‘There is geometry in the humming of the strings, there is music in the spacing of the spheres’

Peninsula Arts Exhibition

9 April – 28 May 2016

EDUCATION PACK FOR UPPER KS2 AND KS3

Quantum Sea (2016) by Mark Francis. Oil on canvas.
## CONTENTS

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>About Peninsula Arts</td>
<td>2</td>
</tr>
<tr>
<td>About This Resource</td>
<td>3</td>
</tr>
<tr>
<td>About The Exhibition</td>
<td>4</td>
</tr>
<tr>
<td>Before You Visit</td>
<td>6</td>
</tr>
<tr>
<td>Pythagoras: The Man, The Mathematician, The Culture Vulture.</td>
<td>8</td>
</tr>
<tr>
<td>The Artists And Their Work</td>
<td>10</td>
</tr>
<tr>
<td>Maths And Architecture</td>
<td>13</td>
</tr>
<tr>
<td>Activities: Geometric Colouring Patterns:</td>
<td>15</td>
</tr>
<tr>
<td>Sevenn</td>
<td>16</td>
</tr>
<tr>
<td>Octaplex</td>
<td>17</td>
</tr>
<tr>
<td>Interflocking Birds</td>
<td>18</td>
</tr>
<tr>
<td>Hyperbloid</td>
<td>19</td>
</tr>
<tr>
<td>Arty Squares</td>
<td>20</td>
</tr>
<tr>
<td>Spirolaterals</td>
<td>21</td>
</tr>
<tr>
<td>Conversations For After Your Visit</td>
<td>25</td>
</tr>
<tr>
<td>Interesting Books</td>
<td>26</td>
</tr>
<tr>
<td>Interesting Links</td>
<td>26</td>
</tr>
</tbody>
</table>
Peninsula Arts is the wide-ranging public arts programme of Plymouth University, catering to many varied audiences, raising aspirations and enriching lives through high quality cultural experiences.

As well as hosting the Peninsula Arts Gallery, the largest contemporary art gallery in Plymouth, it also incorporates the Jill Craigie Cinema, the House with its cutting-edge performance programme, the Ten Tors Orchestra, the professional chamber orchestra for Devon and Cornwall, and a year-long series of fascinating talks that open up the world of history and contemporary culture.

Peninsula Arts are proud to be committed to supporting the arts in Plymouth, and especially to making them accessible to younger audiences – the next generation of creatives. In this spirit we welcome young people of all ages, from primary through to students in further and higher education.

Visiting the Peninsula Arts Gallery could not be easier and we welcome school groups of all ages. We are very happy to discuss your visit with you before you book, so please contact us with any queries or concerns. Please note that all school groups must be supervised by an appropriate number of staff members from the visiting school and we advise teachers to visit the gallery space before making a school visit. Peninsula Arts Gallery is fully wheelchair accessible.

Please contact us if you would like to book a school visit:

**Email:** peninsula-arts@plymouth.ac.uk

**Telephone:** +44 1752 58505

**Peninsula Arts Gallery Visiting Hours:**
Monday – Friday 13.00 – 17.00
Saturday 11.00 – 16.00 (closed Bank Holidays)
The Gallery will be closed on 2 May 2016.

**How to find us:** Peninsula Arts Gallery is situated in the Roland Levinsky Building on Plymouth University campus. It is adjacent to Plymouth City Museum and Art Gallery on North Hill. Peninsula Arts, Roland Levinsky Building, Plymouth University PL4 8AA
ABOUT THIS RESOURCE

So what’s it all about? Are you standing in the gallery wondering what exactly it is you’re meant to say to the sea of faces staring eagerly at you waiting like sponges for your words of wisdom?

This education pack is designed to give you a variety of starting points at which to engage young people with the concept of maths and art being interlinked. A ‘conversation’ between the two that has qualities that anyone can identify, not just the budding Stephen Hawking or wannabe Damien Hirst.

