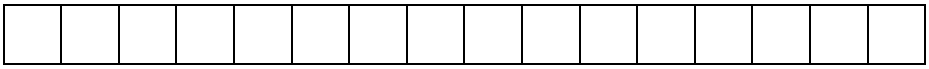
WARM UP #1 - ANSWER

Scarborough Teams Math Olympics 2014

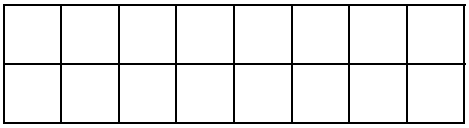
Maria grows several varieties of plants in a rectangular-shaped garden. She uses fencing to divide the garden into 16 squares that are each 1 m by 1 m. She also puts fencing around the perimeter of the garden. What is the smallest amount of fencing that Maria needs?

Solution:
Different rectangular arrangements are possible:

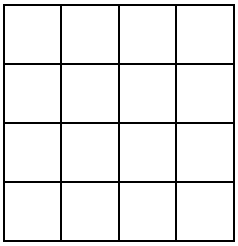
1 x 16



2 x 8



4 x 4



The 4 x 4 would require the least amount of fencing 10 x 4 m = 40 m

WARM UP #2 - ANSWER

Scarborough Teams Math Olympics 2014

Each of the numbers 1,2,3,4,5,6 is painted, one to a face, on the faces of a cube. The cube is placed on a table so that from each of three positions a person can see the top and two other faces. The sums of the numbers showing on the visible faces from the three positions are 9, 14, and 15. What is the number on the bottom face?

Solution

The person whose sum is 15 must see the faces 4, 5 and 6.
The person whose sum is 14 must see the faces 3, 5 and 6

The person whose sum is 9 must share two faces with at least one of the other two people. These must be 3 and 5 so that the third face can be 1.

The number on the bottom must be 2.

COMPETITION ANSWER SHEET

Scarborough Individual Math Olympics 2014

First Name:		
Last Name:		
School:		
Circle:	**Grade: 7 8**	**Gender: F M**

Circle your choice for each question:

1. A B C (D) E	**6.** A (B) C D E	**11.** A (B) C D E
2. A (B) C D E	**7.** (A) B C D E	**12.** (A) B C D E
3. A (B) C D E	**8.** A B C (D) E	**13.** A (B) C D E
4. (A) B C D E	**9.** A B (C) D E	**14.** A B (C) D E
5. A B (C) D E	**10.** A B (C) D E	**15.** A (B) C D E
x 3 =	**x 4 =**	**x 4 =**

Write your answer for each question:

16. 2 cm³	
17. 62	
18. 13	
19. 25	
20. 21	
x 6 =	**Total = / 85 points**

PAIRS EVENT #1 – COUNTING

Scarborough Teams Math Olympics 2014

Team:		
Team Members' Names:	**1.**	**ID#**
	2.	**ID#**
Score:	**DJ Songs**	**/6**
	Clock Hands	**/4**
	Train Passengers	**/8**
	Magic Triangles	**/9**
	Total	**/27**

Instructions

- **Make sure that you have entered your team name and your names in the box provided above.**
- **You have a maximum of 30 minutes to complete this event. Please wait for the Olympic Official's instruction to begin.**
- **Calculators, rulers and graph paper are allowed.**
- **Be sure to hand in all sheets.**

PAIRS EVENT #1 – COUNTING

Scarborough Teams Math Olympics 2014

Part A – DJ Song Sets (6 points)

Your mobile DJ business has 6 Rap songs, 10 Rock songs, 6 Alternative songs, 8 "Oldies" songs and 5 Country songs.

How many different 10-song sets can the DJ play at a party if she plays exactly 3 Rap songs and exactly 4 Rock songs in each set?
Briefly explain your thinking.

Answer:	**4 069 800 sets**

There are 20 ways to select 3 Rap songs from the 6 available,
6 x 5 x 4 ÷ 6 orders

There are 210 way to select 4 Rock songs from the 10 available,
10 x 9 x 8 ÷ 24 orders

There are 969 ways to select the remain 3 songs from the 13 "Oldies" and Country songs available, 13 x 12 x 11 ÷ 6 orders

In all, there are 20 x 210 x 969 = 4 069 800 possible 10-song sets.

Scoring:

0 points	**No attempt**
1-4 points	**Explanation of each type of song but thinks order matters (120, 720,1716)**
5 points	**Considers product of subsets**
6 points	**Correct answer**

Part B – Clock Hands (4 points)

A day has 24 hours from 12:00 Midnight to 12:00 Midnight. How many times a 24-hr day would the minute and hour hands of a 12-hour clock form a right angle?

