NRICH FAQs

Quick answers to commonly asked questions about NRICH

What is it?

NRICH is a website providing **free**, carefully designed mathematics enrichment resources and teaching support materials. There are thousands of resources and each month a new edition of NRICH provides a set of new problems for which students can submit their own solutions.

Who is it for?

NRICH is used by teachers of all Key Stages in their classrooms. The resources are used by all learners aged 5 to 19, not just the highest attaining students.

How do the problems differ from textbook questions?

NRICH problems are all rich mathematical tasks. They frequently allow multiple methods of solution, are open to allow exploration, conjecture and investigation, work at a range of levels of sophistication and provide intriguing and fascinating contexts.

How do I use NRICH problems in the classroom?

NRICH tasks are designed for use in the classroom. Many problems are accompanied by detailed **Teachers' Notes**, giving guidance and support. In addition, our **curriculum mapping documents** give suggestions for suitable tasks at various points in the curriculum.

What will learners gain from using NRICH?

It is well known that rich tasks draw learners into the mathematics, providing a more meaningful, interesting and long-lasting learning experience than traditional bookwork or learning by rote

What are the problems like?

The problems are very diverse: they cover a very wide range of mathematical styles, content and level. Many contain interactive elements. For a few examples, see inside this booklet!

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Director

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KS1 & 2

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KS3 & 4

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KS4 & 5

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NRICH is part of the family of activities within the Millennium Mathematics Project at the University of Cambridge
mmp.maths.org

A quick introduction to KS3&4

NRICH

NRICH is a mathematics enrichment project run by a team of qualified teachers who specialise in rich mathematical thinking. NRICH is ideally placed to offer advice and support to both teachers and learners of mathematics, from Key Stage 1 through to Key Stage 5.

At the heart of what we do are the problems on our website nrich.maths.org. They are free, and there are thousands from which to choose.

NRICH aims to:

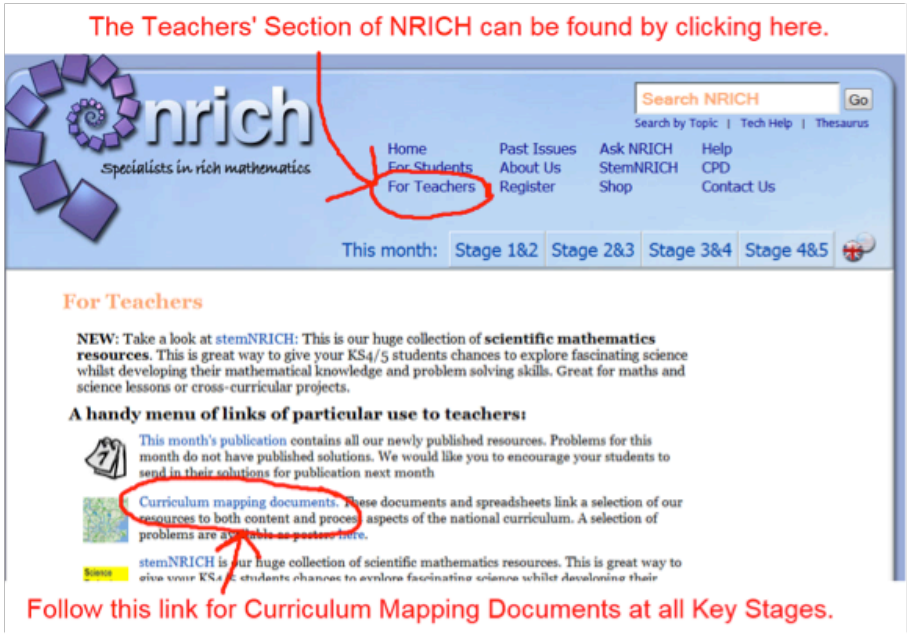
- Enrich the experience of the mathematics curriculum for all learners
- Offer challenging and engaging activities
- Develop mathematical thinking and problem-solving skills
- Show rich mathematics in meaningful contexts
- Work in partnership with teachers, schools and other educational settings

nrich.maths.org

UNIVERSITY OF CAMBRIDGE

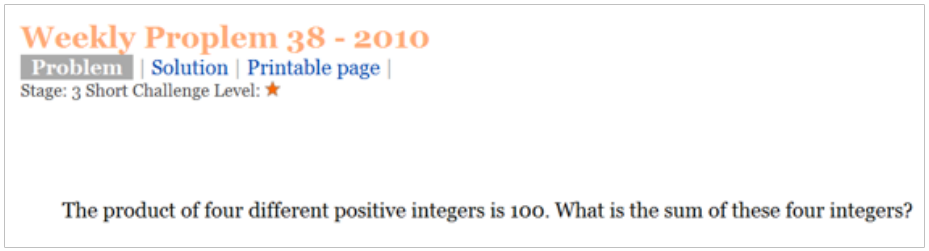
For teachers of mathematics we:

- Offer free enrichment material (problems, articles and games) that will inspire and engage **all** learners.
- Publish curriculum mapping materials and teachers' notes to aid planning and promote rich mathematical thinking in classrooms.
- Offer professional development courses and workshops which help to embed rich tasks into everyday practice.
- Help teachers to think strategically about progression in problem solving.

