Ontario Mathematics Olympics

North York Board of Education
Selection Challenge

Grade 8

Thursday, April 27, 1995.

Time Limit: **30 minutes**

Instructions to Students:

- Calculators may be used (but are not necessary).
- In questions #1 to #4 **circle** the answer you feel is most correct.
- **Full solutions** are required for questions #5 and #6.
  Diagrams may be used.
  If you require more space, use the back of the page (be sure to indicate to the marker that there is more work on the back).
- The full solution questions will be the primary method used to select the twelve finalists. As a result, complete and concise explanations are necessary.
- Be sure to place your name and school on the top of every page.

Your Name: _____
(Please print)

School: _____

ED01-11(Math. Olympics)RM.918

Student's Name: _____

School: _____

Part 1 Multiple Choice

Instructions:

- Read each question carefully.
- Calculations may be done in the space provided or on the paper providec your teacher.
- **Circle** the answer you feel is most correct.

1. A record album that sells for $11.00 at the regular price is on sale for $8.80. T percentage discount off the regular price is:

A) 80% B) 25% C) 22% D) 20% E) 15%

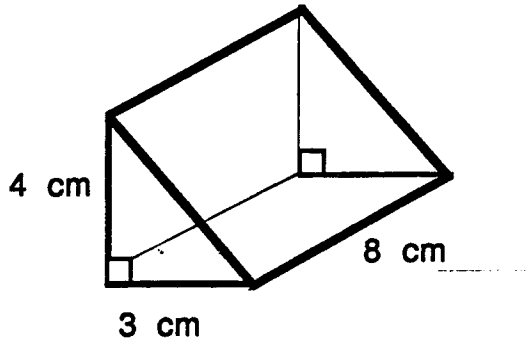
2. A bag contains several marbles. Some are red, some are white, and some are The probability of drawing a red marble is 1/6 and the probability of drawin white marble is 1/3. If the bag contains 4 red marbles and 8 white marbles, many blue marbles does it contain?

A) 6 B)12 C) 18 D) 24 E) 30

Student's Name: _____

School: _____

3. What is the surface area of the this triangular prism?



A) 76 cm^2 B) 96 cm^2 C) 108 cm^2 D) 112 cm^2 E) 120 cm^2

4. If you wrote all the whole numbers from 1 through 100, how many times woulc write the digit 5?

A) 10 B) 11 C) 19 D) 20 E) 30

Student's Name: _____

School: _____

Part 2 Full Solutions

Instructions:

- Read each question carefully.
- Calculations must be done in the space provided. Use the back of the pa you require more room.
- Complete and concise explanations are necessary. We are interested in reasoning that you used to arrive at your answer.

5. Two vertices of a square are at (8,1) and (8,7). Find the coordinates of the ott vertices (there is more than 1 case). Illustrate and explain. Full solution requirec

Student's Name: _____

School: _____

6. You have twelve similiar gold coins. Unfortunately one of the coins is counterfe weight is different from the genuine coins. Identify the counterfeit coin by u an equal arm balance 3 times. Full solution required.

North York Mathematics Olympics

Task 1:

You have ten number tiles containing the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

a) Use seven tiles to make a two-digit-by-two digit multiplication problem with its product being a three-digit-number. There is more than one answer. Record your answer(s) on the sheet provided.

b) Use four tiles to make a division problem, without listing the answer, that has a three-digit dividend and a quotient that is as large as possible.

Definitions: Dividend: A number being divided, eg if 12 is divided by 5, the dividend is 12. (5 is the divisor)
LATIN *dividendum*: to be divided

Quotient: The result of dividing one number by another, eg. if 12 is divided by 5, the quotient is 2.4
LATIN *quotiens*: how many times

c) What is the smallest possible quotient when four tiles are used?

d) What is the greatest possible remainder when four tiles are used?

e) What is the smallest possible remainder when four tiles are used?

1 2

3 4

5 6

7 8

9 0

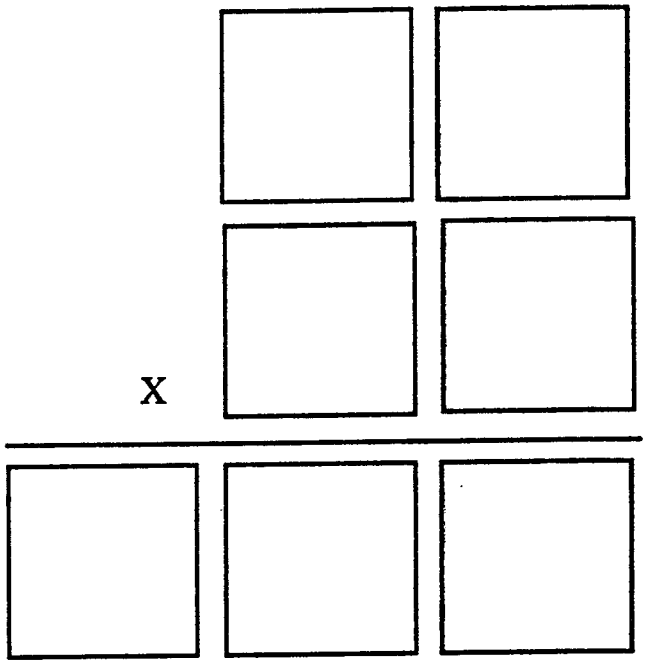
North York Mathematics Olympics

Task 1:

