MATHS HUBS
GREAT NORTH

November Newsletter

Welcome to the November edition of our newsletter! November has been a busy month so far with our Local Leaders of Maths Education (LLME) attending national workshops (virtually!) ready to be able to plan their Work Groups. So keep an eye out in your inboxes for details of Work Groups and how to get involved, they will be coming out to you shortly!

Working online has led us all to consider how we keep our core aims of encouraging, supporting and collaborating when we can't meet with participants face to face. To help us with this, members of our leadership team have attended Desmos training and we hope to bring this to Work Groups soon. Speaking of Desmos, in this article, one of our Level 3 Work Group leads, Tim Johnson, shares his experience of using Desmos in the classroom to help students identify if an image showed a parabola or an arc of a circle. In addition to this, our Deputy Maths Hub lead, Lindsey Hassan shares how the new

DfE Primary Maths Guidance will be incorporated into our subject knowledge for the teaching of mathematics (SKTM) programmes. Read on to see how the area of fractions progresses through the primary curriculum.

As always, we have shared with you the latest updates from NCETM, there are some real gems in there!

Don't forget to visit our website to see what we have on offer this year, contact us to register your interest and watch out on Twitter as our Work Group bookings go live!

Stay safe and well and look after each other,
The Great North Maths Hub team.

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TRAINING SUITE

Tim Johnson

If a picture paints a thousand words...use a graph!

Last year I was part of a cross curricular work group at school, working on a project with the title "Building a knowledge-rich curriculum via cultural capital". The aim was to develop teaching and learning activities that encouraged students to build on their existing knowledge and experiences from both within school and beyond, so that they could deepen their understanding by making learning links across the whole curriculum.

While reflecting on how I might contribute to the group, I remembered how some lines from

Thomas Hardy had struck a chord with me because of a mathematical metaphor. This is how Hardy describes a very old man in *Far From The Madding Crowd:*

"Indeed, he seemed to approach the grave as a hyperbolic curve approaches a straight line – less directly as he got nearer, till it was doubtful if he would ever reach it at all."

Equation 1: y=1/(x−1) +2
Equation 2: y=2
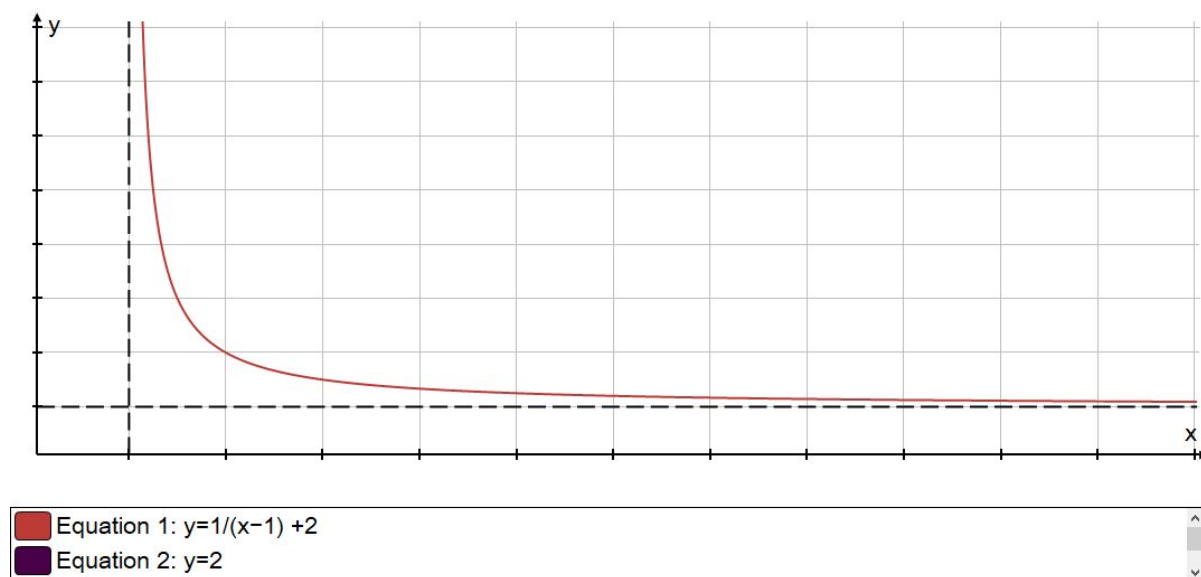
In the context of the project, I could see how my understanding of Hardy's description of the man was enhanced because I was able to visualise a hyperbola approaching an asymptote, but I wondered if that would be true for all of my colleagues, or my students. If not, what could I do about it?

The solution – or part of it – I decided, was to use more graphs more regularly and explicitly in my teaching. The use of manipulatives and the concrete, pictorial abstract approach are tools we

increasingly use to help students by allowing students to visualise problems in number and algebra, so using extending the use of multiple representations to include graphs.

