

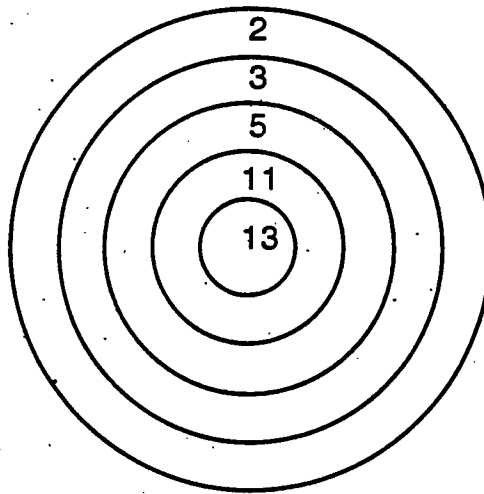
Scarborough  
Board of  
Education

Meeting The Challenge

## SCARBOROUGH MATHEMATICS OLYMPICS

# Event #5 – Four Person

Using only three arrows and this target, which scores between 6 and 39 are NOT possible?



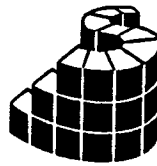
Answer: \_\_\_\_\_

STUDENT NAME

SCHOOL

SCORE

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____



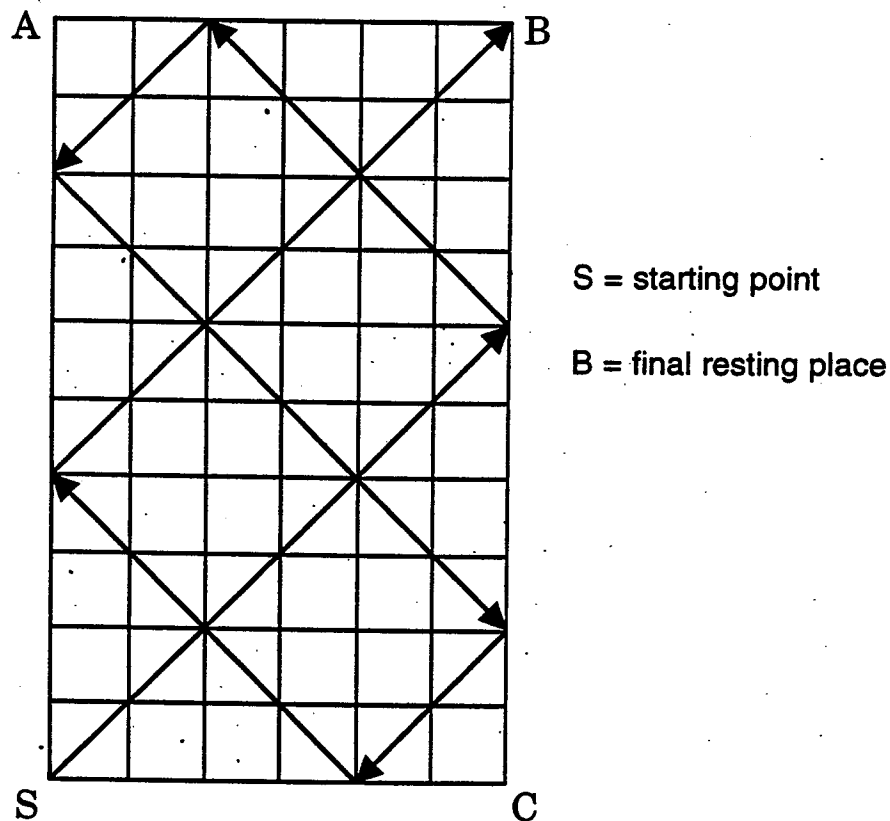
Scarborough  
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Meeting The Challenge

## SCARBOROUGH MATHEMATICS OLYMPICS

# Event #6 – Four Person

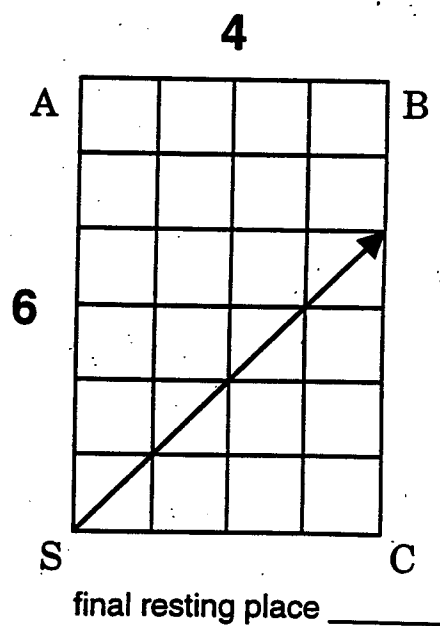
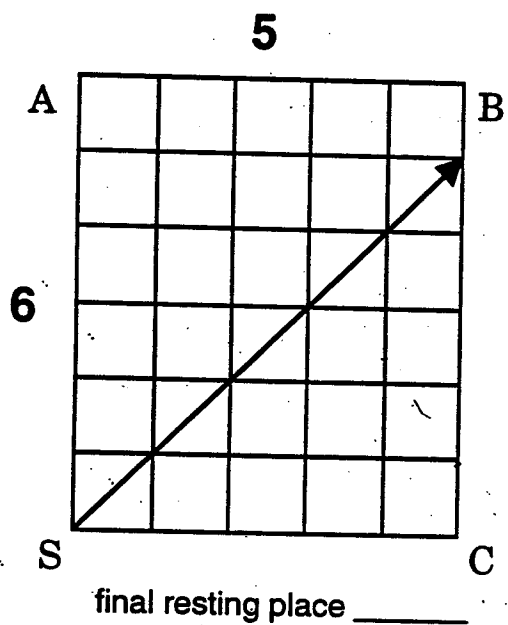
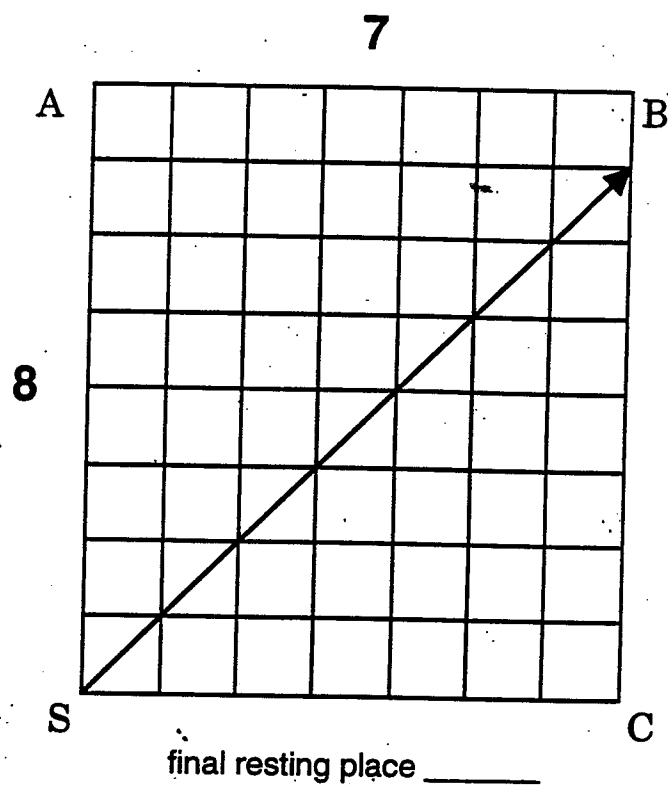
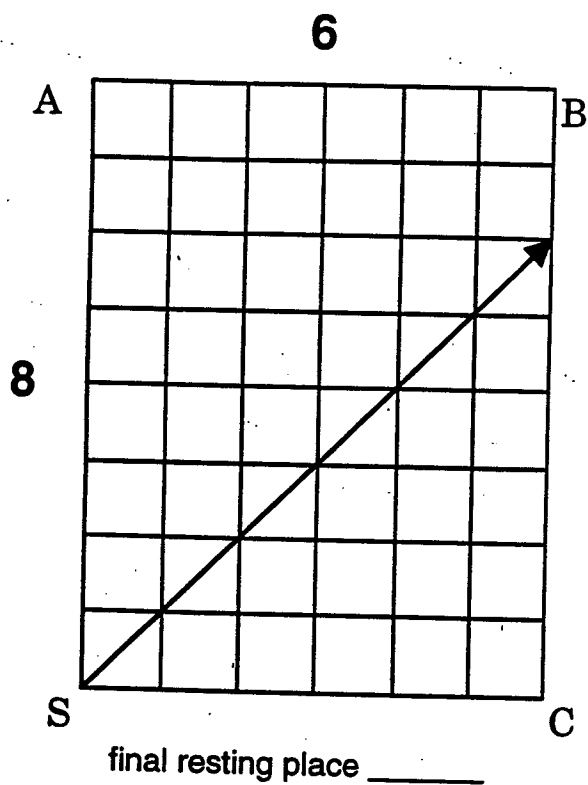
The figure below shows the complete path of a ball that has been struck so that it travels at  $45^\circ$  angles with the sides of a table.

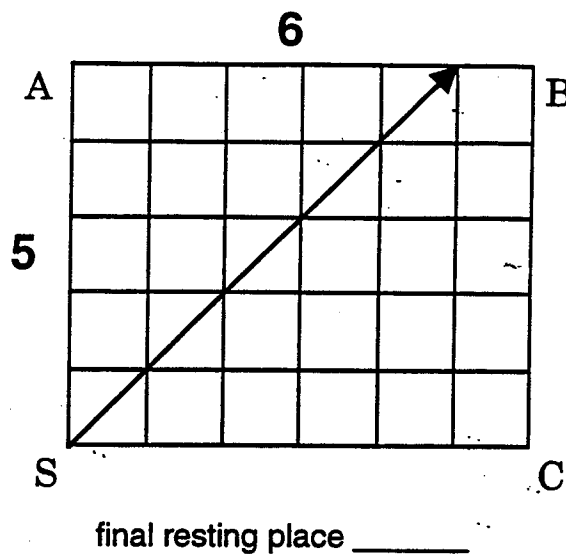
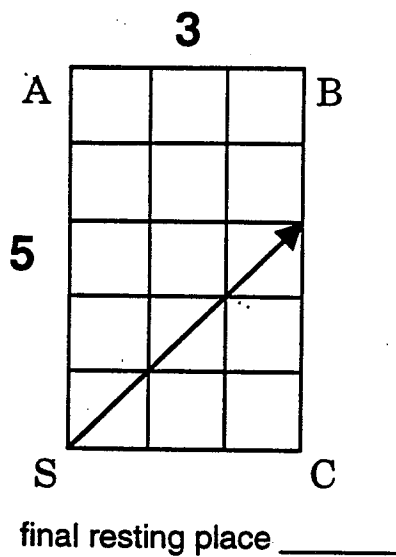


If we were to change the dimensions of the table, could we determine the final resting place of the ball without actually tracing the path?

By examining the next few diagrams and by experimenting on the graph paper provided, you are to answer the questions found at the end of this section.

The ball always starts at **S** and is struck as in the first illustration. Your task is to determine the final resting place in each of the following situations. Ask yourself, what is the effect of altering the **AB** dimension (the width)? What is the effect of altering the **AS** dimension (the length)?





## Questions

If you were given a table in which  $AB = 101$  units and  $AS = 160$  units, where would the ball finally come to rest?

final resting place

If you were given a table in which  $AB = 132$  units and  $AS = 141$  units, where would the ball finally come to rest?

final resting place

**STUDENT NAME**

**SCHOOL**

**SCORE**


# Tower of Power

Team# \_\_\_\_\_

## Instructions: (Calculators permitted)

Three towers made of blocks are hidden behind barriers at the front of the classroom. The object is to discover the number of blocks used or the surface area of the model, and then answer extra questions. Each team member will have 15 seconds to observe one of the models, and then return to the group to report on their observations. Additional visits to any model will cost the team 5 points or more.

Each team should take a few minutes to formulate a plan. You may choose to observe at any time during the activity. As soon as you are ready, one of your team's members should bring up this score sheet to the supervisors. You must wait until others are finished and you are told to begin. You will get the next 15 seconds to observe one of the towers. You may not touch the models or make notes. Don't forget to bring your score sheet back to your table.

Answer the following questions in the space provided. Do as many as possible in the time allowed. When you are told to stop, bring your score sheet to the marking table.

Student helpers should check off the team member (A,B,C, or D) on the team scoring sheet. If any of the team members make a second visit, their team will lose 5 points from their final score. If a team member makes a third visit, their team will lose 10 points from their final score. A fourth visit costs 15 points. Time taken will only be used to break ties.

