THE ALBERTA TEACHERS' ASSOCIATION MATHEMATICS COUNCIL

delta-k

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Editorial Recap

'Active Involvement, Skill Development and Concept Understanding: Are They Compatible?' This was the title of the keynote address by Dr. Robert Eicholz to the annual meeting of the Mathematics Council, at Jasper Park Lodge, October 25/26, 1974.

Dr. Eicholz, senior author for Addison-Wesley (Canada) Ltd., developed this theme very effectively. First, he acknowledged that in the past, teachers had often concentrated on skill development. Secondly, he showed that the "new math" program emphasized concept understanding. Teachers and textbook authors both found that, with teaching the new emphasis, it was difficult not to reduce the effective teaching of skills. Then, in the late 1960s and early 1970s, the emphasis in education became student involvement and teachers began to have "math lab" once a week.

Dr. Eicholz challenged us to plan an integrated program. He urged some concept understanding, much skill development, and active involvement. This can be accomplished by planning each lesson in a way that the involvement of the class in problem-solving will permit development of the concept to be learned through the use of skills known. Then, by leaving the problem open to further investigation, we may introduce new skill techniques and deeper concepts. When we find the students learning new techniques, then further practice in these skills can be introduced to reinforce and fully develop the techniques and skills.

One word of caution here. Every teacher must use his or her own method of approach to make ideas work, and any broad, general outline guides you develop could be profitably shared with other teachers in your subject area. As you may have noticed, there is no mention of mathematics as being the subject of the presentation. However, since the audience was mostly math teachers, Dr. Eicholz did naturally use math examples. A few teacher-guests from other disciplines agreed that the concept presented could apply to all subject disciplines.

A second highlight of the annual meeting was Thomas D. Baker's speech - 'Looking Back at Education in Alberta' - a general picture of educational development in Alberta. Of particular interest were Mr. Baker's remarks about the positive aspects of change, such as advantages of consolidation made

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necessary by technological and sociological changes in our society. He left us with the challenge to make innovations in our classrooms to meet the changing needs of a dynamic society. He cautioned us to move with reason and not to accept every innovation, without examination, for the sake of change.

On the second day of the conference we had six sessions, each with specialists in different levels of instruction -

Elementary - 'Gaining on a Balanced Diet,' Gina Brown-Mogham, Winnipeg

'Experiencing the Role of Activities in the Overall Mathematics Curriculum,' Robert Eicholz

Junior High - 'Junior High School Mathematics Curriculum Materials,' Emery Dosdall and Don Kosman, Edmonton

'A Lab Approach to Metrication,' Moyers Vico Ltd.

Senior High - 'Secondary School Mathematics Enrichment,' Glen Kauffman, Edson

'Individualized Instruction,' Dorothy Burton, Calgary.

(The above list is presented without comment from your editor as he could not be everywhere at the same time.)

At the business session, we accepted two changes in our constitution. (A copy of the constitution, with these changes incorporated, was mailed with the November issue of *Delta-K*.) Fees were increased, beginning January 1, 1975, to: Regular membership $6, Subscription $6, Student $3.

Effective January 1, 1975, the costs for the Metric Missionary Workshops will include expenses of participants, plus an honorarium to MCATA in an amount to be negotiated (minimum $50). The program has been extended to June 1 and could be renewed next year if there is sufficient need expressed.

Book displays at the MCATA annual meeting, 1974. Were you there?

The 1975 MCATA annual meeting is scheduled for Calgary - October 4/5, at the Calgary Inn.

On the Russian Peasant Multiplication Algorithm

- *William J. Bruce*

This simple algorithm for multiplication of natural numbers involves addition, multiplication only by two, and division only by two. It is commonly known as the Russian peasant method because of the limited arithmetical skills required. We consider an example in detail and then prove by mathematical induction that the algorithm holds for any two natural numbers.

Our problem is to find the product of 226 and 35 and the format given below is chosen so as to fully explain each step:

	A	B		Product
a	226	35	b	ab
$2a$	452	17	b_1	$ab = 2ab_1 + a$
$4a$	904	8	b_2	$ab = 4ab_2 + 2a + a$
$8a$	1808	4	b_3	$ab = 8ab_3 + 2a + a$
$16a$	3616	2	b_4	$ab = 16ab_4 + 2a + a$
$32a$	7232	1	b_5	$ab = 32ab_5 + 2a + a$
	7910			

The procedure illustrated above is as follows:

1. Double $a = 226$ in column A to obtain $2a = 452$. Reduce $b = 35$ to an even number, namely 34, and divide 34 by 2 to obtain $b_1 = 17$ in column B. Our new product, $2ab_1$, is short by $a = 226$, since we reduced b by 1. We now have

$$ab = 2ab_1 + a.$$

2. Double $2a = 452$ in column A to get $4a = 904$. Reduce $b_1 = 17$ to an even number again, namely 16, and divide 16 by 2 to obtain $b_2 = 8$ in column B. Our new product, $4ab_2$, is short by an <u>additional</u> amount $2a = 452$, since we reduced b_1 by 1. We now have

$$ab = 4ab_2 + 2a + a.$$

3. Double $4a = 904$ in column A. Since $b_2 = 8$ is even, it is divisible by 2 and we obtain $b_3 = 4$. Our new product, $8ab_3$, is not short by any <u>additional</u> amount,

since b_2 is even. We now have

$$ab = 8ab_3 + 2a + a.$$

4. Continue this procedure to obtain 16a and 32a in column A, and b_4 and b_5 in column B. In these steps no additional omissions have been made in obtaining $16ab_4$ and $32ab_5$. Thus

$$ab = 16ab_4 + 2a + a$$

and

$$ab = 32ab_5 + 2a + a.$$

Now $32ab_5$ is trivially obtained by multiplying by 1. Hence we have

$$P = ab = 32ab_5 + 2a + a$$
$$= 7232 + 452 + 226 = 7910.$$

We can verify that this is correct since

$$b_5 = \frac{b_2}{8} = \frac{b_1 - 1}{16} = \frac{\frac{b-1}{2} - 1}{16} = \frac{b-3}{32}$$

so that

$$P = 32a\,\frac{b-3}{32} + 2a + a$$
$$= ab - 3a + 2a + a = ab.$$

This final step in the algorithm can now be stated briefly. Every time the number in column B becomes even, there is no remainder upon division by 2, hence for even numbers in column B we omit the corresponding numbers of column A. The sum of the remaining numbers in column A gives the product ab.