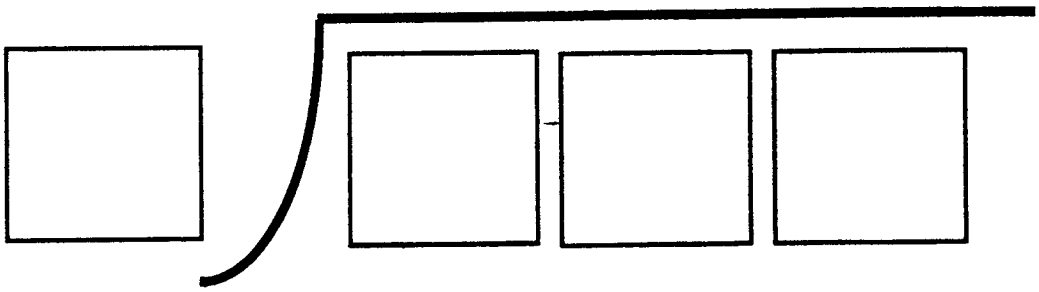
Recording Sheet:

a)

Answer(s)



b) c) d) e)



North York Mathematics Olympics

Task 1:

You have ten number tiles containing the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9.

a) Use seven tiles to make a two-digit-by-two digit multiplication problem with its product being a three-digit-number. There is more than one answer. Record your answer(s) on the sheet provided.
Three answers: 74x13=962, 62x15=930, 52x18=936

b) Use four tiles to make a division problem, without listing the answer, that has a three-digit dividend and a quotient that is as large as possible.

Definitions: Dividend: A number being divided, eg if 12 is divided by 5, the dividend is 12. (5 is the divisor)
LATIN *dividendum*: to be divided

Quotient: The result of dividing one number by another, eg. if 12 is divided by 5, the quotient is 2.4
LATIN *quotiens*: how many times
987÷1

c) What is the smallest possible quotient when four tiles are used?
102÷9

d) What is the greatest possible remainder when four tiles are used?
8 divisor is 9 9x?+8 710÷9=78 R8

e) What is the smallest possible remainder when four tiles are used?
A possible remainder may be 0, so any dividend with a divisor of 1 will be correct. However, 0 might not be considered a remainder by some, so 1 is the next lowest. If the dividend is odd and the divisor is 2, the remainder is 1.

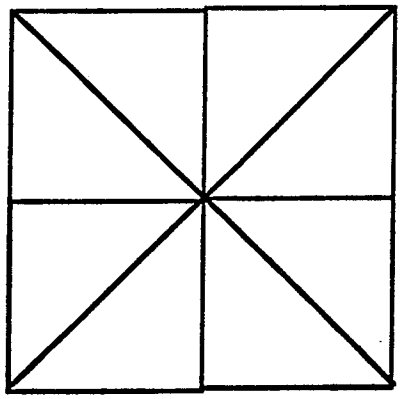
North York Mathematics Olympics

Task 2:

The Math Team sponsor drove 120 kilometres to a competition, going 60 km/h. On the return trip, she drove 40 km/h. Write an explanation to your teacher explaining why the average speed is not 50 km/h.

