

Making mathematics fun through creativity and toys

Chris Budd OBE
University of Bath



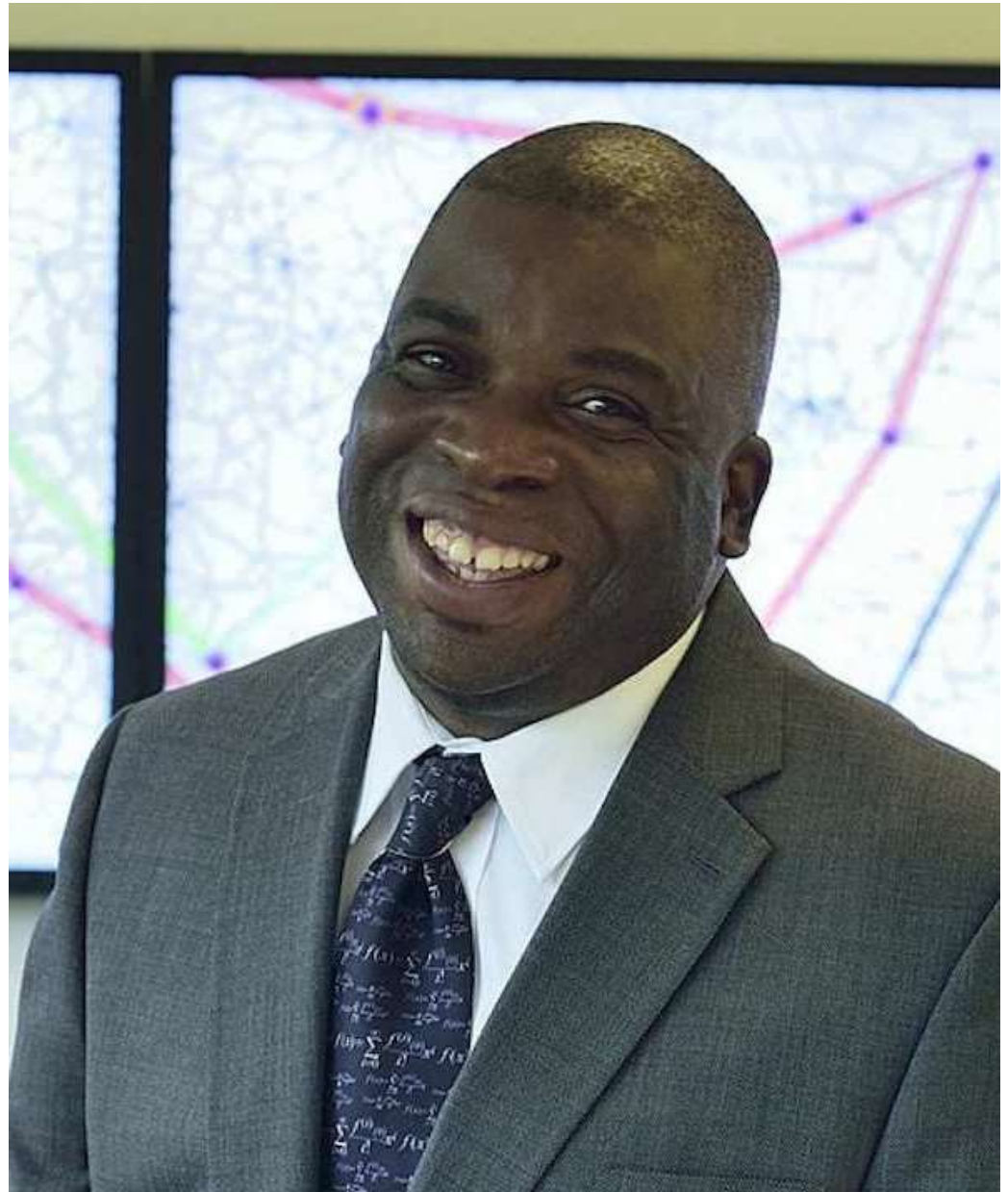
General and Why to do it

Maths is hugely important to our lives and plays a key role in modern technology and in decision making as well as being a great subject in its own right

Everyone can and should be able to access and enjoy mathematics

Nira Chamberlain
OBE, President of
the Institute of
mathematics and its
applications

*You don't need
permission to
be a great
mathematician*



The reward

Mathematical departments in universities produce people who go out into the world and change the world, both in industry and also by crossing into and transforming other disciplines

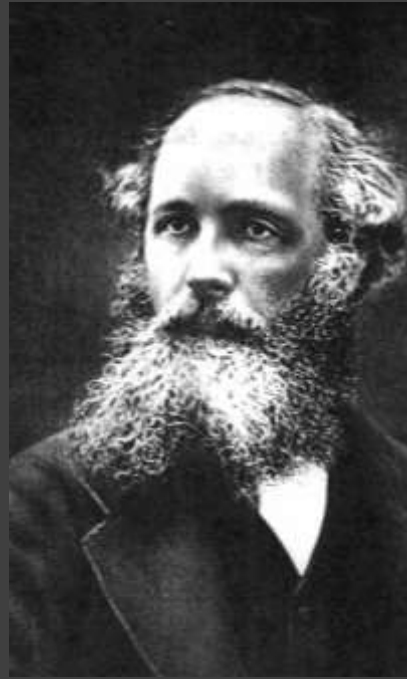
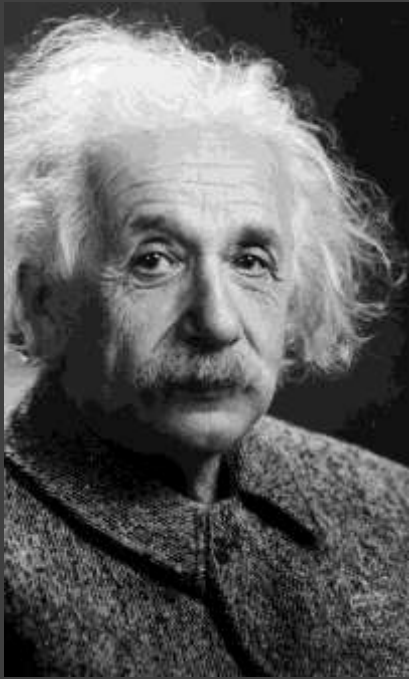
Bond Review



However

- However this role is not well appreciated at all levels of society. Instead the perception is:
- Maths is useless
- Maths is boring
- Maths is uncreative
- Maths is only done by white men
- Maths is impossibly hard





We need to challenge this perception and unlock the potential of all of our students regardless of dyslexia or any other form of diversity

What Help Do Teachers Need ?

