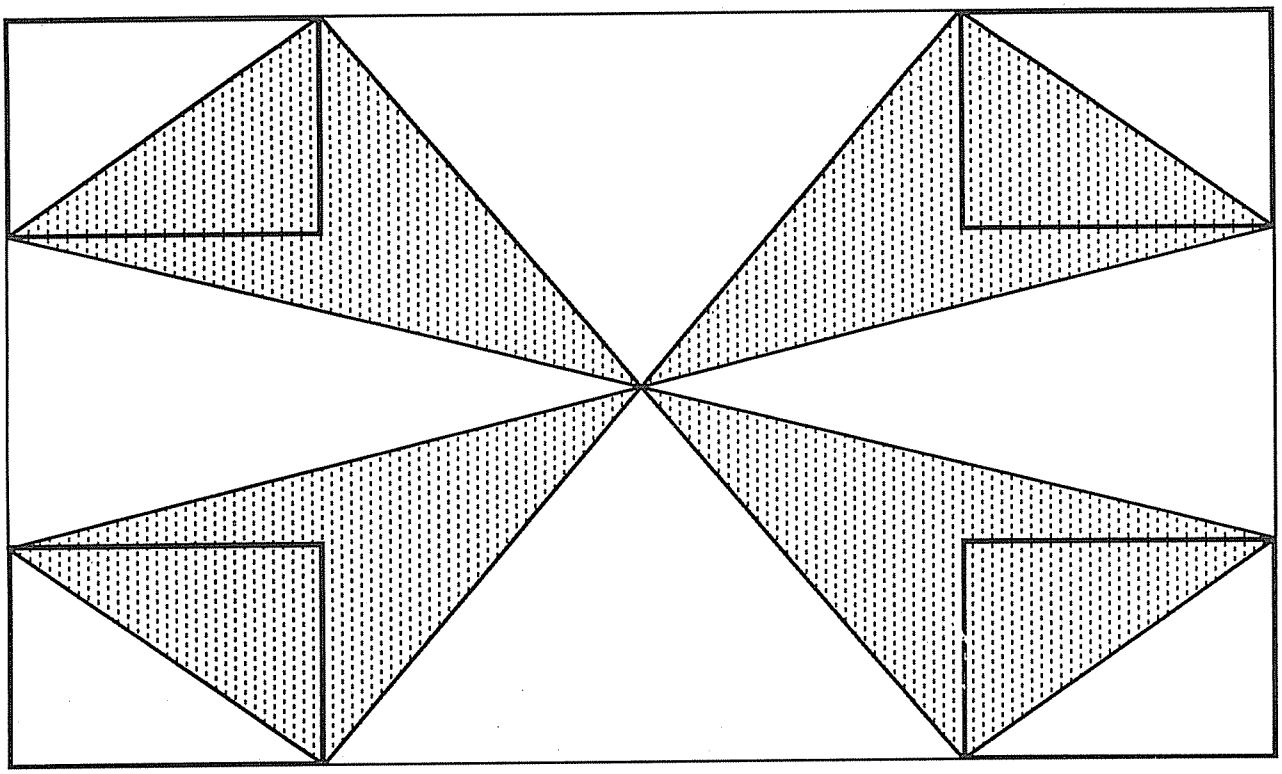
Volume | | |
Number 2

Abacus

publication of the O. A. M. E.

December 1989



Prepared by

George McNabb, Jerry Maloney, Harvé R. Tremblay and Colin Garnham on behalf of the Northern Ontario Mathematics Association

Edited by

Anna-Maria Garnham
HBJ-HRW of Canada, Ltd.

Colin Garnham
Nelson, Canada

A BRIEF LOOK AT THE EXPERIENTIAL APPROACH TO TEACHING MATHEMATICS

"Solving problems is a practical skill like, let us say, swimming. We acquire any practical skill by imitation and practice. Trying to swim, you imitate what other people do with their hands and feet to keep their heads above water and, finally, to swim by practicing swimming. Trying to solve problems, you have to observe and to imitate what other people do when solving problems and, finally, you learn to do problems by doing them.

— George Polya, *How to Solve It*

Using Experiential Approach in the Intermediate Classroom

1. What is the Experiential Approach?

The experiential approach:

a) Relates new learning to students' past experiences and provides new experiences when needed.

b) Provides problems for the students to investigate and to draw conclusions.

c) Provides a non-threatening atmosphere conducive to learning. Student and teacher are encouraged to be risk-takers and problem solvers.

d) Allows the students to take responsibility for their own learning.