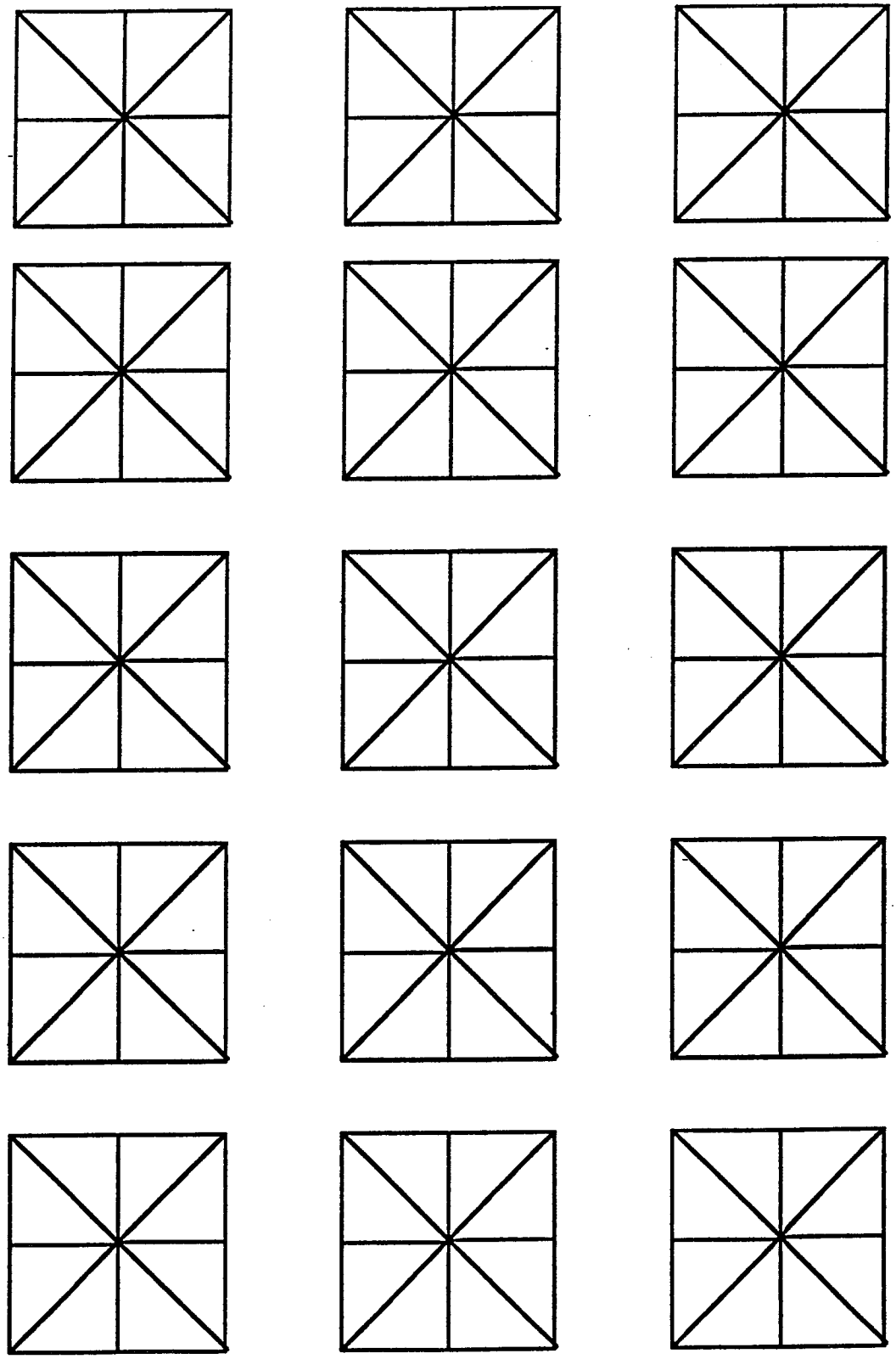
Task 3:

A square is divided into eight parts as shown. If the repeated patterns due to flips or turns are not counted, in how many ways can you shade half the triangular regions?



Names: _____ Grade: _____

_____



North York Mathematics Olympics

Task 4:

How many different paths can be taken to spell ALGEBRA using the following arrangement, if you continue to move downward only? What do you notice?

A

L L

G G G

E E E E

B B B

R R

A

Task 5:

You have three tasks. The first is easier than the other two.

a) Cut up a square so that you can rearrange the pieces into two equally sized squares.

b) Cut up an equilateral triangle so that you can rearrange the pieces into two equally sized equilateral triangles.

c) Cut up a square so that you can rearrange the pieces and make an equilateral triangle.

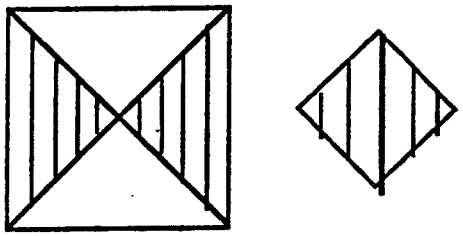
d) What did you notice as you tried to figure out the solutions? Are these three problems related in any way?

North York Mathematics Olympics

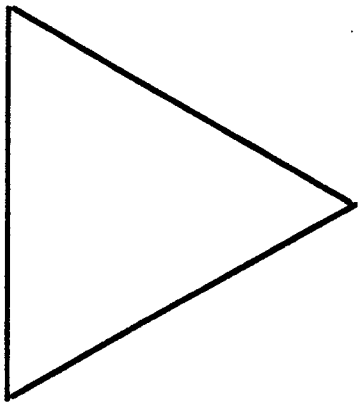
Task 5:

You have three tasks. The first is easier than the other two.

a) Cut up a square so that you can rearrange the pieces into two equally sized squares.



b) Cut up an equilateral triangle so that you can rearrange the pieces into two equally sized equilateral triangles.



c) Cut up a square so that you can rearrange the pieces and make an equilateral triangle.

d) What did you notice as you tried to figure out the solutions? Are these three problems related in any way?