It is here to enable teachers, parents and carers to inspire their charges with the cross-over worlds of art and maths, helping them to recognise this cross over when they see it in the world around them; to help to open up both worlds and show young people that maths isn’t just about boring numbers on a page and that art isn’t all about whether or not you are any good at drawing.

What this pack isn’t about is getting them to understand a difficult mathematical theory or the meaning behind a painting. It’s about giving them the confidence to see these two subjects in a different light. To help them to see that these two seemingly different subjects might actually be more similar than they thought and it is about helping them to recognise those similarities. It is also about showing that this exhibition isn’t just for people who consider themselves to mathsy or artsy but is for anyone who enjoys learning.

This pack links to the curriculum across the subjects of Art and Mathematics.

So read on and enjoy your journey into the crossover world of maths and art.

Mathematical Sculpture Proposal for the Oxford Mathematics building 2013
In 2015, the London Mathematics Society invited curator Barry Phipps to devise and curate an exhibition to celebrate their 150 anniversary and to celebrate and promote mathematics and culture to the widest possible audiences.

The idea behind it was that while science, technology and finance are aware of the crucial importance of mathematics, this awareness did not seem so evident outside of these communities.

Some believe that mathematics has an intrinsic beauty, which is what has inspired people to study it for millennia and it is appearing more often in literature, films, and even in the fine arts, but not enough as far as they are concerned. So this exhibition is all about challenging old stereotypes of what mathematics is, and about it being recognised as a part of our culture.

On this premise, two artists were selected to create projects around conversations with mathematicians, artist Mark Francis and architect George L. Legendre.

Both George and Mark worked closely with the mathematics community for several months, designing works that reflected the beauty and complexity of mathematics – the results are here in the gallery around you.

Alongside them, film-maker Heidi Morstang was commissioned to work with the mathematician Martin Hyland to produce a 60 minute film about how mathematicians think.

As the quote in the exhibition title by Pythagoras suggests, art and mathematics have a long historical relationship. For thousands of years artists as well as mathematicians have been interested in geometry. It is evident that mathematicians have been drawing and modelling geometric forms as a tool for investigating ideas for centuries, and for artists such forms have long been fertile ground for inquiry and inspiration.
Geometry is one of the oldest branches of mathematics. It is concerned with the shape of objects, spatial relationships among objects, and the properties of space. It has been a tool for astronomy, cartography, and the arts from classical Greece through medieval Islam and Renaissance Europe. It arose in response to practical problems such as those found in surveying, constructing buildings, and measuring storage containers. From about the 6th century BC, the Greeks gathered and extended this practical knowledge and from it generalised the abstract discipline now known as geometry from the combination of the Greek words geo ("Earth") and metron ("measure").

This exhibition presents the outcomes of conversations between the artists and the mathematicians with whom they worked, as well as some past work which informed it. In these collected works we glimpse a shared conversation between the disciplines, and find a history, creativity and future common to both.

30 Pieces by George L. Legendre
Well, you’re going to see an exhibition about art. Or is it an exhibition about mathematics?

It’s got to be one or the other, right? It can’t be both?

Well, actually we hope that your visit to the exhibition will prove to you that it can and we hope that it will inspire you and your group to explore the relationship between art and mathematics a bit more.

There is a world-wide conference held every year celebrating the connections between art and mathematics – The Bridges Conference. This year it will be held in Finland – Bridges Finland 2016: Mathematics, Music, Architecture, Education, Culture (link at the end of the pack).

The Edge of Forever (2016) by Mark Francis.
Here are a few ideas for questions to ask your group before they visit:

**Do you see yourself as more artistically or mathematically inclined?**

**Do you switch off when people start talking about mathematics or maybe you think that art is pointless?**

*Tracery (2014) by Mark Francis. Oil on canvas.*

**WHAT CONVERSATIONS OCCUR WHEN THEY TRY TO ANSWER THESE QUESTIONS?**

You may find that they are more interested in either one or the other, that they have already defined themselves as mathematical or creative orientated because on the whole people do tend to put themselves either into a maths pigeon-hole or an art pigeon-hole. Getting them to look at the artwork on display and doing some of the activities in this pack should help to produce further interesting debate around the subject of art and maths as crossover subjects.
Art and Maths have a long and rich history with both artists and mathematicians drawing inspiration from one another - and it goes back further than you might think.