The simplicity of the steps in the example indicate that, intuitively at least, we can see that this algorithm generalizes for products of any natural numbers. Our proof by induction proceeds in the following manner -

The algorithm is true for $b = 1$.

We assume it is true for $b \leq k$, $k \leq b-1$.

Case I: b even. We must prove true for $b = k+1$.

Now $a(k+1) = 2a\,\frac{k+1}{2} = 2ab_1 = 2a\,\frac{b}{2} = ab$, since b is even.

Case II: b odd. We must prove true for $b = k+1$.

Now $a(k+1) = ak + a = 2a\,\frac{k}{2} + a = 2ab_1 + a$, since b is odd.

But $2ab_1 + a = 2a\,\frac{b-1}{2} + a = ab$.

It follows by the principle of mathematical induction that the algorithm is true for every natural number b. Note that the algorithm is commutative and that the number of steps will be fewer when we choose the smaller number for division by 2.

Broad Spectrum Mathematics Project

by *Peter Weygang* and *Alan C. Madgett*

This project is an attempt to modify mathematics curricula and methodology at the senior high school and first year university levels. We hope to create changes in mathematics education by putting into practice three fundamental ideas:

i. That a high school mathematics program should, for the majority of students, provide a wide but solid foundation.

ii. That mathematics is best developed from a consideration of the realistic and relevant mathematics which occurs in the everyday world of business, technology, and the pure and social sciences.

iii. That the products of modern technology, namely the mini-calculator and the computer, are perfectly valid mathematical tools, and should take their rightful place in mathematics education.

In considering these ideas, point by point, we find that the high school mathematics curricula have been controlled, to a large extent, by university entrance requirements. The presumption has always been that schools are preparing students for admission to the honors program in pure mathematics (which is not the intent of the average student). The majority of students are in fact proceeding to an Arts program, Life Sciences, or other similar disciplines in which the mathematics content is not of a highly theoretical or abstract nature, even though the amount of mathematics involvement and usage can be quite appreciable. These students need a program which builds confidence by using simple mathematical ideas, which builds flexibility by presenting a variety of mathematical alternatives, and which builds interest by presenting material which is relevant to the real world.

In considering the second point, it should be noted that the mathematics-user group has experienced a tremendous growth in recent years. It is difficult to find a profession, occupation or activity which does not have a mathematical component, often quite large. Even in baseball, batting averages are given to three digit accuracy! In today's world students are, from dire necessity, brought face to face with a mathematical reality. Many students are not 'turned on' by mathematics; as a result, these resentful students pose a number of problems for the teacher, ranging from discipline to methodology. Motivation has become a big issue in mathematics education because, unlike the Classics, mathematics can not be avoided by students without serious implications for later life.

Fortunately, most students are anxious to get out into the real world, to become adults and full-fledged citizens. The school environment is very artificial and, by contrast, anything which smacks of realism has an inflated appeal. By

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using real problems as a starting point in mathematics we do two things. First, we capture the interest of the student, by capitalizing on his desire for reality. Second, we provide the students with a problem and a treatment in its original context, be it agriculture or nuclear medicine. This incidental background information is of considerable value to the students, and helps to enrich their vision of the world. We feel that this approach opens the students' eyes to career opportunities, provides some new insights, and of course teaches some good solid mathematics!

In considering the third point, it is apparent that students leaving high school enter a world in which the computer is commonplace. Every major university and industry has its own computer, every office desk has its mini-calculator. The age of 'speed of light' arithmetic has arrived everywhere, except in the mathematics classroom. Mathematics teachers have, in general, an ingrained distrust of the slide rule, calculator, or any other means of easing arithmetic computation. At the same time they fail to appreciate that arithmetic difficulties are the prime hurdle to understanding mathematics. Computation is no friend of logic.

The study of fractions will illustrate this point. Historically, fractions, such as 1/2, 1/4, 1/8, were associated with the early tradesman in his day to day calculations, such as in making window sashes, doors and the like. Manipulation of these fractions had a real value since the alternative, reduction to decimals, was a tedious process. At some stage a misguided pedagogue decided that, since 1/12 + 3/4 was a useful piece of mathematics, he was justified in producing lots of practice examples such as 5/7 + 4/11. This in itself was an error since these fractions are almost impossible to conceptualize, as is the answer, 83/77. Nonetheless, this fraction cult still dominates much of junior mathematics. If for some curious reason it were necessary to do this computation, then the sensible way is to use the calculator:

$$\frac{5}{7} + \frac{4}{11} = .71428571 + 36363636 = 1.07792207$$

This answer is probably close enough, and took two seconds!

At a higher level of mathematics we should again be using numerical methods and calculator aids. For example, numerical integration is a genuine alternative to theoretical integration. In fact, the problems which arise in industry are invariably represented by ill-behaved functions or purely empirical data, for which the slick methods of theoretical mathematics are seldom of much value.

Project History

The original concepts which underly this project were formulated some five years ago by Mr. Weygang. This formulation was followed by a discussion with Ontario Ministry of Education representatives on the project's acceptability. Mr. John Milliken (now the Ministry of Education's liaison officer for this project) gave his approval in principle and the way was clear for the next stage. This was a period of consultation with the mathematics faculty at Laurentian University, who provided considerable specific guidance as to desirable course content. Professor A.C. Madgett was a member of the original advisory group, as was Dr. J. Scott-Thomas, the project director.

Following this input Mr. Weygang developed a detailed course outline and some teaching units. The course is now in the fourth year of in-class use and has surpassed its expectations in all but one area, namely, the number and variety of real life applications being too limited. A cross-Canada survey will attempt to collect these materials.

Progress Report (As of September 30, 1974)

The collection of material started in British Columbia where it was possible to enter into productive discussions with representatives of a wide variety of occupations such as oceanography, forestry, natural gas, and fisheries. Some classroom teaching was also done, in Kamloops, and the reaction to the approach and materials was extremely encouraging.