North York Mathematics Olympics

Task 6:

What are the last 2 digits of 7^{999}?

Explain how you arrived at your solution.

Task 7:

Express the number 90 as the sum of two or more consecutive integers in at least three different ways.

Task 8: Equal Arm Balance Problem

You should have:

- an equal arm balance
- a 10 g mass
- a 20 g mass
- a lump of modelling clay
- paper towels

Preliminary work:

- make sure that the equal arm balance is calibrated correctly

Your task:

Use the balance and the 2 given masses to help you make a lump of modelling clay with a mass of 15 grams.

In each pan of the balance, you are permitted to put modelling clay alone, metal masses alone, or a combination of the two.

When the metal rod of the balance comes to rest on the centre line, the contents of the two pans have the same mass. You can adjust the amount of modelling clay or the number of metal masses you are using to make the pans balance.

Summary:

1. Make a lump of modelling clay with a mass of 15 g.

2. Explain how you made your 15 g lump of modelling clay.

Ontario Mathematics Olympics

North York Board of Education
Selection Challenge

Grade 7

Thursday, April 27, 1995.

Time Limit: **30 minutes**

Instructions to Students:

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- In questions #1 to #4 **circle** the answer you feel is most correct.
- **Full solutions** are required for questions #5 and #6.
  Diagrams may be used.
  If you require more space, use the back of the page (be sure to indicate to the marker that there is more work on the back).
- The full solution questions will be the primary method used to select the twelve finalists. As a result, complete and concise explanations are necessary.
- Be sure to place your name and school on the top of every page.

Your Name: _____
(Please print)

School: _____

ED01-11(Math. Olympics)RM.918

Student's, Name: _____

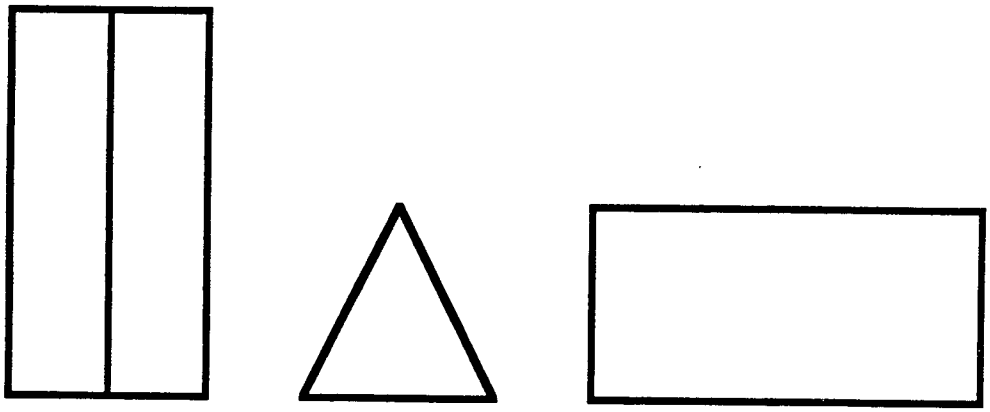
School: _____

Part 1 Multiple Choice

Instructions:

- Read each question carefully.
- Calculations may be done in the space provided or on the paper provided your teacher.
- **Circle** the answer you feel is most correct.

1. The front, top, and side views of a three-dimensional object are given below



Top Front Side

What type of object could be represented by these views?

A) tetrahedron

B) triangular pyramid

C) triangular prism

D) trapezoid

E) hexahedron

Student's Name: _____

School: _____

2. A record album that sells for $11.00 at the regular price is on sale for $8.80. - percentage discount off the regular price is:

A) 80% B) 25% C) 22% D) 20% E) 15%

3. At a certain instant it is 7 o'clock. What time is it 11 999 999 994 hours later?

A) 1 o'clock B) 3 o'clock C) 5 o'clock

D) 7 o'clock E) 9 o'clock

4. If you wrote all the whole numbers from 1 through 100, how many times woulc write the digit 5?

A) 10 B) 11 C) 19 D) 20 E) 30

Student's Name: _____

School: _____

Part 2 Full Solutions

Instructions:

- Read each question carefully.
- Calculations must be done in the space provided. Use the back of the pa you require more room.
- Complete and concise explanations are necessary. We are interested in reasoning that you used to arrive at your answer.

5. A goat is tied by a 6 metre rope to the outside corner of a rectangular shed measuring 4 metres by 5 metres in a grassy field. What is the area of grass the goat can graze? Full solution required.