Names of Team Members	free view	costs 5	costs 10	costs 15
A:				
B:				
C:				
D:				

Total score = \_\_\_\_ - \_\_\_\_ = \_\_\_\_

Time for the team=\_\_\_\_minutes

## The questions:

Team# \_\_\_\_\_

### 1. After you have looked at tower #1, answer each of the following:

- a) How many cubes have been used to make tower #1? \_\_\_\_\_ (15)
- b) If tower #1 was 10 blocks high at the tallest point and the pattern was continued, how many blocks would be used to construct it? \_\_\_\_\_ (5)
- c) If it was 3 blocks high at the tallest point and the pattern was continued, how many blocks would be used to construct it? \_\_\_\_\_ (5)
- d) If it was 100 blocks high at the tallest point and the pattern was continued, how many blocks would be used to construct it? \_\_\_\_\_ (5)
- e) If it was "n" blocks high and the pattern continued, the formula for the total number of blocks used to construct it would be \_\_\_\_\_ (5)

### 2. After you have looked at tower #2, answer each of the following:

- a) If the outside of tower #2 was painted (including the bottom), how many squares the size of one face of a cube would be painted? \_\_\_\_\_ (15)
- b) If it was 10 blocks high, the pattern continued, and the outside painted, how many squares would be painted? \_\_\_\_\_ (5)
- c) If it was "n" blocks high, the pattern continued, and the outside painted, how many squares would be painted? \_\_\_\_\_ (5)

### 3. After you have looked at tower #3, answer each of the following:

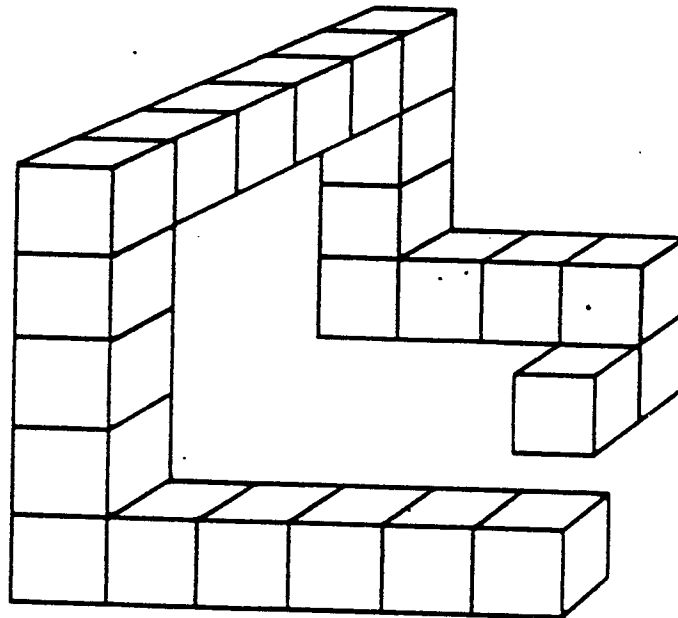
- a) How many blocks were used to make tower #3? \_\_\_\_\_ (15)
- b) If it was 10 blocks high at the tallest point and the pattern was continued, how many blocks would be used to construct it? \_\_\_\_\_ (5)
- c) If it was "n" blocks high at the tallest point and the pattern was continued, how many blocks would be used to construct it? \_\_\_\_\_ (5)
- d) If tower #3 was painted on the outside (including the bottom), how many squares would have to be painted? \_\_\_\_\_ (10)
- e) If tower #3 was 10 blocks high, the pattern continued, and the outside painted, how many squares would be painted? \_\_\_\_\_ (5)

Problem #1

Value = 2 pts

Answer:

Twenty-three cubes have been fitted together face-to-face as shown. What is the smallest number of extra cubes needed to complete the loop?



45 points

## Potpourri Questions

### Instructions

1. Each group will be given 20 minutes to complete as many problems as possible.
2. Each problem is assigned a value that will be assigned to the groups that complete those particular questions correctly.
3. You must submit the entire package of questions to the supervisor of the activity at the end of the 20 minute period.
4. You will be informed when there are five minutes remaining in the activity.
5. You may remove the staple to solve the problems.

Please complete the following:

School(s): \_\_\_\_\_

Time (if less than 20 minutes): \_\_\_\_\_



Problem # 2

Value = 4 pts

Complete the sixth box to logically complete the pattern.

15
5
21
2
27
14
33
9
39
27

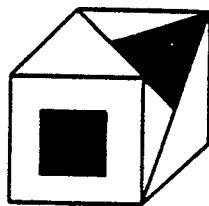
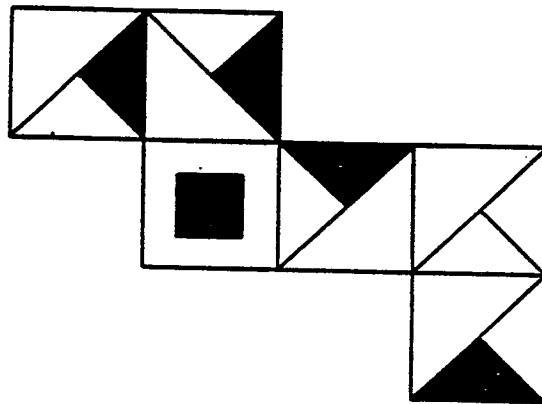
Problem #3

Value = 4 points

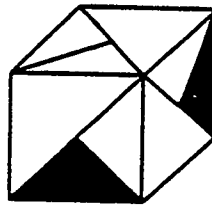
Cube-It

A single die has been unfolded in the diagram below. Which of the two lettered boxes below cannot be made from the die shown?

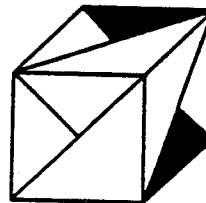
ANSWER



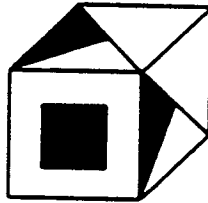
A



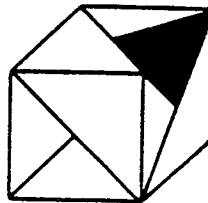
B



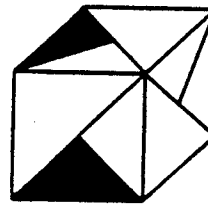
C



D



E



F

Problem #4

Value = 2 pts

Answer:

Each letter in this subtraction stands for a different digit. What is ANN?

$$\begin{array}{r} \text{ANN} \\ \text{RAN} \\ \hline \text{RAN} \end{array}$$

Problem #5

Value = 4 points

Fill in each of the boxes below with a digit from 1 to 6, using each exactly once, to make the multiplication work.

$$\begin{array}{r} \times \quad \square \quad \square \quad \square \\ \hline \square \quad \square \quad \square \end{array}$$

Problem #6

Value = 2 points

If 6 wongles and 3 winkles cost \$21, but 6 winkles and 3 wongles cost \$24, how many wongles can you buy for \$50?

ANSWER

Problem #7

Value = 3 points

"Backward" Logic

Some swimmers who race in the backstroke, have developed the bad habit of doing other things backward too! Every statement they make about the results of the backstroke event is false. Given the 4 statements below, determine which swimmers placed 1st, 2nd, 3rd and 4th.

ART: Clint was 4th  
BRAD: Clint beat Dave  
CLINT: Art beat Brad  
DAVE: I was 1st

ANSWER

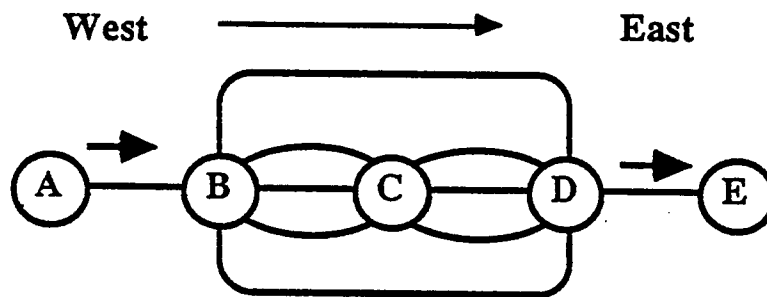
1st -  
2nd -  
3rd -  
4th -

Problem #8

Value = 3 pts.

Answer:

The following is a map of a 5-station railway system. It has a terminus at A and E with 3 interchanges B, C, D. How many ways are there of travelling from A to E if you must travel West to East at all times .



Problem #9

Value = 4 pts

Answer:

a)	
b)	

This is a 2 part question. 2 marks for each part.

(a) Which year in our recorded history has had the greatest number of Roman Numerals in it?

(b) What year will it be when this record is surpassed?

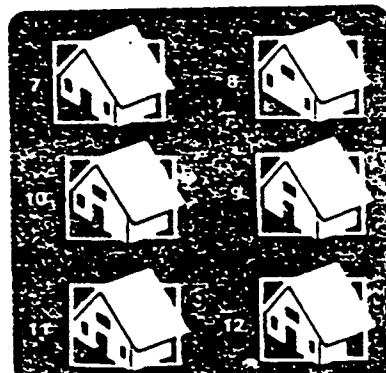
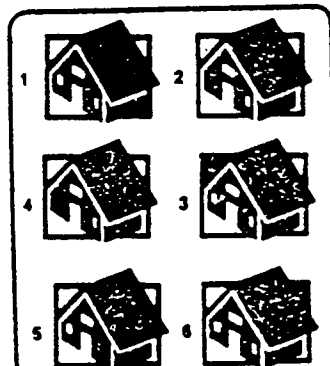
Problem #10

Value = 2 pts

Answer:

--

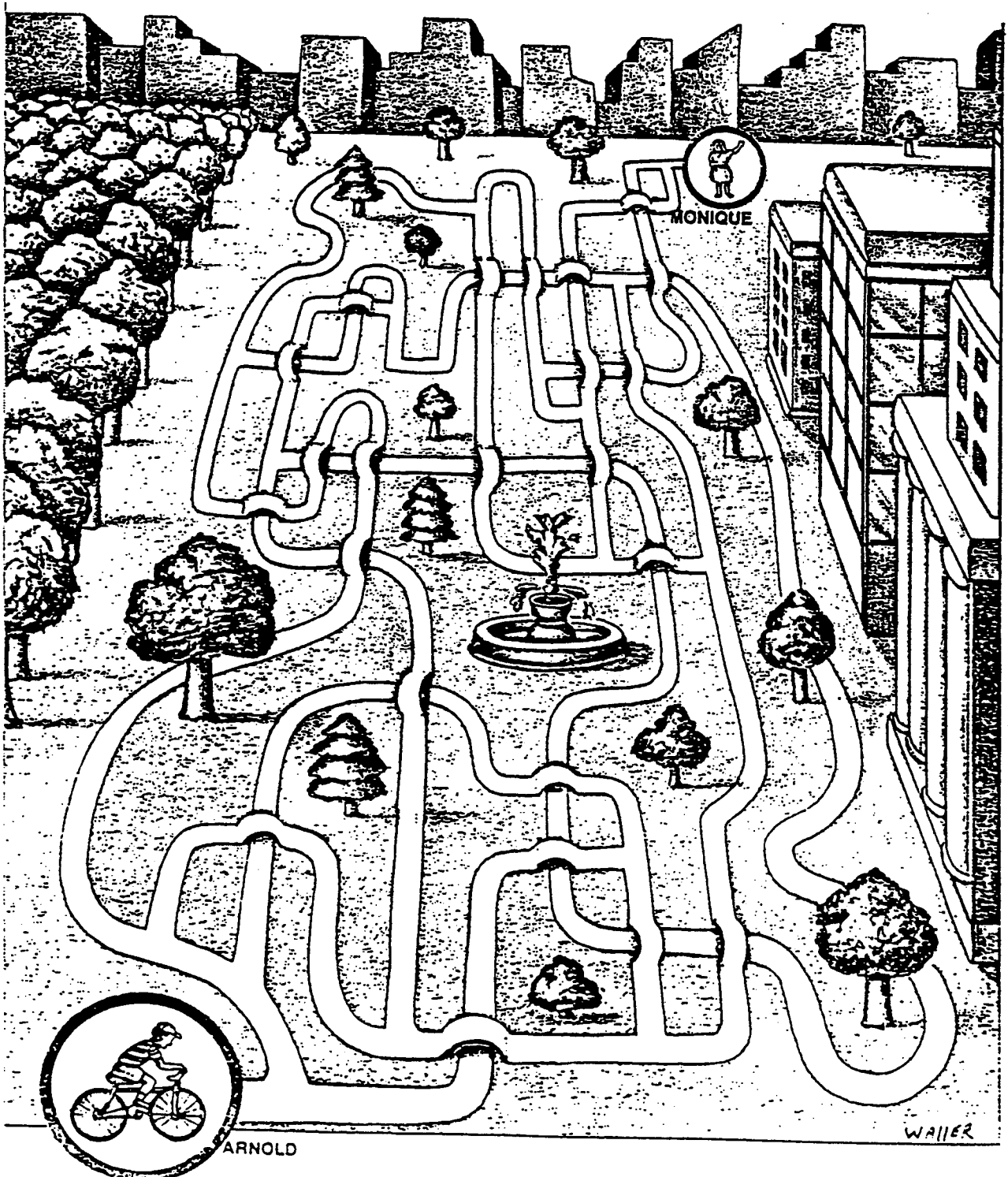
One of the six houses on the left (numbered 1-6) is a perfect match for one of the six photographic negatives on the right (7-12). Find the matching pair.