The title of this exhibition might not sound very snappy but there is rhyme behind the reasoning. It is named after a quote from the Greek philosopher Pythagoras. Pythagoras’ geometry theorem is a formula used to calculate the length of any of the sides on a right-angled triangle or the distance between two points. Some of your group will have heard of Pythagoras and his theory but how many of them will know that he was a maths genius AND a cultural thinker as well!

Pythagoras was born on the Greek Island of Samos in 569 BC and died in 475 BC and essentially he did lots of thinking about maths, music, art & culture and how they all complement and bounce off each other.

For example, Pythagoras noticed that vibrating strings produced harmonious tones when the ratios of the lengths of the strings are whole numbers, and that these ratios could be extended to other instruments. In fact Pythagoras made remarkable contributions to the mathematical theory of music. He was a fine musician, playing the lyre, and he used music as a means to help those who were ill.
Pythagoras studied properties of numbers which would be familiar to mathematicians today, such as even and odd numbers, triangular numbers, perfect numbers etc.

He felt that each number had its own personality - masculine or feminine, perfect or incomplete, beautiful or ugly. He felt that ten was the very best number because it was made up of the first four whole numbers - one, two, three, and four \(1 + 2 + 3 + 4 = 10\) - and these written in dot notation formed a perfect triangle. Pythagoras believed that numbers gave form to matter and that all things were ultimately numbers.

Greek philosopher Aristotle also got in on the act stating that 'The Pythagorean ... having been brought up in the study of mathematics, thought that things are numbers ... and that the whole cosmos is a scale and a number.'

NOTE: For homework, you could ask your group to find more information about Pythagoras and his theories about maths and culture being linked. See if they can see further than his famous theory...
Heidi Morstang works with moving image, photography and experimental documentary and is a lecturer in photography at Plymouth University.

Her practice is rooted in the physical; she is interested in the social, mythological and archaeological histories embedded in landscapes. She uses images to explore and offer insight into complex and often subtle tensions and conflicts that characterize places, however beautiful our environment might appear.

Heidi has exhibited her photographic work and screened her films internationally since 1995 and her work is represented in several private and public collections.

For this exhibition Heidi created a film called Thinking Space to explore the way that mathematicians think. In it, mathematician Martin Hyland interviews 9 mathematicians for Heidi’s 60 minute film that you can watch in the gallery. Through explorations of their various thought processes, the film portrays these mathematicians grappling with advanced mathematical ideas and offers insights into a broad range of mathematical theories. We are presented with the concepts of imagination, intuition, and wonder, as well as rigorous mathematical deduction.


‘Maths and music are closely linked’ says Heidi of her experience. ‘They speak the same language but use different forms’ she says. ‘There is an unspoken communication. I didn’t understand the maths when I was filming and listening to the mathematicians talking and I still don’t but what I realised is that you don’t need to understand the maths because what it is really about is the thinking process. It is about thinking – where and how, not what.

For the film I wanted to let each person decide the spaces they were filmed in and the result is that the film conveys a sense of rhythm, movement and sound.’
Mark Francis is a Northern Irish painter living and working in London. He is an artist of international reputation whose work is represented in numerous international collections including Tate Gallery, Irish Museum of Modern Art and the Metropolitan Museum of Art, New York.

In 2015 Mark Francis was invited to take part in an artist’s residency by the London Mathematical Society – an opportunity he seized, having enjoyed an earlier residency at The Institute of Astronomy at Cambridge.