In Alberta it has been possible to visit representatives of the plywood industry, corrosion engineers, petroleum engineers connected with the Athabasca Tar Sands, environmental specialists, and a host of others. In all areas we have been able to obtain significant contributions, both as information and examples, which relate mathematics to real world situations.

The collection stage of the project, which is funded by the Ontario Ministry of Education, will be completed in June of 1975. At that time we will begin the mammoth task of collating and re-working the material into a form which will be of maximum use to classroom teachers. The final form will probably be a set of resource books incorporating problems spanning a wide range of mathematical ability and grade levels. Each problem will be preceded by a short explanation of the technology involved, in order to 'set the scene'. The problem will be followed by a solution (sometimes several solutions of increasing refinement will be presented). The solutions will be followed by some notes and suggestions which may be of value to the teachers.

We are very fortunate to be able to undertake this project and we appreciate that most teachers do not have the time, energy or financial resources to make such a survey. The re-establishment of contacts between education and reality is one of our most pressing needs. We hope and trust that the end product of this project will be of use to all teachers of mathematics throughout Canada.

Sources of Funding

1. Ontario Ministry of Education: Grants-in-Aid of Educational Research Program $20,000.
2. P. Weygang - Ontario Secondary School Teachers' Federation Travelling Scholarship $3,000.
3. A.C. Madgett - President's Research Fund, Laurentian University $3,000.

VISITATIONS

British Columbia

1. Environment Canada, Vancouver (Commercial Fisheries Operations)
2. Environment Canada, Patricia Bay, Victoria (Marine Sciences Division)
3. Fisheries Research Board of Canada, Nanaimo
4. B.C. Forest Products Limited, Vancouver
5. Westcoast Transmission Limited, Vancouver (Natural Gas Pipe Lines)
6. B.C. Hydro, Vancouver (Hydro-electric Power Generation)
7. Seaspan International Limited, Vancouver (Shipping)
8. B.C.I.T., Industry Services Division, Vancouver

Alberta

1. Alberta Agriculture (Food Production), Edmonton
2. Alberta Environment, Edmonton (Air Management, Water Quality, Hydrology, Pesticides)

3. Zeidler Plywood Corporation, Edmonton
4. Wardair Canada Limited, Edmonton (Air Transportation)
5. Caproco Corrosion Prevention Ltd., Edmonton
6. Gainers' Ltd., Edmonton (Meat Packers)
7. Great Canadian Oil Sands, Edmonton (Athabasca Oil Sands: Oil Recovery)
   Athabasca Realty, Edmonton (Housing - Athabasca Oil Sands)
8. Numac Oil & Gas Ltd., Edmonton (Exploration)
9. Sherritt Gordon Mines Limited, Fort Saskatchewan (Nickel Processing)
10. Alberta Research Council, Edmonton
11. Imperial Oil Gas Separation Plant, Redwater
12. Fleetwood Homes of Alberta, Red Deer
13. Energy Resources Conservation Board, Calgary
14. Canadian Petroleum Association, Calgary
15. Schlumberger of Canada, Calgary
16. Dowell of Canada, Calgary
17. Water Survey of Canada, Calgary
18. City of Calgary: Transportation Department
    Management Systems Development Department
19. General Hospital, Nuclear Medicine Dept., Edmonton
20. Sicks' Lethbridge Brewery, Lethbridge
21. Catelli Ltd., Lethbridge
22. Agri-Analysis Lethbridge
23. Lilydale Poultry Sales, Lethbridge
24. Alberta Agriculture (Lethbridge): Poultry Branch

Metric Manual

As the United States prepares for conversion to the metric system, J.J. Keller & Associates, Inc., have announced the publication of the "Metric Manual," dealing with metric data relative to the conversion process.

The deluxe binder edition provides practical background information necessary to understand the full implications of metrication. The "Metric Manual" has required several years of planning and research - and parallels the announcements by several major industries and organizations to convert to the metric system.

Ideal for home and business libraries, the "Metric Manual" is published in loose-leaf, three-ring binder format and contains: History of Measurement Development of Metrology, U.S. Metric Considerations, Standards, Government Agencies, Metric Training, Personal Applications, Business Considerations, Industrial Foundation, Professional Concerns, Related Organizations, Foreign Commerce, Measurement Comparisons, Glossary and Appendix.

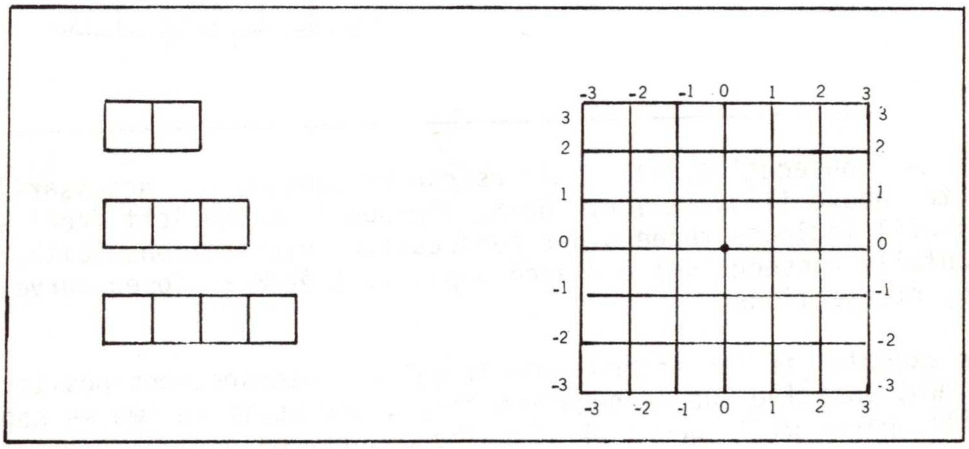
I have made a study of the above publication and find the review satisfactory. At the time it was introduced to the public (August, 1974) it was being offered at a special introductory price of $25, direct from the publisher: J. J. Keller & Associates, Inc., 145 W Wisconsin Avenue, Neenah, Wisconsin 54956. (Editor)