Briefly explain your thinking.

Answer:	**44 times**

During most hours, the hour hand and the minute hand form a right angle twice. The exceptions are between 2:00 and 2:59 & between 8:00 and 8:59, where the hands form a right angle only once.

In a 24-hour day, the hour hand and the minute hand would form a right angle
20 x 2 + 4 x 1 = 44 times.

Scoring:

0 points	**No attempt**
1 point	**Some explanation but result not clear**
2 points	**Answer is 48 with no explanation**
3 points	**Clear reasoning with incorrect answer**
4 points	**Clear reasoning with correct answer**

PAIRS EVENT #1 – COUNTING

Scarborough Teams Math Olympics 2014

Part C – Train Passengers (8 points)

A train goes one way to twenty stations and, at each station, picks up a group of passengers, one of which will get off at each of the remaining stations. For example, at station 5, the train picks up a group of passengers. One passenger of that group will get off at station 6, another at station 7, and so on. At station 20, the last passenger of that group gets off.

Briefly explain your thinking.

i) What is the total number of passengers that get on the train?

Answer:	**190 passengers**

At Station 1, 19 passengers get on.
At Station 2, 18 passengers get on.
At Station 3, 17 passengers get on.
…
At Station 19, 1 passenger gets on.

The total number of passengers that get on the train is 19 + 18 + 17 +…+ 2 + 1 = 20 x 9 + 10 = 190

Scoring:

0 points	**No attempt**
1 point	**Incorrect answer**
2 points	**Correct answer**

ii) From which station did the train leave with the most passengers?

Answer:	**Station 10**

At Station 2, 18 passengers get on and 1 passenger gets off.
At Station 3, 17 passengers get on and 2 passengers get off.
At Station 4, 16 passengers get on and 3 passengers get off.
…
At Station 10, 10 passengers get on and 9 passengers get off.
The train leaves Station 10 with the most passengers. After Station 10, more passengers are getting off the train than getting on.

Scoring;

0 points	**No attempt**
1 point	**Incorrect answer with no explanation**
2 points	**Incorrect answer with some explanation**
3 points	**Correct answer with reasoning**

iii) How many passengers were on that train when it left the station in (ii)?

When the train leaves Station 10,
a total of 19 + 18 + 17 +…+ 11 + 10 = 29 x 5 = 145 passengers got on the train and
a total of 1 + 2 + 3 +…+ 8 + 9 = 45 passengers got off the train.

The train left Station 10 with 145 – 45 = 100 passengers.

Answer:	**100 passengers**

Scoring:

0 points	**No attempt**
1 point	**Incorrect answer with no explanation**
2 points	**Incorrect answer with some explanation**
3 points	**Correct answer with reasoning**

PAIRS EVENT #1 – COUNTING

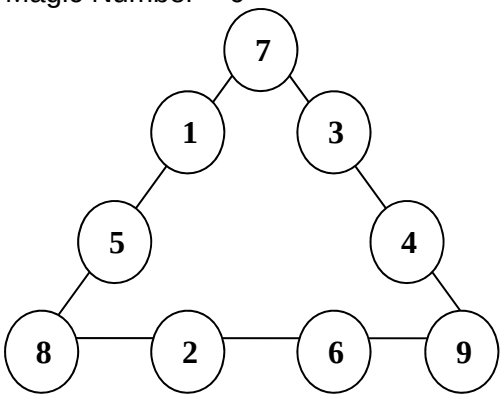
Scarborough Teams Math Olympics 2014

Part D – Magic Triangles (9 points)

Place the digits 1-9 in the circles on the "Magic Triangle" in the diagram using each digit only once. For each side of the triangle, the sum of the two "inside numbers" subtracted from the sum of the two "end numbers" must be the same "magic number'.

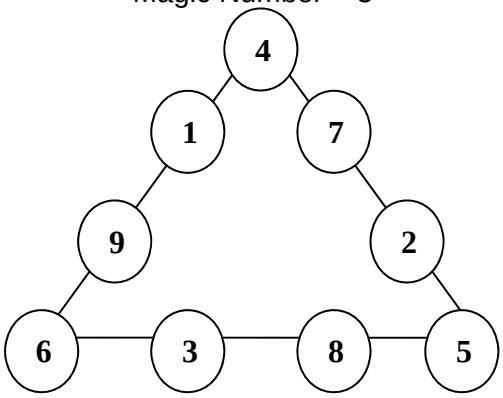
Find an arrangement for each of the Magic Numbers 0, 3, and 9.

