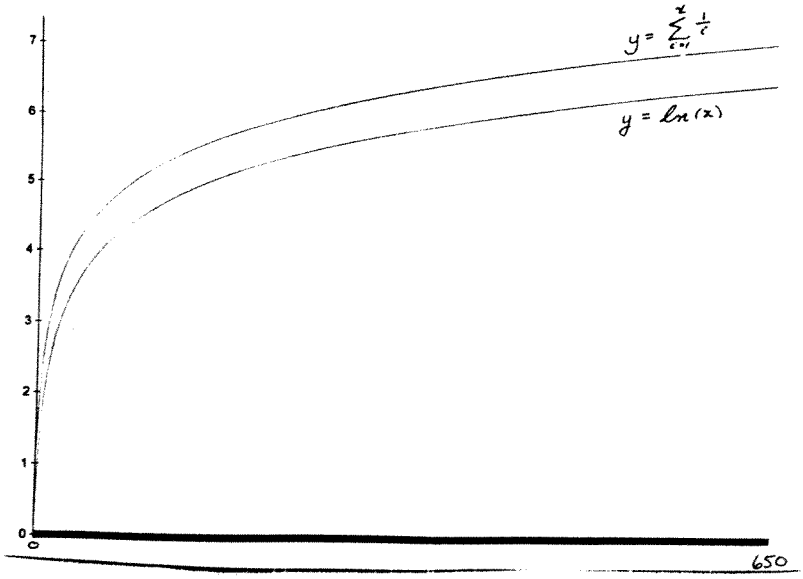
Each grouping will always add to more than 1/2 because the number of fractions in each group is always exactly half the size of the denominator of the smallest fraction in that grouping. Since the denominators of the last fraction in each grouping forms a geometric sequence they can be used to determine the number of fractions required in the next grouping. The carnality of each groupling can be represented by successive powers o 2. Therefore, the number of sums which are greater than 1/2 must be infinite and the series must diverge.

If one places the successive sums into a computer)which can easily be accomplished using a spreadsheet), the resulting graph produces an interesting result. The graph of $y = \sum_{i=1}^{x} \frac{1}{i}$ has a shape very similar to a **logarithmic curve**. In fact, the curve is approximately equal to a vertical shift of the function $y = \ln(x)$. Recall that the function $y = \ln(x)$ represents the area under the curve defined by $y = \frac{1}{x}$. . The difference between the two curves is a result of the fact that the area function is continuous whereas the sequence is summing only the integral values of x. However, as x becomes increasingly large, the two curves appear to become more and more parallel; as shown in the diagram below for 1 $1 \le x \le 650$.

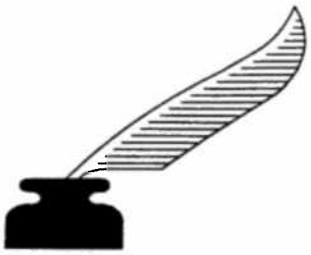


Using the connection between the two graphs we can approximate the number of bounces it would take for the ball to reach a given height, say 100 metres. This would mean that ln(x)= 100, or . To appreciate just how large this number is, consider the following:

If each bounce took only one second, it would take 8.519^{39} years to reach that height. Considering that the universe is thought to be approximately 15 10^{9} years old, this is a **big number.**



Using Rubrics



I have been experimenting with various rubrics in my mathematics class over the past three years. These rubrics have allowed me to obtain a quick overview of each of my students, without testing them to death and defaulting their self-esteem. Our school presently uses a rubric (EPAN) in all of the mathematics courses and it takes the students a little time to fully understand the impact of an outcome-based objective linked to a rubric. There is a transition period that students must undergo to help them realize the benefits of such an outcome based rubric system.

I have devised a transitional rubric based on the colours; Green, Yellow, and Red corresponding to the action words: go, proceed with caution and stop. My students have no trouble understanding the colours concept. The next thing is to relate the three colours to an outcome. I link this rubric to the first assignment I give them (design your own title page for your math notebook). This assignment is handed out on the first day of the semester (Tuesday) and is due on Friday. A student who hands in his/her title page before Friday receives a green colour, a yellow colour is assigned to a student who hands his/her assignment in on Friday, and a red colour for a late assignment. I take all their title pages and run them through the laminating machine and display them on the wall in the classroom. I don't take them down until I have 100% participation. This is a visual reminder for those students who still haven't handed in their assignment to join our community and take some ownership in this environment. Hopefully, they will learn form this first assignment and be punctual on their next. My approach is always an invitational one. I let my students make their own choices and learn from their mistakes. My philosophy is, "It's not a mistake unless you repeat it."