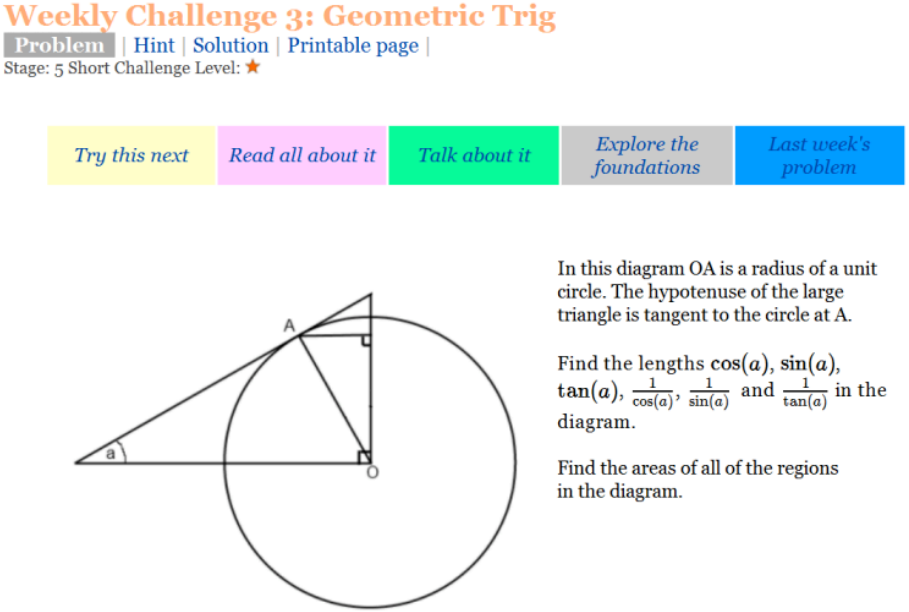


Each week...

A weekly problem is published each week to give students a short work-out:



For Post-16 and keen younger students we publish a weekly challenge with links to articles and related problems:



See http://nrich.maths.org/weeklychallenge for the live challenge

Solutions

Each problem has tabs at the top where you can access the teachers' notes, hints, and solutions. During the month that a problem is featured, the solution tab allows you to submit a solution. Solutions are a great way of seeing different ways of approaching our rich tasks and very motivating for students and classes who can submit the results of their hard work.

For those learning mathematics we:

- Provide free and interesting mathematical problems, articles and games which will challenge you to think in new ways.
- Invite you to send in your solutions to our problems for publication on the website.
- Have a lively discussion board, Ask NRICH, where you can discuss mathematics and receive help and advice from a supportive community of mathematicians.
- Give you the chance to explore a wider range of mathematical ideas than you might meet at school or college.

Each month...

Each month there is a selection of new problems and articles at each stage.

What do Stage and Challenge Level mean?

'**Stage**' simply means '**Key Stage**' in the UK.

We love low threshold - high ceiling: **Challenge Level** indicates the threshold.

Challenge Level: ★ Easier to get started with, although often very rich.

Challenge Level: ★★ Harder to get started with, but again often very rich.

Challenge Level: ★★★ Reserved for very difficult or involved problems!

Teachers' notes to *Shady Symmetry*

Why do this problem?

This problem is a good activity for the visualisation of symmetry, and for encouraging learners to work systematically.

Possible approach

As the class come into the room, display the two patterns from the problem at the front for everyone to see. Ask learners to discuss the two images in pairs, focusing on what they notice about the two pictures, what is the same and what is different. Then bring the class together to share their ideas.

Explain that the challenge will be to explore symmetrical patterns drawn on grids of triangles or squares, and give learners a little longer with their partners to come up with some lines of enquiry to explore. Collect their ideas together on the board at the front (some suggestions are made in the problem if more ideas are needed).

Now allow pairs or small groups to choose one of the ideas to work on, and hand out some of these square and triangular grids. Make the class aware that at the end of the time spent on this (it could be over several lessons) they will be expected to display their work in a way that will convince others that they have considered every possible symmetrical pattern for their chosen question. While learners are working on the task, there may be opportunities to share what people are thinking about through mini-plenaries, particularly to draw attention to those who are working in a systematic way.

Key questions

What different types of symmetry do the initial grids exhibit?
If you colour a triangle or square here, what else must be coloured in to keep it symmetrical?
What are the possible symmetries of a finished pattern?
How can you be sure you have found all the symmetric patterns?

Possible extension

The problem can be extended to be done on these 4 by 4 square and triangular grids.