Problem #11

Value = 4 pts

Find a path from Arnold to Monique that passes over no more than 5 bridges. There is no limit to the number of bridges that Arnold can pass under.

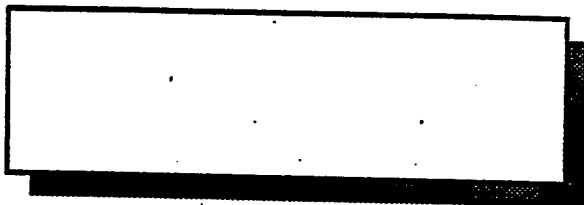


Problem #12

Value = 2 points

Use six 3's and any operations to make the number 30.

ANSWER





Problem #13

Value = 2 points

The last upside-down year was 1961 - that is you could turn 1961 upside down without changing its value. When will the next upside-down year occur?

ANSWER

Problem #14

Value = 2 points

What is the smallest number which, when divided by 2, 3, 4, 5, and 6 will give the numbers 1, 2, 3, 4, and 5 as remainders, respectively?

ANSWER

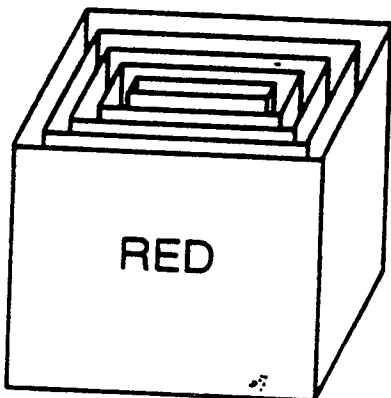
Problem #15

Value = 3 points

The red box pictured below contains four boxes, some of which are red and the remainder are white. List the colour of each box, starting from largest to smallest, given the following information:

- of the 5 boxes, there is a red box that contains only 1 white box
- there is a white box that contains only 1 red box and is contained by only 1 red box

ANSWER



Problem #16

Value = 2 points

Start counting from one. How high will you have to count before you reach a number with the letter 'a' in it?

ANSWER

1. 20% of 80 =  $12\frac{1}{2}$  % of \_\_\_\_\_

- a) 12.8                      b) 160.4                      c) 128.0                      d) 132                      e) 160

2. The reciprocal of  $\frac{1}{3} + \frac{1}{2}$  is:

- a) 0.83                      b)  $1\frac{8}{11}$                       c) 0.54                      d) 1.2                      e) 1.4

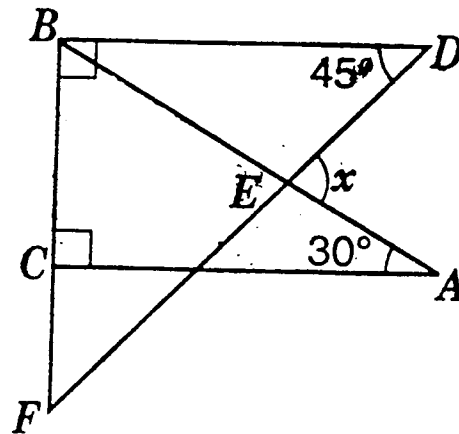
3. The lengths of the sides of a triangle are 12, 16, 20. What is the area of the triangle?

- a) 120 units<sup>2</sup>                      b) 96 units<sup>2</sup>                      c) 160 units<sup>2</sup>                      d) 240 units<sup>2</sup>                      e) 192 units<sup>2</sup>

4. A piece of ribbon is 62 cm long. Where must it be cut for one piece to be 3 times longer than the other piece?

- a) 160 mm from one end.  
b)  $15\frac{1}{3}$  cm from one end.  
c) 152.5 mm from one end.  
d) 1.6 cm from one end.  
e) 1.55 dm from one end.

5.



Given the diagram above determine the measure of  $\angle x$ .

- a)  $65^\circ$       b)  $45^\circ$       c)  $75^\circ$       d)  $30^\circ$       e) cannot be determined

6. What is the next term in the following pattern?

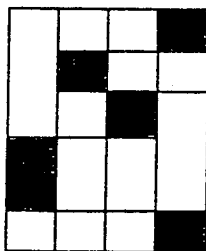
$$\frac{1}{3}, \frac{1}{3}, \frac{1}{2}, \frac{1}{2}, 1\frac{2}{3}, 3, 5\frac{2}{3}, 10\frac{5}{6}, \dots$$

- a) 14      b)  $16\frac{1}{2}$       c) 16      d)  $21\frac{1}{6}$       e)  $21\frac{1}{2}$

7. How many integers are between  $\sqrt{8}$  and  $\sqrt{80}$ ?

- a) 5      b) 6      c) 7      d) 8      e) none

8. What fractional part of the figure is shaded (assuming all horizontal lines are parallel, all angles are right, and all vertical lines are equally spaced and parallel)?



- a)  $\frac{1}{5}$       b)  $\frac{4}{7}$       c)  $\frac{2}{5}$       d)  $\frac{3}{7}$       e)  $\frac{1}{4}$
9. There are three houses next to one another and two kids live in each house. One house has two boys, one house has two girls, and one house has a boy and a girl. If you were to walk into a house at random and see a girl, what is the probability that the other kid in the house is also a girl?

- a)  $\frac{1}{5}$       b)  $\frac{1}{3}$       c)  $\frac{2}{3}$       d)  $\frac{1}{4}$       e)  $\frac{3}{4}$

10. An airplane flies 1000 km due west in 3 hours and then flies 1000 km due east in 2 hours. What is the average speed of the airplane for the entire 2000 km trip?

- a) 200 km/hour  
b)  $208\frac{1}{3}$  km/hour  
c)  $333\frac{1}{3}$  km/hour  
d) 400 km/hour  
e)  $416\frac{2}{3}$  km/hour