Have You Tried This?
Challenge the Teacher

by *George L. Henderson*

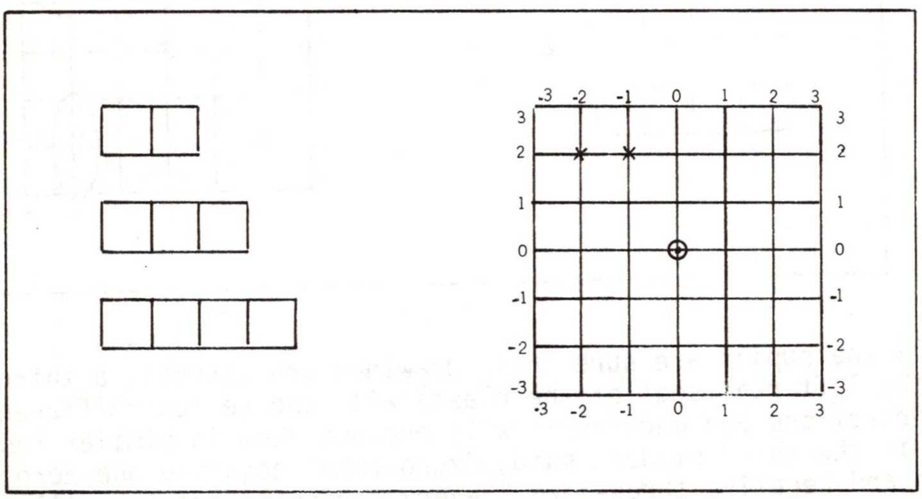
"Today is *Challenge the Teacher* day! You may compete against me; however, keep in mind that I usually win." The name of the game is "Battleship."

On a piece of paper, teacher and pupils each draw the following diagram.

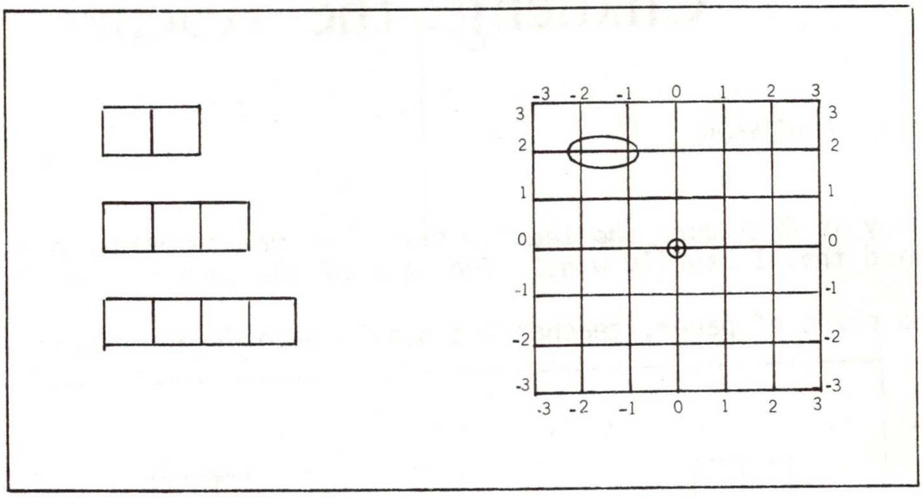


When everyone has the diagram completed, the teacher is to leave the room. Once the teacher is out of hearing, the pupil in the right front seat of the class will indicate to the other pupils TWO consecutive (either horizontally or vertically consecutive) intersections of the lattice.

For example, if the pupil says, "intersections negative two - positive two and negative one - positive two," he will be describing the intersections marked below. (Note, the first number in a pair indicates where to go, horizontally, the second number tells the vertical location of the point.

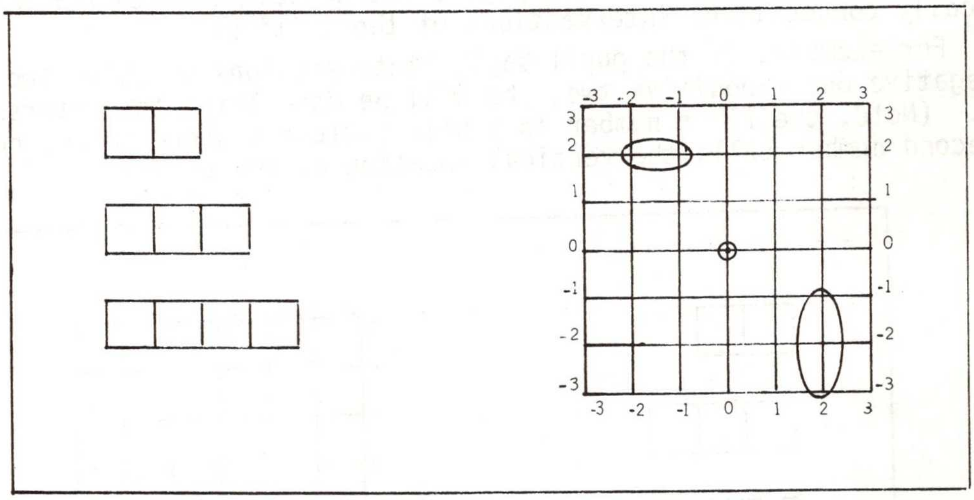


Once all class members understand which two consecutive intersections are indicated, each pupil is to draw a closed curve around the two intersections, as illustrated below.

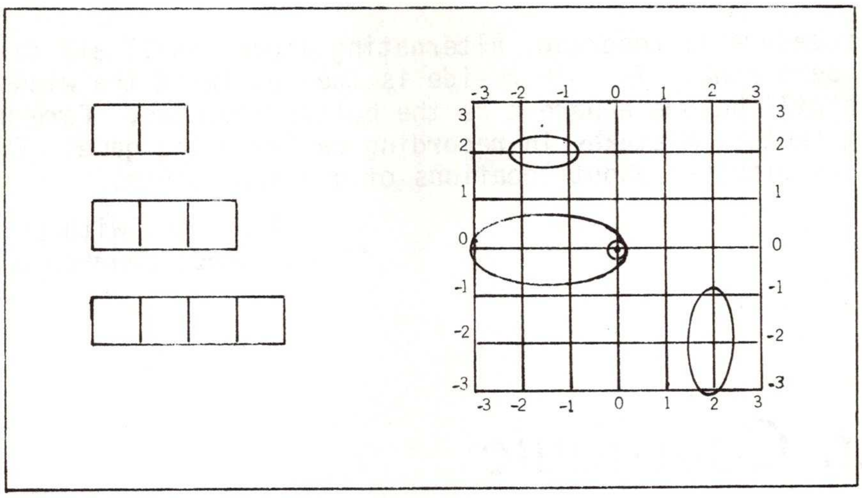


Any two consecutive intersections can be chosen, not necessarily those shown in the above illustration. Next, the pupil in the left front seat of the class will indicate three other consecutive intersections (either vertically or horizontally consecutive) and each pupil will draw a closed curve around the indicated intersections.