Here are a few activities I have tried, mainly based on Autograph and Desmos, but they could be adapted for other packages. Initially I used them with Year 12 students, but found that slightly simplified versions also worked well with Year 11.

Activity 1:

### Is this a parabola or a circle?

Warning: two thirds of maths teachers who answered this question before trying the activity got it wrong!

You may know the answer to this, especially if you have ever been lucky enough to see a rainbow from an aeroplane, but this you can use a nice feature of Autograph for this activity: By selecting 3 points on the curve, you can use them to define either a circle or a quadratic function, and then superimpose the resulting curve on to the image to see which is the better fit:
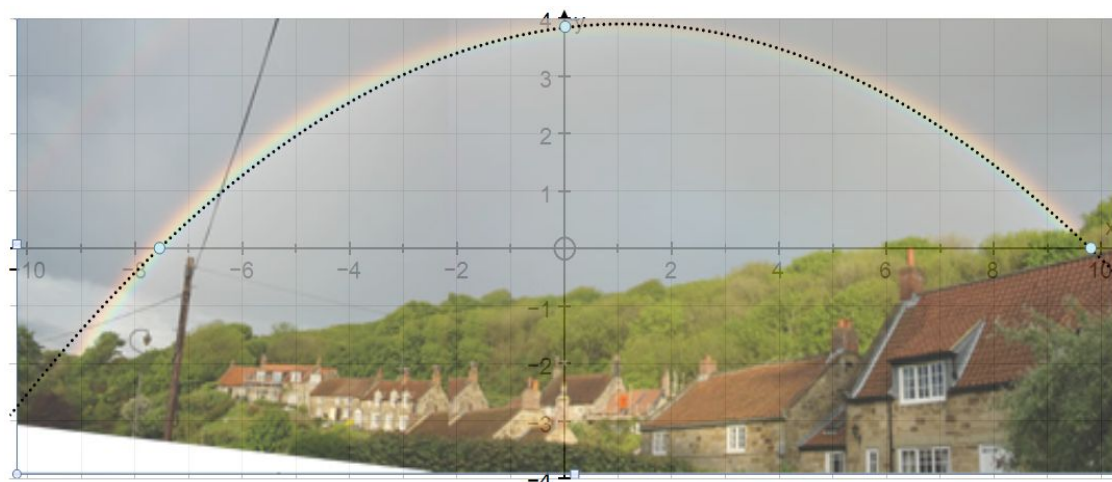
This is the parabola formed from the quadratic equation that passes through 3 points on the rainbow. Note that it does not fit the rainbow perfectly on the left hand side of the image.
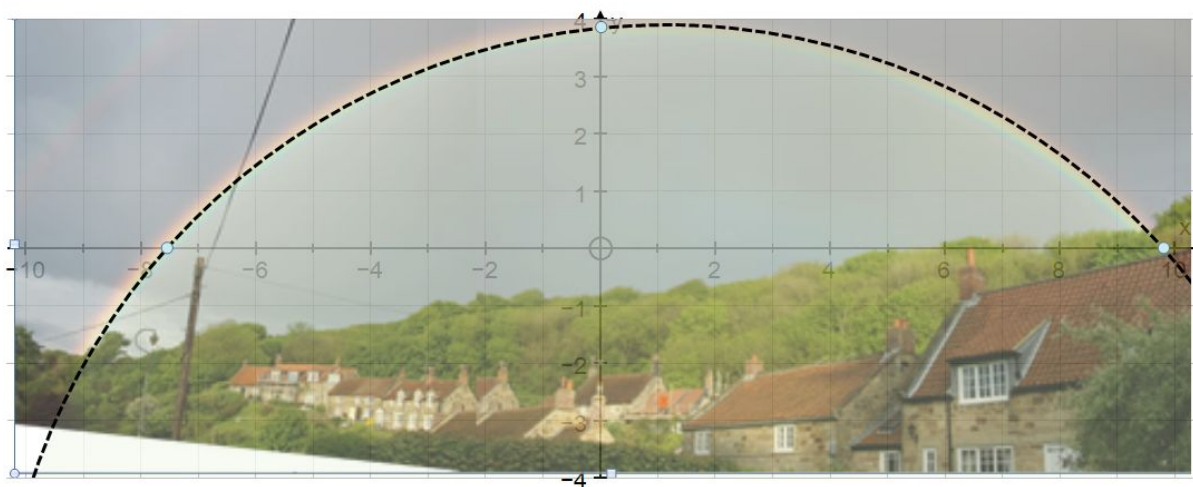
This is the circle defined by the same 3 points on the rainbow. It is a much better fit because rainbows are circular – you can find many images of full circle rainbows if you google it.