 **Top five** things that would **most** help teachers to inspire students with the power of maths 

- 75%** More **positivity** about maths in popular culture
- 55%** Greater **access** to maths industries so pupils, teachers and parents can see real-life maths in action
- 41%** More **diverse role models** in maths
- 38%** Greater **promotion** of the '**STEAM**' movement – i.e including the arts alongside science, technology, engineering and maths
- 34%** Ideas to make maths **more creative** in the classroom

The Pearson Power of Maths survey was carried out on 2,125 primary teachers and secondary maths teachers in October 2020 by polling organisation Teacher Tapp.

If students understand the significance and application of Maths in their lives, they are inspired to study, practice and learn it.

Pupils want to work 'differently', in a problem solving way and with more open questions.

Almost six in 10 (58%) secondary maths teachers believe that negative caricatures or stereotypes around mathematicians are impacting their students' interest in maths and/or maths careers.



We Can Make maths accessible by

1. Emphasising discovery, challenge and creativity
2. Showing its awe and wonder

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \dots$$

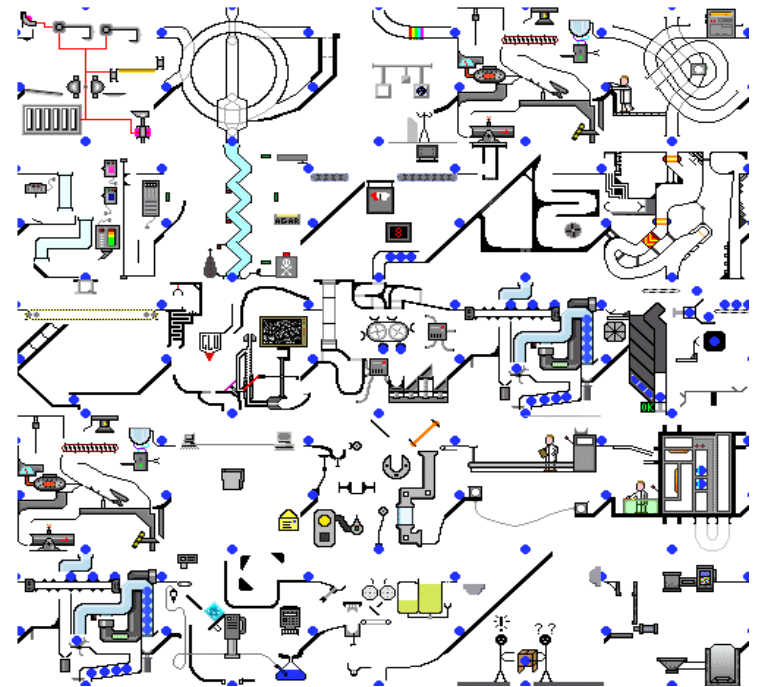
3. Finding links between maths and art/music/real life/people
4. Demonstrating that **MATHS IS FUN AND MATHS IS USEFUL**

Some uses of maths are
Telecommunications,
aerospace, power
generation, iron and steel,
mining, oil, weather
forecasting, security,
finance, medicine



And also

Fighting COVID, Retail,
government, food, zoos, sport,
entertainment, movies, graphic
design, media, forensic service,
hospitals, air-sea-rescue,
education, transport, risk,
health, biomedical,
environmental agencies, art, ...



And you too can be a mathematician ...





- Maths is all about finding and learning about patterns.
- To find the patterns you need to play
- You don't need a laboratory or any one's permission to do great maths

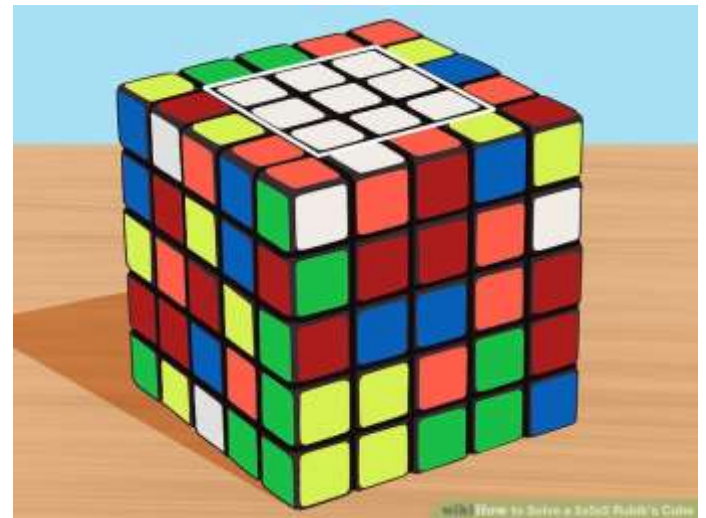
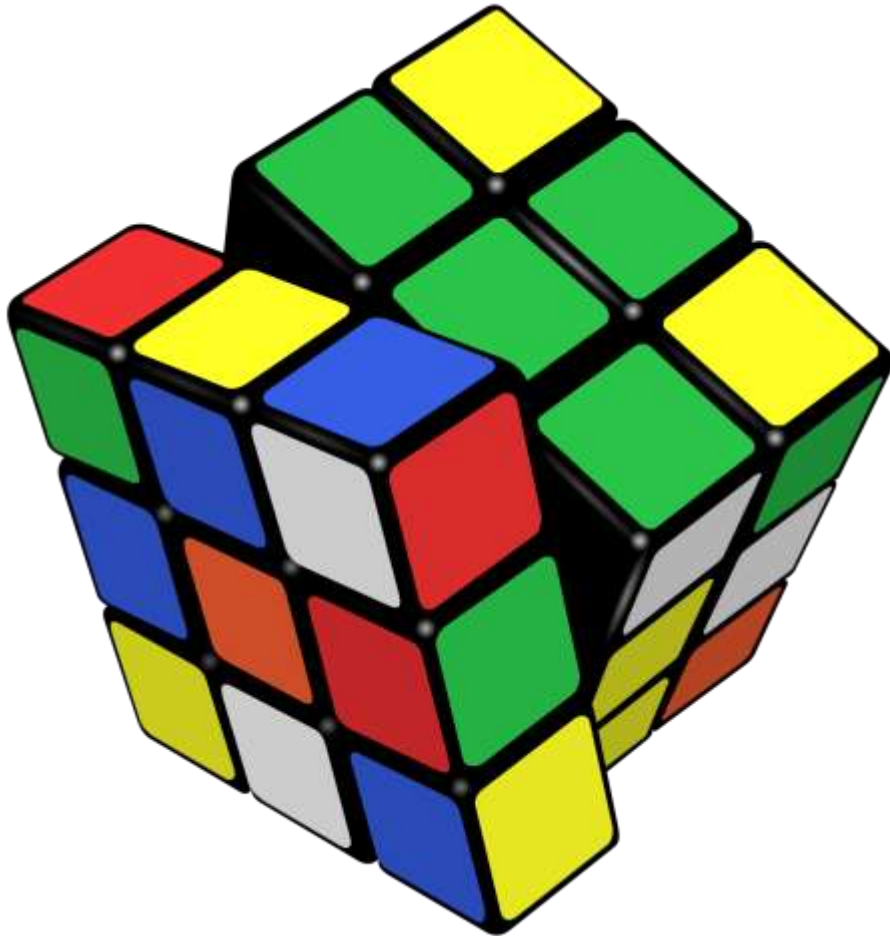
Maths, creativity and puzzles