‘My residency at the London Mathematical Society was a very interesting experience. I realised that the mathematicians’ approach in gathering and applying information to solve particular problems is very similar to mine. It gave me a chance to view my ideas on the Universe from a different perspective.’

‘There was one particular set of drawings and notes by Dr Iain Moffatt on knot theory which drew my attention. They echoed an artist’s sketchbook and had the same conscious and unconscious workings. An artist’s studio can be akin to a mathematician working out a theory on a blackboard. Both are places where success and failure can happen through a journey of enquiry. It’s the continuous loop of information going back and forth which adds learning, whether it’s a painting or an equation.

‘The outcome of the residency so far has been a large sculpture and a number of related paintings. Sculpture is a valuable recent addition to my practice, and the chance to walk around the sculptures and explore their internal space has enriched my knowledge and understanding of the themes that I am interrogating within my paintings.

‘Construction is a wall-mounted work - both a painting and a sculpture - comprising layers of metal mesh, glass, wood, wire, electrical cable and paint. Through this I am trying to articulate my visual ideas around the Universe operating on a grid system and that within this grid both order and chaos can reside and be intrinsically linked. Mathematical grids and networks are present in so many ways, through architecture, transport systems and mapping. I continue to find them a powerful device for exploring the dynamics of expansion and restriction.’
George L. Legendre is a founding partner of IJP, a London-based architecture practice exploring the natural intersection between space, mathematics, and computation.

Legendre graduated from the Harvard Graduate School of Design in 1994 and served as lecturer and Assistant Professor of Architecture there from 1995 to 2000.

IJP’s work includes covering a central London Street with 1000m² of glass and Henderson Waves, a 1000-foot-long bridge located in Singapore, as well as the Bat House, a high-tech, sustainable shelter recently completed in the London Wetlands Centre.

George L. Legendre’s fusion of design, mathematics and computation took off in print starting with IJP: The Book of Surfaces (AA Publications, 2003). A regularly published essayist, he edited a special issue of AD Magazine on the Mathematics of Space and Pasta by Design. In his own words, George explains things simply when he says, ‘In a nutshell, we use mathematics to design stuff, from bridges to pasta shapes’.
There are lots of examples of mathematics informing art and architecture in the world around us.

The Core education centre at the Eden Project was designed using Fibonacci numbers. Fibonacci sequences are numbers that run in a sequence in which each number is the sum total of the previous two numbers starting with either 0 or 1. For example, 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 and so on. The sequence of numbers is named after Italian mathematician Leonardo Bonacci who lived between 1170 and 1250.

Many patterns in nature can be linked to the Fibonacci sequence including plant spirals, pine cones, seeds, snail shells and sunflowers. If you are lucky enough to visit the Eden Project then make sure that you take a look at the The Core Education building. From up high, the roof’s design is based on Fibonacci spirals and if you head inside the building right to the centre, you will be able to see The Seed, a huge sculpture by artist Peter Randall-Page made out of a single piece of granite whose surface has been carved with 1,800 nodes in the pattern of a Fibonacci spiral. It took Peter more than two years to carve this amazing sculpture. Peter acknowledges the role that mathematics plays in his work. In his own words, ‘geometry is the theme on which nature plays her infinite variations, and can be seen as a kind of pattern book on which the most complex and sophisticated structures are based’.

Note: There are some more examples of Peter’s sculptures in the University that look very like the seed pod at Eden. See if the children can spot them.

Clue: If you leave the gallery via the doors that go into the main foyer of the university, turn right and out of the revolving doors that lead outside, the sculptures are to your left.

The Seed by Peter Randall-Page
Islamic and Hindu cultures have long used images based on geometric design and there are signs of this in their temples and shrines.

It was while reflecting on the role of maths as a contemplative medium that writer Alex Bellos, alongside illustrator Edmund Harriss decided to compile a colouring book full of mathematically minded pictures.

