# Abacus

## From the desk of the Abacus editor

HELLO ... IS THERE ANYBODY OUT THERE??? Once again the time has come for me to write an *Abacus* editorial and, once again, I am about to beg and plead for you to send in *Abacus* material. In an organization of this size, with members as TALENTED and CREATIVE as yourselves, I shouldn't have to beg for activities. Please, do your part for your journal and submit something today!

This issue of the *Abacus* presents activities that could be used to help grades 7 and 8 students prepare for the Ontario Mathematics Olympics which will be held in Ottawa on June 3, 1995. However, there are several things to note about these activities:

- most are adaptable for a range of student abilities and grade levels
- most emphasize divergent thinking — in most cases there is more than one correct solution to the problem, and more than one way to arrive at that answer
- they rely on group work and cooperation between students
- they link mathematics with other subject areas (language arts, science, technology)
- they incorporate a variety of topics and skills in mathematics — in fact, one activity deals with frequency distributions, an excellent way to reinforce elementary statistics concepts

***For more information about this year's Ontario Math Olympics, contact Jeri Lunney***

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## What's My Rule? Devine la Règle!

*Acknowledgement: This activity was included in the sample package from the Ontario Math Olympics organizers. Permission has been granted to reproduce the activity here, so that it will be available to more teachers.*

**Example:**

If 2↔5, 8↔17 and 20↔41, then 10↔ 21
Si et donc

**One rule is:** multiply by 2, then add one
**Une règle:** multiplier par 2, puis ajouter un

**1.** If 16↔9, 35↔28 and 21↔14, then 11↔ ☐
Si et donc

**One rule is:** _____
**Une règle:**

**2.** If 11↔38, 42↔131 and 5↔ 20, then 18↔ ☐
Si et donc

**One rule is:** _____
**Une règle:**

**3.** If 2↔175, 5↔70 and 25↔14, then 10↔ ☐
Si et donc

**One rule is:** _____
**Une règle:**

**4.** If 6↔18, 16↔208 and 10↔70, then 13↔ ☐
Si et donc

**One rule is:** _____
**Une règle:**


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# MATH AND SPELLING

*Acknowledgement: These activities were submitted by Loma Morrow from the North York Board of Education.*

You will probably want to use a calculator for these problems. Work with a partner.

**Activity 1:** For this problem, a vowel is worth 5 and a consonant is worth 2. For example,

ARITHMETIC = 5+2+5+2+2+2+5+2+5+2 = 32

Which of the number words from ELEVEN to NINETEEN is worth the most using these values? Which is worth the least?

Which of the 'tens' words (TWENTY, THIRTY,... , NINETY) is worth the most? Which is worth the least?

**Activity 2:** For this problem each letter of the alphabet has been given a number value. See the chart below. For example,

GEOMETRY = 7+5+15+13+5+20+18+25=108

Try to use a different word for each problem.

1. Find a math word that is worth (a) less than 100; (b) less than 50.
2. Can you find a math word that is worth (a) less than 20? (b) less than 10?
3. Find a math word that is worth (a) between 20 and 40; (b) between 40 and 60.
4. Find a math word that (a) contains the letter T and is worth between 50 and 60; (b) contains the letter R and is worth between 50 and 60.

## Chart:

| | | | |
|---|---|---|---|
| A = 1 | H = 8 | O = 15 | V = 22 |
| B = 2 | I = 9 | P = 16 | W = 23 |
| C = 3 | J = 10 | Q = 17 | X = 24 |
| D = 4 | K = 11 | R = 18 | Y = 25 |
| E = 5 | L = 12 | S = 19 | Z = 26 |
| F = 6 | M = 13 | T = 20 | |
| G = 7 | N = 14 | U = 21 | |

**Activity 3:** Here are some math words with missing letters. To help you determine the missing letters, each letter has been given a value (see chart from Activity 2) and the total value of all letters in a word is given.