2. What is the Purpose of the Experiential Approach?

The experiential approach, with its emphasis on individual student manipulation of materials, brings a sense of relevance into the mathematics classroom.

Through the handling of carefully chosen manipulative materials, the students can gain experience from which they can construct mathematical concepts. It is an effective way for a teacher to evaluate the students' skills in problems solving, understanding of basic concepts, skills in computation, attitudes and perseverance.

3. How Can You Organize an Experiential Approach in Your Classroom?

a) Readiness:
- — games, play activities and open-ended questions
- — concentrate on *selected* experiences
  e.g. Measure various parts of different-sized circles to develop the concept of π
  — a guidesheet helps the students to focus attention on circumference and diameter.

b) Concept Synthesis:
- — allows the students to review, organize and integrate ideas
- — could include teacher-directed discussions, student discussions, student preparation of report or display, student reading of the textbook, etc.

c) Recall:
- — paper and pencil activities, games, flash cards, etc. to reinforce knowledge — help students to pin-point difficulties in using skills and provide practice which leads to mastery

d) Application:
- — application of mathematical concepts
- — includes such things as textbook problems, questions related to the students' environment, and real problems related to topic under study

ONTARIO TRAVEL CHALLENGE (O. T. C.)

You have been awarded $1000.00 for a trip to be taken completely within Ontario. You are to travel as far as possible and spend as much of the $1000.00 as you can without exceeding this amount.

The rules of the O. T. C. are

1. trips must begin and end in Sudbury
2. all travel must be in Ontario
3. no section of highway may be travelled twice
4. maximum daily travel time is 10 h
5. trips must last 7 d
6. you must submit completed Daily Travel Logs for each day plus a Trip Summary Sheet.

INFORMATION

Gasoline costs	48.6¢/L	
Your car travels	8.7 km/L of gas	
Average Speed:		
2-lane highway	90 km/h	
4-lane highway	100 km/h	
Secondary road	70 km/h	
Meals Cost:		
Breakfast	$2 - $6	N.B. All meals and hotel rooms
Lunch	$3 - $10	are subject to 8% sales tax.
Dinner	$8 - $45	
Accommodations Cost:		
Luxury Hotel	$56 - $100	
Medium Range	$30 - $50	
Flea Bite Special	$20 - $30	

HAPPY MOTORING

DAILY TRAVEL LOG

Day _____

Depart From _____

Destination _____

Depart from	HWY (# Lanes)	Stop At	Distance	Fuel Used	Time Travelled

Total Distance Travelled_____

Total Fuel Consumed_____

EXPENDITURES

Gasoline: _____L at 48.6¢/L _____

Meals: Breakfast _____ + ____ tax _____

Lunch _____ + ____ tax _____

Dinner_____ + ____ tax _____

Accommodations:
Total Expenditure Day ____ _____

Total Daily Expenditures _____

TRIP SUMMARY SHEET

This trip planned by: _____

_____

Day	Start From	End At	Total Distance	Fuel Costs	Meals Cost	Accommodation Cost	Total
1							
2							
3							
4							
5							
6							
7							
Totals							

Average Distance Travelled/Day _____

Average Fuel Costs/Day _____

Average Meal Costs/Day _____

Average Accommodation Costs/Day _____

Average Total Cost/Day _____

Ontario Travel Challenge

Notes to Teachers:

1. Students will need recent Ontario road maps. These are obtainable from the Ministry of Transport.
2. An outline map of Ontario showing details of the trip could be an added requirement.
3. Project could perhaps be piggybacked and given some credit by Geography teacher.
4. Students working in pairs require about four different 40 min periods to complete it.
5. It may be useful if students attach a map of Northern Ontario and sample trip forms.

THE GAME OF 99

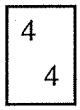
Learning Objective: To practice addition and subtraction of whole numbers quickly.

Materials: Standard deck of playing cards (remove jokers).

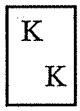
Players: 2 to 5 people can play at once.

Goal: To keep from going over 99 on your turn.