The latest trends have seen a huge surge in colouring books for Mindfulness and Relaxation and now Colour Yourself Clever: Snowflake, Seashell, Star by Alex and illustrator Edmund Harris adds maths into the mix. Simply by picking up a colouring pen and filling in the spaces you will be engaging with mathematically artistic ideas.

Alex is a writer who knows that Maths made some people anxious but he wanted them to be able to dip into the world of maths and have a soothing, relaxing and illuminating experience so he came up with the idea of a colouring book.

And you need have NO MATHEMATICAL OR ARTISTIC KNOWLEDGE WHATSOEVER to enjoy the wonderful mathematical colouring patterns that came out of Alex’s mathematical musings!

See the ACTIVITIES pages for samples from Alex and Edmund’s book.
GEOMETRIC COLOURING PATTERNS

Suitable for KS2 AND KS3

Curriculum links to art, design, mathematics.

Activity Location: A quiet space

You will need: Colouring pens and pencils, enthusiasm.

Edmund and Alex have kindly let us have some of their mathematical colouring patterns for this pack so that you can have a go yourselves.

So, grab some colouring pencils, find a quiet space and start doing some maths. And some colouring.

Give everyone at least ten minutes with their heads down and their tongues sticking out!
SEVENN
A Venn diagram shows every possible overlap between two or more sets. At left is a simple Venn diagram with just three sets. The seven-set Venn diagram, above, requires a very peculiar shape that looks like a squid or a ghost. To see it, try using your finger to trace the outline of just one set.

Art copyright © Edmund Harriss. Text © Alex Bellos. This page may be photocopied for educational use. Please include this statement on all copies.

From
SNOWFLAKE, SEASHELL, STAR:
Colouring Adventures in Numberland
Alex Bellos and Edmund Harriss | £12.99 | 9781782117889
Available wherever books are sold.
**OCTAPLEX**

The 3-D shape at left is an octahedron, which has eight triangular faces. If you imagine a fourth dimension, you can build the **octaplex**, a 4-D shape with 24 **octahedrons** as faces. Above is the 2-D "shadow" of the octaplex, flattened onto the page.

Art copyright © Edmund Harriss. Text © Alex Bellos. This page may be photocopied for educational use. Please include this statement on all copies.

---

*From* **SNOWFLAKE, SEASHELL, STAR:**
**Colouring Adventures in Numberland**

Alex Bellos and Edmund Harriss | £12.99 | 9781782117889

Available wherever books are sold.

#colouryourselfclever

SHARE YOUR ARTWORK ONLINE!

CANON® GATE

www.canongate.co.uk
@canongatebooks
**INTERFLOCKING BIRDS**

A tiling is an arrangement of shapes that leaves no gaps or overlaps. A tiling is periodic if it has a repeating pattern. Imagine copying these birds onto tracing paper, and then sliding the tracing paper to a new position. Is there another position where your copy will line up perfectly with the original?

Art copyright © David Bailey (www.less-elation.co.uk). Text © Alex Bellos. This page may be photocopied for educational use. Please include this statement on all copies.

---

From

**SNOWFLAKE, SEASHELL, STAR:**
Colouring Adventures in County Durham
Alex Bellos and Edmund Harriss | £12.99 | 9781782117889
Available wherever books are sold.

#colouryourselfclever
SHARE YOUR ARTWORK ONLINE!

CANON GATE
www.canongate.co.uk
@canongatebooks
HYPERBOLOID

Using a straightedge, follow the numbers to connect the bottom row of dots with the top row. Each of the dots on the bottom goes with two dots on the top, except for the very first and last. Straight lines are all it takes to draw the hyperboloid, a 3-D solid with a curvy surface!

Art copyright © Edmund Harris. Text © Alex Bellos. This page may be photocopied for educational use. Please include this statement on all copies.

From
SNOWFLAKE, SEASHELL, STAR:
Colouring Adventures in Numberland
Alex Bellos and Edmund Harriss | £12.99 | 9781782117889
Available wherever books are sold.

#colouroffyourselfclever
SHARE YOUR ARTWORK ONLINE!