Magic Number = 0

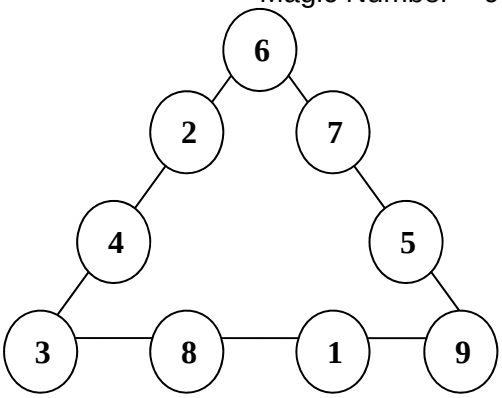


Scoring:	
0 points	No attempt
1 point	One side satisfies criteria
2 points	Two sides satisfy criteria
3 point	All sides satisfy criteria

Magic Number = 3



Magic Number = 9



PAIRS EVENT #2 – CUTTING

Scarborough Teams Math Olympics 2014

Team:		
Team Members' Names:	**1.**	**ID#**
	2.	**ID#**
Score:	**Rectangle**	**/5**
	Square	**/20**
	Total	**/25**

Instructions

- **Make sure that you have entered your team name and your names in the box provided above.**
- **You have a maximum of 30 minutes to complete this event. Please wait for the Olympic Official's instruction to begin.**
- **Calculators, rulers and graph paper are allowed.**
- **Be sure to hand in all sheets.**

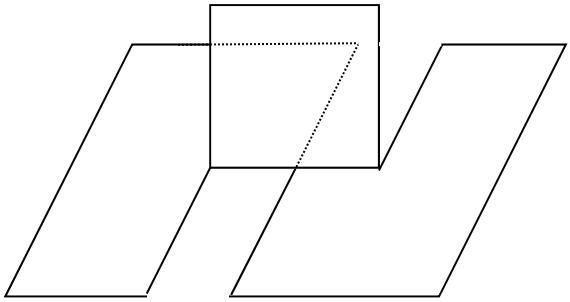
PAIRS EVENT #2 – CUTTING

Scarborough Teams Math Olympics 2014

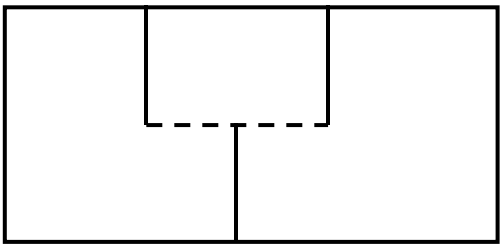
Part A – RECTANGLE (5 points)

Use a rectangular piece of paper provided for this problem.

1. Clearly explain how to cut and fold the piece of paper to form the 3-D shape shown in the diagram.
   Tape and glue may NOT be used to hold pieces of paper together.



Solution:
Continuous lines represent cuts.
Dotted lines represent a fold.



Scoring:

0 points	**No attempt**
1 point	**Some explanation but end result is unclear**
2 points	**Got the idea but confusing to follow**
3 points	**Clearly explained process**

2. Execute your plan and glue the paper in the space below.

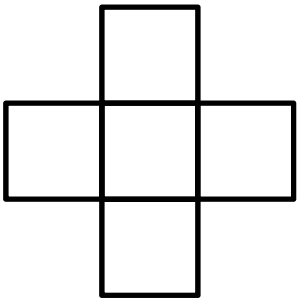
Scoring:

0 points	**No attempt**
1 point	**Some attempt but not correct result**
2 points	**Result resemble diagram, relative size does not matter**

PAIRS EVENT #2 – CUTTING

Scarborough Teams Math Olympics 2014

Part B – SQUARE (4 x 5 points)

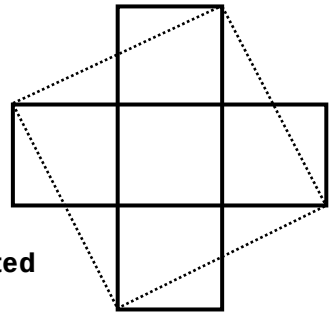


A piece of paper is the size of 5 congruent squares arranged as shown.
Use the pieces of paper provided for this problem.

Task:
Cut the paper so that resulting pieces can be rearranged and glued to form the one large rectangle.

- There cannot be any parts of the original paper that are leftover or unused in the square.
- Folding is allowed.