For example, if the second student said, "intersections positive two -- negative two, positive two -- negative three, and positive two -- negative one," each pupil's paper will then look like the diagram below.



Once all the pupils are sure their drawings are correct, a third student (the one in the left rear seat of the class) will choose four different consecutive intersections and each pupil will enclose them in similar fashion. For example, if the third student said, "zero-zero, negative one-zero, negative two-zero and negative three-zero," every student's drawing will then look like the following.



The closed curves indicate locations of the pupils' "battleships." Counting consecutive enclosed intersections serves to identify two "two-ship," "three-ship," and "four-ship." All pupils are to turn their papers face down on their desks, then one brings the teacher back into the classroom.

The teacher should already have positioned three battleships on his paper, and he should make sure that no student sees their locations when he returns to the classroom.

The teacher then takes his seat in front of the class, placing his paper so he can see it and write on it but so no pupil can see it. Students turn their papers so they can see them and write on them without the teacher seeing them. Shields can be erected, using books or pads of paper. Preparations for the "battle" now are complete. Play goes as follows.

The pupils collectively make up one side and the teacher is the opponent. When "shots" are made, they are recorded on all papers.

The teacher gets "first salvo." He has one shot for each of his floating ships. During the course of the game, if one of his ships is "sunk," he no longer gets a shot for it as part of his salvo. A ship is sunk when all intersections in it have been hit.

The teacher shoots by calling aloud the relation-pairs of numbers indicating the intersections he wishes to "blast."

After the teacher has called his opening three shots, the pupils must admit whether or not he "hit" any of their ships, indicating which ship and how many hits it sustained, but not saying which of the teacher's shots did the damage.

For example, the students may say, "you hit our three-ship once." Then the teacher can mark one hit in the three-ship drawn beside his lattice. This serves as a round of his hits.

Note: all players mark all hits by writing symbols on the intersections blasted.

Next, the students shoot a salvo, taking turns, in order, around the class shooting single shots. In other words, three pupils each get one shot.

This procedure is repeated, alternating sides, until all three ships on one side have been sunk. The other side is then declared the winner. Shooting strategies will become apparent as the battle advances. Care must be taken when recording shots. Mistakes in recording can ruin the game. The teacher has final say in disputes about locations of previous shots.

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Wisconsin Teacher of Mathematics

You Can Contribute To Future NCTM Yearbooks

The NCTM is using a new approach in the development of yearbooks, the rationale for which was presented in the 1974 November issues of the *Arithmetic Teacher* and the *Mathematics Teacher*. The major portion of each yearbook will be composed of essays organized around a theme, with the treatment being neither definitive nor exhaustive. Nonthematic essays deserving widespread distribution to Council members will also be included.

The theme for the second of these new-look NCTM yearbooks will be alternative patterns in organizing for instruction in mathematics for grades K-12. It will include a presentation of instructional possibilities as well as their particular classroom applicability and implications. This will be another yearbook that every council member will want to read and will be able to use as a valuable resource.

The editor for the Alternatives in Organizing for Mathematics Instruction Yearbook, scheduled for publication in 1977, will be F. Joe Crosswhite, Ohio State University. Council members are encouraged to contribute original essays on this topic or on other topics of general interest to mathematics teachers. Guidelines for writers are available from the NCTM Yearbook General Editor, Robert E. Reys, 209 Laboratory School, University of Missouri-Columbia, Columbia, Missouri 65201.

Think Denver

The opening address to the annual meeting of the National Council of Teachers of Mathematics, April 23, 1975 in Denver, will be given by Eric McPherson, University of Manitoba, Winnipeg. The convention is planning 200 section meetings, classified as elementary, junior high, secondary, two-year college, general interest, teacher education, and research in mathematics education. Approximately 115 workshops, including computer workshops, are also planned. A program will be mailed to NCTM members about the middle of February. Non-members may obtain one by writing to the National Council of Teachers of Mathematics, 1906 Association Drive, Reston, Virginia 22091.

1.4 Kilograms Of Hamburger and A Liter Of Milk Please

by *Dr. S. A. Lindstedt*

Canada is adopting the Metric system of measurement. Mr. S.M. Gossage, chairman of the Metric Commission, has stated that he thinks we will be a "predominantly" metric country by 1980. In so doing we will join over 95 percent of the countries of the world; this will help our international trade and facilitate world-wide understanding in the fields of commerce, industry and communications.

But, of course, international trade and communication is not the only reason for "going metric." There are other fundamental reasons for the adoption of this system of measurement.

A. The metric system is easier. Yes, it is. The units and subunits are all based on a decimal system and this means that conversion from one unit to another is just a matter of shifting the decimal point. For example, the length of a Canadian football field is 100.584 meters. The following chart shows how easy it is to change this measurement using other units of length.

Length of Football Field

1 0 0 5 8 4	millimeters	(mm)
1 0 0 5 8.4	centimeters	(cm)
1 0 0 5.8 4	decimeters	(dm)
1 0 0.5 8 4	meters	(m)
1 0.0 5 8 4	decameters	(dam)
1.0 0 5 8 4	hectometers	(hm)
0.1 0 0 5 8 4	kilometers	(km)

It is also easier to complete calculations. For example, if your granary is 20 ft. 6 in. long, 15 ft. 4 in. wide and 10 ft. 2 in. high, you need to perform the following calculations to find out the number of bushels it will hold:

20-1/2 x 15-1/3 X 10-1/6 X 6-1/4 X 1/8 bushels.

That's a pretty awkward computation - even an electric calculator would have some difficulty with it.

