Primary
& Early Years
Magazine 59

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to Issue 59 of the Primary Magazine. In this issue, The Art of Mathematics features the artist Yayoi Kusama. A Little Bit of History continues its series on inventions: in this issue we look at calculators. Focus On... features the second article on place value by Barbara Carr, and Maths to Share looks at subtraction.

Contents

Editor's extras

In *Editor's Extras* we have a reminder of the NCETM PD Lead Support events and the growing NCETM suite of videos to support the implementation of the new Primary Curriculum. We also have news of workshops for Film in Education's London Primary School Silent Film Festival, and a great video clip about Fibonacci numbers.

The Art of Mathematics

In this issue, we explore the life and works of the Japanese artist Yayoi Kusama, also known as the Queen of Polka Dots. If you have an artist that you would like us to feature, please let us know.

Focus on…

In this issue we have the second of three articles by Barbara Carr on whether we really make the most of our wonderful number system. If you have anything that you would like to share, please let us know.

A little bit of history

This is the tenth in our series about inventions. In this issue we look at another important piece of classroom equipment – the calculator! If you have any history topics that you would like us to make mathematical links to, please let us know.

Maths to share – CPD for your school

In *Maths to Share* we look at the development of the column method for subtraction to ensure conceptual understanding and the importance of encouraging children to look at calculations and make decisions on the most efficient methods to use to solve them. If you have any other areas of mathematics that you would like to see featured please let us know.

Editor's extras

The National Curriculum

We have recently started publishing sections of a new area on our site, dedicated to helping teachers plan lesions in line with the new curriculum. At this stage, this new resource and planning tool includes only material for Year 6 teachers. But other year groups will follow soon. This follows the new curriculum 'Essentials' page, published last term, which is a 'one-stop shop' with links to resources on the NCETM portal that will be helpful to subject leaders who are beginning to consider how to support teachers in readiness for the new programmes of study. Both of these are linked to from our central new curriculum page that will keep you up to date with relevant news of the new curriculum as it becomes available.

As part of this support we have produced a suite of 16 videos focusing on calculation and the associated skills and understanding (for example, the concepts of place value and exchange). The videos seek to demonstrate how fluency and conceptual understanding can be developed in tandem. One of the aims of the new National Curriculum, that children should 'reason mathematically', is demonstrated throughout. Each set of videos has an accompanying presentation to stimulate thought and discussion about teaching and learning. We hope you enjoy the videos and find them helpful in supporting teacher professional development. We'd be delighted to receive your feedback and to learn how you use them. In the near future this suite will include videos focusing on fractions, algebra and division, and including footage from secondary classrooms as well. So keep a look out for these!

The NCETM Professional Development Lead Support Programme (PDLSP)

We're pleased to confirm more new dates for our programme of national free face-to-face events for Primary CPD leads, the NCETM Professional Development Lead Support Programme (PDLSP).

Those who complete the programme are accredited by the NCETM to provide professional development in the priority areas of arithmetic proficiency in primary schools; to date over 140 participants in the programme have been accredited, with more to come.

The dates and locations for the new Primary cohorts are:

Places	Date	Location	Region
20	29 January	Guildford	SE
	1 April		
20	14 March	Nottingham	EM
	9 May		

Note: the events above are being run as two one-day events, times to be confirmed.

The PDLSP microsite has full details of the programme - including support materials, and information about how to book your free place.

Colleagues who have completed the first cohorts have said about the programme:

> *"I really valued the input from experienced colleagues and the diversity of viewpoints was very refreshing."*
>
> *"One of the main criteria for successful PD is that it stimulates new thinking – it certainly did that for me."*
>
> *"The course is definitely impacting on my daily work."*

New online material for subject leaders to support high attainers in mathematics in primary schools

Have you seen the section of our website which aims to support schools in evaluating and supporting their provision for high attaining pupils in mathematics in primary school? High Attaining Pupils in Primary Schools will help subject leaders, senior leaders and teachers to identify and support pupils who are attaining higher than expected standards in mathematics, not just in Year 6 but from the time they begin school.

London Primary School Silent Film Festival

You might be interested in attending the workshops for Film in Education's London Primary School Silent Film Festival. If you are, they are booking up quickly! Be part of this year's festival, and give your children the opportunity to explore maths through drama, film and creative writing. Children work with a professional film crew to write and shoot their own short film, based on curriculum subjects and each film is entered into the festival in July 2014. There is also an awards ceremony to celebrate the children's achievements. For more information, or to book your workshop, email Film in Education.

And finally…

You might be interested in watching this video clip where mathemagician Arthur Benjamin shows how logical, functional and inspiring mathematics is, as he explores the hidden properties of Fibonacci numbers.

You might also be interested in Dan Lewis's blog, which describes how as a dad he explains square roots to his five-year old son. It makes interesting reading and makes you realise just what some young children are capable of!

The Art of Mathematics
Yayoi Kusama

First of all some information about the artist…

Yayoi Kusama, often known as 'The Polka Dot Queen', was born on 22 March 1929 in Matsumoto, Nagano, Japan. She was the fourth child of a wealthy family of seedling merchants. Their wealth came from the management of whole sale seed nurseries. Apparently, since childhood Yayoi experienced hallucinations and severe obsessive thoughts which were often of a suicidal nature. She had an unhappy childhood claiming that she suffered severe physical abuse at the hands of her mother.

