## Global Teacher Empowerment Network GTEN

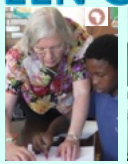
Saturday 11 December 2021

# FIFTEEN GAME COLLECTION

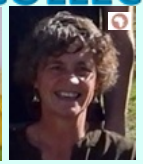
Write down all the winning combinations of 3 numbers that add up to 15

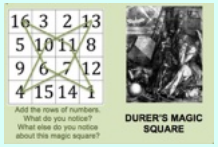
1 + 9 + 5
1 + 8 + 6
2 + 9 + 4
2 + 8 + 5
2 + 7 + 6
3 + 8 + 4
3 + 7 + 5
4 + 6 + 5

Pick numbers in turn. To win get 3 numbers that add up to 15


Toni Beardon


Caroline Ainslie


Elizabeth Turok

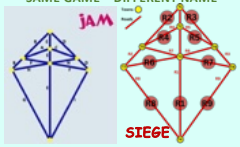



All rows, columns and diagonals must have the same total.

1 2 3 4 5
6 7 8 9

SAME GAME - DIFFERENT WORDS


SAME GAME – DIFFERENT NAME




1

## AIMS African Institute for Mathematical Sciences SCHOOLS ENRICHMENT CENTRE

MATHS TOYS

## Global Teacher Empowerment Network (GTEN)

### PROGRAMME FOR FIFTEEN GAMES COLLECTION WORKSHOP

**Learning Spiral**

IMPROVE SKILLS, KNOWLEDGE AND UNDERSTANDING OF:

- Working Systematically
- Looking for patterns
- Counting all possible outcomes
- Making connections
- Isomorphism
- Simple coding

| | |
|---|---|
| | **10.** Why does play matter? |
| | **9.** Coding for all ages |
| UPPER SECONDARY | **8.** Comparing different games |
| | 7. Jam Game |
| LOWER SECONDARY | 6. An-On-Line Game |
| | 7. Making your own Magic Square |
| | 6. Patterns in Durer's Magic Square |
| UPPER PRIMARY | 5. Fifteen Game |
| | 4. Target 100 Game and Target 1000 Game |
| LOWER PRIMARY | 3. Spin High Spin Low Game |
| EARLY YEARS | 2. 10 reasons for learning through play |
| STARTER ACTIVITY | **1.** Noughts and Crosses Game |

2

## PLAY FOR FUN ** THINK TO WIN ** PLAY AND LEARN

MATHS TOYS

Do the activities.
Questions are in green with this icon.
Please do the activities even if you make guesses.
That way you'll get more benefit
out of the workshop.

3

## STARTER GAME FOR EVERYONE
## TIC TAC TOE OR NOUGHTS AND CROSSES

| | A | B | C |
|---|---|---|---|
| 3 | O | X | X |
| 2 | O | X | O |
| 1 | X | O | O |

Have you played this game before?

Do you know any strategies?

What else do you know about the game?

Game for 2 players - O and X
Take turns to put your O or X in a square
Get 3 in a line to win

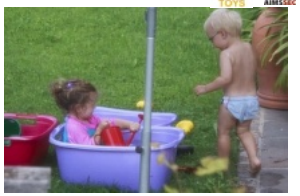
4

## PLAY POWER

Play and group interaction is crucial for developing young people's communication skills.
Here are 10 reasons why it is so important:

1. **Play lays the foundation for literacy and numeracy.** Through play children learn to make and practise new sounds. Play helps with vocabulary development and critical thinking. Children try out new talk on their own or with friends, and exercise their imagination through storytelling.
2. **Play is learning. Play nurtures development and fulfils a baby's inborn need to learn.** Play takes many forms, from shaking a rattle to peek-a-boo to hide-and-seek. Play can be done by a young person alone, with one other young person, in a group or with an adult.
3. **Play encourages adults to communicate with the children in their lives.** Adults support play by giving children opportunities to play, and by knowing when to intervene, and when not to intervene.

National Literacy Trust https://literacytrust.org.uk/



5

## PLAY POWER

**4. Play gives young people the chance to be spontaneous.** You may think your child should be rolling the truck on the ground or doing a calculation in the way you do it, but that doesn't mean that the truck is not equally useful as a stacking toy, or the calculation won't work out in the child's own way.