Activity 2

Inspired by the previous activity, I looked for other images that my students would recognise to see if we could use find equations to describe them:

Once we had decided that the Tyne Bridge was a parabola and not the arc of a circle, we then explored the shape using the constant controller on Autograph to see if we could find the quadratic equation that produced the same curve as the image of the bridge:
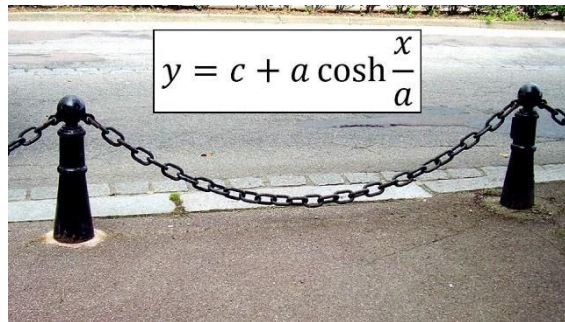

Equation 1: $y = ax(x-b)$

Constant Controller - [Page - 4]

Options = 9.127 Step: 0.001
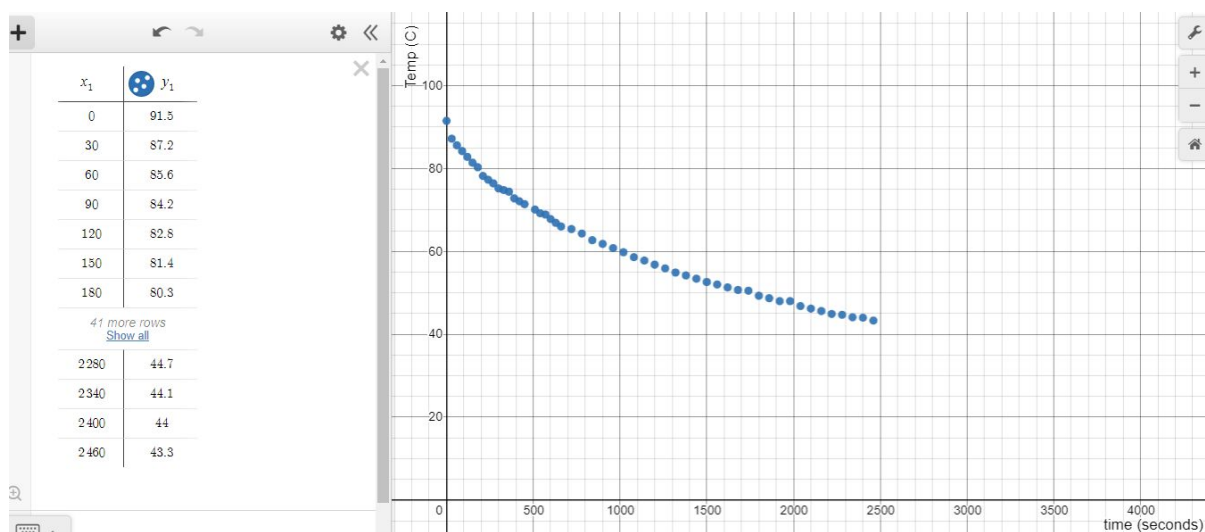
Extension for A level Further Maths:

The equation of a catenary (the curve formed by a heavy chain or cable hanging freely between two points of equal height) is <u>not</u> quadratic; you need hyperbolic functions to describe it.

$$y = c + a\cosh\frac{x}{a}$$

Activity 3

The final activity was to use our knowledge of the shape of graphs to suggest a model for some data we had recorded, then test our model using the curve fitting tools on Desmos. It started with another literary reference, this time from *The Hitch Hiker's Guide to the Galaxy;* "a fresh cup of really hot tea."

The temperature of the tea after different periods of time was recorded on a spreadsheet which could then be copied directly into Desmos to produce the graph:

x_1	y_1
0	91.5
30	87.2
60	85.6
90	84.2
120	82.8
150	81.4
180	80.3
41 more rows Show all	
2280	44.7
2340	44.1
2400	44
2460	43.3

A fantastic feature of Desmos allows us test models by trying to fit curves to graphs we have plotted.

By entering a possible equation for the curve using the syntax $y_1 \sim f(x_1)$, we can see how different curves will fit the plot, and even calculate and display residual values.