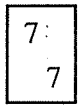
Rules: Each player is dealt 5 cards. The remainder of the cards are laid face down in the centre of the group. Special cards and their meanings are:



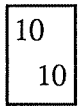
——————— reverse order of play



——————— sum immediately goes to 99



——————— skip turn



——————— subtract 10



——————— counts as +1

All other face cards count as +10

To play: The first player lays a card then draws one from the deck. The value of the card laid is the running total so far. The next player lays a card then draws one. The value of the card laid is added to the running sum. Play continues in this manner until someone is forced to go over 99. That player is then out of the game and play continues with the remaining players. The last player left is the WINNER.

One Potato, Two Potato

Children can be very creative in the ways in which they determine who will pick first in a game, who will go first when playing a game, etc.

We have all heard children decide who goes first using the following chant.

> One potato, two potato, three potato four.
> Five potato, six potato, seven potato more.
> Your out.

This simple chant provides you with many opportunities to use mathematics and ask your students to solve some problems. Some examples of problems are shown below. The students can be encouraged to use manipulatives whenever they solve the problems or work with others in the class to simplify the problems.

1. Suppose there are eight people that are trying to go first using this chant. You are the "Chanter" and will start counting with the person to your right.
   (a) Who will win? Give reasons for your answer.
   (b) Who will win if you start counting with yourself and not the person to the right? Give reasons for your answer.

2. Suppose there are 8 people that are trying to go first using the chant. With whom would you start so that you always win?

3. If there are still 8 people, with whom would you start so that you are always eliminated during the first chant? Give reasons for your answer.

4. Suppose there are only 4 people that are trying to go first using the chant. Repeat Questions 1 and 2 using 4 people. How are your answers alike? How are they different?

5. Repeat Questions 1 and 2 for 7 people and 6 people. How are your answers alike? How are they different?

Now that you have had your students solve problems based on this chant, it is time to have them solve problems based on a chant of their own. Have your studenbts make up a chant of their own. The chant can be similar to the one that was used above, or it could be one that they have heard before.

Now, have them create and answer similar questions for themselves. Then ask classmates to solve their problems. They can compare their solutions to that of their classmates and record any similarities and differences they see.

LESSON PLAN FOR QUICK COMPUTATION — GRADES 2, 3 OR 4

Model: Hundred Chart

— Getting a quick recall of numbers may help students perform quick computations. To do this, you might display a hundred chart on the projector or an enlarged one on the board. Ask children to discuss any relationships they see between the numbers. For example, the last digit in each column is the same, all of the numbers along one diagonal have the same digits, etc. Allowing the children to verbalize patterns such as these will help them to see the structure of our number system.

— Use the hundred chart to count by tens, going down certain columns. For example, start with 10 then 20, 30, 40, ... Now start with 4 then 14, 24, 34, ... Practice this several times as a class activity. Try going alone one column from bottom to top. Encourage students to try this without looking at the hundred chart (use the patterns they have discovered instead).

— Give students about 30 s to memorize the entire hundred chart (emphasize using patterns to do this). Next, turn off the projector and ask students to use the recall they have of the chart to answer your questions. For example,

what number is below 26?

what number is above 43?

what number is to the right of 13?

(To convince students, flip the projector on and check each response.)

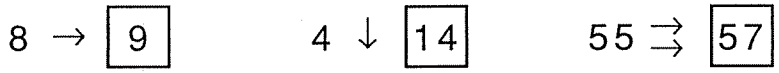
— Cover up parts of the hundred chart and ask students to locate certain numbers. This type of activity will help students use the patterns and their memory.

— Project the hundred chart. Ask students to find the number 10 more that 49, 20 more than 49, and 30 less than 49. Where are these numbers in relation to each other? Ask more questions of this type. Students should begin to notice and be confident using patterns they have discovered.

Try some of the same type of questions without the hundred chart. (What is 20 more than 42?)

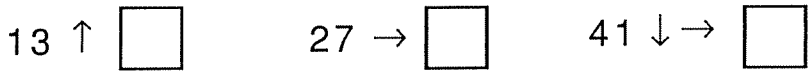
A nice follow-up or extension of this activity is to introduce the operations of **ARROW**.

— Tell students you are going to show them several examples of the **ARROW** operation and you want to see who can figure out the mysterious operation. Display a hundred chart and put examples such as this on the board:



Does anyone know how these answers are obtained? Do several more until students discover the secret operation.