CANON GATE
www.canongate.co.uk
@canongatebooks
ARTY SQUARES

Suitable for KS2 AND KS3

Curriculum links to Art, Design, Mathematics.

Activity location: Classroom

You will need: Paper squares, backing paper, scissors, glue sticks, creative energy.

This activity challenges you to create symmetrical designs through the process of cutting a square into a variety of different shaped and sized strips and creating a piece of abstract artwork from a square shape.

Start by folding the square piece of paper exactly in half.

Keep the square folded and hold it so that the fold is on the left or the right. Then cut from top to bottom of the folded square, near the open edges.

You could cut in a straight line, in a ‘zig-zag’ line or in a wavy line, it is completely up to you. You should now have two strips of paper and the rest of the folded square.

Repeat this a few times so that each time, you cut off two pieces of paper from the open edge of the rest of the folded square.

You should be left with lots of strips and the folded edge, which you can open out:

Mark out the centre of the backing paper.

Next, stick the piece which was the folded edge of the square onto the backing sheet so that the centre of the backing sheet is exactly underneath the fold.

Can you lay out the strips of paper on either side of the folded piece so that they form mirror images of each other, with the fold being the mirror line?

You could try other ways of creating your arty squares once you have mastered the basis. For example, what happens if you ...

Fold the square of paper in half in a different way?

Have the mirror line in a different orientation (e.g. horizontal, vertical ...)?

Fold two (or more) squares together so that you cut them in exactly the same way but arrange them differently on the backing paper?

Fold in half again before cutting?

Once you have all finished your arty squares, lay them all out and contrast and compare. See what happens when you take maths and mix it with art!
In this investigation children work on a rectangular grid and by following a simple sequence of commands, trace out spiral patterns of increasing complexity called Spirolaterals.

The basic idea of the Spirolateral is attractively simple but the results can be surprising. Spirolaterals are spiralled, structured designs that are created through a sequence of commands involving lengths and turns.

Spirolaterals are abstract artistic forms which whilst holding beauty also have unexpected complexity allowing for mathematical investigation. Whilst they can be studied at an undergraduate level, identifying potential formulas and algebraic terms to describe the patterns, they can be explored by primary or secondary aged pupils in their simplest form.

The term Spirolateral originates from two roots: lateral, referring to the flat surface and spiro, since the original series of spirolaterals was generated from the term ‘square spiral’. They can range from very basic to elaborate, depending on the angle and number used. However, for the premise of this activity, this has been restricted to 90 clockwise turns and straight lines. Although at first glance they appear to be complicated, once they are understood they are easy to create.

The task offers children the opportunity to take control of their learning and to describe, explain, generalise, prove and communicate as precisely and as convincingly as they can and whilst the task is based in mathematics it is not dependent on advanced mathematical content. It also has a clear artistic side with it allowing for an exploration of a multitude of patterns. As the task itself is broad and the children will investigate in varying ways, they will explore the task from different perspectives. The scenario presented to them is broadly based in geometry and so the children may draw on areas of mathematics such as symmetry, both reflective or rotational, and even at higher level algebra if attempting to make and prove generalisations.

Whilst web-based programmes allow for the generation of spirolaterals, with this activity children can access them at a simple pen and paper level and can advance some interesting concepts. Depending on how long is spent on the idea, the
children may be able to build on each other’s spirolaterals. The unpredictable nature of Spirolaterals makes them an area of continuing interest in the field of mathematics and allows for the creation of unique art.

**The Basic Idea:**
Starting at a point on the grid of square paper draw along the length of 1 square and then turn your paper 90° clockwise before drawing along the length of the next 2 squares. Turn 90° clockwise again, then draw along the length of 3 squares, then repeat along the length of 4 boxes and 5 boxes each time turning 90° clockwise. At this point it may appear that the pattern will continue 5 boxes along but this is an order 5 spirolateral and so at this point you are beginning the sequence again, travelling 1cm, 2cm, 3cm and so on, always remembering to turn 90° clockwise after each line has been drawn until the pattern reaches it’s starting point or a pattern emerges.