The corresponding metric units to the same degree of precision would be: length 6.25 meters, width 4.67 meters, height 3.10 meters. To find the capacity of the granary you would complete this calculation:

6.25 X 4.67 X 3.10 X 1 kiloliters

Not difficult at all.

B. The metric system will simplify package sizes and make price comparisons much easier. For example, washing detergent is sold in a great variety of sizes at various prices. In a recent survey I counted 28 different sizes on one shelf in a supermarket - here are the sizes and prices of eight which I selected -

5 lbs. - $2.43
75 oz. - $2.39
42 oz. - $1.35
40 oz. - $1.91
32 oz. - $0.89
28 oz. - $1.21
23 oz. - $1.09
16 oz. - $0.75

Quick now, which is the best buy?

Toothpaste, on the other hand, is now sold only in "metric" sizes. I noted the following on display:

150 *mℓ* - $1.43
100 *mℓ* - $1.03
50 *mℓ* - $0.66

(*mℓ* is the symbol for milliliter)

You see, you have a much better chance to compare prices.

Well, what <u>is</u> this marvelous, elegant system of measurement?

What are the basics?

Because we have been taught and have used Imperial units such as the inch, quart and pound, we may think that metric units are very numerous and very disorganized. Not so. There are <u>three</u> new basic units to learn for most of the everyday uses of measurement. They are:

1. The meter, (symbol m), a unit of length. It is about half the height of an ordinary door.

2. The liter, (symbol ℓ), a unit of capacity. It is just a bit smaller than the Canadian quart - and, as it happens, just a bit larger than the American quart. (At least the use of the liter will eliminate <u>that</u> confusion.)

3. The gram (symbol g), a unit of mass (or "weight," as it is commonly called). It is a very small unit - less than the weight of a paper clip. For that reason the kilogram (symbol kg) which is 1 000 grams will be in common use.

Now for each of the above three units, we derive larger and smaller units indicated by the following six prefixes:

for the bigger units

-kilo-, meaning "1 000 times"
-hecto-, meaning "100 times"
-deca-, meaning "10 times"

for the smaller units

-deci-, meaning "1/10 of"
-centi-, meaning "1/100 of"
-milli-, meaning "1/1000 of"

For different units of length we combine the above prefixes with the meter -

a kilometer (symbol km) is 1000 meters
a hectometer (symbol hm) is 100 meters
a decameter (symbol dam) is 10 meters
a meter (symbol m) is 1 meter
a decimeter (symbol dm) is 1/10 of a meter
a centimeter (symbol cm) is 1/100 of a meter
a millimeter (symbol mm) is 1/1000 of a meter.

(Go back and review the example of the length of a football field.)

For different units of capacity we have a similar arrangement - we combine the same prefixes (and they keep their own meanings) with the liter to get a kiloliter (kℓ), a hectoliter (hℓ), a decaliter (daℓ), for the bigger units, and a deciliter (dℓ), a centiliter (cℓ), and a milliliter (mℓ) for smaller units. Although these units do exist, we will probably not use all of them in everyday practice. We will use the big one - the kiloliter - for measuring the capacity of storage tanks, granaries, oil tankers, reservoirs, etc. We will use the very small one - the milliliter - for measuring the capacity of toothpaste tubes, medicine drops, shampoo bottles, etc., and we will use the liter itself for milk, paint, gasoline, oil, antifreeze, etc.

Similarly we combine the same prefixes with "gram" to get units of mass. The kilogram will be used in buying meat, vegetables, fruit, sugar, flour, fertilizer, lawn seed, cement. First class passengers on air lines will be allowed 30 kg of luggage; economy class must get along with 20 kg.

Even the kilogram (1 000 grams) is a fairly small unit. Therefore a larger metric unit - the tonne (symbol t), sometimes called the "metric ton," will be used for larger quantities. The tonne is equal to 1 000 kilograms; it is about 10 percent bigger than the ordinary ton of 2,000 pounds. It will be used to measure loads of wheat, gravel, sand, bricks. The milligram (mg) is a tiny, tiny unit of mass. It will be used to measure pharmaceutical quantities.

We will not become metric overnight, nor by a certain date. We will move into the system at various places at different times. Because the students in our schools of today will undoubtedly graduate into a metric world of tomorrow, we should begin as soon as possible to include the metric system of measurement in school programs. All weather forecasts will be using metric units of measurement during the year 1975 - snowfall will be measured in centimeters, rainfall in millimeters, wind velocity in kilometers per hour and temperature in degrees Celsius. During the year 1976 we can expect the metrication of highway signs - distances in kilometers, speeds in kilometers per hour, the heights of mountains in meters. In 1977 all grain will be measured, for local sales, in metric tons. Even at the present time, we sell our wheat overseas in metric tons. Many household products will start to appear in "metric packages." As already mentioned, toothpaste tubes have been metricated. Heavy industries will take the first opportunity to replace worn-out or obsolete machines and tools with metric calibrated equipment. Many have already made the change - the Pinto Ford is a metric car manufactured in the States; International Harvester, I.B.M., Stelco Steel are going metric. General Motors has announced similar intentions. In sports we are already accustomed to the 100 meter dash, the 50 meter swim, the high dive from the 10 m board; the new racetrack at Stampede Park in Calgary is one kilometer in length.

Some things will not change. We often use units of measure just as a manner of speaking rather than as an application of serious measurement. We sing the song "I love you a bushel and a peck" without really thinking of measuring out the love. But I hope we won't destroy the charm of these little expressions by insisting on the metric translation, "I love you 36.369 liters and an additional 90.922 deciliters."

Metric Conference

Last March, the Ontario Ministry of Education and York University's Centre for Continuing Education co-ordinated the first Metrication Conference. It was an instantaneous success. Accordingly, the Centre has responded to the needs of mathematics teachers across the country and organized a more extensive conference - MATH '75, to be held at York University in Toronto, May 28/30, 1975.

Its format will be similar to York's well-established Reading Conference with educators from across the continent being invited to share their knowledge and gather new expertise. "In-service up-dating for educators at all levels" will be the focus of MATH '75. The three-day program will offer -

- Pre-conference seminars on fractions, geometry, shapes, metrication, and Piaget and mathematics
- Four distinguished conference speakers

- Eight sessional speakers
- Twenty-eight workshops and seminars
- Films and a publishers' exhibit of learning materials.