She began painting using polka dots at around the age of ten, using watercolours, pastels and oils. Her earliest recorded work was of a Japanese woman (possibly her mother) wearing a kimono which was completely covered in spots. She is now recognised as one of the most important living artists to come out of Japan. As well as her art she is also known for her writing and fashion design.

In 1948 Yayoi left home and began to study *Nihonga* (traditional Japanese-style) painting in Kyoto and her early work was of a distinctly Japanese style. She found studying this frustrating, hating the rigidities of this type of art work. She became interested in European and American avant-garde (essentially experimental and innovative art). Maybe as a form of rebellion to her Japanese studies, in the 1950s Yayoi would cover any surface, such as, walls, floors, canvases and household objects with the polka dots that became a trademark of her work. The polka dots, or 'infinity nets', as Yayoi called them, were taken directly from her hallucinations.

Flowers that Bloom at Midnight

In 1957, she moved to the USA. She spent a year in Seattle and then, encouraged by artist Georgia O'Keefe, moved to New York City where she stayed for 14 years. Here, she produced and showed a series of paintings influenced by the abstract expressionist movement. She then went on to produce and show large paintings, soft sculptures and environmental sculptures using mirrors and electric lights.

In the 1960s, Yayoi staged various events such as body painting festivals (where she covered naked bodies in polka dots!), fashion shows and anti-war (Vietnam) demonstrations. These all took place in prominent locations such as in Central Park and on Brooklyn Bridge, so it was difficult to ignore them! She also experimented with film production and newspaper publication.

Throughout her career Yayoi produced many different types of art, including painting, collage, sculpture, performance art and environmental installations. Installation art is a genre of three-dimensional artwork that is often site-specific and designed to transform a person's perception of a space. People can walk into them, move around them and sometimes are part of them. Most of Yayoi's works, including her installations, show her interest in psychedelic colours, repetition and pattern. Her work is seen to be a precursor of the pop art, minimalist and feminist art movements. She influenced several well-known artists such as Andy Warhol.

Yayoi began work on her series of Mirror/Infinity Rooms in 1963 and continued for many years. These are complex installations with purpose-built rooms lined with mirrored glass and containing many neon coloured balls, hanging at various heights as well as piped music. Light is repeatedly reflected off the mirrored surfaces creating an illusion of a never-ending space.

Yayoi has also completed several major outdoor sculptural commissions, mostly in the form of brightly hued monstrous plants and flowers, for public and private institutions. One of the best known is Pumpkin, created in 1994 for the Fukuoka Municipal Museum of Art.


Infinity Dots Mirrored Room

In 1973, Yayoi moved back to Japan. She found the art scene very tame compared to the art scene in New York. However, she became an art dealer, but this wasn't a very successful venture and her business folded after a few years. She began to suffer from psychiatric problems and, in 1977, she voluntarily admitted herself to a hospital, where she has taken up permanent residence. She has a studio close to the hospital so she is able to continue to produce artworks in a variety of mediums. She has also published several novels, a poetry collection and an autobiography. She has also illustrated Lewis Carroll's *Alice's Adventures in Wonderland*. Yayoi is often seen in photographs of her new works of art.

Yayoi was almost as prolific in the fashion world as she was in the art world. In 1968, she established Kusama Fashion Company Ltd, and began selling avant-garde fashion in the 'Kusama Corner' at Bloomingdales. In 2009, she designed a handbag-shaped mobile phone, a pink dotted phone in a dog-shaped holder, and a red and white dotted one inside a mirrored, dotted box. In 2011 she created the artwork for six limited-edition lip glosses by Lancôme. In the same year, she worked with American fashion designer Marc Jacobs on a line of Louis Vuitton products, including leather goods, ready-to-wear clothes, accessories, shoes, watches, and jewellery.

Information sourced from:

- Wikipedia
- Yayoi Kusama.

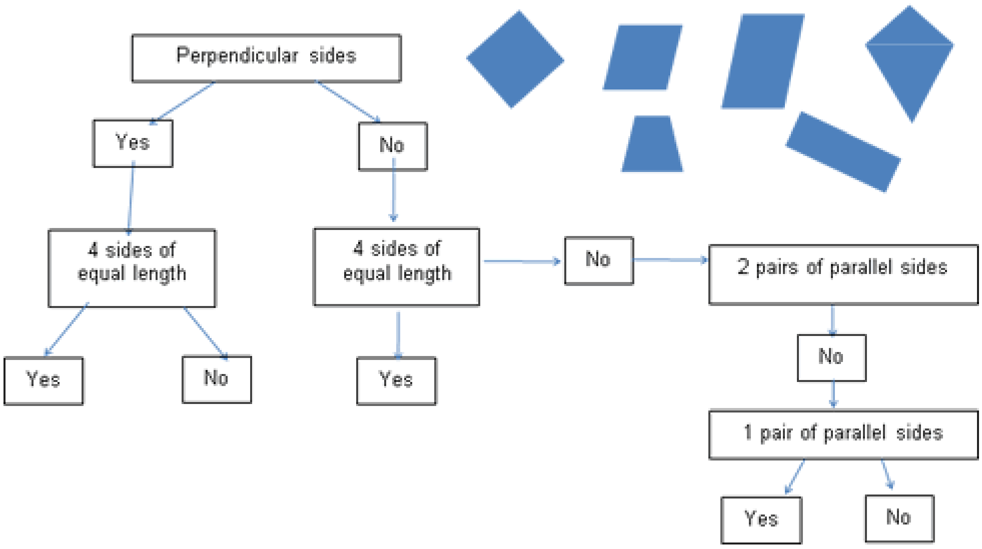
Now for some mathematics!