Maths is **the subject** of puzzles and games

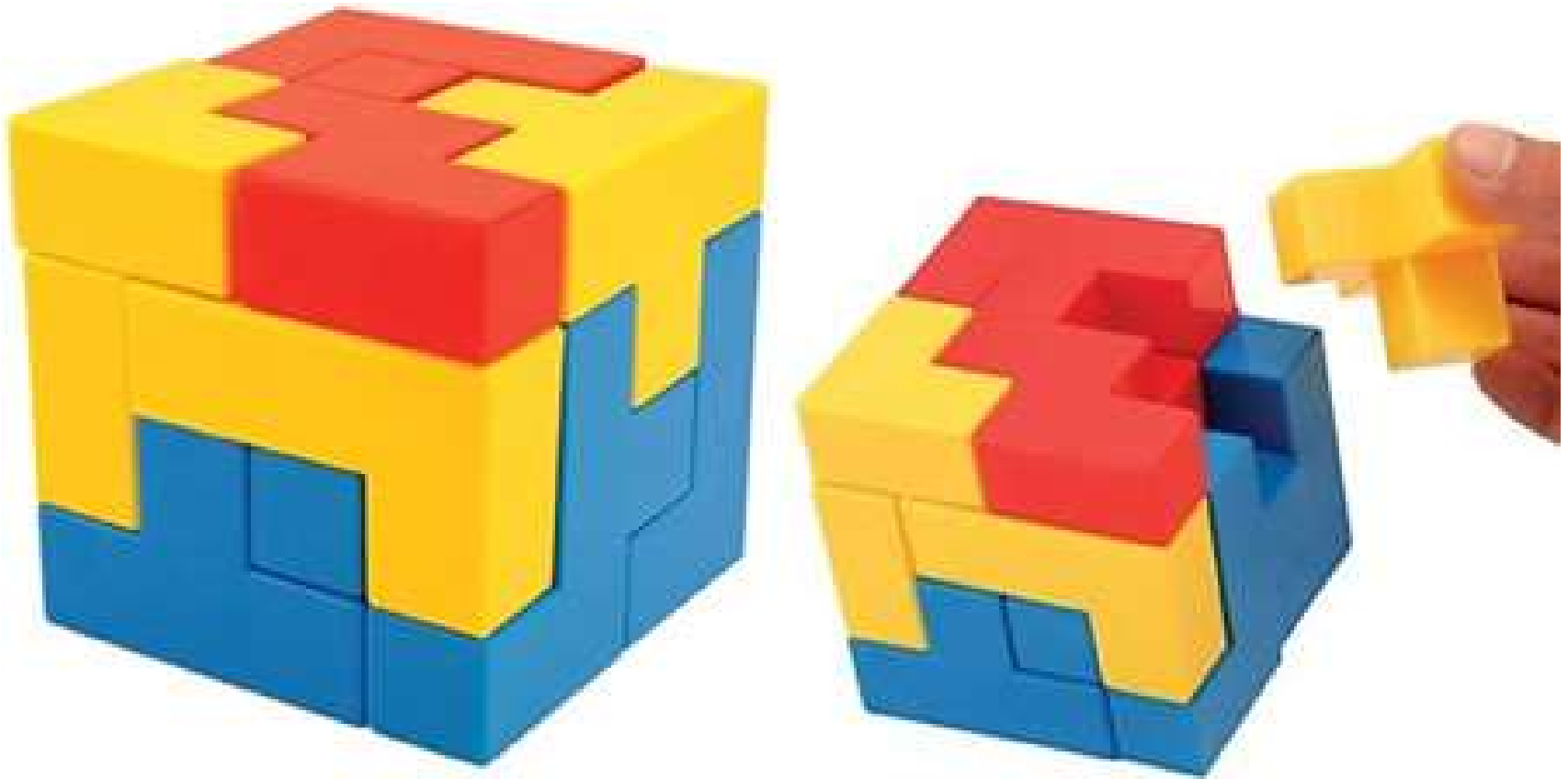
Sudoku, Griddler, number puzzles, topological puzzles, mind reading,

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

Rubik's cube

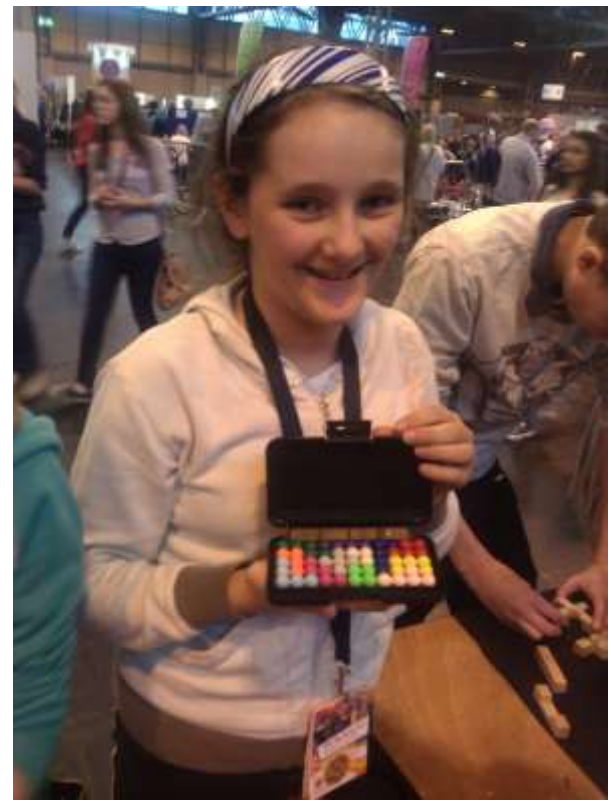


group theory (alternating groups). God's number!



How to solve the 'Bedlam Cube' by Jasmine Age 8

https://www.youtube.com/watch?v=jhVgG_0-In0



Huge sense of
achievement on solving!!

Often spend an hour at
the stall

Future mathematicians?