**5. Play gives children choice and enables them to make decisions for themselves.** Having sufficient access to play outdoors in open spaces and near trees, and having objects to play with, or activities to choose from, will allow children to express themselves.

**6. Play outdoors gives children space.** To practise physical movement and balance and to test their own limits.

**7. Play gives parents and teachers the chance to learn how to play again.** One of the most challenging parts of play is incorporating yourself in it.

6

## PLAY POWER

**8. Play is fun. Play can help young people learn how to be good losers.** Learning to play well, both by themselves and with others, sets children up to be contented and sociable.

For Lower Primary Spin High Spin Low can be played with 2 boxes (just numbers up to 99)
or with 3 boxes
(numbers up to 999).

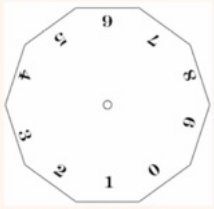
For Upper Primary it can be played with 4 boxes
(numbers up to 9999).

.

PLAY FOR FUN*THINK AND WIN*PLAY TO LEARN
https://aiminghigh.aimssec.ac.za/spin-high-or-low/

Spin 4 times.
Each time write the digit in one of the boxes.
The winner is the player with the highest number.
Vary the game by aiming low.


NUMBER SENSE AND PROBABILITY



MAKE A SPINNER
Cut out the template and mark lines as shown. Open up a paper clip and pin it and the template down on a flat surface so that the paper clip spins easily.

7

## PLAY POWER

**9. Play allows parents and teachers to learn their child's body language.** Knowing when you should incorporate yourself in children's play is key.

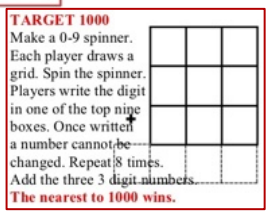
**10. Play teaches parents and teachers emotional intelligence, patience and understanding.** If you do choose to join in children's play make sure that you do not try to take it over and force incorporation of your ultimate learning objectives into their play. Structured adult-led activities have their time and place. But remember to allow time for children to control and decide their own play because they too need to develop emotional intelligence, patience and understanding.

TARGET 100

| H | T | U |
|---|---|---|
| | | |

Spin a 0 to 9 spinner. Each player must write the digit in one of the top 4 squares. Once written the number cannot be changed. Spin 3 more times. The winner is the one whose total is closest to 100.

TARGET 1000
Make a 0-9 spinner. Each player draws a grid. Spin the spinner. Players write the digit in one of the top nine boxes. Once written a number cannot be changed. Repeat 8 times. Add the three 3 digit numbers. **The nearest to 1000 wins.**



8

CARDS FOR FIFTEEN GAME

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |

| | |
|---|---|
| EAT | AN |
| LINE | LAF |
| LOT | FOE |
| IF | IT |
| ON | |

CARDS FOR ANONLINE GAME

9

PLAY FOR FUN *** THINK TO WIN *** PLAY IS LEARNING

## FIFTEEN GAME

Take it in turns to choose one of the numbers 1 to 9.

It is now your number and your opponent cannot choose it.

Each number can be chosen only once.

To win, be the first to pick 3 numbers that add up to 15.


Write down all the winning combinations of 3 numbers that add up to 15

1 + 9 + 5
1 + 8 + 6
2 + 9 + 4
2 + 8 + 5
2 + 7 + 6
3 + 8 + 4
3 + 7 + 5
4 + 6 + 5

10

PLAY POWER

LEARN TO WRITE COMPUTER CODE

You can download free Logo software, either FMS Logo for Microsoft Windows or ACS Logo for Mac OS X

Start our series of challenges not knowing how to write code and learn to draw many different geometrical patterns.


**RIGHT 90** tells you to make a quarter turn clockwise.
**FORWARD 5** tells you to take 5 steps forward
**LEFT 90** tells you to make a quarter turn anticlockwise.

Each square represents one step. Write commands to make your robot go from S to F in exactly 30 steps. Draw his path.