I also survey my student's attitude about mathematics on the first day by asking them to respond to this statement:

"I like Mathematics," circle one number.

1 2 3 4 5 6 7 8 9 10

One being "Strongly Disagree," Five being "Neutral," and Ten being "Strongly Agree."

Then I convert the responses to a Green (10-8), Yellow (7-5), and Red (below 5) rubric. I have on occasion checked their response at the end of the semester to see if there has been any growth in this area. It is quite interesting to see some students attitude about Mathematics climb 1 or 2 points upward but it's quite overwhelming to see some students climb 4 or 5 points upward! I get the feeling that I must be doing something right!

I have a mathematics achievement wall set up in the classroom which was an outgrowth of the title pages display. The question now becomes: How long do I want to be on the math wall? (not Do I want to be on the math wall?) For the organized student who is an achiever he/she will want to stay up on the wall as long as possible during the semester whereas for the unorganized student, the time element will be the shortest (but they will be motivated to try get on the wall more often.) It's like playing "King or Queen of the hill." Once you have been on the top and you got knocked off the hill, you want to be on top again. Here I invite my students to become King and Queen as long as they want to but it always is in a spirit of co-operation, not one of fierce competitiveness! My math wall allows for more than one King or Queen. It really works!

I'll be sharing more ideas regarding this topic in the upcoming Math Fest in the Spring. Hope to see you there.

By Gill Dunn
Notre Dame S.S.
Dufferin-Peel Roman Catholic Separate School Board

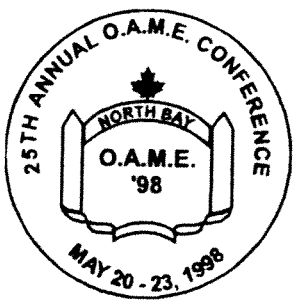
THE ONTARIO MATHEMATICS OLYMPICS

Well done MAC² for putting on a very succesful Math Olympics this past June. CHAMP sent 3 teams to compete against teams from the other 14 regions of OAME. The teams from St. Marks and Camilla Sr. Public Schools both placed in the top ten with Queens Elizabeth Park School not far behind.

The "*Matheletes*" were challenged in a variety of events. A very unique one was when the students themselves were part of the problem (above). The students had to work as a team and get a ring off the ropes that they were tied together with. A great activity to test both logic skills and teamwork.

Special thanks to the coaches, John Duivyn, Judy Pike, Lynda Bowen and Lloyd Gough. Watch for the announcments in February announcing the **2nd Annual Olympic Team Trials** which is the preliminary event for next years Olympics.

Lloyd Gough Queen Elizabeth Park School Halton.



GATEWAYS

ONTARIO ASSOCIATION FOR MATHEMATICS EDUCATION
ASSOCIATION ONTARIENNE POUR L'ENSEIGNEMENT DES MATHÉMATIQUES

25TH Annual O.A.M.E. Conference
May 20 - 23, 1998
Nipissing University
North Bay

Learn about the latest in mathematics education. Work with the best math teachers from across the country and the province!

Keynote Speakers:
- Ivars Peterson
- Theoni Pappas

and others

150 elementary & secondary workshops

entertainment, banquet
25th anniversary celebration

Publishers' Display

Registration Fee: (approximate at this time)
O.A.M.E. Member,
Full Conference $140.00
One Day $75.00
Non-member $185.00

Accommodations:
Nipissing University Residence
$90.00 for 3 nights
Many local hotels & motels
Reasonable rates

LOOK FOR REGISTRATION FORMS LATER IN THE SCHOOL YEAR. FOR MORE INFORMATION, CONTACT:

Susan Stuart 705-474-3461, ext 4236 — e-mail sues@einstein.unipissing.ca
Shawn Godin 705- 494-8600 — shagodin@enoreo.on.ca
Dan Charbonneau 705-566-9605 (Sudbury) — charbod@sudburyrc.edu.on.ca