1. Can this task be done using **exactly 4 cuts**?
   Clearly explain how to do it and glue your results to this page
   OR explain why it cannot be done.

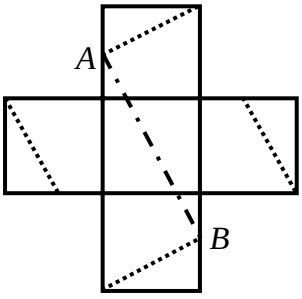


<u>4-cut solution:</u>
Cut along the dotted lines.
Paste resulting triangles into missing parts of the square.

Scoring:

0 points	**No attempt**
1 point	**Square created with no explanation**
2 points	**Some explanation but end result is unclear, no square created**
3 points	**Got the idea but confusing to follow, no square created**
4 points	**Square created, explanation somewhat clear**
5 points	**Clearly explained process with resulting square**

2. Can this task be done using **exactly 3 cuts**?
   Clearly explain how to do it and glue your results to this page
   OR explain why it cannot be done.

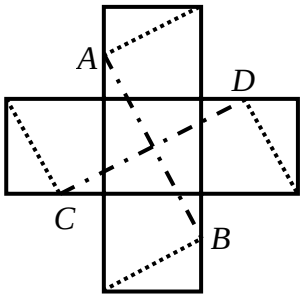


<u>3 cut solution</u>: Fold along one of the lines AB.
Now, with a single cut, you can cut two triangles.
Cut the two remaining triangles.

PAIRS EVENT #2 – CUTTING

Scarborough Teams Math Olympics 2014

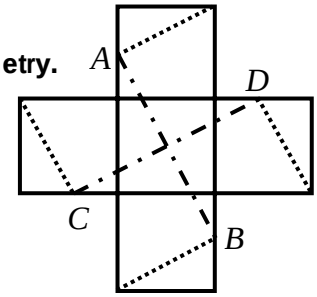
3. Can this task be done using **exactly 2 cuts**?
   Clearly explain how to do it and glue your results to this page
   OR explain why it cannot be done.



<u>2 cut solution</u>: Fold along one of the lines AB or CD.
Now, with a single cut, you can cut two triangles.
Repeat by folding first along the other line.

4. Can this task be done using **exactly 1 cut**?
   Clearly explain how to do it and glue your results to this page
   OR explain why it cannot be done.

<u>1 cut solution</u>: Make both folds along the lines AB and CD.
The resulting figure has a line of symmetry. Fold along that line of symmetry.
Now, with a single cut, you can cut off all four triangles.



TEAMS EVENT - PUZZLES

Scarborough Teams Math Olympics 2014

Team:		
Team Members' Names:	**1.**	**ID#**
	2.	**ID#**
Score:	**Dominoes**	**/6**
	Tangrams	**/18**
	Ken Ken	**/14**
	Total	**/38**

Instructions

- **Make sure that you have entered your team name and your names in the box provided above.**
- **You have a maximum of 30 minutes to complete this event. Please wait for the Olympic Official's instruction to begin.**
- **Calculators, rulers and graph paper are allowed.**
- **Be sure to hand in all sheets.**

TEAMS EVENT - PUZZLES

Scarborough Teams Math Olympics 2014

Part A – Dominoes (6 points)

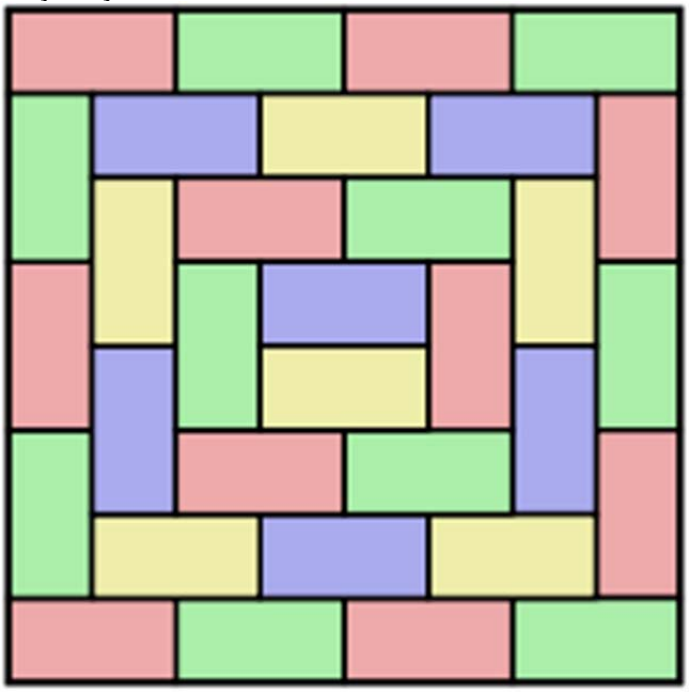
Tile the grid below (using 2 × 1 dominoes) so that no four dominoes touch at a point.
Extra grids provided - Circle your answer.