Student's Name: _____

School: _____

6. One day Alana met Kim on the street.
"Hi, Kim!"
"Hi, Alana! How's your family?"
"Fine," replied Alana.
"Tell me," asked Kim, "how old are your three children?"
"Well!" said Alana, with a grin. "The product of their ages is 36 and the sum the same as the number of that house across the street."
Kim noted the house number and then went home. The next day Kim calle Alana and complained that she wasn't given enough information.
Alana said, "My eldest child is a girl."
Kim immediately gave the correct ages. What are the ages of Alana's chil

Full solution required.

MATHEMATICS OLYMPICS

Team Activities

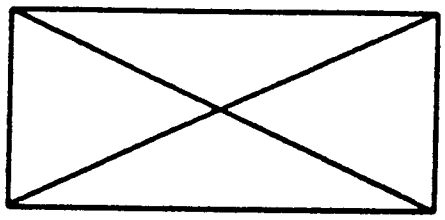
April 20, 1995

CAMBRIAN COLLEGE

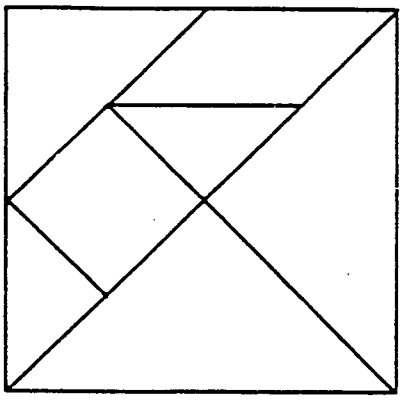
1. What is the positive integer N for which

$$22^2 \times 55^2 = 10^2 \times N^2?$$

2. The diagonals of the rectangle below intersect 8 cm farther from the shorter side than they do from the longer side. If the perimeter of the rectangle is 88 cm, what is its area?

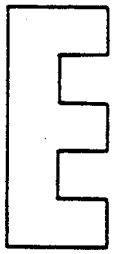


3. A tangram begins as a large square like this



Cut it into 7 pieces. Each piece is called a tan.
Any shape made up of all 7 pieces is called a tangram.

Use all 7 pieces to form this letter.



(Tape your pieces to the answer sheet.)

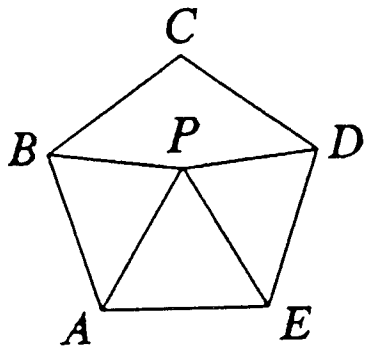
4. Misters Blue, White, and Gray have shirts and ties that are blue, white, and gray. No man's clothing is the same color as his name. If Mr. Blue's tie is the same color as Mr. Gray's shirt, what is the color of Mr. White's shirt? (Hint: A chart may help.)

5. Pay Attention!

What is the next letter?

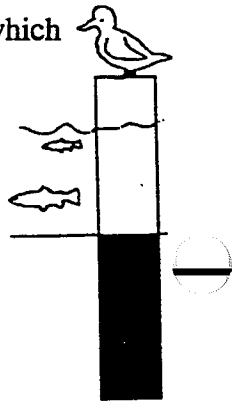
W, I, T, N, _____

6. In the diagram given below, ABCDE is a regular pentagon, and triangle APE is equilateral. What is the measure of obtuse angle BPD?



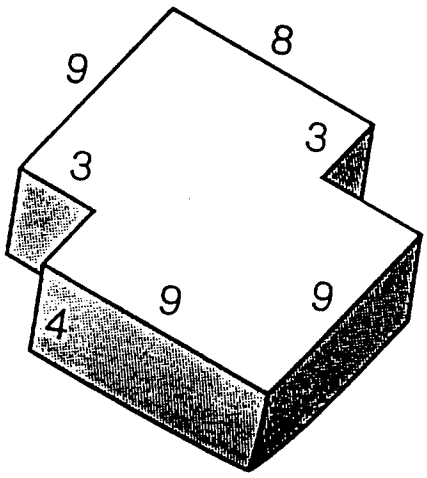
7. How many of the first 500 positive integers are divisible by 2, 3, 5, and 7?

8. One-half of a post stands in the mud, one third is in the water, and the remainder which is 6 dm is above the water. What is the whole length of the post in decimetres?



9. How many different secret code words can be made using three stars and two dashes in each word?

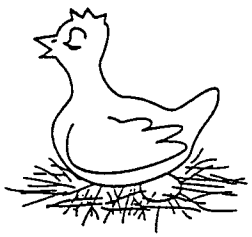
10. Find the volume of this figure. All angles that appear to be right angles are right angles.