— Now, see who can complete these sentences:



Provide as many examples as necessary. Students should be given their individual hundred charts to better see what is displayed. Students may want to challenge others in the class by posing problems for them. Be sure students initially use the hundred chart and, if necessary, move their fingers about it to determine answers.

— Ask children this time to fill in the missing arrows:

4 34 5 7 20 36 31 82 47 67

Can there be more than one solution? How many solutions are possible for the first one? Can it be done in 2 arrow movements? in 3 arrow movements? in 4 arrow movements?

— With more experience and practice, you will want students to find solutions to these types of questions using their recall of the chart rather than the hundred chart. You may discuss with them what a down arrow (↓) really means (add ten). What does two down arrows (↓ ↓) mean (add twenty)? What does ↓ ↓ → mean?, and so on.

— Continue this activity as long as you feel that students are getting a better idea of the structure of the number system and how it can be used to compute a variety of problems quickly .

Fill in the missing number.

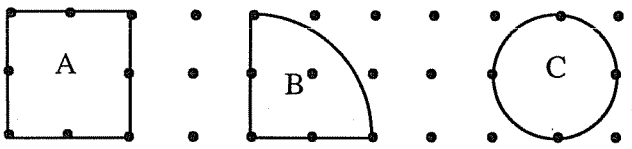
7 →	
14 → ↑	
27 → ↓ ↓ ↓	
90 ↑ ↑ ↓	
36 ⇉ ↓ ↓	
54 ↑ ↓ → ←	

Fill in the missing arrows.

25	36
76	66
12	14
45	44
59	59

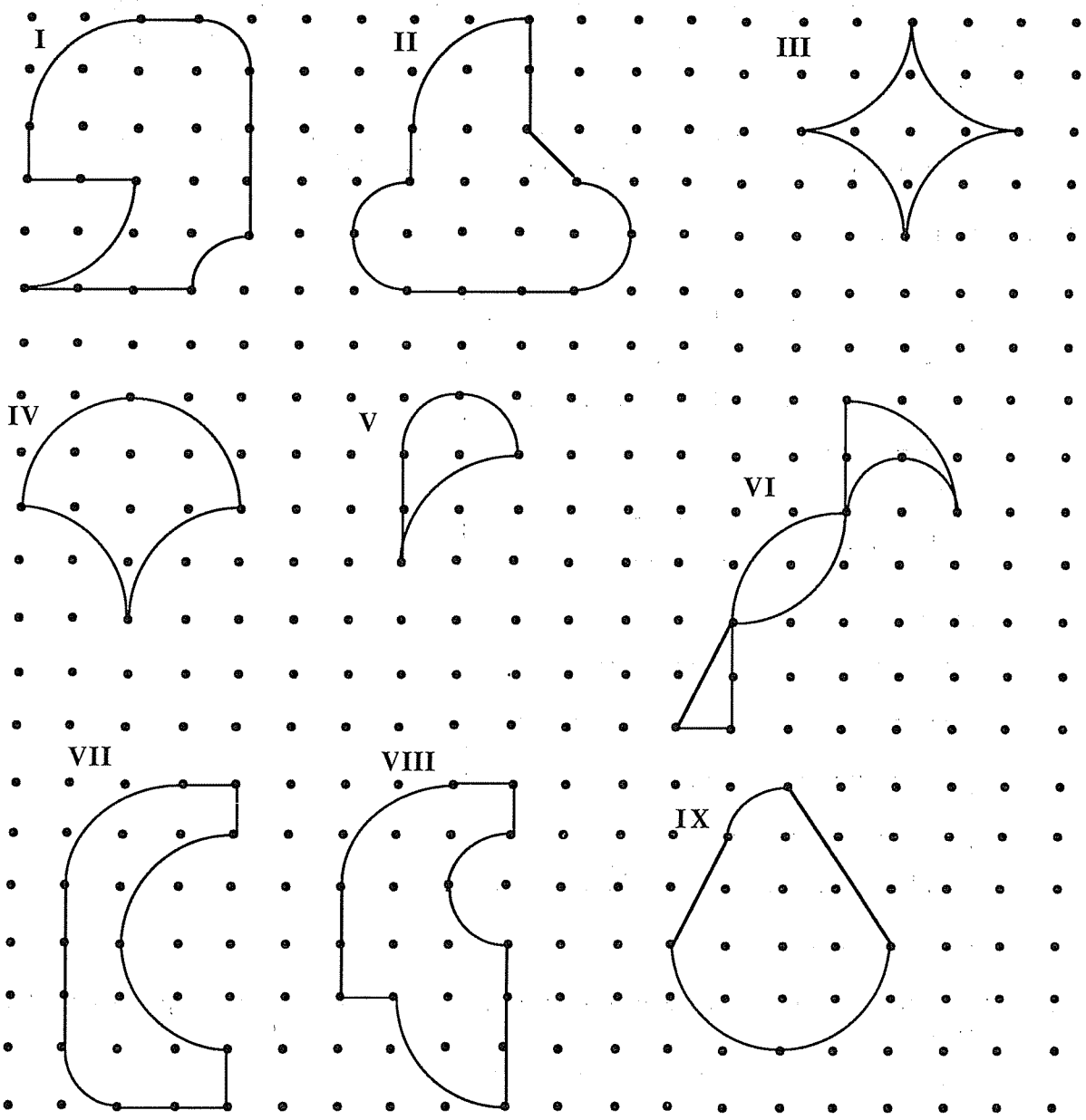
Have your students each create a problem of their own, solve the problem and compare their solution to others in the class.