11. If this lattice was continued, what number would be directly below 100

```

      1
    2 3 4
  5 6 7 8 9
10 11 12 13 14 15 16

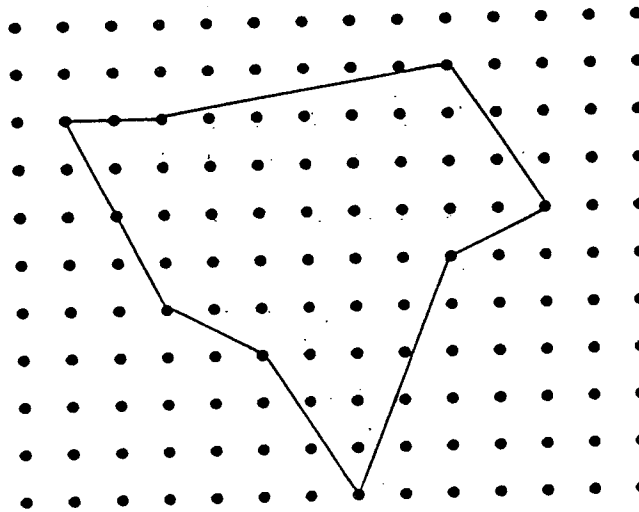
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- a) 110      b) 115      c) 120      d) 125      e) 118

12. The areas of irregularly shaped polygons can be calculated by using the formula:

$$A = \frac{1}{2}b \text{ plus } i \text{ minus } 1,$$

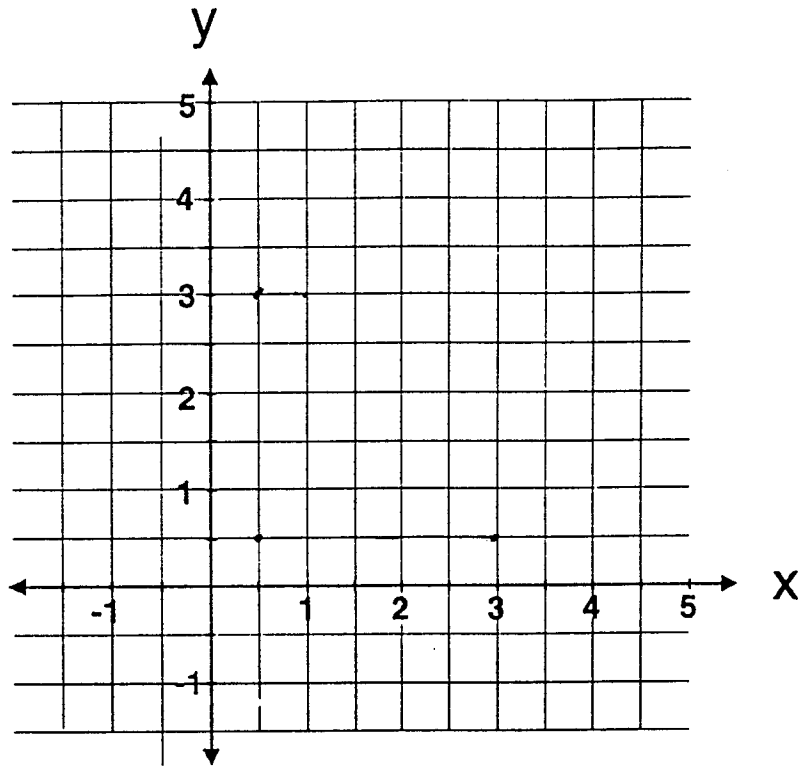
where  $b$  is the number of points on the boundary and  $i$  is the number of points in the interior. This is Pick's theorem. What is the area of the following irregularly shaped polygon?



- a) 42.5 units<sup>2</sup>    b) 44 units<sup>2</sup>    c) 40 units<sup>2</sup>    d) 40.5 units<sup>2</sup>    e) 46 units<sup>2</sup>

13. What is the perimeter of the triangle whose vertices are  $(\frac{1}{2}, \frac{1}{2})$ ,  $(\frac{1}{2}, 3)$ ,  $(3, \frac{1}{2})$ .

Round your answer to the second decimal place.



- a) 16.08 units      b) 7.63 units      c) 16.81 units      d) 8.54 units      e) 17.07 units

14. The average mark on a math test that five students completed was 68. If the first four students got 75, 62, 84 and 53 respectively, what was the fifth student's mark?

- a) 65      b) 68      c) 66      d) 67      e) 69

15.

**Percent of Pages Devoted to Fraction Instruction**

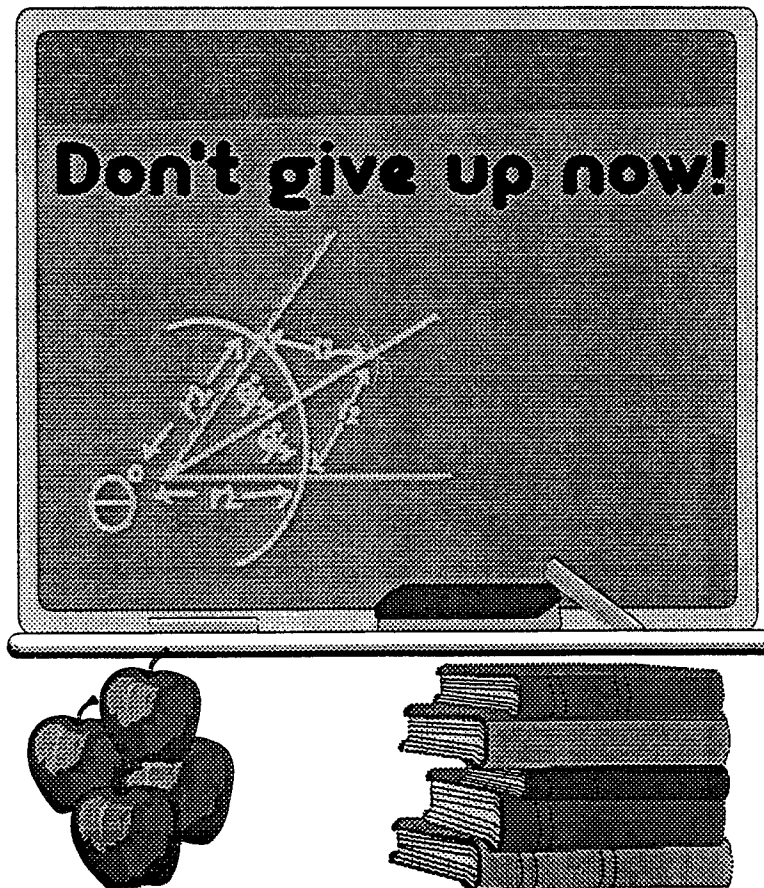
	Series 1		Series 2		Series 3	
	No. of Pages	Percent of Total Pages	No. of Pages	Percent of Total Pages	No. of Pages	Percent of Total Pages
Grade 1	8	2%	6	2%	10	2%
Grade 2	16	4%	16	4%	23	5%
Grade 3	58	12%	37	7%	61	12%
Grade 4	68	14%	86	19%	93	18%
Grade 5	146	29%	154	34%	197	38%

Examine the table above carefully. Approximately how many pages are not devoted to fraction instruction in the grade 3 Series 2 textbook?

- a) 550                      b) 492                      c) 532                      d) 528                      e) 535

16. The length of a radius of a circle is decreased by 20%. This causes the area to be decreased by:

- a) 30%                      b) 36%                      c) 25%                      d) 80%                      e) 61%





17. An old cat climbed up a tree whose height was exactly seventy plus twenty-three. Every day the cat went up eighteen. Every night the cat came down thirteen. If the cat did not pause or stop, when did its claws first reach the top?

- a) on day 18      b) on day 17      c) on day 16      d) on day 19      e) on day 15

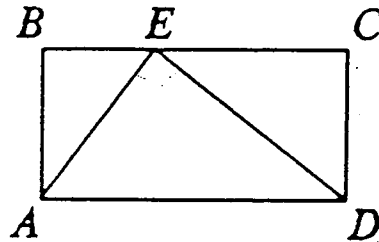
18. Of 50 students, 38 have brown hair, 29 have brown eyes, and 23 have both brown hair and brown eyes. How many have neither brown hair nor brown eyes?

- a) 6      b) 8      c) 12      d) 10      e) 14

19. If  $\frac{2}{3} \times \frac{3}{4} \times \frac{4}{5} \times \frac{5}{6} \times \frac{6}{7} \times \frac{7}{8} \times \frac{8}{9} \times \frac{9}{10} \times \frac{10}{11} \times \frac{11}{12} = \frac{1}{n}$ , what is  $n$ ?

- a) 5      b) 4      c) 13      d) 8      e) 6

20.



In the diagram above,  $AE = 3$ ,  $DE = 4$  and  $AD = 5$ . What is the area of rectangle ABCD?

- a)  $6 U^2$       b)  $12 U^2$       c)  $24 U^2$       d)  $16 U^2$       e)  $8 U^2$

# 1995 MATHEMATICS OLYMPIAD

## TIE BREAKERS

21. If  $6 \Leftrightarrow -1$ ,  $19 \Leftrightarrow 6$ ,  $40 \Leftrightarrow 21$ ,  $69 \Leftrightarrow 44$ , then  $106 \Leftrightarrow$  ?

- a) 80      b) 65      c) 70      d) 75      e) 105

22. In an "upside-down" year, each digit can be turned  $180^\circ$  to form a new year. For example, 1981 is an upside-down year since it becomes 1681 when each digit is rotated  $180^\circ$ . Between 1982 and 2000, how many upside-down years are there?

- a) 6      b) 7      c) 8      d) 10      e) 14

# Grade 7 and 8 Mathematics Olympics Group Challenges

## Student Instructions

You will find yourself in a group which includes one female and one male from grade seven and one female and one male from grade eight. Your final challenges will be broken into two segments - **The 2/3-D Elastic Band Activity** and **The Verbal Communication Activity**. You will be judged not only on the quality and accuracy of your solutions, but also, on your ability to work cooperatively and effectively in a small group.

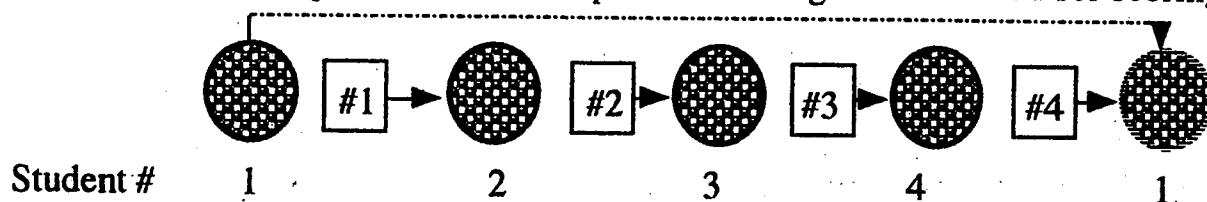
### The 2/3-D Elastic Band Activity - 15 Minutes

Each person in the group must always be touching the large elastic loop which will be given to you. The presider will state the name of a planar or space filling geometric figure and you must replicate using the large elastic loop. When you have accomplished the task, you will be given the name of another figure to form. Each figure is assigned points based on its difficulty and your score will be the sum of the points for the figures you have successfully completed.

- N.B.**
1. All edges of three dimensional objects must be formed.
  2. You must complete each task in sequence before you are given the next challenge.

### The Verbal Communication Activity - 20 Minutes

This is a relay challenge. Each person sits facing in the same direction with a gap of about one metre between each of you. The student at the rear of the line turns over a card marked #1 when told to begin. S/he describes the object to the student immediately in front of him or her and that person draws it as accurately as possible on the sheet provided. Upon completion, this student flips over the card marked number two and describes it to the student in front of them. In the meantime the student in the rear moves to the front of the line and sits facing in the same direction as the rest of the team. This process continues until all four challenges are completed or time is up. The drawings are collected for scoring.