PEANUT BUTTER AND JELLY SANDWICH

The theme is coding.
The challenge is to write instructions for someone who has never done it before to do an ordinary job like making a peanut butter and jelly sandwich.
The instructions will be followed literally.
The result may be far from what was intended.

https://aiminghigh.aimssec.ac.za/command-the-robot-1/
https://aiminghigh.aimssec.ac.za/command-the-robot-2/

11

## ANONLINE GAME

EAT AN LAF IT

LINE IF LOT ON

FOE

Game for 2, take words alternately.
You win if you get all the occurrences of the same letter.

| | |
|---|---|
| EAT | AN |
| LINE | LAF |
| LOT | FOE |
| IF | IT |
| ON | |

CARDS FOR ANONLINE GAME

12

## Melancholia

Engraving 1514
Albrecht Durer
1471 - 1528

Look for the magic square in the picture.

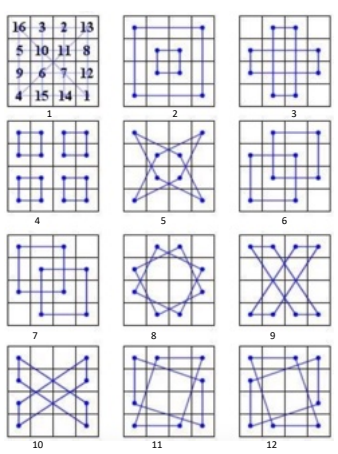
13

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

Add the rows of numbers.
What do you notice?
What else do you notice about this magic square?

**DURER'S MAGIC SQUARE**

14



## DURER'S MAGIC SQUARE

What do you notice about the quadrilaterals in these diagrams?

Add the numbers at the vertices.
Look for symmetries.

Describe the symmetries giving
- mirror lines (axes of symmetry) for reflections
- centres of rotation and orders of rotation for rotations.

15

## 3X3 MAGIC SQUARE

| | | |
|---|---|---|
| | | |
| | | |
| | | |

| | | | | |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | |

Put one number in each cell so that each row, column and diagonal have the same total.

1 + 9 + 5
1 + 8 + 6
2 + 9 + 4
2 + 8 + 5
2 + 7 + 6
3 + 8 + 4
3 + 7 + 5
4 + 6 + 5

1. What is the sum of all the numbers from 1 to 9?
2. What must the total be in each row?
3. How many times do these numbers come up?

Twice: 1, 3, 7, 9 — Midpoints
3 times: 2, 4, 6, 8 — Corners
4 times: 5 — Centre

16

Yellow dots are towns.

Roads are labelled A, B, C, D, E, F, G, H, I

Notice there are 8 towns and 9 roads.

Towns all have 3 roads through them.

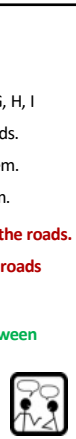
Roads have 2, 3 or 4 towns on them.

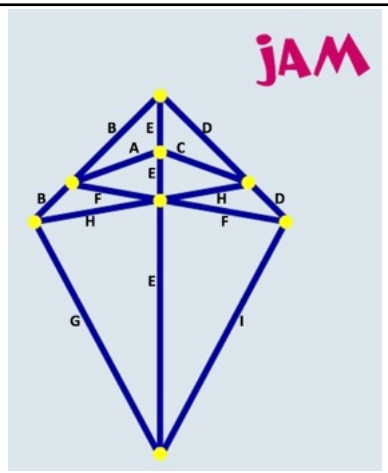
**Players take turns to claim one of the roads.**

**To win a player must capture all 3 roads through one of the towns.**

**What similarities do you notice between**

- **the JAM Game**
- **the Noughts and Crosses Game,**
- **the 15 Game,**
- **the AN-ON-LINE Game and**
- **the 3 by 3 Magic Square?**






17

## MATHEMATICAL DISGUISES

## ISOMORPHISM

### FIVE GAMES BUT ONE

**Fill in the grid to compare the 5 games.**

| GAME CONNECTIONS | FIFTEEN | TIC TAC TOE | MAGIC SQUARE | ANONLINE | JAM |
|---|---|---|---|---|---|
| Collect to win | | | | | |
| Objects | | | | | |
| Number of objects | | | | | |
| Relations between objects | | | | | |
| Number of relations | | | | | |