Mathematical Magic

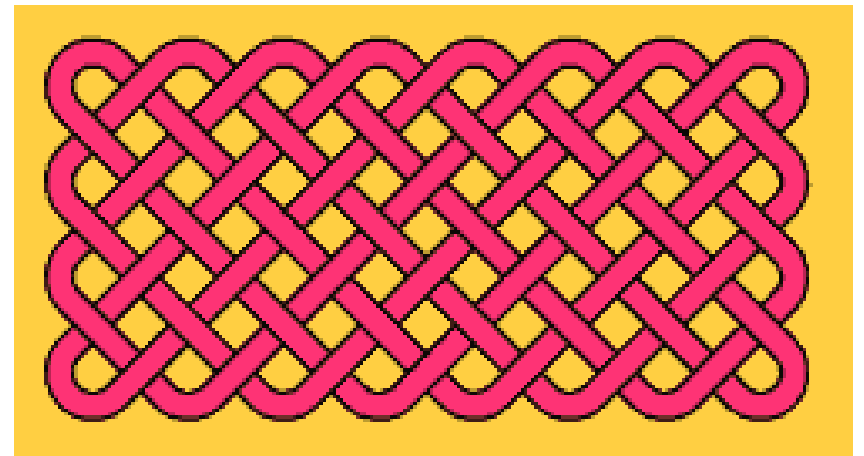
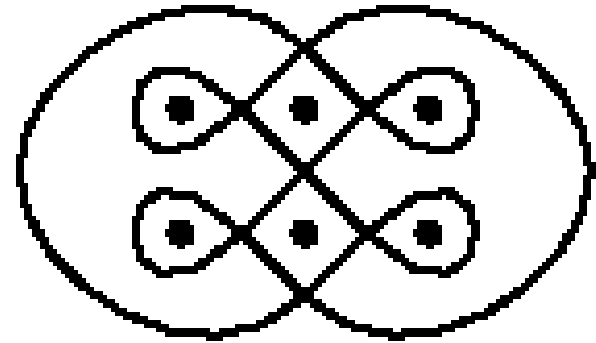


Where's the Joker? (An exercise in algebra)

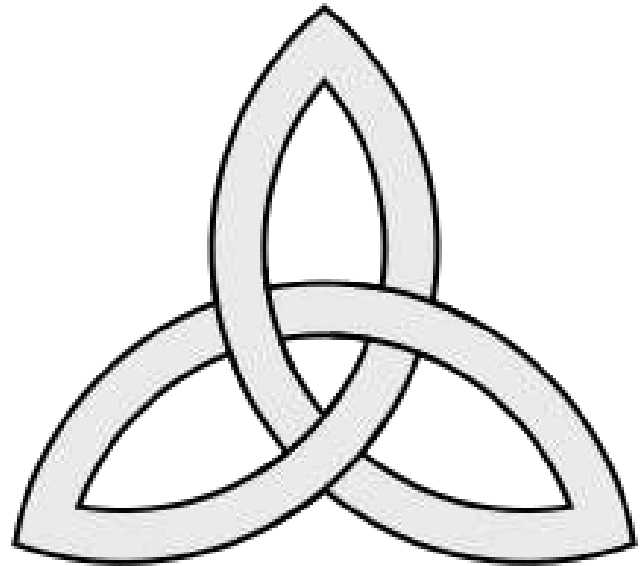
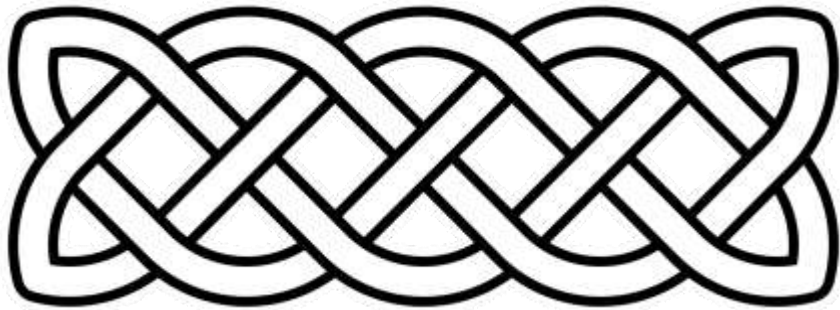
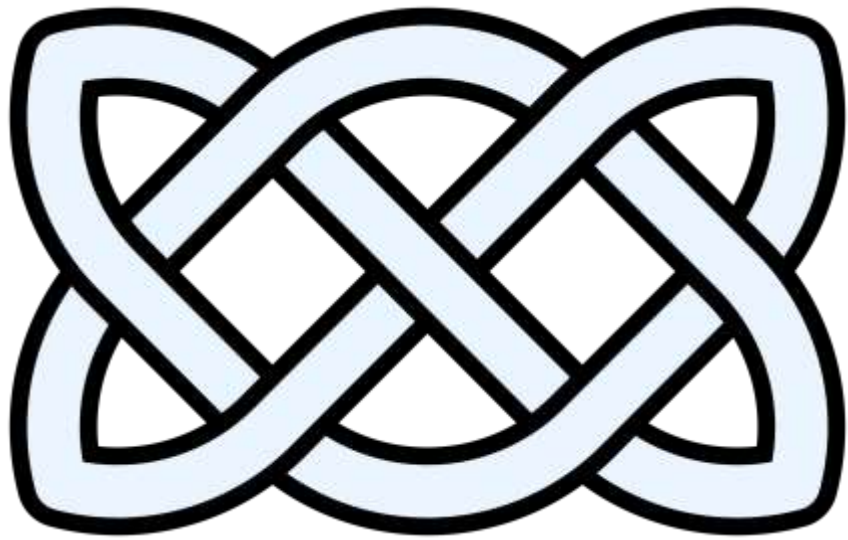
10	1	9
11	2	9
12	3	9
13	4	9
14	5	9
15	6	9
16	7	9
17	8	9
18	9	9
19	10	9

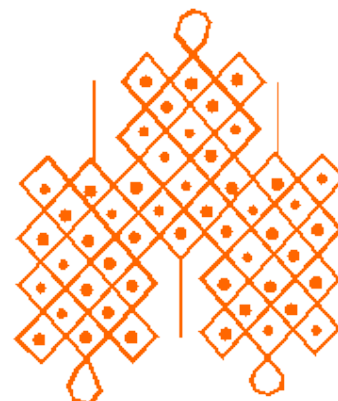
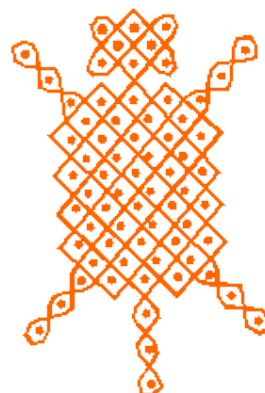
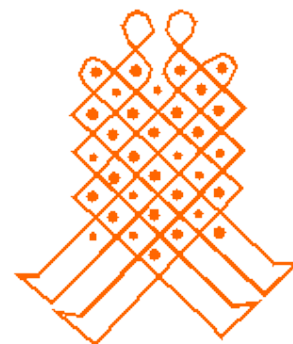
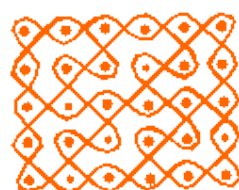
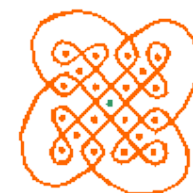
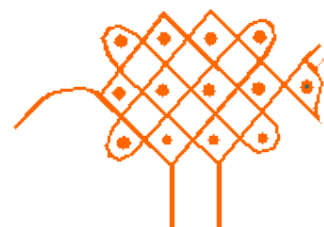
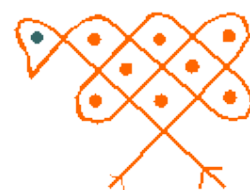
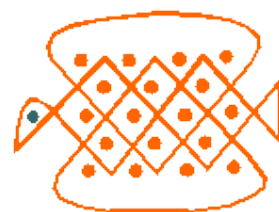