Once children have understood how the thing works, they can investigate spirolaterals of order 1, 2, 3, 4, 5, 6 and so on... Children can compare results but this activity can be done independently. Unfortunately due to the complex nature of the activity the majority of lower KS2 children might struggle when attempting to engage with this activity but it is perfect for upper level KS2 and KS3.

Results for spirolaterals up to order 7 are displayed below. Children may be able to spot the difference between order 4 and orders 1-7. Can they find any other similar spirolaterals?
Spirolaterals are patterns involving spirals created using a simple sequence of commands.

A spirolateral is created using $90^\circ$ clockwise turns on squared paper.

Here is the spirolateral for ‘order 1’:

This has been created by drawing along 1 square, turning $90^\circ$ and drawing along 1 square, turning $90^\circ$ and drawing along 1 square, turning $90^\circ$ and drawing 1 more square along. The pattern has reached its starting position so the spirolateral has been completed.

Here is the spirolateral for ‘order 2’:

This has been created by drawing along 1 square, turning $90^\circ$ and drawing along 2 squares, turning $90^\circ$ and drawing along 1 square, and finally turning $90^\circ$ and drawing along 2 more squares. The pattern has reached its starting position and so the spirolateral has been completed.

Finally here is the spirolateral for ‘order 3’:

This has been created by drawing along 1 square, turning $90^\circ$ and drawing along 2 squares, turning $90^\circ$ and drawing along 3 squares, turning $90^\circ$ and drawing along 1 square, turning $90^\circ$ and drawing along 2 squares, turning $90^\circ$ and drawing along 3 squares. This continues until the pattern has reached its starting position. It should look something like this:

Now it’s your turn!

Have a go at making some of these Spirolaterals and then continue the pattern – can you make one for order 4? Order 5? Order 6?

Can you create a whole page design? If you can, you have just made your own mathematical colouring page. That means you have just combined maths, art and design in one activity!
Well, we hope you enjoyed the exhibition and have gone away with lots of new ideas. If you want to discuss things further with your group then here are a few ideas for questions you might like to pose to them to encourage more debate around the maths/art conversation:

How would you describe yourself now you have been to the exhibition? Would you say you were maths, art, maybe a bit of both or none of the above?

Do you think that maths and art are linked having seen the work presented to you by the artists and filmmaker?

What new ideas have you taken away from the exhibition? Do you think you could create a piece of art based on mathematical ideas? Or an artistic pieces of maths?

Do you think that Heidi Morstang is right when she says you don’t have to understand the process of mathematics to enjoy the film she made?

What did you enjoy the most in the exhibition? Was it a picture, an idea, a bit of relaxing colouring in or just the chance to get out of school for the day?

Do you agree that maths, art and culture are linked and can you explain why you think this?

Do you think you could design a colouring page like Alex and Edmund did?

What do you think about the idea that maths, art and culture are all linked together?

Has this exhibition changed the way you think about maths and art?

Can you find any other examples of maths and art in the world around you?
Interesting Books

Mathematics Through Art and Design
published by Collins Educational.

Mathematics and Art: A Cultural History
by Lynn Gamwell

Snowflake Seashell Star: Colouring Adventures in Numberland
by Alex Bellos and Edmund Harriss

Pasta By Design
by George L. Legendre

Interesting Links

For more information about Mark go to
www.markfrancisstudio.com

For more information about Alex and his book go to
www.alexbellos.com

For more information about Heidi go to
www.hcmorstang.co.uk

For more information about George go to
www.ijpcorporation.com

For more information about Peter Randall-Page’s Seed sculpture go to
www.youtube.com/watch?v=Dig0UcTUUYQ

For more information about Bridges Finland 2016: Mathematics, Music, Art, Architecture, Education, Culture go to www.bridgesmathart.org