AREA ASSIGNMENT



The area of A is a and the area of B is b and the area of C is b.

Find the areas of the following in terms of a and b.



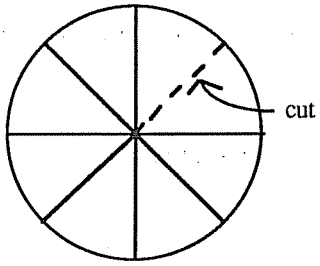
CIRCLES TO CONES

What happens when you make different cones from circular regions of the same size?

1. Draw eight circles, radius 8 cm.

2. Divide each circle into 8 congruent parts. Do not fold on these lines.

3. Cut out each circle and cut along one radius of each.



4. Make a 6-part cone by sliding 2 parts underneath the others and taping the edge.

5. Make a 5-part cone by sliding 3 parts underneath the others and taking the edge.

6. Make all the other cones. For the cones with smaller number of parts, it is easier to cut some of the parts away before taping.

Of all these cones, which has the greatest volume?

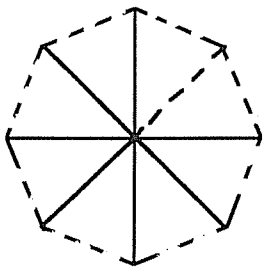
7. Complete the following chart:

Cone	Height	Relationship to previous cone	Circumference of base	Relationship to previous cone	Radius of base	Relationship to previous cone	Capacity	Relationship to previous cone
1-part								
2-part								
3-part								
4-part								
5-part								
6-part								
7-part								

*The height could be determined by holding the cone between 2 books and measuring the distance.

**To find capacity, tape each cone well and measure the amount of some dry substance which will fill each.

8. Repeat the above investigation using pyramids of varying sizes. Cut on dotted lines.



LEARNING LINKS: ACTIVITÉS AU CYCLE PRIMAIRE

J'ai acheté des chaînons pour chaque école d'Immersion car j'étais certain qu'on pouvait les utiliser pour faire plusieurs activités différentes. En donnant les chaînons aux enseignant(e)s du cycle primaire, je leur ai demandé de me donner cinq activités possibles avec ces chaînons.

J'aimerais remercier tout particulièrement Michelle Cusack d'Alexander P. S. d'avoir contribuer des activités. Voici la liste que j'ai rédigée.

Apprenons avec des chaînons

1. Fais une chaîne qui mesure 1,0 mètre de longueur.
   Fais une chaîne qui mesure 2,0 mètre de longueur.

2. Fais une chaîne et demande à un(e) ami(e) de la mesurer.

3. Fais une chaîne pour mesurer la largeur de la classe.
   Fais une chaîne pour mesurer la largeur de bureau.

4. Fais une chaîne pour mesurer ta hauteur, ta taille . . .

5. Fais une chaîne avec un nombre impair de chaînons. Nomme le nombre. Fais une chaîne avec un autre nombre impair de chaînons. Nomme le nombre.

6. Fais une chaîne avec un nombre pair de chaînons. Nomme le nombre. Fais une chaîne avec un autre nombre pair de chaînons. Nomme le nombre.