*Sponsored by TE<sup>2</sup>Y<sup>2</sup>MS, a chapter of the Ontario Association for Mathematics Education*

# *The 2/3-D Elastic Band Activity Challenges*

Team Members: 7F \_\_\_\_\_ 7M \_\_\_\_\_  
8F \_\_\_\_\_ 8M \_\_\_\_\_

**N.B. No Definitions May Be Provided!**

Challenge #	Object	Points	Successes
1	Square	1	
2	Obtuse Triangle	1	
3	Hexagon	2	
4	Rhombus	2	
5	Right Trapezoid	2	
6	Cube	3	
7	Rectangular Prism	3	
8	Triangular Prism	3	
9	Square Based Pyramid	4	
10	Tetrahedron	4	
		Total	

## Scoring Key for the Blind Communication Exercise

Team: 1. \_\_\_\_\_ 2. \_\_\_\_\_  
3. \_\_\_\_\_ 4. \_\_\_\_\_

- 4      Size, shape, and location of the objects is nearly exact
- 3      One or two flaws in the size, shape, or location of the objects
- 2      General appearance of drawing is similar to the original but there are a number of errors in the size, shape, and location of the objects
- 1      Major inaccuracies in the size, shape, and location of the objects
- 0      Drawing incomplete or bears no resemblance to the original

Drawing #1 \_\_\_\_/4

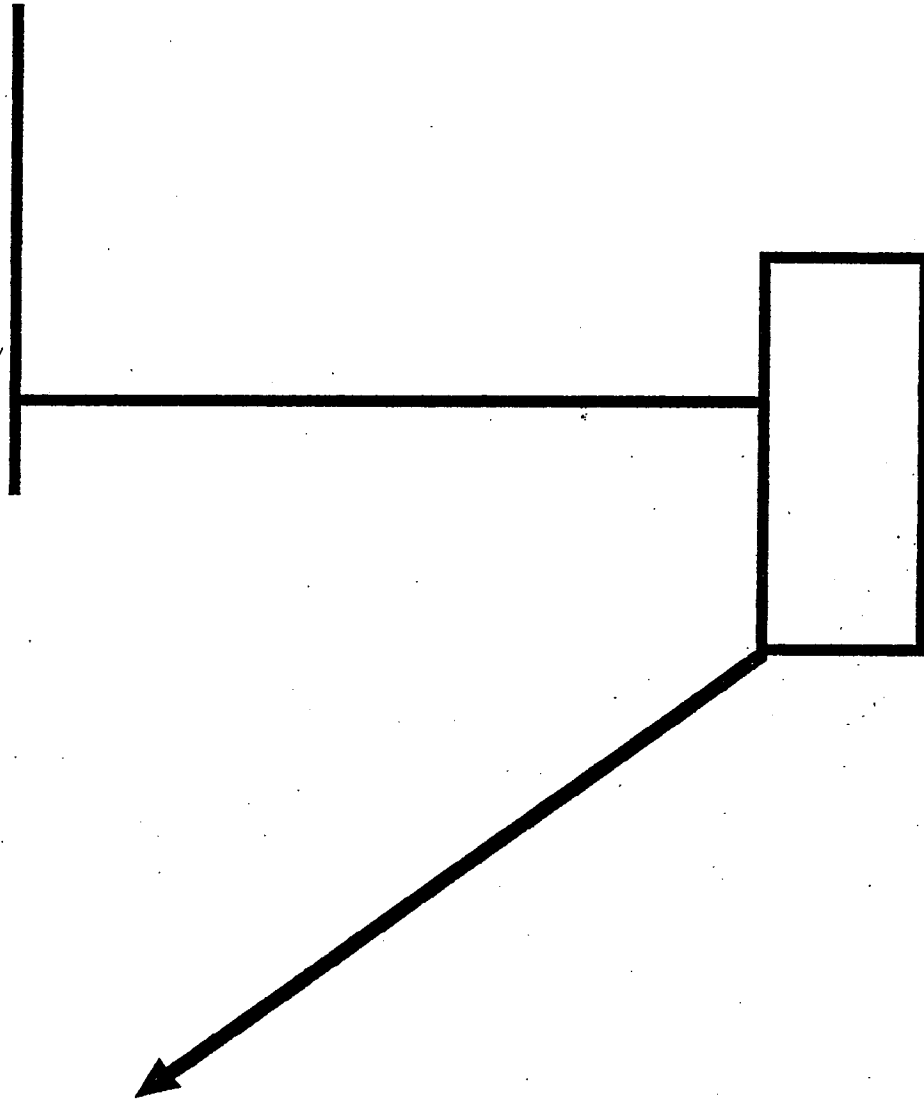
Drawing #2 \_\_\_\_/4

Drawing #3 \_\_\_\_/4

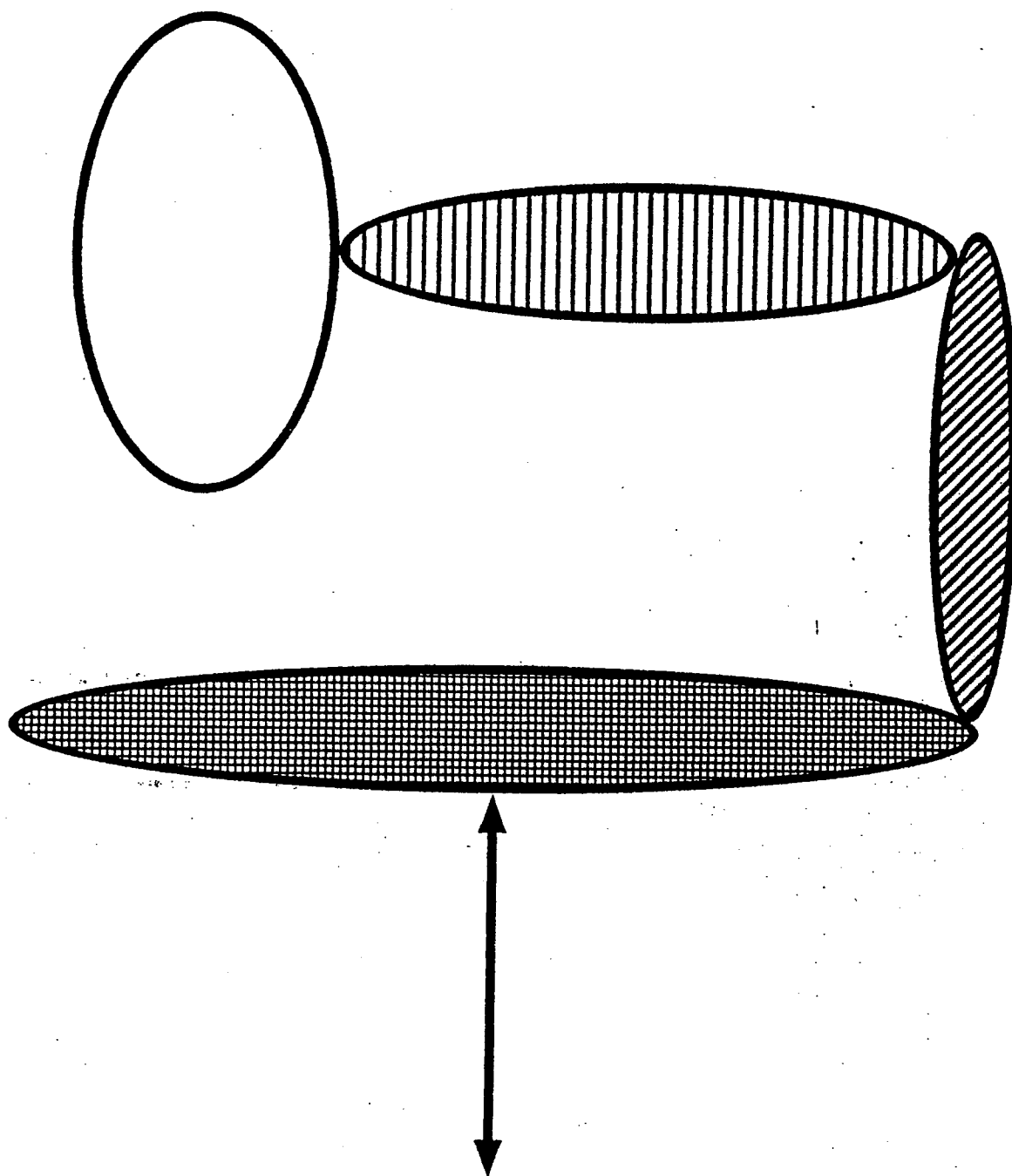
Drawing #4 \_\_\_\_/4

Total: \_\_\_\_/16

# *Challenge #1*

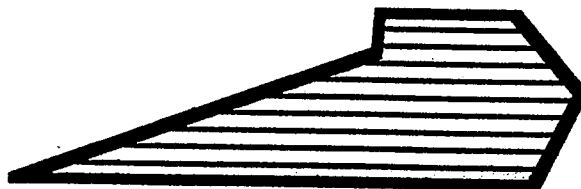
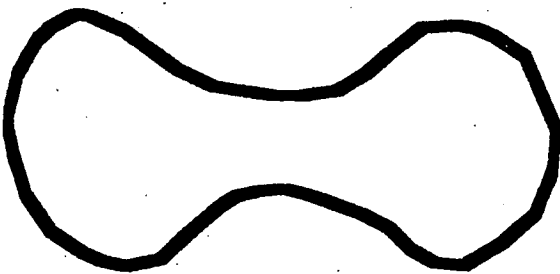
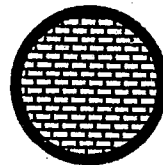
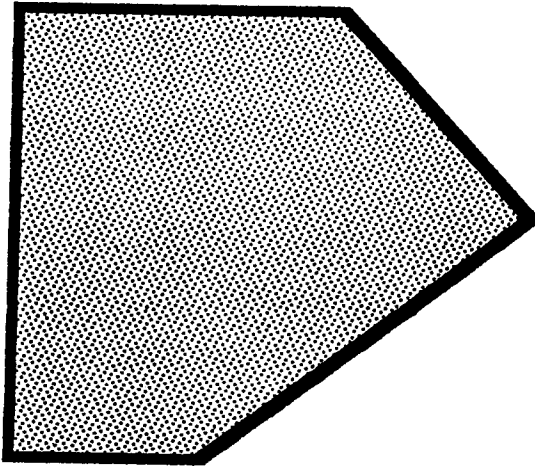


## *Challenge #2*



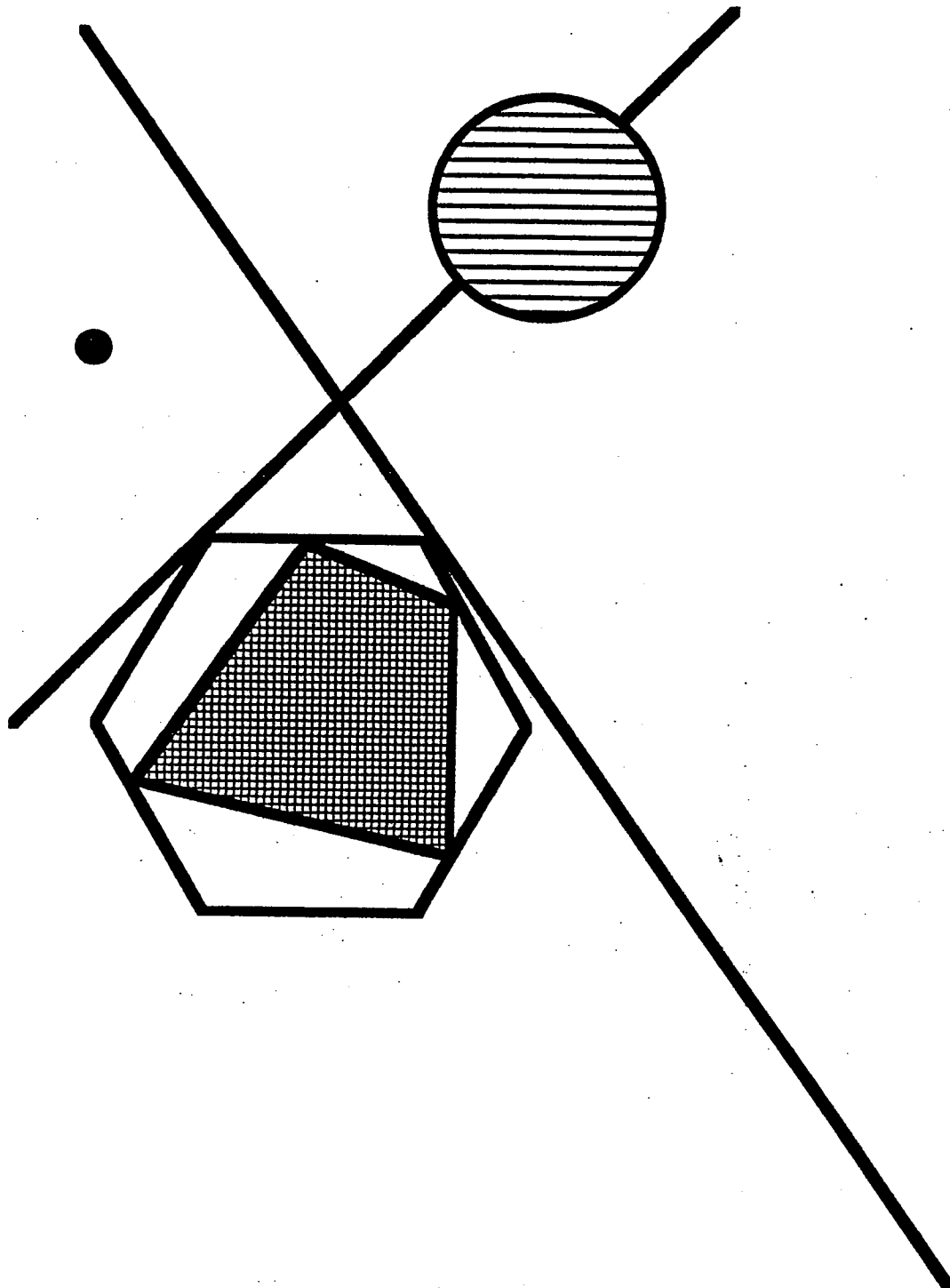
*Sponsored by TE<sup>2</sup>Y<sup>2</sup>MS, a chapter of the Ontario Association for Mathematics Education*

## *Challenge #3*





## *Challenge #4*



*Sponsored by TE<sup>2</sup>Y<sup>2</sup>MS, a chapter of the Ontario Association for Mathematics Education*



# Pairs Investigation

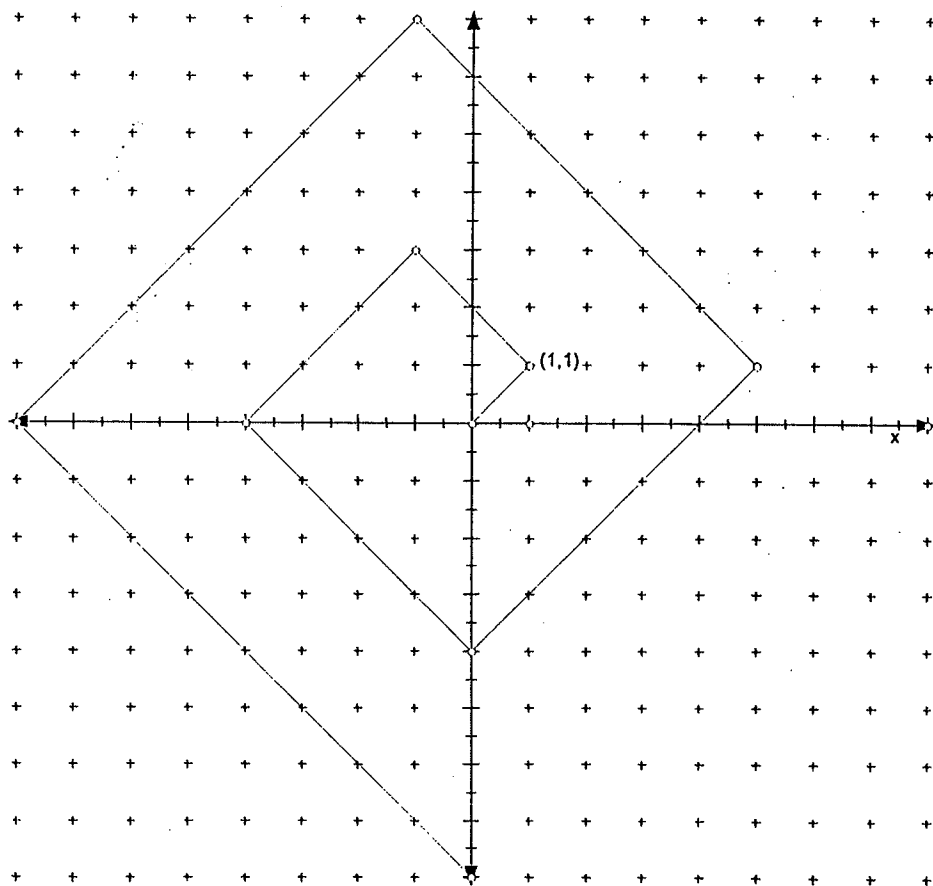
## GRID WALK

The first part of a grid path is shown below. We will call a “step” the diagonal of a unit square. The directions for following the path are as follows:

- Begin at the origin. Move to  $(1,1)$ .
- Turn 90 degrees counterclockwise and move to  $(-1,3)$ .
- Turn 90 degrees counterclockwise again and move to  $(-4,0)$ .

Continue this pattern.

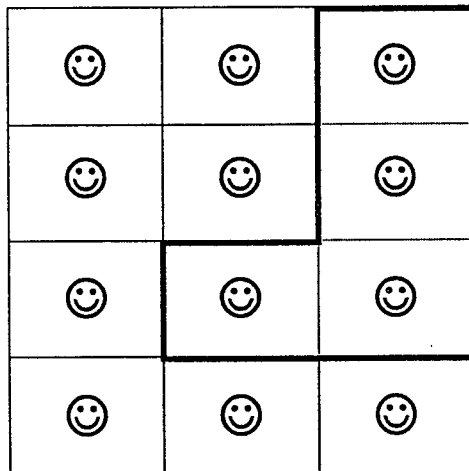
- What is the position after 12 moves?
- What is the final position after 100 moves?



## *DIVIDING STAMPS*

You have a  $4 \times 3$  block of stamps. How many ways are there to detach a connected set of 4 stamps, if the remaining set of 8 stamps must also remain connected?

One possible way is shown below:



## Sum Dice: Modulo 4

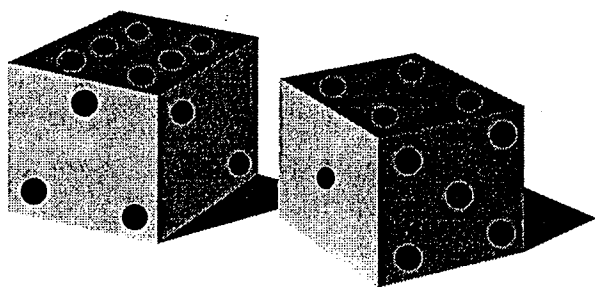
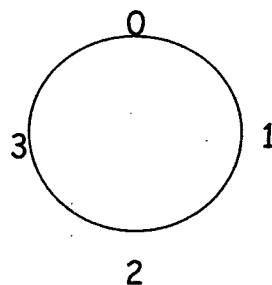
Play the following game 10 times:

Rules:

- Decide who will be "Player A" and who will be "Player B"
- Toss 2 cubic dice and add the numbers modulo 4.
- If the result is 0 or 1, Player A gets a point. If the result is 2 or 3, Player B gets a point.
- The first player to 10 points wins.

1) Is this a fair game? Explain your reasoning.

*[Modulo arithmetic can be thought of as "round the clock". To calculate " $1 + 5 \pmod{4}$ ", start at 1 on the clock face and count 5 places clockwise. You end up at 2, so  $1 + 5 = 2 \pmod{4}$ .]*

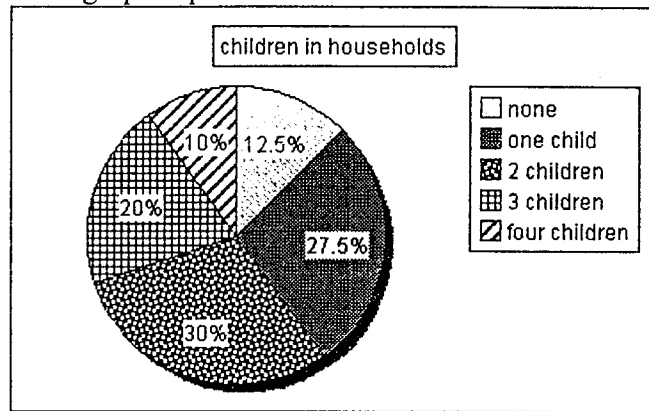




## OMO '99 Sample: Short Answer

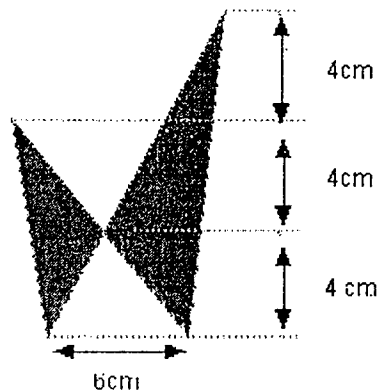
### DATA MANAGEMENT & PROBABILITY

- 1) What is the most probable total when 2 octahedral dice, numbered in standard fashion, are tossed?
- 2) The graph shows the results of a survey of four hundred households. Construct a table showing the actual data which the graph represents.



### MEASUREMENT

- 3) New square tiles with perimeter 24 centimetres are installed on a rectangular floor region. If 576 tiles are used, what is the smallest possible perimeter for the region?
- 4) Determine the area of the shaded region.

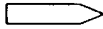


### PATTERNING & ALGEBRA

- 5) At the ring toss event at the carnival, players have to trade in small prizes for better prizes. The trading system includes the following exchanges:  
2 rubber balls = 1 stuffed bear; 3 stuffed bears = 2 gorillas; and  
4 plastic whistles = 1 rubber ball.  
How many whistles are needed to trade for 1 gorilla?

- 6) The students in Mr. Pal's class exchange friendship cards at a class party. Each student gives a card to every other student in the class. They do not give a card to themselves. Each student also gives a friendship card to Mr. Pal. The thickness of each card is 0.125 centimetres. When the students stack all the cards in one pile, the height of the stack is 1.28 metres. Mr. Sweets does not give cards to his students because he is friendly to them every day. How many students are in the class?

### NUMBER SENSE AND NUMERATION

- 7) The symbol  represents one or more arithmetic operations.

If  $5 \text{ } \langle \rangle \text{ } 3 = 6$

and  $7 \text{ } \langle \rangle \text{ } 4 = 12$

and  $8 \text{ } \langle \rangle \text{ } 7 = 7$

Determine  $6 \text{ } \langle \rangle \text{ } 2$ .

- 8) What number am I?  
 I am a whole number less than 100.  
 I have 8 factors (including myself and 1).  
 If you reversed my digits, I would only have 6 factors.  
 My digits are consecutive numbers.

### GEOMETRY AND SPATIAL SENSE

- 9) A rectangular prism with dimensions  $5 \times 6 \times 3$  is dipped in paint, then cut into 1-cm cubes. How many of the cubes are completely unpainted?