Mathematical Art



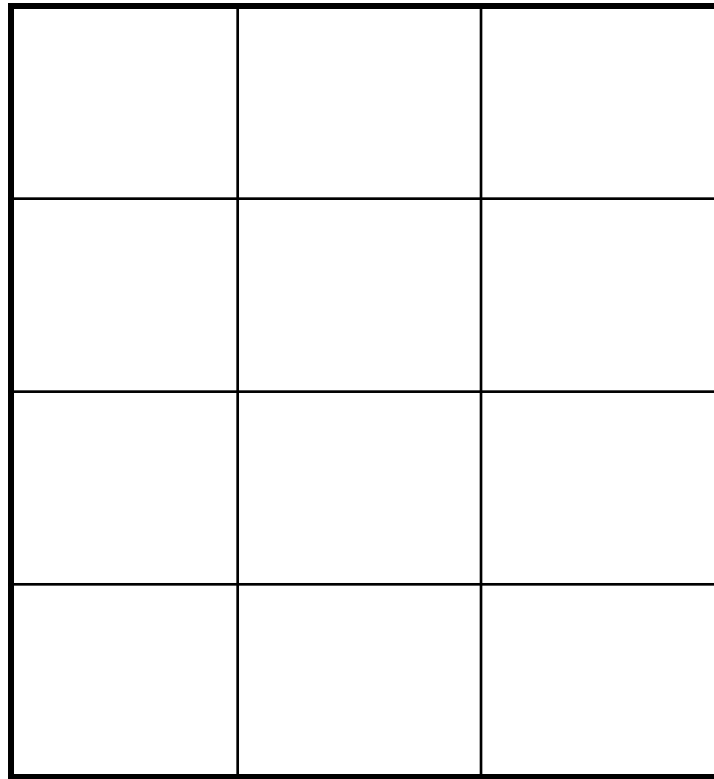
Maths and art are linked through creativity





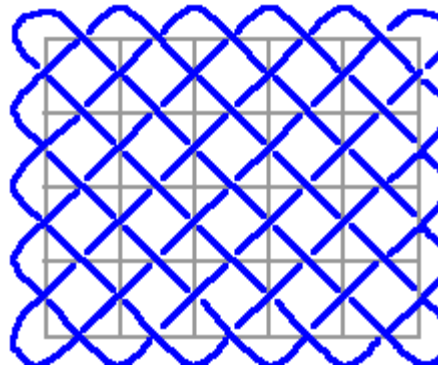
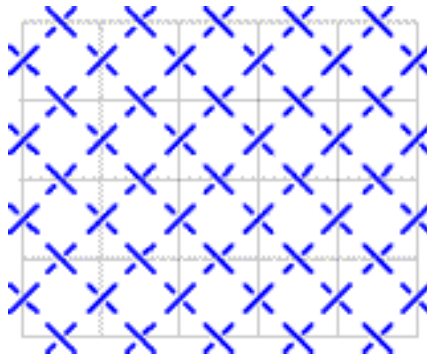
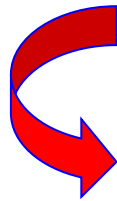
How to draw **simple** Celtic Knots

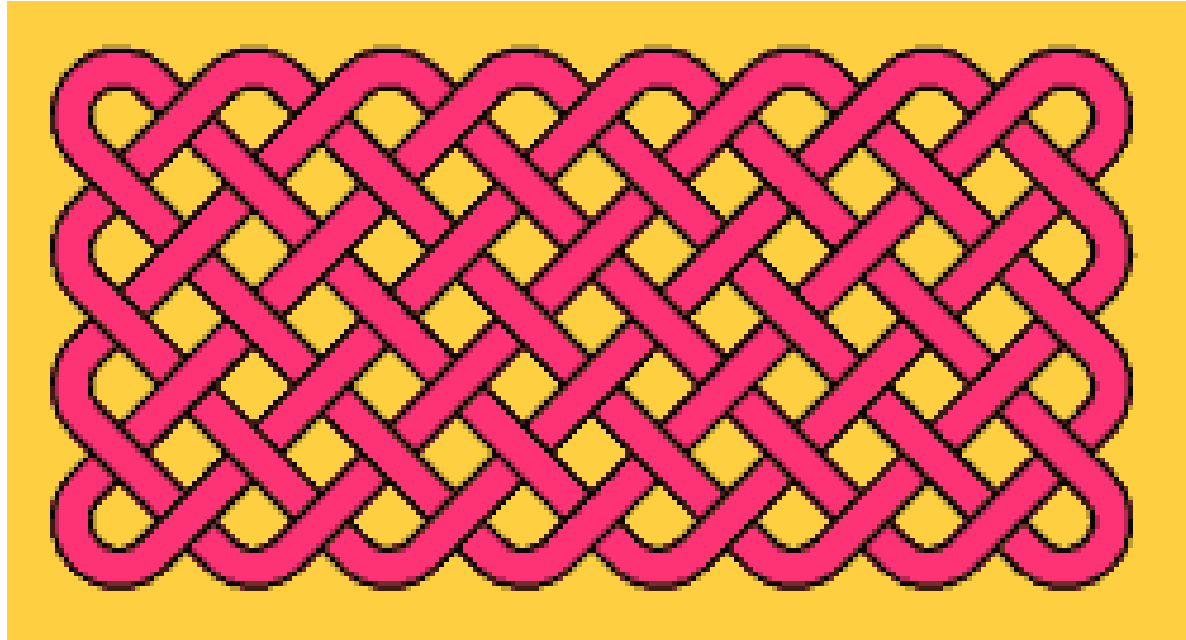
Start with a **grid of 5 horizontal and 4 vertical lines**



(5 , 4) grid

(5,6) Celtic Knot





(4,8) Celtic Knot

How many pieces of string are needed?

How many pieces of string are needed?