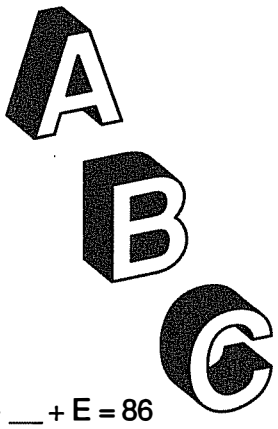
For example, __ + A + __ + __ = 42.

This could be

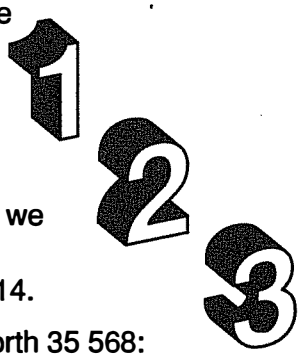
M + A + T + H = 13 + 1 + 20 + 8 = 42.

(You may be able to find a different answer.)

Use the values of the letters given to help you determine the missing letters. Use a calculator to help you.




1. __ + N + __ = 34
2. __ + E + R + __ = 64
3. T + __ + __ = 39
4. T + __ + __ = 58
5. A + __ + G + __ + E = 39
6. T + __ + __ + A + __ + G + __ + E = 86
7. R + __ + __ + __ + A + __ + G + __ + E = 85
8. P + __ + I + __ + M = 75
9. P + __ + __ + __ + M + I + __ = 86
10. M+A+T+__+__+M+A+T+__+__+__=112
11. Make one up. Give it to a friend to solve.




**Activity 4:** Using the values of the letters given for Activity 2, the word BIG is worth 14 if we multiply the values:
B x I x G = 2 x 1 x 7 = 14.

The word SMALL is worth 35 568:
S x M x A x L x L = 19 x 13 x 1 x 12 x 12 = 35 568.

Use a calculator to find a word as close to 1,000,000 as you can. It is not necessary to use a math word for this problem.

## NOTES FOR THE TEACHER:

**Activity 1:** For this activity you may want to review "vowel" and "consonant". The problem involves simple addition but primary children in particular should use calculators to avoid getting bogged down in the computation. This is especially critical because children (adults, too?) find adding a string of numbers in horizontal format more difficult than in vertical format.

Students need to know how to spell the various number names. For this reason, working in pairs or small groups is helpful.

If students do not keep their work reasonably neat, they may make errors by neglecting to count some letters or by neglecting to add all the numbers.

**Activity 2:** This is a variation on Activity 1. Giving students a range of values makes the problems easier than giving a single value, but a fair bit of addition will still take place.

Discuss with students their strategies. For example, to find a word less than 10, one might think of very short words that use letters from the beginning of the alphabet.

**Sample answers are:**

1 (a) TRIANGLE (86) See Activity 3, # 6
(b) ANGLE (39) See Activity 3, # 5

2 (a) or (b) ADD (9)

3 (a) AREA (25)
(b) SIX (52)

4 (a) or (b) THREE (56)

**Activity 3:** This activity involves more problem–solving. One way to approach it is to subtract the values of the given letters from the total as a first step. For example, for # 1, N = 14; 34–14=20; so we need two letters whose sum is 20 and that can be used to make a math word with 'N' in the middle. One pair totalling 20 is A + S; another is K + I; another is O + E. The first will not make a word; the second makes a word, but not a 'math word' (INK); the third meets both criteria (ONE). Answers are ONE, ZERO, TEN, TWO, ANGLE, TRIANGLE, RECTANGLE, PRISM, PYRAMID, MATHEMATICS.

Students may recognize that they can use the answer to #5 (ANGLE) to help them solve #6 and #7 (TRIANGLE, RECTANGLE).