- 10) The six faces of a cube are marked with the following patterns:



a



b



c



d

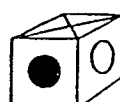
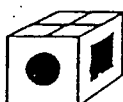
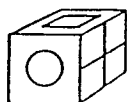


e



f

Here are three different views of the cube:



Match each face with the one that is directly opposite to it on the cube.



#	answer	Notes
1	9	
2	(0 - 4 children) 50,110,120,80,40	
3	$576\text{cm}^2$	Square region gives minimum perimeter. Tile side length is 6 $\sqrt{576} = 24$ ; Floor side length is $24 \times 6$ ; Floor perimeter is $24 \times 6 \times 4 = 576\text{cm}^2$
4	$18\text{ cm}^2$	Smaller shaded triangle: $24\text{ cm}^2$ ; Larger shaded triangle: $36\text{ cm}^2$ ; Subtract the overlap triangle twice: $60 - 12 - 12 = 36\text{ cm}^2$
5	48 whistles	
6	32 students	An 8-card stack is 1cm high. 128cm means 1024 cards. Every student gives every other student a card, and gives the teacher a card. 1024 is the square of the number of students: 32
7	8	Subtract the second operand from the first operand and multiply the result by the second operand to get the final result.
8	54	
9	12 cubes	
10	Side a $\rightarrow$ d Side b $\rightarrow$ c Side e $\rightarrow$ f	

OMO '99 Sample: Five Extra Questions

DMP

Given the following set of numbers, one of the numbers is chosen at random. What is the probability that the mean of the list will increase by 2 or more if the chosen number is removed from the list?

24    9    14    37    8    40    29

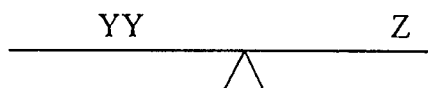
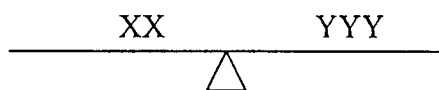
M

Find the Volume of a Box

I know the areas of the top, side, and front of a rectangular box. The top is  $112 \text{ cm}^2$ , the side is  $84 \text{ cm}^2$ , and the front is  $48 \text{ cm}^2$ . What is the volume of the box?

PA

The following diagrams show scales balanced with masses, X, Y, and Z. If the scale is cleared, and 2 X's and 1 Y are placed on the left side, how many Z's would need to be placed on the right side to balance?



NSN

Determine the value of  $x$ :  $\frac{2+x}{x+5} = \frac{1.53}{6.12}$

GSS

Three cubes are stacked on top of each other on a table. Consider tracing "paths" by starting at one vertex of the top cube, and following edges until you get to the table. If you are not allowed to re-visit any point, what is the longest path (in terms of edge-lengths) that you can find?

*OMO '99 Sample*

## Five Extra Questions

#	answer	Notes
DMP	$2/7$	
M	$672 \text{ cm}^3$	
PA	$2z$	
NSN	$X = -1$	
GSS	12	



## Story Graphs

Several students went out for a walk one morning. They were to end their walk at a park picnic area. Shown below are 4 graphs and 3 stories.

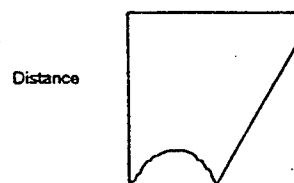
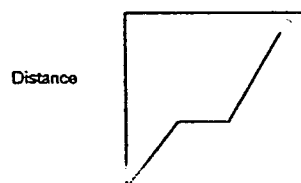
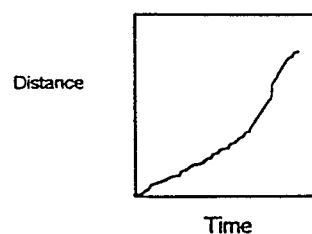
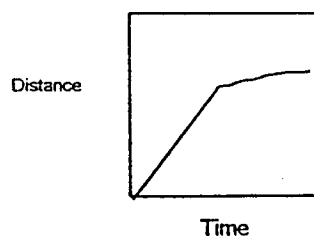
- Match the graph to the story. Place the student's name on the graph.
- Write a story that Malka may have told using the information on the remaining graph.

Abdul: I started out on my walk when I realized that I forgot my door key. I went back home to get it and then started my walk at a faster pace.

Joe: I was so anxious to get going on my walk that I missed a step up on to the curb. I fell down and hurt my knee slightly. I had to continue my walk slowly due to the injury.

Kenisha: I really enjoyed my walk in the sunshine. I was taking my time, but then I realized that it was getting late. I had to walk more quickly in order not to miss the food.

Malka's story:





# TEY2MS MATH OLYMPICS

April 1995

NAME: \_\_\_\_\_ SCHOOL \_\_\_\_\_

## WHAT'S MY RULE?

(2 Marks Each)

Find the pattern and fill in the missing quantities for each of the following.

1. 1, 4, 9, 16, 25, 36, 49, \_\_\_\_\_, \_\_\_\_\_.

2. 1, 1, 1, 3, 5, 9, 17, \_\_\_\_\_, 59, \_\_\_\_\_.

3. 1, 2, 6, 15, 31, 56, 92, \_\_\_\_\_, \_\_\_\_\_.

4.

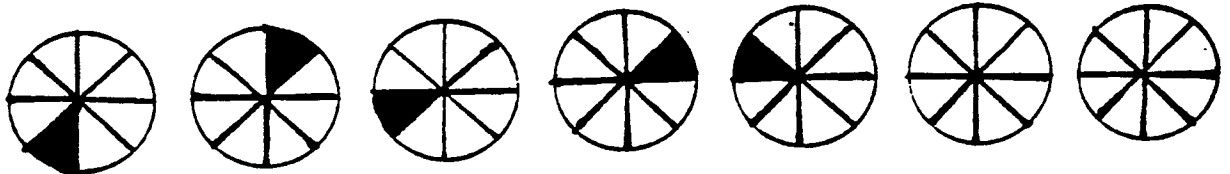
$$\begin{aligned} 3 \times 3 &= 09 \\ 33 \times 33 &= 1089 \\ 333 \times 333 &= 110889 \\ 3333 \times 3333 &= 11108889 \\ 33333 \times 33333 &= \end{aligned}$$

5. If  $3 \Delta 2 = 11$ ,  $5 \Delta 4 = 29$ ,  $7 \Delta 6 = 55$ , then  $9 \Delta 8 =$  \_\_\_\_\_ and  $5 \Delta 7 =$  \_\_\_\_\_.

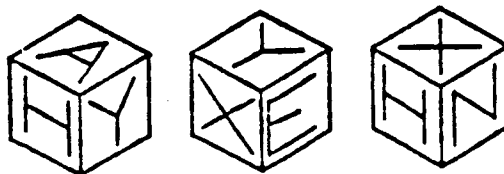
## CAN YOU FIGURE ME OUT?

(2 Marks Each)

6. Shade the appropriate sector in the two unshaded circles.



7. Three views of a cube are given below. What letter is opposite the letter X?



ANSWER: \_\_\_\_\_

8. Which two of the ropes shown will **not** tie themselves into knots when the ends are pulled?



A



B



C



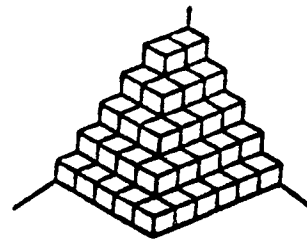
D



E

ANSWER: \_\_\_\_\_

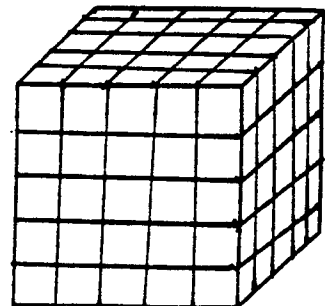
9. The tower shown is made of horizontal layers of unit cubes, not all being visible in the diagram. How many unit cubes are contained in the tower?



ANSWER: \_\_\_\_\_

10. The outside of a 5 cm wooden cube is painted red. The painted cube is then cut into 1 cm cubes.

How many of the 1 cm cubes do not have red paint on any face?



ANSWER: \_\_\_\_\_



## CAN YOU SOLVE IT?

(3 Marks Each)

11. Allan, Bernice, Carmelita and Desai are all friends.  
Desai: "Carmelita is my sister and I am the eldest in the family."  
Allan: "I am older than all of you!"  
Carmelita: "I know that Bernice is younger than me."

List the friends in order from oldest to youngest.

ANSWER \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_,

12. Two friends are planning a party. They have enough money to buy 30 doughnuts or 20 cans of pop. They found that they actually needed 18 doughnuts. How many cans of pop can they now buy?