(2,2)	?
(5,4)	1
(5,6)	1
(4,4)	4

Highest common factor (m,n)

$$(2,3) =$$

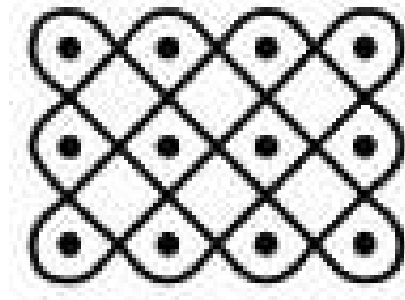
$$(4,7) =$$

$$(4,12) =$$

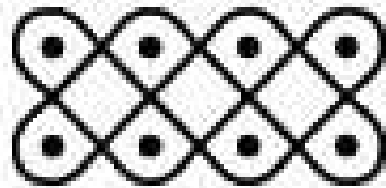
$$(27, 99) =$$

Sona drawings

Sand patterns from Angola and Mozambique

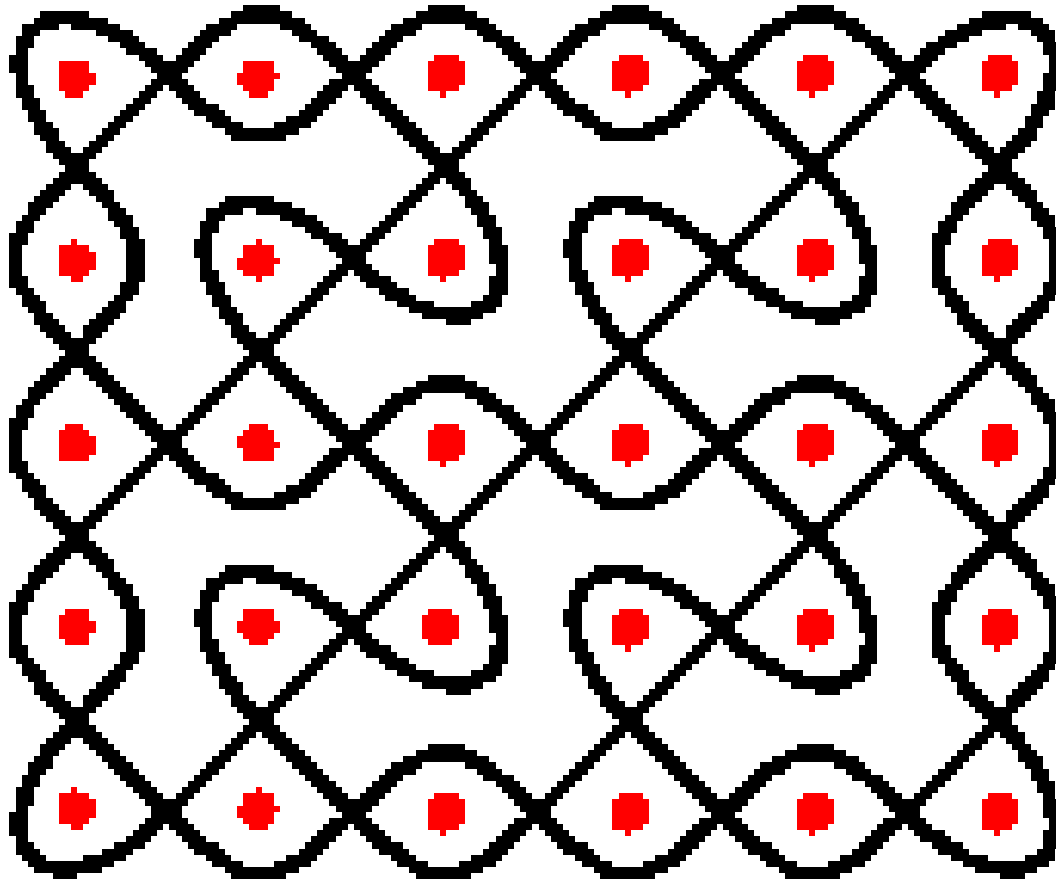


(3,4)

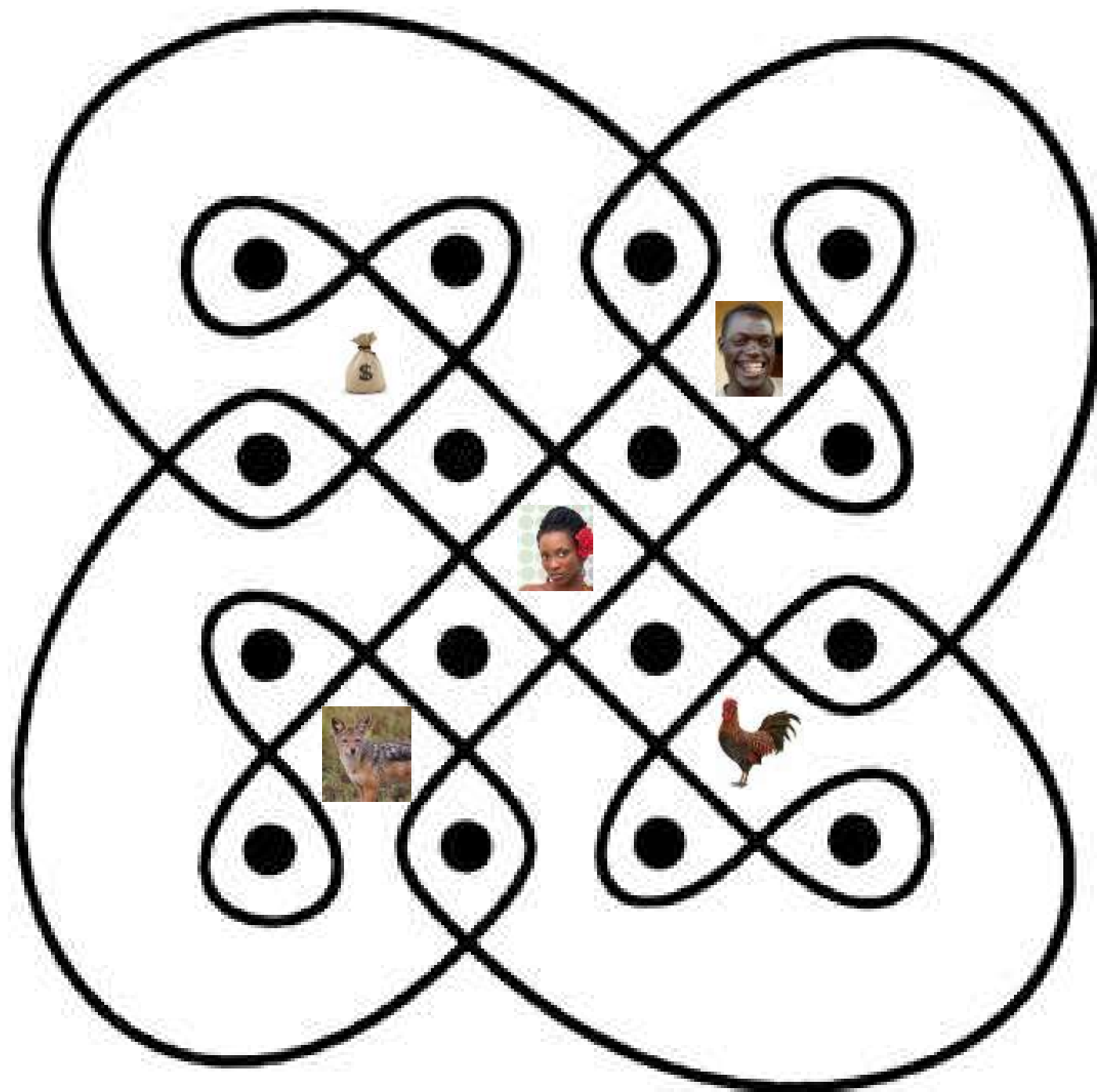


(2,4)