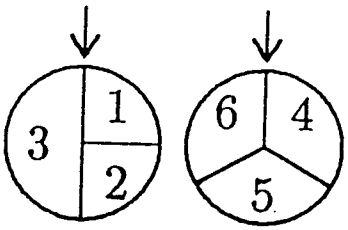
11. Two math-explorers John and Mary are captured by a fearsome Sphinx who holds two checkered squares: one is 8 x 8 and the other is 6 x 6. She says, "Cut them both into two pieces and out of the four resulting sections form a 10 x 10 square. If you can, I will release you."
How can they escape from this deadly trap?

(Tape your 10 x 10 square to the answer sheet.)

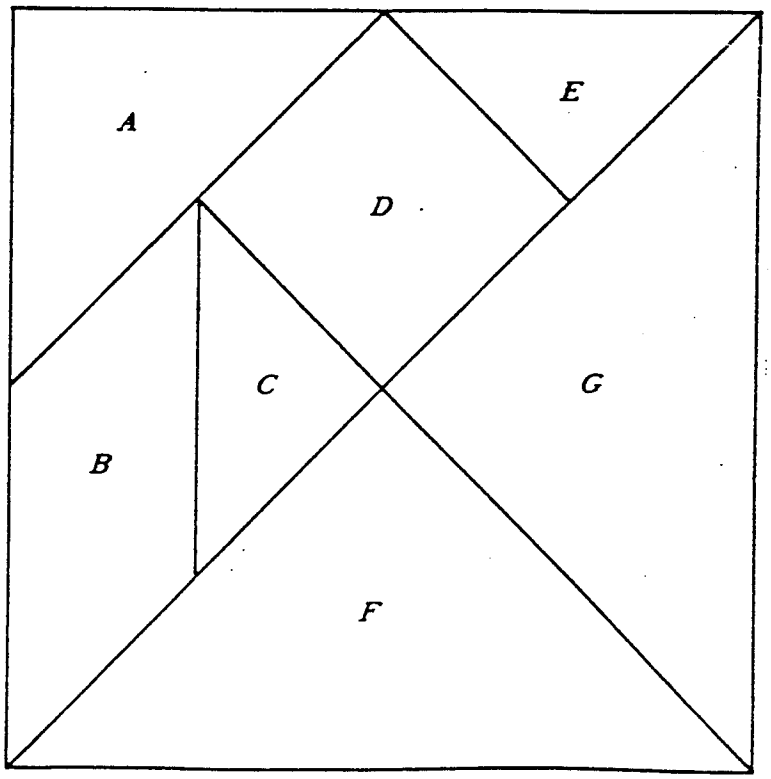
12. If a hen and a half lay an egg and a half in a day and a half, how many hens are needed to lay a dozen eggs in one day?



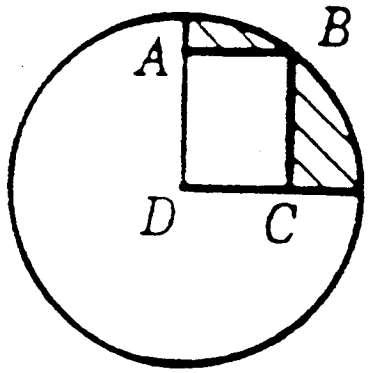
13. The two wheels shown below are spun and the two resulting numbers are added. What is the probability that the sum of the two numbers is even?



14. A large 10 x 10 square is made up of several tangram pieces. What percent of the whole area is tangram C?



15. ABCD is a rectangle, D is the center of the circle, and B is on the circle. If AD = 8 and CD = 6, what is the area of the shaded region?



16. If you walk from one vertex of a square, x, to a diagonally opposite vertex, y, about what percent less distance is that to walk than along the sides to go from x to y?

17. Village A has a population of 1600, which increases by 120 per year; village B has a population of 4200 which decreases by 80 per year. What will be the combined population of the two villages when they have the same number of people in each?

18. You have six matchsticks of equal size. From them, you have to form four triangles of the same size, with a matchstick length as the length of each side. How?

(Draw your answer on the answer sheet.)

19. Find three consecutive numbers whose sum is 375.

20. John is twice as old as Mary. In five years the sum of their ages will be thirty-four. Find their present age.

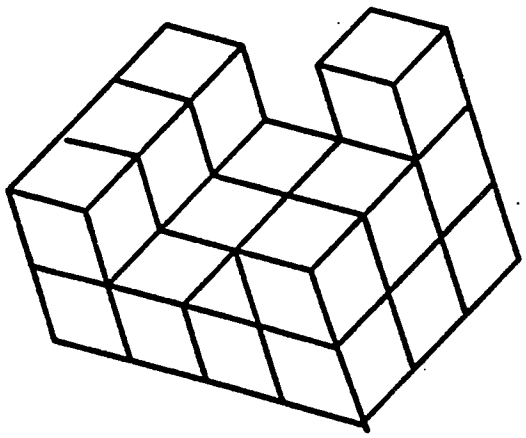
21. Two cars left Sudbury at the same time, one travelling east and the other west. Their average speeds differ by 5 km/h. After 2 hours they are 210 km apart. Find the speed of each car.