ANSWER: \_\_\_\_\_

13. On her first stop, a schoolbus driver drops off half her students and picks up 4 students. She does the same thing on her next two stops. At the last stop she drops off the remaining 10 students. How many students did she have initially?

ANSWER: \_\_\_\_\_

14. Five Grade 7 friends set up their own telephone system. How many telephone calls are required, if each pair of friends speak together once?

ANSWER: \_\_\_\_\_

15. The values of A, B and C are 5, 9 and 12 but **not necessarily** in that order. What is the largest value of  $BA + AC$ ?

ANSWER \_\_\_\_\_

16. Find the value of  $A + B$  given that  $A$  and  $B$  are whole numbers and  $\frac{A}{11} + \frac{B}{3} = \frac{31}{33}$ .

ANSWER: \_\_\_\_\_

17. What is the value, in simplest fractional form, of

$$\frac{6 + 12 + 18 + 24 + 30 + 36 + 42 + 48 + 54 + 60 + 66 + 72 + 78 + 84 + 90 + 96}{8 + 16 + 24 + 32 + 40 + 48 + 56 + 64 + 72 + 80 + 88 + 96 + 104 + 112 + 120 + 128} ?$$

ANSWER: \_\_\_\_\_

18. Mario found all the divisors of 60, including 1 and 60. He then added their reciprocals together. What sum did he get? (Note: The reciprocal of a number  $N$  is the fraction  $\frac{1}{N}$ ).

ANSWER: \_\_\_\_\_

# ANSWER KEY - QUIZ

## TEY2MS MATH OLYMPICS

April 1995

NAME: \_\_\_\_\_ SCHOOL: \_\_\_\_\_

### WHAT'S MY RULE?

Find the pattern and fill in the missing quantities for each of the following.

1. 1, 4, 9, 16, 25, 36, 49, 64, 81.

2. 1, 1, 1, 3, 5, 9, 17, 31, 59, 107. Sum of three preceding terms

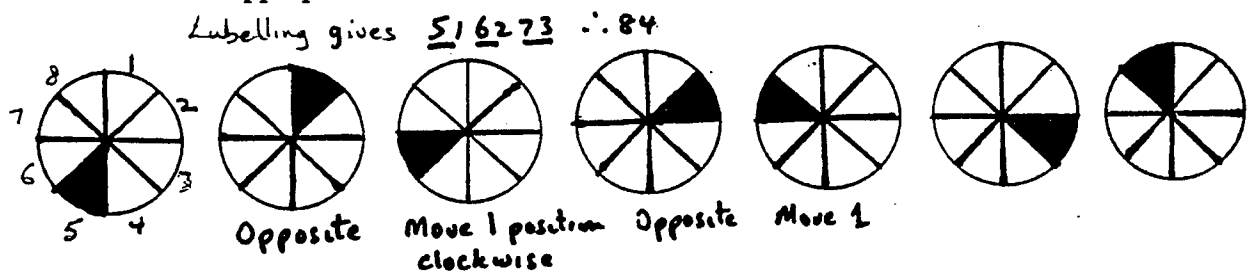
3. 1, 2, 6, 15, 31, 56, 92, 141, 205. Look at successive differences (1, 4, 9, 16, 25, 36, ...)

4.  $3 \times 3 = 09$   
 $33 \times 33 = 1089$   
 $333 \times 333 = 110889$   
 $3333 \times 3333 = 11108889$   
 $3333333 \times 3333333 = \underline{1111110888889}$ . 6 ones, 6 eights

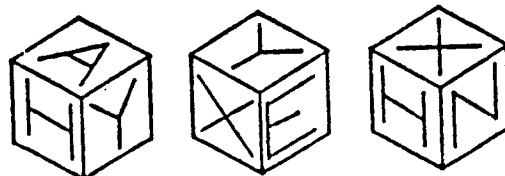
5. If  $3 \Delta 2 = 11$ ,  $5 \Delta 4 = 29$ ,  $7 \Delta 6 = 55$ , then  $9 \Delta 8 = \underline{89}$  and  $5 \Delta 7 = \underline{32}$ .  
 $a \Delta b = a^2 + b$  or  $a \Delta b = a(b+2) - 1$   $\therefore 89, 44$  also

### CAN YOU FIGURE ME OUT?

6. Shade the appropriate sector in the two unshaded circles.



7. Three views of a cube are given below. What letter is opposite the letter X?



Opposite A is X  
H is E  
Y is N

ANSWER: A

8. Which two of the ropes shown will **not** tie themselves into knots when the ends are pulled?



A



B



C



D



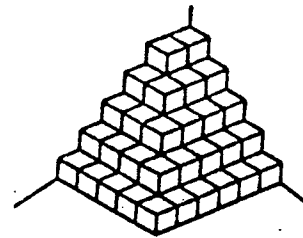
E

ANSWER: C, E ✓

9. The tower shown is made of horizontal layers of unit cubes, not all being visible in the diagram. How many unit cubes are contained in the tower?

$$(5 \times 6) + (4 \times 5) + (3 \times 4) + (2 \times 3) + (1 \times 2)$$

$$30 + 20 + 12 + 6 + 2$$



ANSWER: 70

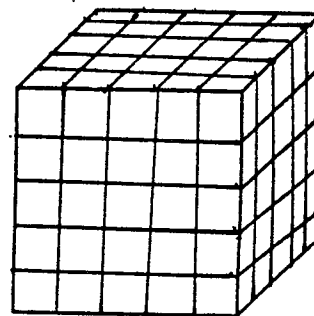
10. The outside of a 5 cm wooden cube is painted red. The painted cube is then cut into 1 cm cubes.

How many of the 1 cm cubes do not have red paint on any face?

Left with 3cm x 3cm x 3cm cube

∴ 27 cubes

ANSWER: 27



# CAN YOU SOLVE IT?

(3 Marks Each)

11. Allan, Bernice, Carmelita and Desai are all friends.

Desai: "Carmelita is my sister and I am the eldest in the family."

Allan: "I am older than all of you!"

Carmelita: "I know that Bernice is younger than me."

List the friends in order from oldest to youngest.

ANSWER Allan, Desai, Carmelita, Bernice.

12. Two friends are planning a party. They have enough money to buy 30 doughnuts or 20 cans of pop. They found that they actually needed 18 doughnuts. How many cans of pop can they now buy?

ANSWER: 28

$$\begin{aligned} 30d &= 20c & 12 \text{ doughnuts can} \\ 1d &= \frac{2}{3}c & \text{be replaced with} \\ 12d &= 8c & 8 \text{ cans} \\ & & \therefore 20 + 8 \text{ cans} \end{aligned}$$

13. On her first stop, a schoolbus driver drops off half her students and picks up 4 students. She does the same thing on her next two stops. At the last stop she drops off the remaining 10 students. How many students did she have initially?

ANSWER: 24

14. Five Grade 7 friends set up their own telephone system. How many telephone calls are required, if each pair of friends speak together once?

ANSWER: 10

$$\frac{5 \times 4}{2}$$

Each person speaks to 4 other people  
but  $A \rightarrow B$  same as  $B \rightarrow A$

15. The values of A, B and C are 5, 9 and 12 but not necessarily in that order.

What is the largest value of  $BA + AC$ ?

$$\begin{aligned} A(B+C) \quad \text{so} \quad 5(9+12) &= 5 \times 21 = 105 \\ 12(5+9) &= 12 \times 14 = 168 \\ 9(5+12) &= 9 \times 17 = 153 \end{aligned}$$

ANSWER 168

16. Find the value of  $A + B$  given that  $A$  and  $B$  are whole numbers and  $\frac{A}{11} + \frac{B}{3} = \frac{31}{33}$ .

ANSWER:  $2 + 3 = 5$

$$B = 1 \text{ or } 2$$

$$\frac{A}{11} = \frac{31}{33} - \frac{B}{3}$$

$$B = 1 \Rightarrow \frac{A}{11} = \frac{31}{33} - \frac{1}{3} = \frac{20}{33}$$

$$B = 2 \Rightarrow \frac{A}{11} = \frac{31}{33} - \frac{2}{3} = \frac{3}{11}$$

$$\therefore B = 2, A = 3$$

17. What is the value, in simplest fractional form, of

$$\frac{6 + 12 + 18 + 24 + 30 + 36 + 42 + 48 + 54 + 60 + 66 + 72 + 78 + 84 + 90 + 96}{8 + 16 + 24 + 32 + 40 + 48 + 56 + 64 + 72 + 80 + 88 + 96 + 104 + 112 + 120 + 128} ?$$

$$\frac{6(1+2+3+\dots+16)}{8(1+2+3+\dots+16)} = \frac{6}{8}$$

ANSWER:  $\frac{3}{4}$

18. Mario found all the divisors of 60, including 1 and 60. He then added their reciprocals together. What sum did he get? (Note: The reciprocal of a number  $N$  is the fraction  $\frac{1}{N}$ ).