This shows four dominoes touching at a point.

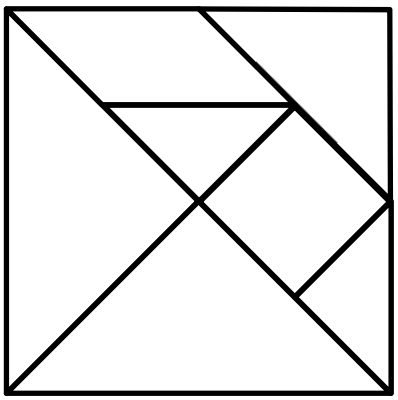
Scoring:

0 points	**No attempt**
1 point	**2 rows almost complete satisfying criteria**
2 points	**4 rows almost complete**
3 points	**5 rows almost complete**
4 points	**6 rows almost complete**
5 points	**7 rows complete**
6 points	**Complete grid satisfies criteria**

Answers may vary.



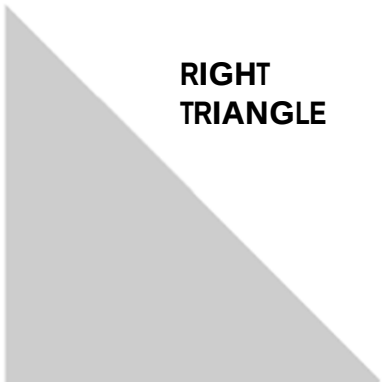
Part B – Tangrams (6 x 3 points)



Use all the Tangram puzzle pieces to form each of the other shapes.
Draw the positions of the Tangram pieces on to each shape below.

HEXAGON

MAN



RIGHT TRIANGLE

BARN

SLEEPWALKER

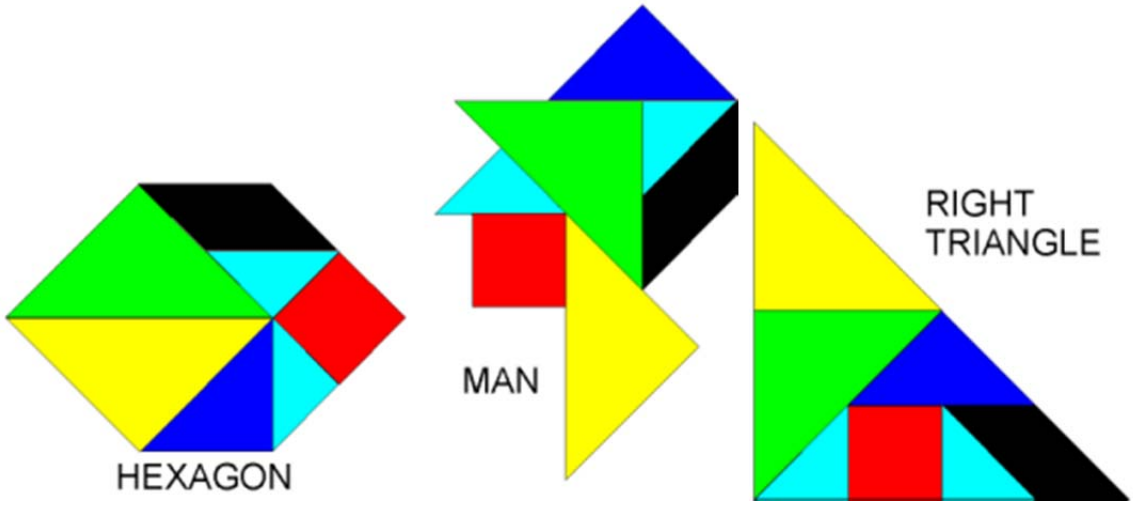
SLEEPWALKER (NO LEGS)