These are used to tell stories



Chased Chicken

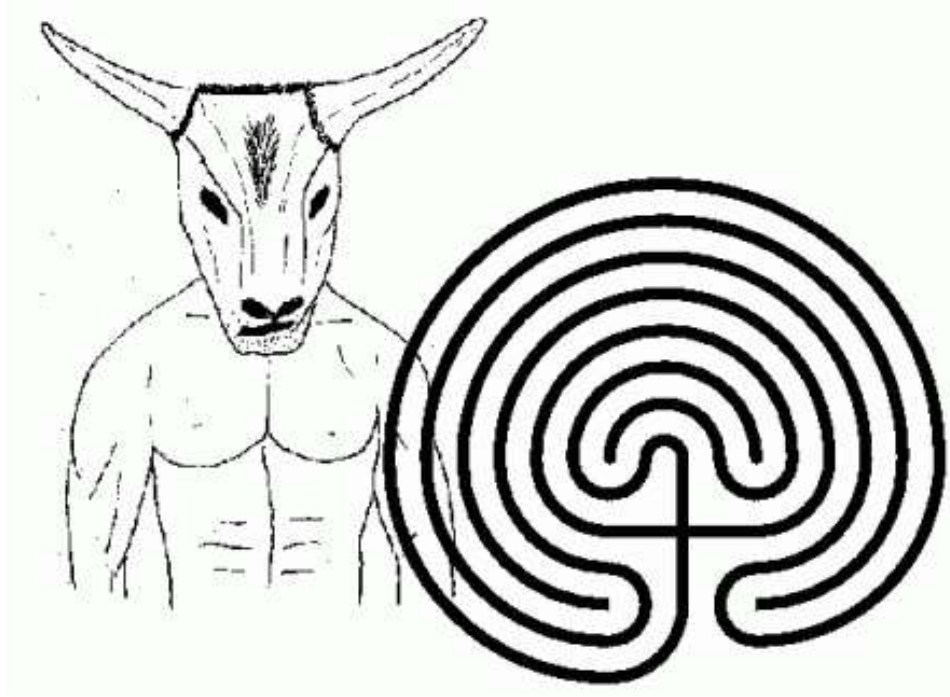


Now go for it! (quilting show)





Going on a field trip: Amazing maths



Cretan Labyrinth:

History of maths

Unicursal diagrams

Fractals

Hampton Court Maze:

Networks

Internet

Hamilton Circuits





Large group
projects:
school/university
Labyrinths

London Underground



Mark Wallinger Turner prize winning artist



Is this circular network familiar?
Can you identify the stations?
Knowing how things are connected together
is sometimes more important than knowing
where they actually are.
Understanding the mathematics behind all
kinds of networks - including mobile phone
transmitters, roadways, and the internet -
helps us to improve their efficiency, allowing
us to move vital materials and information
around more quickly and safely.

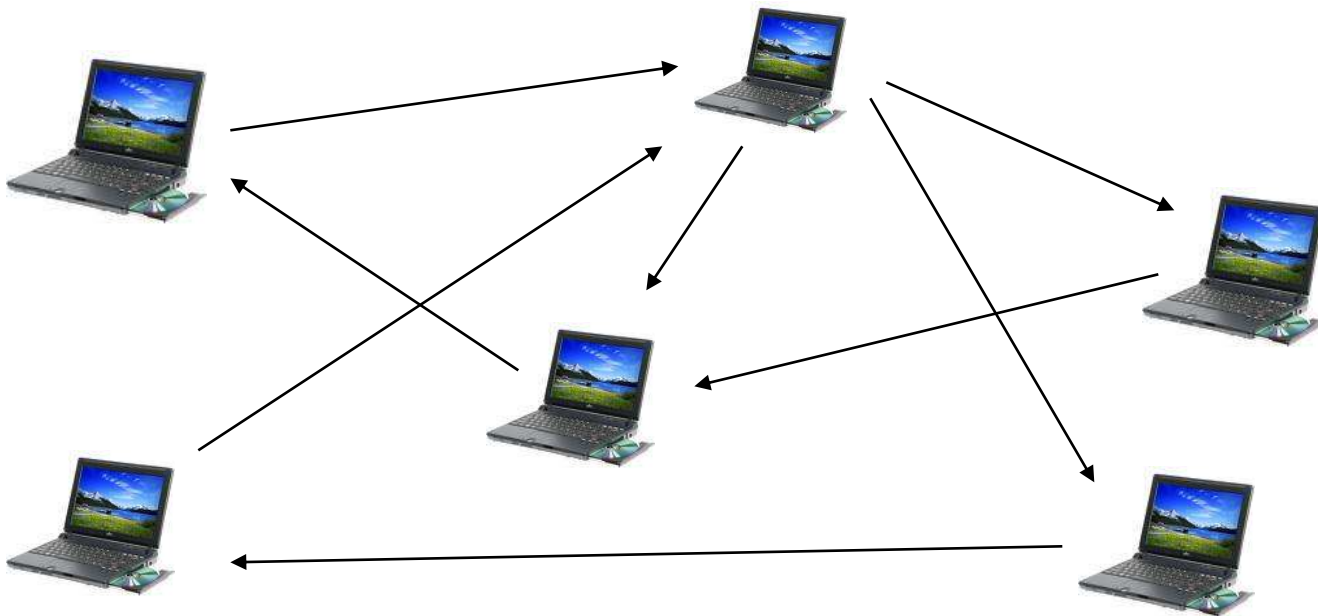
"Maths Connects" first appeared in the trains of the London Underground in June, 2000.
Graphic Design: Copyright (c) A. D. Burbanks.
Cretan maze, concept: C. J. Budd (U. Bath), C. J. Sangwin (U. Birmingham).
Concept: H. K. Moffatt, R. E. Hunt, A. D. Burbanks.