7. Compte par deux en mettant deux chaînons de la même couleur ensembles. Peux-tu compter par 3? par 4?

8. Fais une addition en utilisant 2 couleurs différentes de chaînons. Combien de chaînons en tout? Ecris une équation pour chaque chaîne.

9. Fais une addition en utilisant 3 couleurs différentes de chaînons. Ecris une équation pour chaque chaîne.

10. Fais un chaîne de 7 chaînons. Enlève 3 chaînon. Ecris (ou raconte) une histoire pour décrire l'opération.

11. Fais une chaîne de 9 chaînons, et place-la dans un sac. Enlève des chaînon et montre-les à un(e) ami(e). Demande-lui: "Combien de chaînons sont dans le sac?"

12. Fais une chaîne avec une série de couleurs variées. Demande à un(e) ami(e) de continuer la série.

13. Peux-tu faire et compléter la série suivante?

a. RB - RRBB - RRRBBB - _____

b. RBV - RBBV - BRRVV - _____

c. JBVR - JBVR - JBVR - _____

V = vert
R = rouge
J = jaune, B = bleu

14. Mets les chaînons ensemble pour former un cercle, un triangle, un carré et un rectangle.

15. Mets les chaînons ensemble pour former un cercles, un triangle, un carré et un rectangle. Quel est le périmètre des formes?

16. Fais une chaîne qui a $\frac{1}{4}$ des chaînons rouges.

Fais une chaîne qui a $\frac{1}{5}$ des chaînons jaunes.

Fais une chaîne qui a $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$ des chaînons verts.

17. Fais une chaîne de quatre chaînons qui a $\frac{1}{2}$ des chaînons rouges. Nomme la fraction équivalente à $\frac{1}{2}$.

Fais une chaîne de huit chainons qui a $\frac{1}{2}$ des chaînons rouges. Nomme la fraction équivalente à $\frac{1}{2}$.

18. Fais une chaîne de 8 chaînons en utilisant 3 couleurs différentes de chaînons. Ecris une équation de fractions pour la chaîne. $\left(\frac{3}{8} + \frac{4}{8} + \frac{1}{8} = \frac{8}{8}\right)$

19. Fais une chaîne de huit chaînons de couleurs différentes. Ecris une histoire de fractions pour décrire la chaîne.

20. Utilise les chaînons pour faire des graphiques. Exemple: Suspendre les chaînons sous l'image du biscuit pour trouver le biscuit favori des enfants.

Manipulative Number Tricks

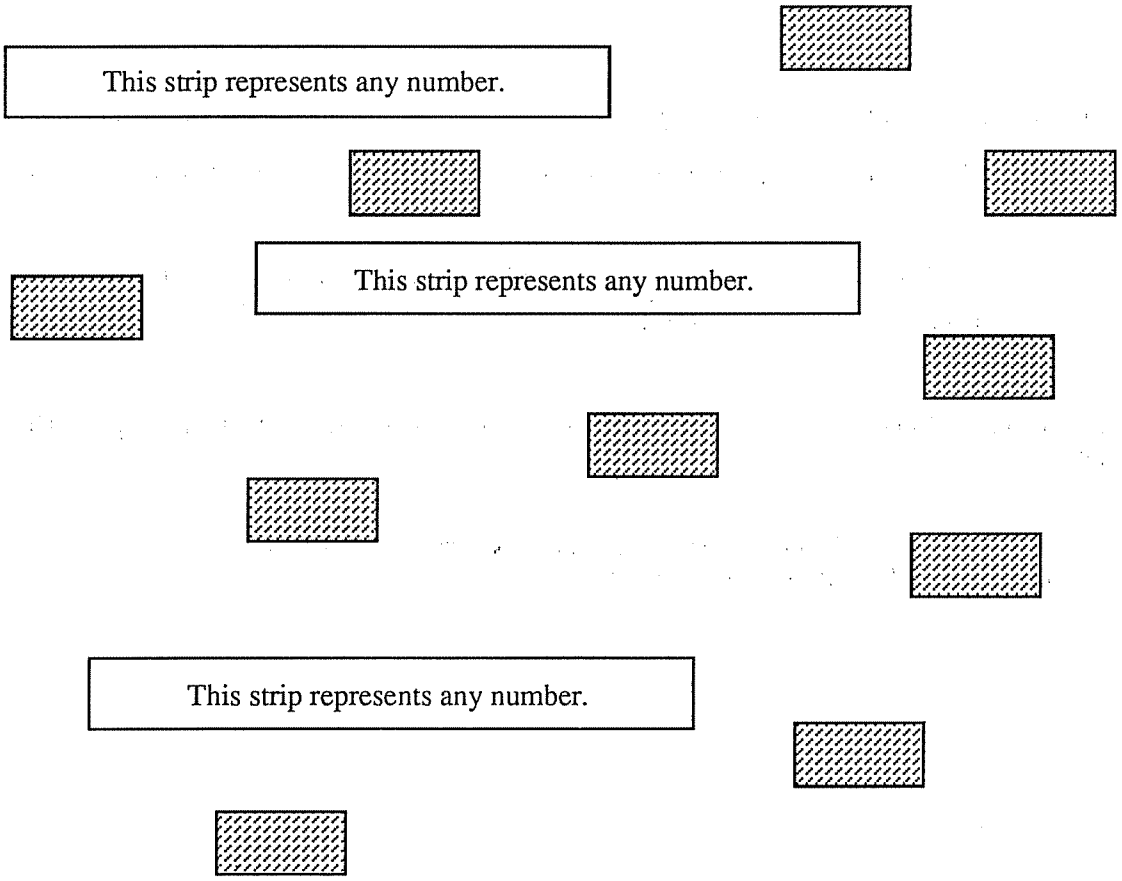
Have you ever tried number tricks like the following to try and fool people?