**Activity 4:** This variation uses multiplication and should definitely be done with a calculator. A word worth exactly 1 000 000 is not possible, but students should try to get as close as possible. Discuss with students the various strategies they used. For example, some might make a list of numbers that can be multiplied together to get 1 000 000 and then look for letter combinations using those or near–by numbers — e.g. 1 000 000 = 2x2x2x2x2x2x5x5x5x5x5x5 or 10x20x25x8x5x5

*Editor's Note:*

*I'm not convinced that a million dollar word is impossible. We will immortalize you in print if you submit a million dollar word for the next issue.*

# Math, Science & Technology Challenges

*Acknowledgement: These activity ideas were submitted by Wendy Ayoub–Wade, Jane Lind and Sharon Young from the Wellington County Board of Education.*

Each of these challenge problems are designed to be tackled by a students working in pairs or, more ideally, in a small group. The students are challenged to design unique solutions to technological problems by using a variety of everyday materials. Some of these materials (which parents could be encouraged to send in) include:

- wheels
- pie plates
- tubing
- styrofoam trays
- garden hose
- straws
- piping
- fabric
- rope
- string
- inner tubes
- bicycle
- cardboard tubes
- containers
- spools
- cardboard
- coffee creamer containers
- ribbon
- balloons
- film canisters
- old hand tools
- foil, plastic wrap
- wool
- Velcro
- cork
- Canadian Tire Money

***Things to Remember:***

1. Materials suggested in some of the challenges should be readily available in your school. However, these are only recommendations. The dimension of the activity may be extended by changing the materials used.
2. The students should always draw a plan prior to constructing the model and conclude with a blueprint drawing.

**Challenge #1:** Design, build and test a stadium model for the Olympic opening ceremonies.

The stadium must provide:

- wheelchair accessibility
- sufficient fire exits
- adequate lighting
- a place for the Jumbotron
- box seating for judges and dignitaries

**Challenge #2:** Design a model bobsled run with one S–curve, 2 other curves and 4 straight aways. Test your run using a marble.

You must include:

- overhangs for some parts of the run for safety
- a pulley device to return the sled to the starting line

**Challenge #3:** Design and build a model ski jump. Test the ski jump for best slope and curvature to achieve the greatest jumping distance. Material will need to be selected for a snow substitute. It must leave an impression on landing for an accurate measurement.

**Challenge #4:** The Olympics have introduced 2 new events:

**Snowball Shoot:** Design, build and test a catapult that will launch a snowball with a 5 cm diameter as far as possible.

**Iceboat:** Design, build and test a model of an aerodynamic hull complete with a sail and 3 wheels. Model should not exceed 30 cm in length and 20 cm in height. Test for distance travelling in a straight line when propelled by a box fan from a starting line.

**Challenge #5:** You have been hired to build a bridge linking P.E.I. to the mainland. Design and construct a model of the longest free standing bridge.

**Materials:** •8 1/2 x 14 bristol board (3 sheets) •masking tape or paper fasteners

**Tools:** scissors

**Challenge #6:** Living in an isolated community you need to build a communication tower that will let you listen to the Saturday night hockey games. Design and construct a model of the tallest free standing structure that will support a centicube.

**Materials:** •8 1/2 x 14 bristol board •masking tape •centicube

**Tools:** scissors

**Challenge #7:** Your mother just had a baby. Your job is to entertain the baby from when you arrive home until 6 o'clock. Design a mobile that revolves quickly when you blow on it.

**Materials:** •string •paper •straw or dowel

**Tools:** scissors

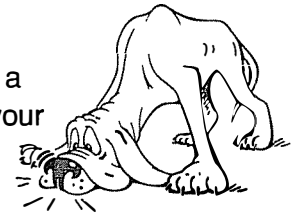
**Challenge #8:** You have been chosen to design the model for a new water slide at Canada's Wonderland. Design a marble maze as a model for this slide that will give you the longest ride.

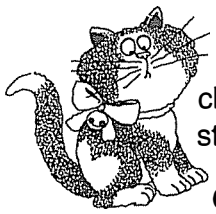
**Materials:** •tubing •marble •masking tape

**Tools:** scissors

**Challenge #9:** Your pet mouse is alone all day while you are at school. Design a safe playground for your pet.

**Challenge #10:** Design a feeding mechanism for your pet.





**Challenge #11:** Design a clean–up unit (sanitation station) for your pet.

**Challenge #12:** Jack and Jill must supply large quantities of water for their grandfather's show horses. Design a model of a conveyor system from the well to the horses, a distance of 100 metres, using a scale of 10 metres to 1 centimetre.