ANSWER:  $\frac{14}{5}$

Divisors are 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60

$$\text{Sum} = 1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{6} + \frac{1}{10} + \frac{1}{12} + \frac{1}{15} + \frac{1}{20} + \frac{1}{30} + \frac{1}{60}$$

$$= \frac{60 + 30 + 20 + 15 + 12 + 10 + 6 + 5 + 4 + 3 + 2 + 1}{60} = \frac{168}{60}$$

$$= \frac{\text{Sum of divisors of number } N}{\text{Number } N} = \frac{14}{5}$$

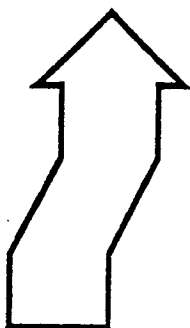
# OLYMPIADES MATHÉMATIQUES D'O-H MATH OLYMPICS

## ACTIVITY #1

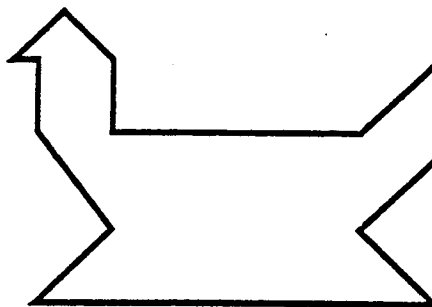
## ACTIVITE #1

1. Use all seven tangram pieces to make each design. Sketch the way the pieces fit.  
Utilise les sept morceaux du casse-tête chinois pour réaliser les dessins suivants.  
Indique par des traits la façon dont les morceaux s'assemblent.

a)



b)



2. If the tangram is thought of as a whole, what fraction of the whole is each part of the tangram? (Hint: Which shape is the basic unit from which all the other shapes can be tiled?)  
Si on considère le casse-tête chinois comme un tout, quelle fraction du tout chaque morceau représente-il? (Indice: Quelle est la forme de base par laquelle toutes les autres formes peuvent être trouvées?)

A = \_\_\_\_\_

B = \_\_\_\_\_

C = \_\_\_\_\_

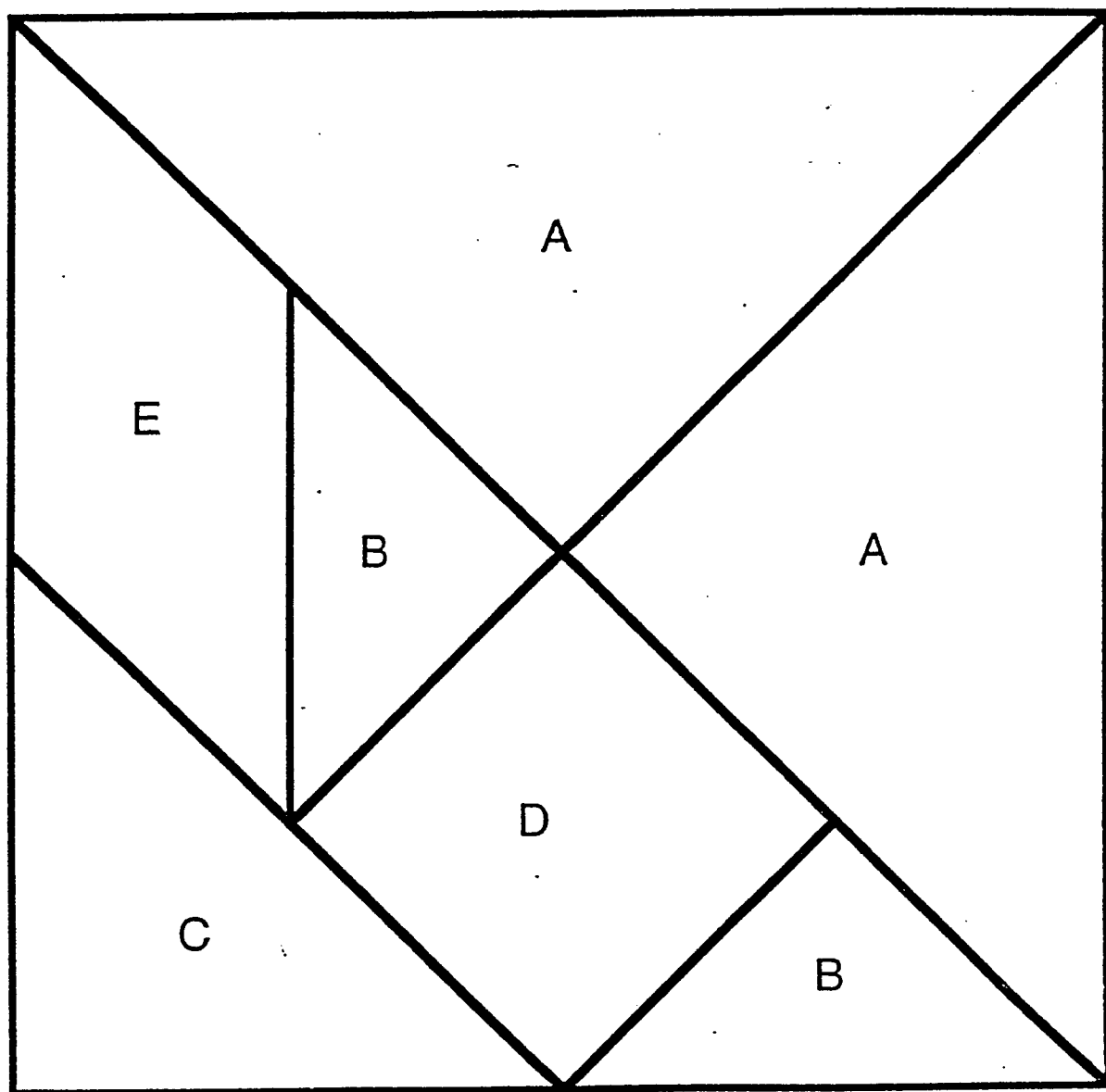
D = \_\_\_\_\_

E = \_\_\_\_\_





# TANGRAM



CASSE-TETE CHINOIS



# OLYMPIADES MATHÉMATIQUES D'O-H MATH OLYMPICS

ACTIVITY # 2

ACTIVITE # 2

## MATH QUIZ PETIT TEST MATHÉMATIQUE

Answer as many of the following as possible.

Trouve le plus de réponses possibles.

1. Evaluate  $2^2$  1. \_\_\_\_\_  
Evalue
2. The smallest number exactly divisible by 1,2,3,4,6,8,12 and 24 is 2. \_\_\_\_\_  
Le plus petit nombre divisible exactement par 1,2,3,4,6,8,12 et 24 est
3. The greatest common factor of 70 and 168 is 3. \_\_\_\_\_  
Le plus grand facteur commun de 70 et 168 est
4. The lowest common multiple of 24 and 54 is 4. \_\_\_\_\_  
Le plus petit multiple commun de 24 et 54 est
5. This number backwards is the product of the first three odd 5. \_\_\_\_\_  
prime numbers.  
Ce nombre à l'envers est le produit des trois premiers nombres premiers impairs.
6. 347 - 10% of 347 is 6. \_\_\_\_\_  
347 - 10% de 347 est
7. 26.3 + 20% of 263 is 7. \_\_\_\_\_  
26,3 + 20% de 263 est
8. Three quarters of this number equals 72 8. \_\_\_\_\_  
Trois quarts de ce nombre égale 72
9. 1.35 of 46 is 9. \_\_\_\_\_  
1,35 de 46 est
10. 0.04 of this number is 241 10. \_\_\_\_\_  
0,04 de ce nombre est 241



# OLYMPIADES MATHÉMATIQUES D'O-H MATH OLYMPICS

ACTIVITY # 3

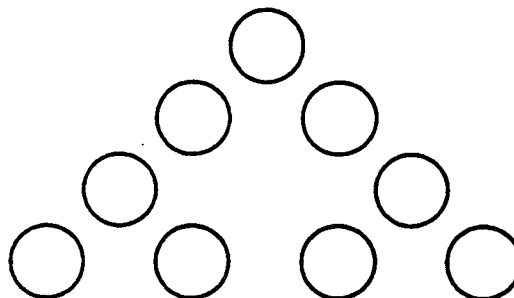
ACTIVITE # 3

## SUM TRIANGLE LA SOMME TRIANGULAIRE

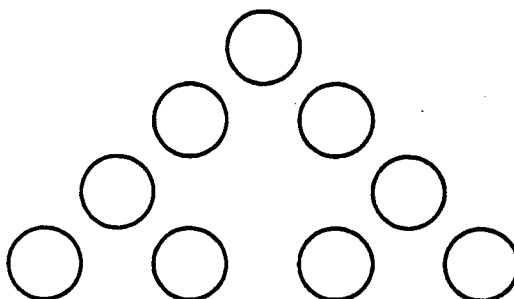
Using the digits 1,2,3,4,5,6,7,8,9, place one in each circle so that the sums along each side of the triangle equals the amount shown. DO NOT USE ANY NUMBER MORE THAN ONCE. Bonus marks are given for extra solutions.

Place les chiffres 1,2,3,4,5,6,7,8,9 dans les cercles afin que la somme des nombres de chaque côté égale la somme donnée. N'utilise chaque chiffre qu'une seule fois. Des points bonus sont donnés pour des solutions supplémentaires.

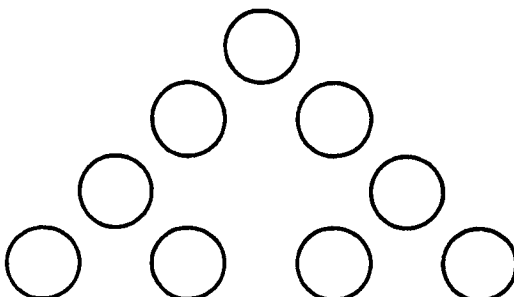
SUM = 21  
SOMME = 21  
4 solutions possible  
4 solutions possibles



SUM = 20  
SOMME = 20  
6 solutions possible  
6 solutions possibles



SUM = 19  
SOMME = 19  
4 solutions possible  
4 solutions possibles





8



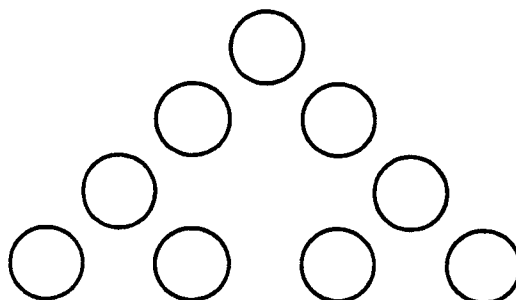
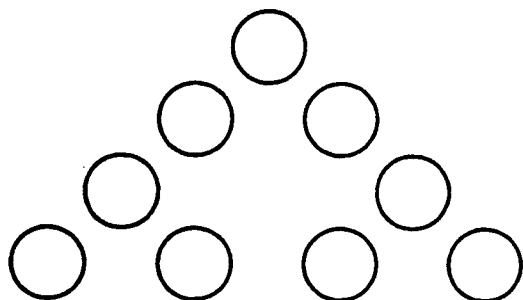
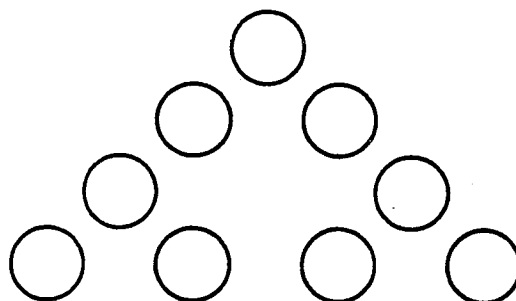
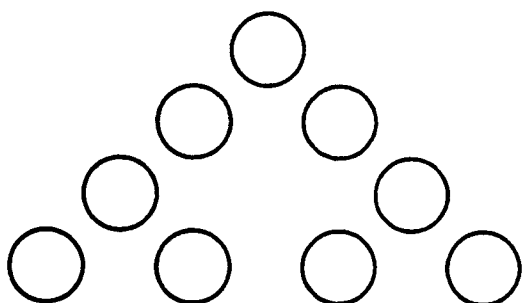
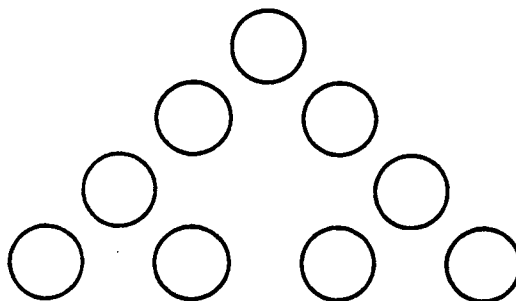
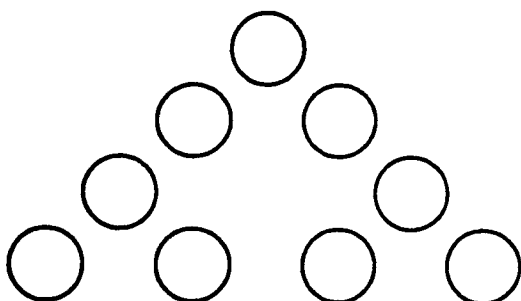
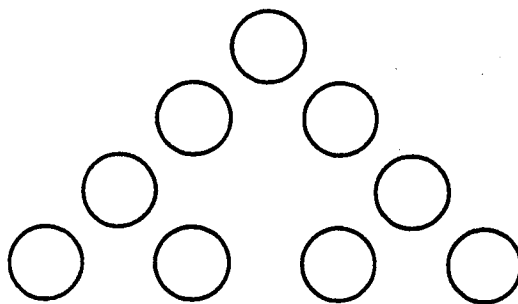
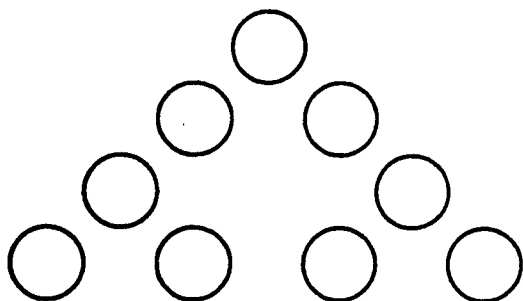
# OLYMPIADES MATHÉMATIQUES D'O-H MATH OLYMPICS

ACTIVITY # 3

ACTIVITE # 3

## SUM TRIANGLE worksheet

Feuille de travail pour LA SOMME TRIANGULAIRE







# OLYMPIADES MATHÉMATIQUES D'O-H MATH OLYMPICS

ACTIVITY # 4

ACTIVITE # 4

## WHAT'S MY RULE ? DEVINE LA REGLE !

EXAMPLE: If  $2 \leftrightarrow 5$ ,  $8 \leftrightarrow 17$  and  $20 \leftrightarrow 41$  ... then  $10 \leftrightarrow$

21

EXAMPLE: Si \_\_\_\_\_ et \_\_\_\_\_ donc

The rule is : multiply by 2, then add one

La règle: multiplier par 2, puis ajouter un

1. If  $16 \leftrightarrow 9$ ,  $35 \leftrightarrow 28$  and  $21 \leftrightarrow 14$  then  $11 \leftrightarrow$

Si \_\_\_\_\_ et \_\_\_\_\_ donc

The rule is \_\_\_\_\_

La règle \_\_\_\_\_

2. If  $11 \leftrightarrow 38$ ,  $42 \leftrightarrow 131$  and  $5 \leftrightarrow 20$  then  $18 \leftrightarrow$

Si \_\_\_\_\_ et \_\_\_\_\_ donc

The rule is \_\_\_\_\_

La règle \_\_\_\_\_

3. If  $2 \leftrightarrow 175$ ,  $5 \leftrightarrow 70$  and  $25 \leftrightarrow 14$  then  $10 \leftrightarrow$

Si \_\_\_\_\_ et \_\_\_\_\_ donc

The rule is \_\_\_\_\_

La règle \_\_\_\_\_

4. If  $6 \leftrightarrow 18$ ,  $16 \leftrightarrow 208$  and  $10 \leftrightarrow 70$  then  $13 \leftrightarrow$

Si \_\_\_\_\_ et \_\_\_\_\_ donc

The rule is \_\_\_\_\_

La règle \_\_\_\_\_

5. If  $9 \leftrightarrow 9$ ,  $8 \leftrightarrow 26$  and  $2 \leftrightarrow 86$  then  $\square \leftrightarrow 65$

Si \_\_\_\_\_ et \_\_\_\_\_ donc

The rule is \_\_\_\_\_

La règle \_\_\_\_\_



# OLYMPIQUES MATHÉMATIQUES O-H MATH OLYMPICS

ACTIVITY # 5

ACTIVITE # 5

## CUBE COUNT DENOMBREMENT DE CUBES

All of 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? Écris le nombre à côté 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.