The Maths Behind



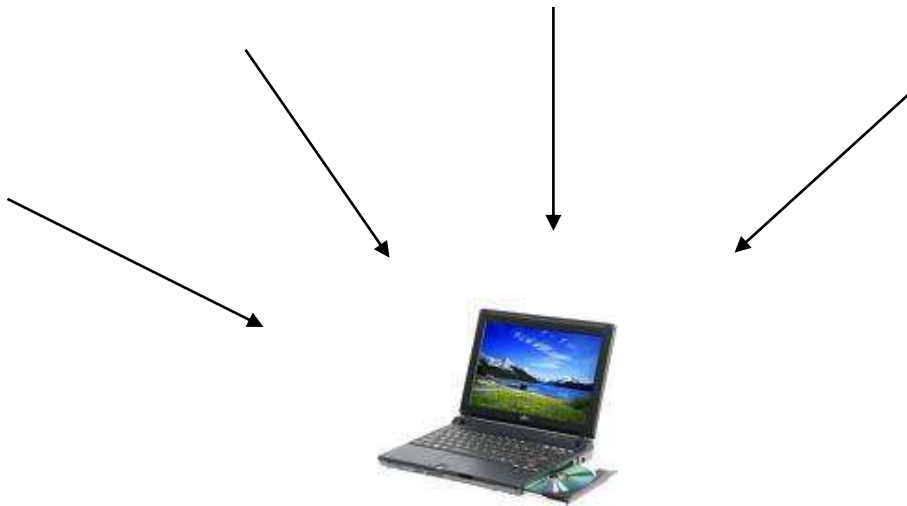
Google searches for **information** stored on many **web-sites**.

Web-sites are linked together by a **network** showing which web-site points to which other web-site

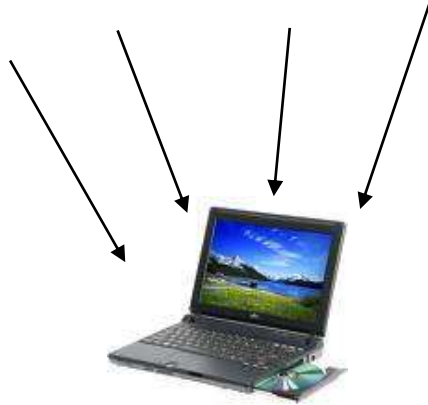


It RANKS web-sites in order of the importance of the information that they contain.

IDEA A website is important if lots of other websites link to it.



A website is even more important if it is linked to by important websites

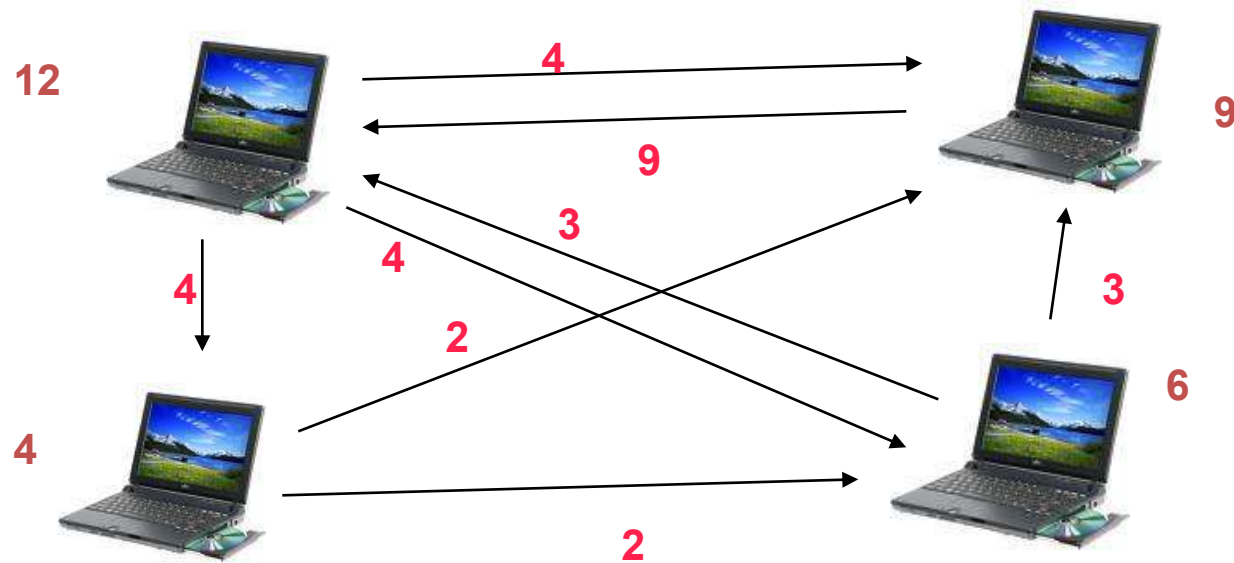


Each Web-site has a **PAGE RANK** **R**



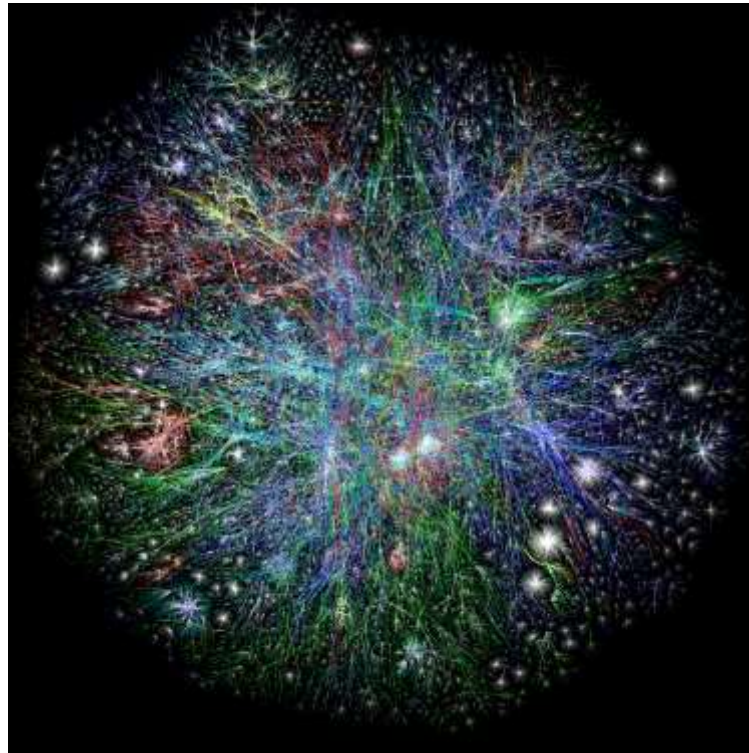
Divide **R** by the number **N** of web-sites that this web-site links, to get **S=R/N**

For each web-site, calculate **R** by adding up the values of **S** for every web-site that connects to it.



Now do the same for 1 000 000 0000 more computers

Need to calculate the unit eigenvector of an extremely large matrix!



And make many \$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$\$

General Good Practice



Good practice for any presentation or article or online material concerned with communicating maths can follow the following guidelines



Audience. Remember who they are, what they know, and how you want to reach them



Belief. Believe that maths is a great subject with a great message (if we don't, then who will?)



Content. Have great content, tailored to your audience



Deliver. Your content in a way appropriate to the audience



Enthusiasm. Carries all before it



Finish. Have a BIG finish which leaves the audience with the message you want to convey



Making it happen:

Royal Institution Maths
Masterclasses