At first Year 11 students suggested that there might be a linear relationship between the temperature of the tea and the time:
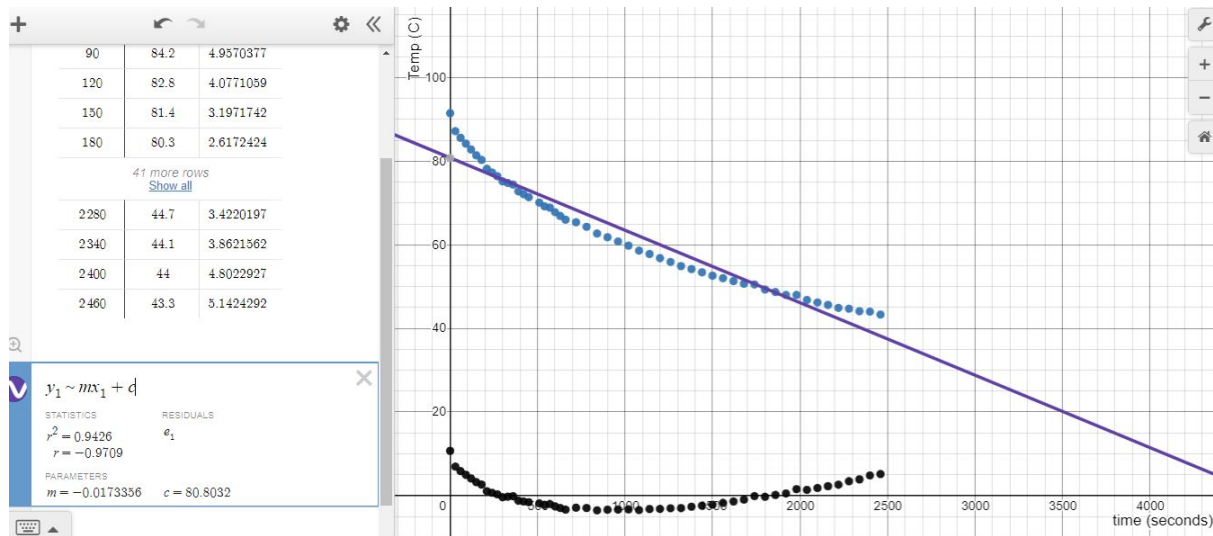
After some prompting, this was changed to an exponential model based on the shape of the curve:
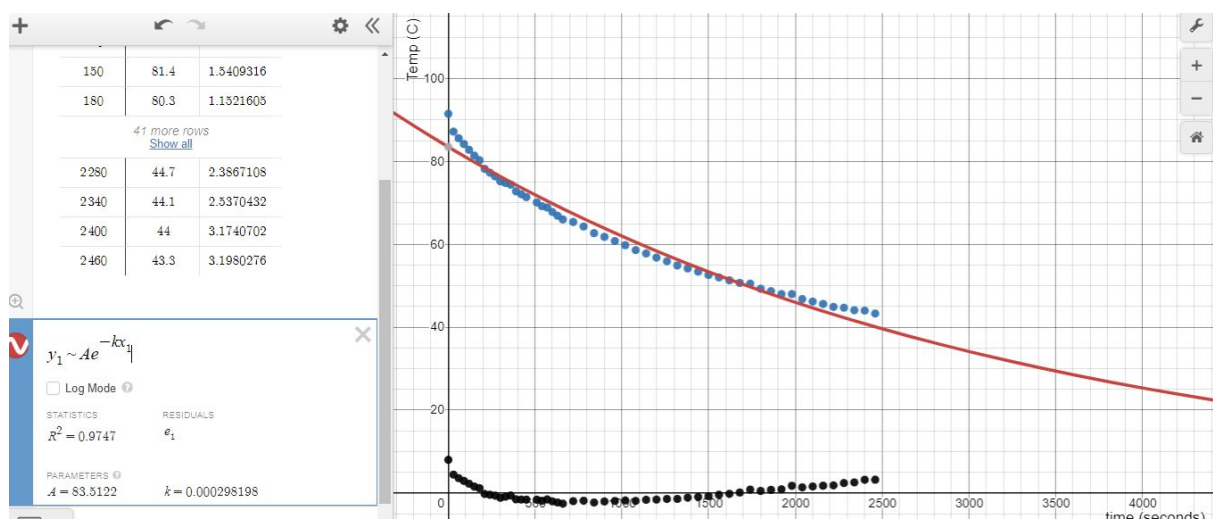
An extension of the activity with Year 12 was to refine the model by adjusting the value of the constants, then check if the relationship was exponential by using logs to reduce the equation to linear form, and then see if the resulting graph produced a straight line.

NCETM Updates

NCETM have created six professional development units designed for ITE tutors to use with primary trainee teachers when exploring how to teach maths. Each unit includes PowerPoint slides, comprehensive session notes and a handout. These resources allow an ITE tutor to run six full sessions on the ideas behind teaching for mastery, aimed at a novice audience. These can be found here on the NCETM website:

https://www.ncetm.org.uk/classroom-resources/primary-ite-professional-development-materials/

NCETM's latest podcast episode is out and features a Year 1 teacher discussing the benefits of active learning.

Our director, Charlie Stripp has written a good news blog about GCSE results, A Levels and Core Maths. Have a read here:

https://www.ncetm.org.uk/features/two-bits-of-good-maths-news/