22. Let W, X, Y and Z be four different digits selected from the following set.

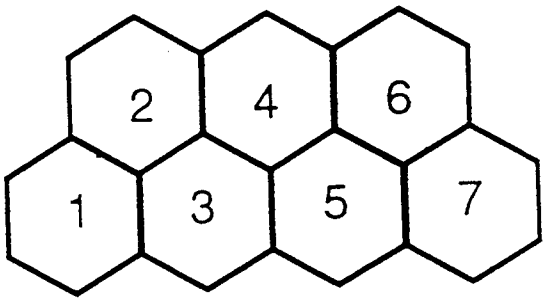
{1, 2, 3, 4, 5, 6, 7, 8, 9}

If the sum $\frac{W}{X} + \frac{Y}{Z}$ is to be as small as possible, then to what must $\frac{W}{X} + \frac{Y}{Z}$ equal?

23. Find the surface area of the following shape. (You may find it helpful to build it with cube-a-links.)



24. How many routes from 1 to 7 can you find if you always move to an adjacent cell and always to the right.



25.

Examine carefully the sequence above. What symbol comes next? (Draw the symbol on your answer sheet.)

26. A grandfather clock takes 30 seconds to strike six. How long does it take to strike twelve?

27. Fifty percent more than what number is 25% less than 60% more than 10?

28. Fill in each square with a different whole number so that the sum of each row, column, and diagonal is 30. Cut out the 4 x 4 square and tape it to the answer sheet.

15			
	10	9	
			11
3			

STUDENT ANSWER BOOKLET

TEAM ACTIVITIES

GROUP NUMBER _____ GROUP SCORE ___ / 30

NAMES: _____ _____
(Print clearly)

_____ _____

_____ _____

_____ _____

1. N equals _____. (1)

2. The area is _____ cm^2. (1)

3. Tape your solution here. (1)

4. Mr. White's shirt is _____. (1)

5. The next letter is _____. (1)

6. The measure of angle BPD is _____. (1)

7. There are _____integers. (1)

8. The post is _____dm long. (1)

9. _____ different code words. (1)

10. The volume is _____ u^3. (1)

11. Tape your 10 x 10 square below. (1)

12. The number of hens needed is _____. (1)

13. The probability is _____. (1)

14. The percent is _____. (1)

15. The area of the shaded region is _____. (1)

16. The percent less distance is _____. (1)

17. The combined population is _____. (1)

18. Draw or explain your answer in the space provided below. (1)

19. The three consecutive integers are:

_____, _____, and _____. (1)

20. Mary is _____. (2)

John is _____.

21. The speed of each car is _____ and _____. (2)

22. $\frac{W}{X} + \frac{Y}{Z}$ must equal _____. (1)