**Challenge #13:** You are planning a cross–country trip to the Rockies. Because of the great distance you want a flying device that is light enough to carry in your backpack. Design a model glider with a mass of not more than 150 grams. The resources for your prototype are limited.

**Materials:** •cardboard •paper •paper clips

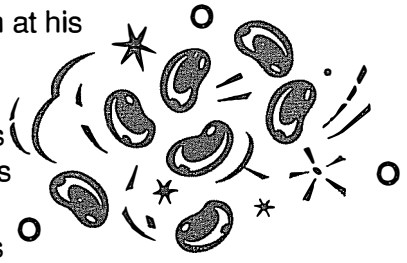
**Tools:** scissors

**Challenge #14:** You have just returned from your holidays in Texas where you were fascinated by the tumbleweeds rolling across the desert. Design a windball that rolls along the ground when the wind acts upon it. Which materials work best? Have the wind come from two directions at the same time.

**Materials:** •kleenex •tissue paper •newspaper

**Tools:** •electric fan •hairdryer

**Challenge #15:** Willie Wonka has a transportation problem at his chocolate factory. He needs a new type of vehicle to transport his everlasting Jelly Beans from his factory. Employ different forms of energy to move the vehicle.



**Hint:** Try using a ramp on which the vehicle can leave and enter the factory.

# Some Statistical Games

*Acknowledgement: These games were prepared by Lorna Morrow from the North York Board of Education.*

### *Game 1: BET ON YOUR FAVOURITE VOWEL!*

- In a group of 5, each person chooses one of the vowels and places a marker on that vowel beside START.
- Select a page from any book — fiction, history, drama, science, math, or any other.
- Count the vowels word by word.
- Each time your vowel occurs, move your marker one space along the race track. Play until at least three vowels have finished the race.
- Which vowel reached FINISH first? second? third?
- Try again with another book or another page in the same book. Did you get the same results? Did other groups get the same results?

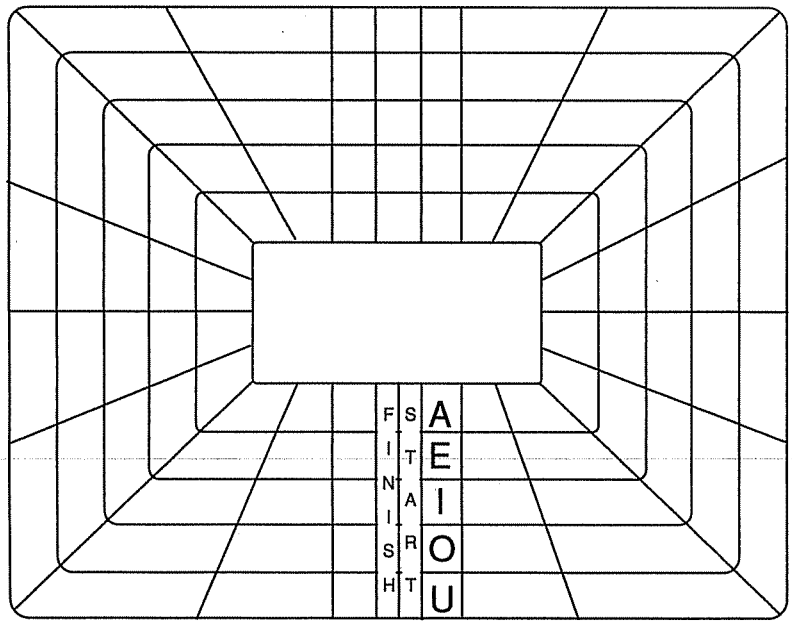



### *Game 2: BET ON YOUR FAVOURITE CONSONANT!*

- Put the consonants N, T, S, R, and Y on the race track in place of the vowels.
- Predict the order in which the consonants will finish.
- Choose a page from any book and check word by word for your consonant. Move your marker around the race track as for Game 1.
- Which consonant finished first? second? third?
- Try with another book or another page in the same book. Did you get the same results? Did other groups get the same results?
- Try the game beginning with other consonants. Which ones do you think are the most common in English? Which ones are not used very often?

**Variations:** Would the vowel race or the consonant race have similar results if you chose a page in French or some other language? Try it and see.