Possible support

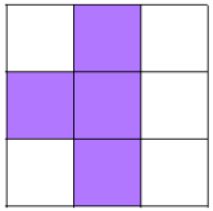
Encourage learners to begin by looking at all the patterns that can be made by first colouring in just one cell, then two, then three and so on. Have tracing paper available if required.

A full NRICH problem: *Shady Symmetry*

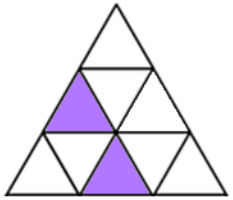
Shady Symmetry

Problem | Teachers' Notes | Hint | Submit a solution | Printable page |
Stage: 3 Challenge Level: ★

Charlie created a symmetrical pattern by shading in four squares on a 3 by 3 square grid:



Alison created a symmetrical pattern by shading in two triangles on a 3 by 3 isometric grid:



Choose whether you would like to work on square grids or isometric grids.

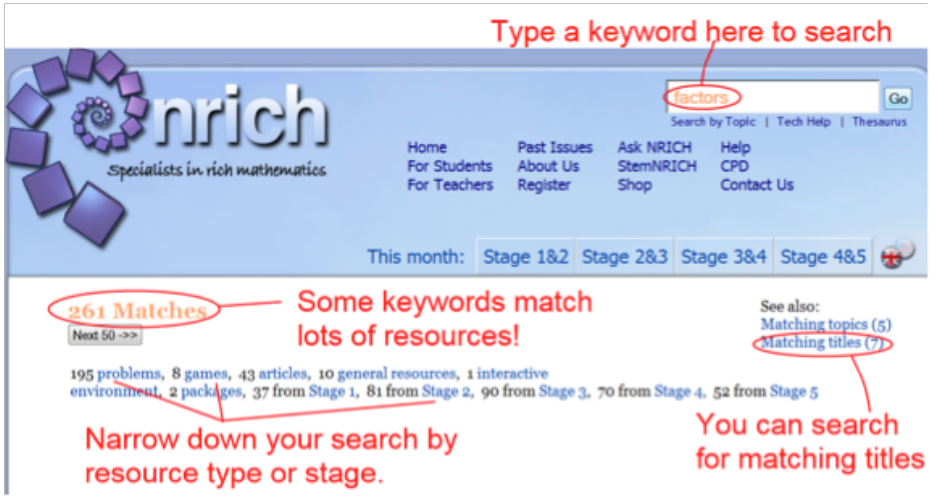
How many different symmetrical patterns can you make?

Here are some questions you might like to consider:

- How many different patterns can you make if you are only allowed to shade in one... two... three... four cells?
- How does the number of patterns with 6 cells shaded relate to the number with 3 cells shaded?
- Can you make patterns with exactly one... two... three... four lines of symmetry?
- Can you make patterns with rotational symmetry AND lines of symmetry?
- Can you make patterns with rotational symmetry but NO lines of symmetry?
- Can you make patterns using more than one colour?

Getting to know the NRICH site

Searching for problems and games:



Extracts from some NRICH problems

The NRICH site contains thousands of rich mathematical resources.
Here are a few extracts from problems:

Sticky Numbers

Problem | Teachers' Notes | Hint | Solution | Printable page |
Stage: 3 Challenge Level: ★

Look at the following row of numbers:

10 15 21 4 5

They are arranged so that each pair of adjacent numbers adds up to a square number:

Can you arrange the numbers 1 to 17 in a row in the same way, so that each adjacent pair adds up to a square number?

Pair Products

Problem | Teachers' Notes | Hint | Solution | Printable page |
Stage: 3 Challenge Level: ★★★

Choose four consecutive whole numbers, for example, 4, 5, 6 and 7.

Multiply the first and last numbers together.

Multiply the middle pair together.

Choose different sets of four consecutive whole numbers and do the same.

What do you notice?

Choose five consecutive whole numbers, for example, 3, 4, 5, 6 and 7.

Multiply the first and last numbers together.

Multiply the second and fourth numbers together.

Choose different sets of five consecutive whole numbers and do the same.

What do you notice now?

M, M and M

Problem | Teachers' Notes | Hint | Solution | Printable page |
Stage: 3 Challenge Level: ★

There are several sets of five positive whole numbers with the following properties:

- Mean = 4
- Median = 3
- Mode = 3

Can you find **all** the different sets of five positive whole numbers that satisfy these conditions?
Can you convince us you have found them all?

What's Possible?

Problem | Teachers' Notes | Hint | Solution | Printable page |
Stage: 4 Challenge Level: ★★

Many numbers can be expressed as the difference of two perfect squares. For example,

$$20 = 6^2 - 4^2$$

$$21 = 5^2 - 2^2$$

How many of the numbers from 1 to 20 can you express as the difference of two perfect squares?

Here are some questions to consider:

What do you notice about the difference between squares of consecutive numbers?

What about the difference when I square two numbers which differ by 2? By 3? By 4...?

When is the difference between two square numbers odd?
And when is it even?

What do you notice about the numbers you CANNOT make?

Can you prove any of your findings?