18

## MATHEMATICAL DISGUISES

## ISOMORPHISM

### FIVE GAMES BUT ONE

**Fill in the grid to compare the 5 games.**

| GAME CONNECTIONS | FIFTEEN | TIC TAC TOE | MAGIC SQUARE | ANONLINE | JAM |
|---|---|---|---|---|---|
| Collect to win | Triples of Numbers | Marks in a row | Triples in lines | Words | Roads |
| Objects | Cards | 0s or Xs | Numbers | Cards | Marks on roads |
| Number of objects | 9 Numbers | 9 Squares | 9 Numbers | 9 Words | 9 Towns |
| Relations between objects | Add up to 15 | 3 0s or 3 Xs | Add up to 15 | Contain Same Letter | Go Through One Town |
| Number of relations | 8 Triples Add up to 15 | 8 Lines Up, Across Diagonal | 8 Lines Up, Across Diagonal | 8 Sets of Words | 8 Towns |

19

## PLAY POWER

In international comparisons of student achievement in mathematics Finland ranks very highly.

Students achieve highly, despite starting school at the relatively late age of 7, despite having shorter school days, despite the fact that teachers and local authorities have far greater autonomy than in many other high-performing countries, and despite the fact that play features powerfully in Finnish education.


**Professor Kristina Kumpulainen, Department of Teacher Education, University of Helsinki**

20

## PLAY POWER

**WHY DOES PLAY MATTER?**

1. Our understanding of learning has changed. **Research shows that there are clear relationships between academic achievement, experiences of play and the development of social self-regulatory skills.**
2. **Play helps people to build the skills needed in life.** It is hard to predict career paths for young people or the social demands that they will face.
   A. They will need to adapt to change, to take new roles, to continue lifelong learning and learn to understand the factual basis and technical processes in new jobs and at also at home.
   B. People will need to engage in creative problem solving and to exercise resilience and flexibility in new conditions.

21

## Global Teacher Empowerment Network (GTEN)

**NEW SKILLS NEW HOPES NEW HORIZONS**
**for teachers and learners worldwide**

**FIFTEEN GAMES COLLECTION AND OTHER GAMES**

FIFTEEN GAMES COLLECTION https://aiminghigh.aimssec.ac.za/fifteen-game-collection/

DURER'S MAGIC SQUARE https://aiminghigh.aimssec.ac.za/durers-magic-square/

PICTURE PUZZLER https://aiminghigh.aimssec.ac.za/picture-puzzler/

SPIN HIGH SPIN LOW https://aiminghigh.aimssec.ac.za/spin-high-or-low/

TARGET 100 and Target 1000 Games https://aiminghigh.aimssec.ac.za/target-100/

CLEAR INSTRUCTIONS FOR MAKING A PEANUT BUTTER AND JELLY SANDWICH https://www.youtube.com/watch?v=Ct-lOOUqmyY

| | | | | |
|---|---|---|---|---|
| 23 | 6 | 19 | 2 | 15 |
| 10 | | 1 | | 22 |
| | 5 | | | 9 |
| 4 | 12 | | 8 | |
| 11 | | 7 | | |

22

## LET'S PLAY MATHEMATICALLY AND LEARN

**Order from AMAZON or TARQUIN** https://www.tarquingroup.com/products/aiming-high-lets-play-mathematically


Play Mathematically

- to develop a love for mathematics
- to unlock knowledge and understanding
- to improve numeracy and visualisation skills
- to practise mathematical procedures
- to motivate concentration and critical thinking
- to boost confidence in mathematical ability.

This **first book** in this AIMING HIGH series provides 36 games that are easy to learn and enjoyable to play for any age. Each comes with reflective questions and materials designed to bring out mathematical thinking and provide a deeper understanding of the topic that underlies the game. Even for the youngest players, this can be transformational.

The **second book** offers suggestions for teachers for using games and puzzles in lessons to teach the regular curriculum with different ideas for different age groups.. It is due to be published in mid 2026.

23

AIMS African Institute for Mathematical Sciences SCHOOLS ENRICHMENT CENTRE

Thanks for coming to this workshop.
Use the AIMSSEC ideas on AIMING HIGH and add comments.
Share what you have learned with other teachers.
Try to help all your learners to have a 'Yes I Can' attitude to mathematics.


24