Would the races give similar results if you used a page from the telephone book? Why or why not?



**A challenge:** Try to write an English sentence at least 10 words long with no E's; with no T's; with no E's **or** T's. Use a dictionary or thesaurus to find words if you wish.

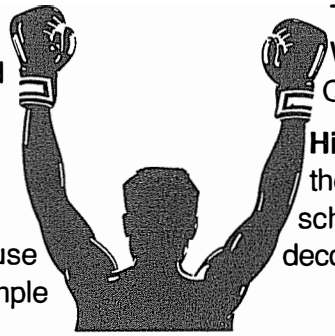
### *Game 3: VOWEL AND CONSONANT COMBINATIONS*

The most common letter in the English language is E. The next most common is T. The vowels O, A, and I are the next most common; then comes the letter N. Some letter combinations are more common than others. To discover whether a combination is used often in English, play the race track game with:

(a) TH, SH, ST, and two consonant combinations of your choice.

(b) EA, AI, OU, and two vowel combinations of your choice.

Try to predict which combination will be first, second or third. Then play the game to check.



### *Game 4: A Code Challenge*

Code–breakers (cryptologists) use information like this to break simple substitution codes. In the sentence below each letter stands for another. For example, the letter D will stand for the same letter every time it occurs. Use what you know about common letters to decode the message. Cover the hints with a piece of paper until you need them.

DMRA EXCEFX GC RCQ JRCL QBMQ QBX NQOGA CS DMQBXDMQTUN UMR BXFE QBXD WXMG CW LWTQX M UCGX.

**Hint 1:** A one–letter word in English is either I or A. (Can you think of any other one–letter words?) In this message the one–letter word is A. This means that the letter M can be changed to the letter A wherever it occurs.

**Hint 2:** QBX stands for the most common three–letter English word. What do you think it is? It is the word "the". Thus, Q stands for T, B stands for H, and X stands for E. What word might QBMQ stand for? or QBXD?

**Hint 3:** DMQBXDMQTUN stands for the name of a subject you study in school. You are using that subject to decode this message.

## Notes for the Teacher:

The ideas here involve an analysis of letter frequency, a topic of interest in Language as well as Math. Math ideas involved are frequencies, graphing, tallies, decoding.

Knowing some letter frequencies may help some students with spelling.

Letter frequencies could be recorded as tallies or on graphs. You may wish to extend the ideas into graphing. For example,

(1) graph the number of times each vowel occurs in a given paragraph.

(2) graph the number of times each vowel 'won' the race (use results from the whole class)

(3) give each vowel a score (5 for first, 4 for second, ... , 1 for fifth) and graph the total scores of the five vowels.

The same types of graphs could be used for consonants, or for letter combinations.

Exploring the common letters or combinations of different languages should give students a better understanding of the differences between languages.

Trying to write sentences without using certain letters or letter combinations can be quite challenging. Students could simply write any sentence first and then use a dictionary or thesaurus to find replacement words without the forbidden letter or letters.

As an extension, ask two students to have a brief dialogue without using particular letters. They might wish to script this first.

The coded message reads "Many people do not know that the study of mathematics can help them read or write a code." Decoding this is not an easy task. Students should work in groups.

Students could encode messages of their own for their classmates to decode. Encourage them to use everyday language, otherwise the letter frequencies may be quite different and therefore of no help.

# CUBE COUNT
# DENOMBREMENT DE CUBES

*Acknowledgement: This activity was contained in the sample package for the Ontario Math Olympics. Permission was given to reproduce the activity here.*

All the shapes shown below were made with cubes. How many were used for each one? Write the number beside each pile. If there is a block missing from the outside of a pile and you cannot tell what is behind it, assume that all blocks in that row or column are missing.

Toutes les formes ci–dessous sont faites de cubes. Combien de cubes ont été utilisés pour chaque forme? Ecrit le nombre à coté de chaque pile. S'il manque un cube de l'extérieur d'une pile et si tu ne peux pas dire ce qui est derrière lui, suppose que tous les blocs de cette rangée ou colonne sont manquants.