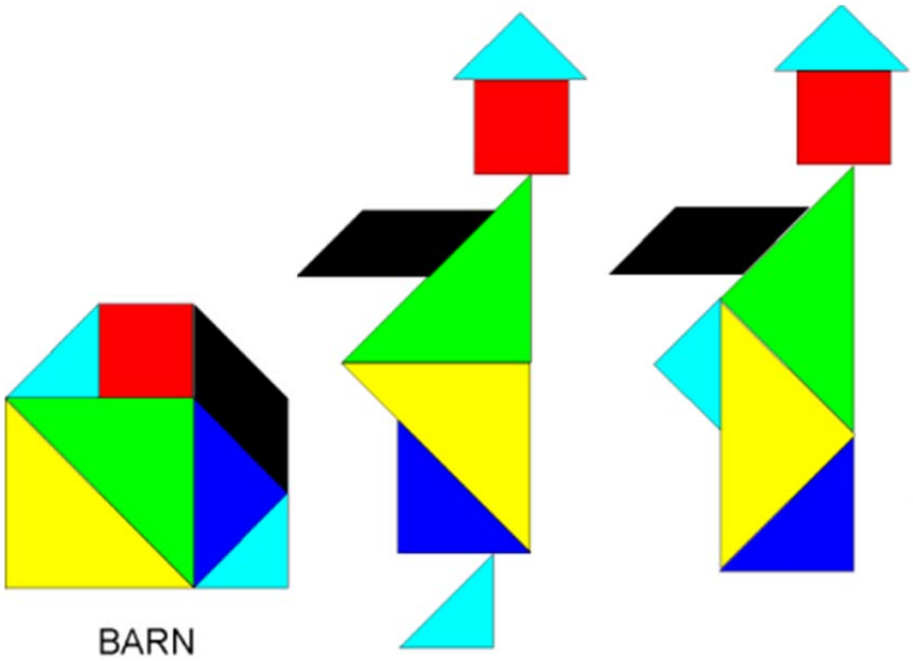
TEAMS EVENT - PUZZLES

Scarborough Teams Math Olympics 2014

Scoring for each figure:

0 points	**No attempt**
1 point	**2 pieces in correct positions**
2 points	**4 pieces in correct positions**
3 points	**All pieces in correct positions**





SLEEPWALKER

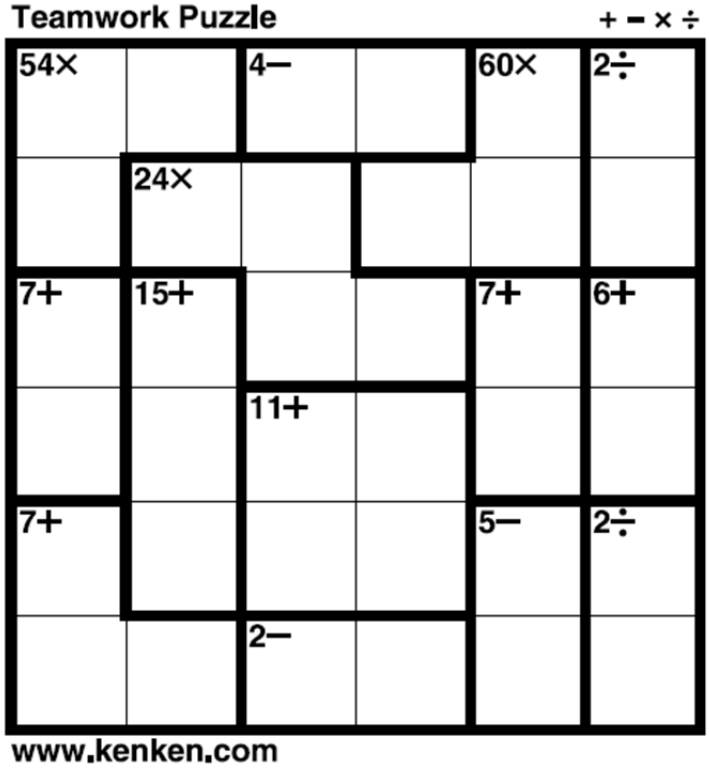
SLEEPWALKER (NO LEGS)

TEAMS EVENT - PUZZLES

Scarborough Teams Math Olympics 2014

Part C – Ken Ken (14 points)

Fill in the numbers 1 through 6 in each row and each column. The value in each block represents the answer when the operation is applied to the numbers in that block.
Extra grid provided - Circle your answer.



Scoring: 2 points for each block that satisfies criteria

54× 6	3	4− 1	5	60× 2	2÷ 4
3	24× 1	4	6	5	2
7+ 2	15+ 4	6	1	7+ 3	6+ 5
5	6	11+ 3	2	4	1
7+ 1	5	2	4	5− 6	2÷ 3
4	2	2− 5	3	1	6