The keynote conference speakers are Dr. Howard Fehr, director of Secondary School Mathematics Curriculum Improvement Studies at Columbia University, New York, who will speak on "Geometric Instruction: Goals and Content," Professor Morris Kline, a visiting distinguished professor at Brooklyn College, New York, who will consider "The Value of Senior High Mathematics," Miss Angela Armitt, director of the Summer School and Extension Department, University of Western Ontario, whose topic is "Communication Through Humour," and, Dr. Robert E.K. Rourke, mathematician and lecturer, who will expound on "When Everyone is Somebody, Then No One's Anybody."

The fee for the three-day conference is $75. Complete details on MATH '75 is readily available from the Centre for Continuing Education, York University, 4700 Keele Street, Downsview, Ontario; telephone (416)667-2502.

Triscore

by A.B. *Wacowich*,
St. Thomas More Junior High School
Edmonton, Alberta

Addition, subtraction, multiplication, and division are the main points covered in this game. Factoring is also used.

The grade level is three and up. We have used them as high as grade nine - at this level many students became innovative and introduced powers and roots. Students like the game and we seem to have no difficulty in keeping them active for a complete period playing it.

The game consists of a playing board divided into squares, and numbered chips which are placed on the board by the players. Two to four players may play at a time. Five games, with variations within each, are explained. Students of more ability soon make up other games when those explained become too simple.

The basic idea is to use three chips out of five at any one turn, placing them horizontally or vertically on the squares on the board. The numbers are, let us say, added to get a sum of fifteen. If they get the sum fifteen, then points are given to that player. If the sum of fifteen cannot be obtained by the player, he must still place his chips but score no points. Play ends when the board is full. The winner is the player with the highest score. Similar rules apply to games of product-sum; product-factor; product-sum-difference; numeral factor; other variations of the sum game.*

**Can be obtained at Western Educational Activities Limited Edmonton, Alberta. (Canadian Distributors)*

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0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

This ruler is marked off in millimeters - 10 mm = 1 cm

Think Metric

1. *Units of Length:*

	1 mm	(millimeter), is about the thickness of a dime.
10 mm =	1 cm	(centimeter), about the width of a fingernail.
10 cm =	1 dm	(decimeter), about the width of your hand.
10 dm =	1 m	(meter), about half the height of an ordinary door.
10 m =	1 dam	(decameter), about the height of a 3-storey building.
10 dam =	1 hm	(hectometer), about the length of a football field.
10 hm =	1 km	(kilometer), about the length of a brisk 10 minute walk

2. *Units of Capacity or Volume:*

1 cm^3 (cubic centimeter) = 1 mℓ (milliliter), a small eye dropper full.
1 000 cm^3 = 1 ℓ (liter), about 4 coffee cupsful.
1 m^3 (cubic meter) = 1 kℓ (kiloliter), about 5 gasoline drums.

3. *Units of Mass (Commonly called weight)*

1 g (gram), is the mass of a medium sized raisin, or the mass of 1 mℓ of water.
1 000 g = 1 kg (kilogram), about the mass of five oranges, or the mass of 1 ℓ of water.
1 000 kg = 1 t (tonne, or "metric ton"), about the mass of a Volkswagon or the mass of 1 kℓ of water.

4. *Units of Area:*

1 cm^2 (square centimeter) is about the area of your small fingernail.
10 000 cm^2 = 1 m^2 (square meter), about the area of an ordinary refrigerator door
10 000 m^2 = 1 ha (hectare), an average city block.

5. *Units of Temperature: (In degrees Celsius)*

200°C - Hot oven.
175°C - Moderate oven.
100°C - Boiling water at sea level.
40°C - High fever.
37°C - Normal body temperature.
30°C - A warm day.
22°C - Normal room temperature.
0°C - Freezing point of water
-20°C - Very cold.
-30°C - Extremely cold.

This Information Sheet was prepared by Dr. S. A. Lindstedt, Consultant, Metric Measurement.

This ruler is marked off in centimeters (cm). 100 cm =1 m

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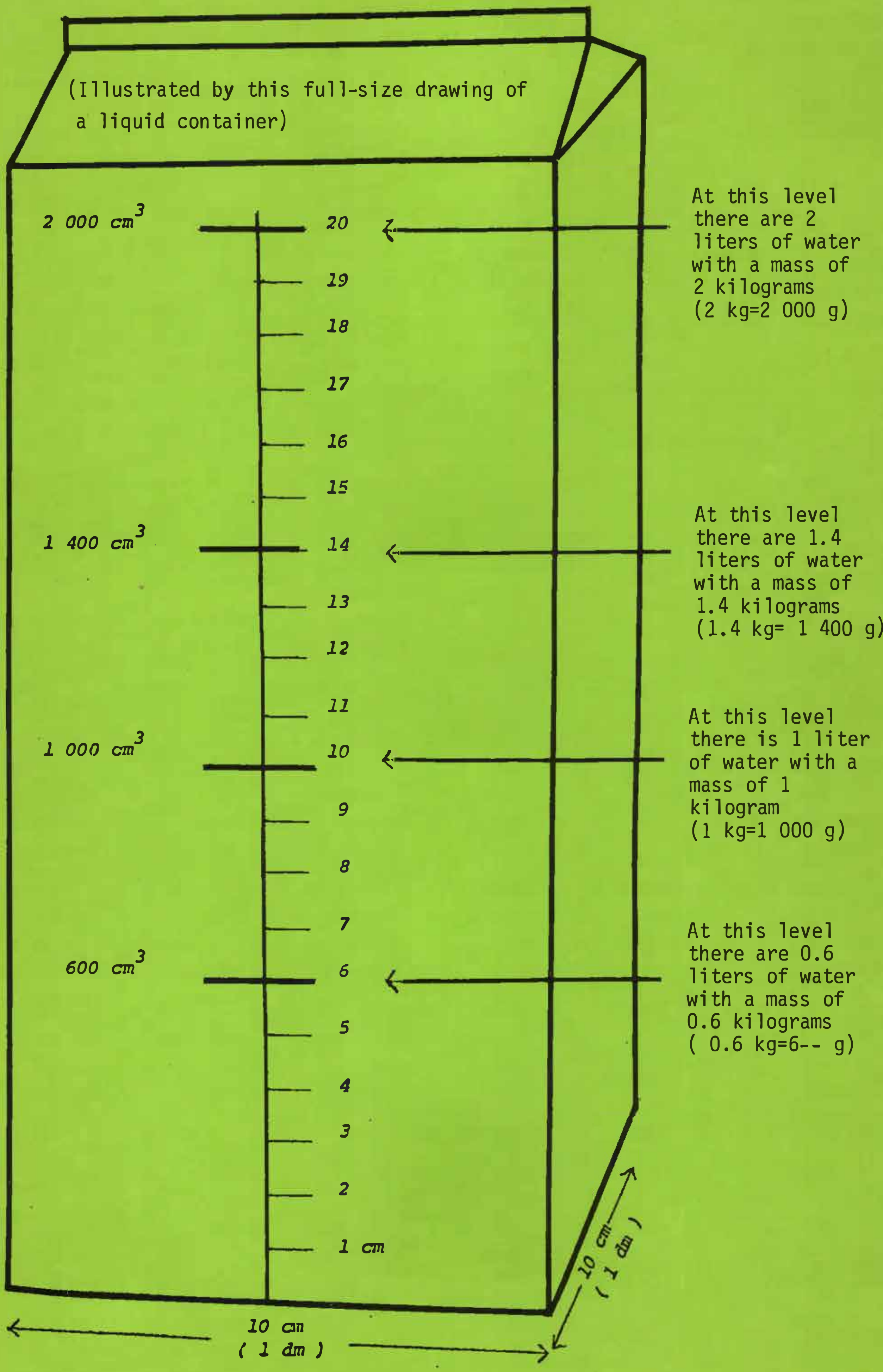
Metric Units Of Volume, Capacity and Mass