Pick any number.
Double it.
Add 10.
Take half of the result.
Subtract 4.

Based on the result of the final calculation, you can now predict the number that was originally chosen.

By working with strips of paper, like the following, you can have your students determine how these tricks actually work. A method for doing so is shown on the next page.

Before you begin, have your students cut out and trace the following strips of paper. The long strip represent the selection of any number. The shaded strips of paper represent the number one.



Now, to figure out how the number trick works, work in step. The first step is to pick any number.

This strip represents any number.

Double it.

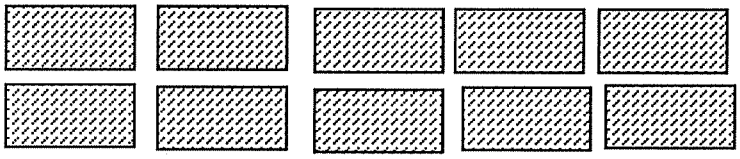
This strip represents any number.

This strip represents any number.

Now add 10.

This strip represents any number.

This strip represents any number.



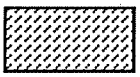
Take half of the result.

This strip represents any number.



Subtract 4.

This strip represents any number.

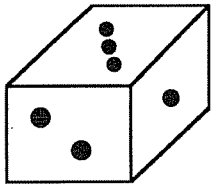


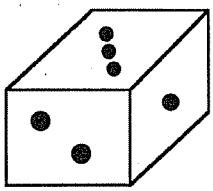
Look at what is left over. You simply have the number with which you started plus one. Thus, you will always predict that the starting number is 1 less than the result.

Try these manipulatives with other number tricks. Your students will now be able to see mathematics happenning "in front of their very eyes".

This is Pairadice

No, we did not spell the word wrong. We all know that learning mathematics is, indeed, paradise. However, for this section, we are going to do some work using a pair of dice (We do hope that you will excuse us).





This game is designed to give your students practice using integers. Shown below is a checkerboard. However, the squares are filled with integers and not colours. You play the game the same as you would play checkers. To move, you throw the dice. The person who throws the dice can place a + or a - on each number. Then, use the integers and find the product, difference, quotient or sum. You can move your checker to a square that has the integer at which you have arrived. The person wins when they have captured all the other persons checkers.

+8	-9	+22	-1	+1	+32	-5	+7
-11	+14	-8	+10	-2	+5	-28	-12
+13	-27	+30	-32	-18	+16	+12	-14
-24	-7	+15	-4	-6	+18	-20	-3
+11	-12	+16	-8	+6	-20	+11	-5
-9	+14	+3	-2	+5	-24	+8	+7
-3	+5	+12	-12	-16	+20	-5	-8
-9	-3	+6	+4	+14	-8	+16	-7