23. The surface area is _____ u^2. (1)

24. There are _____ routes. (1)

25. This symbol comes next _____. (1)

26. It takes _____ seconds to strike twelve. (1)

27. The number is _____. (1)

28. Tape your 4 x 4 square in the space below. (1)

STUDENT ANSWER BOOKLET

TEAM ACTIVITIES

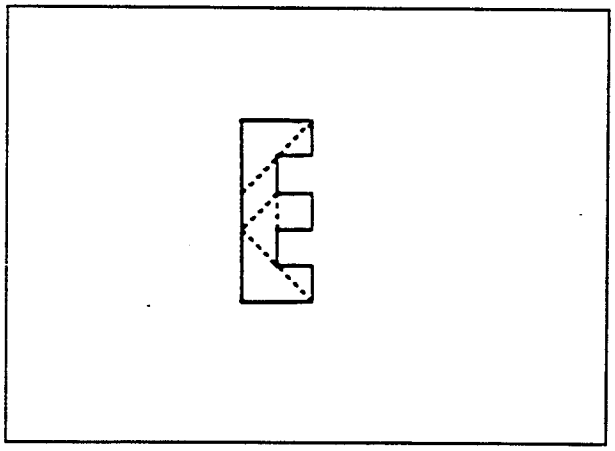
GROUP NUMBER _____ GROUP SCORE ___ / 30

NAMES: _____ _____
(Print clearly)
_____ _____
_____ _____
_____ _____

1. N equals 121. (1)

2. The area is 420 cm^2. (1)

3. Tape your solution here. (1)



4. Mr. White's shirt is blue. (1)

5. The next letter is L. (1)

6. The measure of angle BPD is 168°. (1)

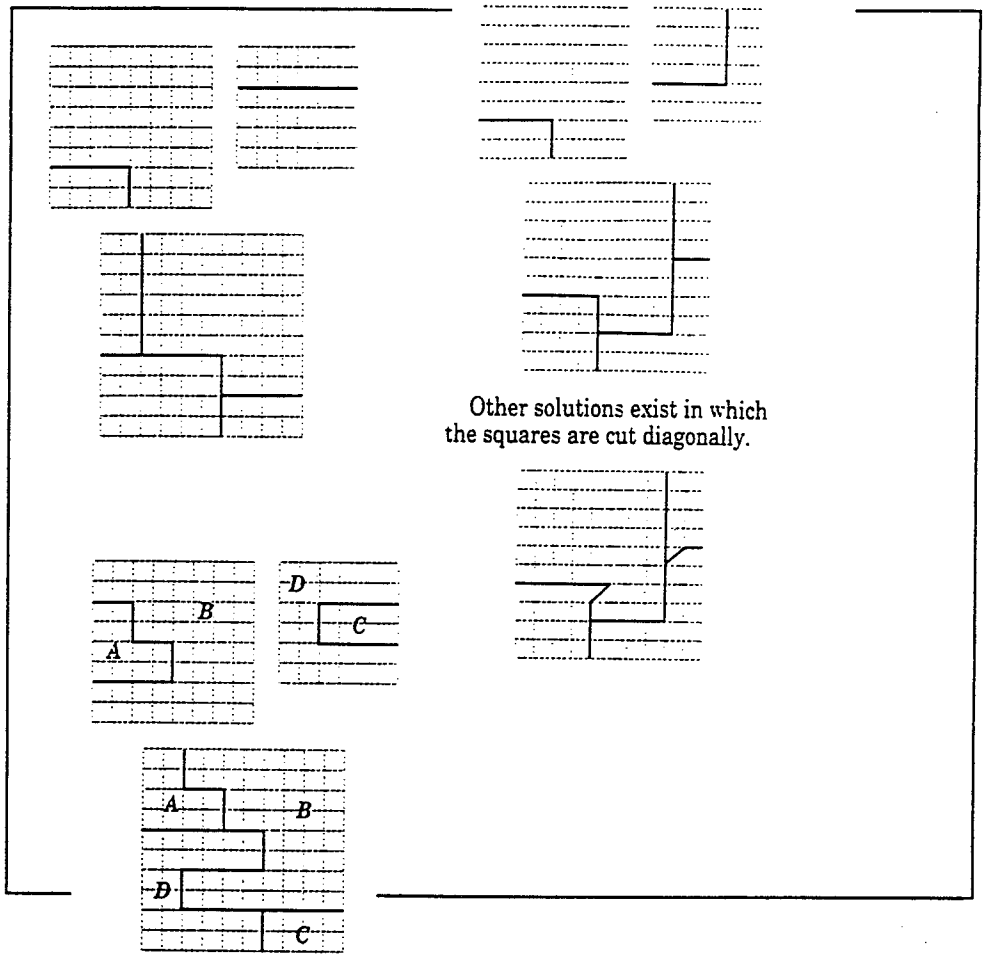
7. There are two integers. (1)

8. The post is 36 dm long. (1)

9. Ten different code words. (1)

10. The volume is 492 u^3. (1)

11. Tape your 10 x 10 square below. (1)



12. The number of hens needed is 18. (1)

13. The probability is 5/12. (1)

14. The percent is 6.25% or 6¼%. (1)

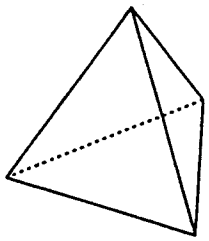
15. The area of the shaded region is 30.5. (1)

16. The percent less distance is 30% and 31% are both acceptable. or anything in between 30% and 31%. (1)

17. The combined population is 6320. (1)

18. Draw or explain your answer in the space provided below. (1)

-tetrahedron
-triangular pyramid



19. The three consecutive integers are:

124, 125, and 126. (1)

20. Mary is 8. (2)

John is 16.

21. The speed of each car is 50 and 55. (2)

22. $\frac{W}{X} + \frac{Y}{Z}$ must equal $25/72$. (1)

23. The surface area is 58 u^2. (1)

24. There are 13 routes. (1)

25. This symbol comes next . (1)

26. It takes 66 seconds to strike twelve. (1)

27. The number is 8. (1)

28. Tape your 4 x 4 square in the space below. (1)

15	1	2	12
4	10	9	7
8	6	5	11
3	13	14	0