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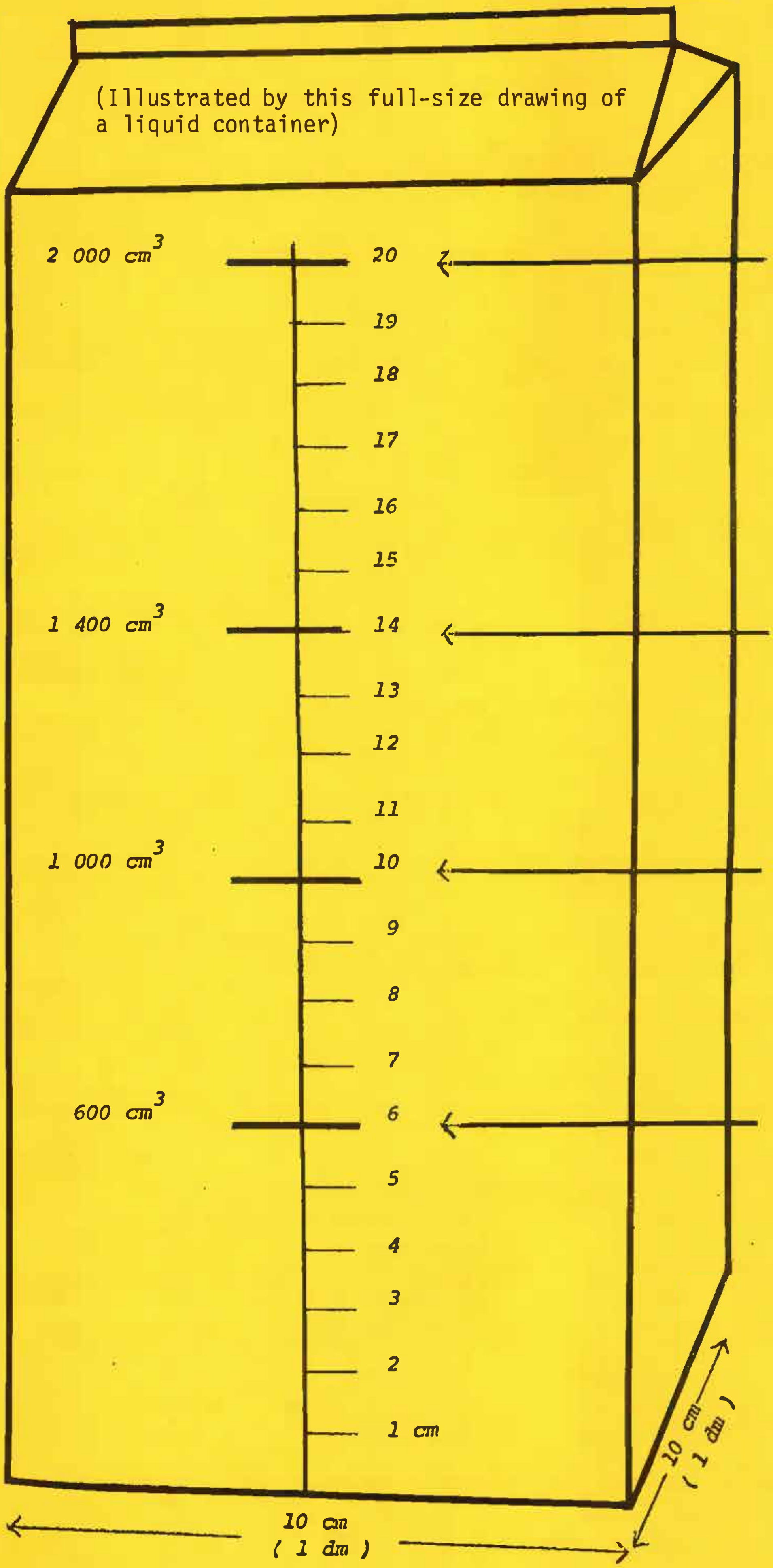
Metric Units Of Volume, Capacity and Mass



At this level there are 2 litres of water with a mass of 2 kilograms (2 kg=2 000 g)

At this level there are 1.4 litres of water with a mass of 1.4 kilograms (1.4 kg= 1 400 g)

At this level there is 1 litre of water with a mass of 1 kilogram (1 kg=1 000 g)

At this level there are 0.6 litres of water with a mass of 0.6 kilograms (0.6 kg=6-- g)