Show Spreading Love and Peace

Ask the children to count the different things that can they see. Can they recognise anything? What shapes can they see? How many circles? How many triangles? Can they identify the types of triangles? You could ask them to draw examples of each type and discuss their properties in terms of symmetry. You could focus on angles, naming the types (acute, obtuse, right). You could also give them protractors and ask them to estimate and then measure the angles of the triangles that they have drawn.

Can they see any perpendicular and parallel lines? You could ask them to identify those in the classroom. They could draw different regular and irregular shapes with pairs of these.

You could explore the following named quadrilaterals: square, rectangle, parallelogram, rhombus, trapezium and kite. Ask the children to sort these using a decision tree diagram. They should decide on their own criteria but encourage them to make at least one that involves parallel or perpendicular sides. Here is an example:



They could repeat this idea for the following triangles: equilateral, isosceles, right-angled isosceles, scalene, right-angled scalene.

You could explore the properties of a parallelogram (quadrilateral with two pairs of parallel sides). Which quadrilaterals are also parallelograms? After investigating, the children should be able to tell you that a square, rectangle and rhombus are also parallelograms. They should also be able to tell you that a square is also a rhombus (quadrilateral with all sides the same length and two pairs of parallel sides)

You could ask the children to draw or paint a picture similar to Yayoi's that includes parallel and perpendicular lines and also a variety of triangles and circles.

Show Butterfly

Ask the children to estimate how many polka dots there are on the butterfly. You could give copies of this painting to pairs of children to explore. Discuss a good way to make their estimate, for example, count how many dots there are in one part of the butterfly and estimate how many times that part will fit into the whole and multiply.

You could give the children piles of counters and ask them to find out how many there are by making arrays. Encourage them to explore all the possible arrays that they can make, discarding any that don't fit. They could then write multiplication and division facts for their different arrays. Once they have done this, they could work in a group, find the total number of counters and then arrange them to make a butterfly.

You could use the butterfly to explore symmetry. The body of the insect in the painting is symmetrical but the wings aren't. You could give each child a piece of plain paper and ask them to fold it in half. They paint dots on one half in the shape of half a butterfly and then fold again, pressing the two halves firmly together. When they unfold the paper they should have a symmetrical dotty butterfly!

You could ask them to cut out their butterflies and put all of them together to create a large rectangular butterfly painting.

Show Yellow Pumpkin

Ask the children if they recognise and can name the vegetable. You could show some pictures of different vegetables and ask the children to tell you what each are. You could do a data handling activity. Ask the children to tell you which of the vegetables they like the most. Collect this information as a tally and then display as a frequency table. The children could then put the information into a pictogram, bar chart, bar line graph or pie chart.

You could make a collection of real vegetables and explore ways to sort them. If you can't get hold of enough real vegetables you could print out some pictures for them to sort. Encourage them to sort into a Venn or Carroll diagram.

Show the picture with the two large flowers from the series Alice's Adventures in Wonderland

Ask the children to tell you what flowers those in the painting remind them of. Agree that they are similar to sunflowers and discuss the arrangements of the seeds and petals. What shapes can they see in these arrangements, for example, can they see the pattern of concentric circles made by the seeds?

You could use this painting to explore measures, in particular, length. According to one website the heights of medium sized sunflowers range from 5ft to10ft. The heights of giant sunflowers range from 10ft to 20ft.

According to the Guinness Book of World Records, the tallest recorded sunflower was 8.23m when it was measured in Kaarst, Germany, on 4 September 2012. The owner of the sunflower was Hans-Peter Schiffer. This record broke the previous world record – which he set in 2009!

You could ask the children to compare the world record sunflower with the maximum and minimum heights of the medium and giant size sunflowers. This means converting all heights to the same unit. Can the children imagine how high these are? They could measure their heights and scale these up to the size of, for example the world record sunflower.

You could ask the children to scale down the measurements and draw five different sunflowers that are of the heights above. They could also scale down their heights and add a stickman of them to their drawing.

You could decide on an average height for the medium sized sunflower, scale this down by an amount that would allow the children to paint one each on a piece of A3 or A4 paper. Once they have painted their sunflower ask them to cut it out. You could use these to make a large field of sunflowers.

Show the installation Dots obsession

Using the information in the article, tell the children what one of these is.

Ask them to describe what they can see. How many polka dots do they think there are? Why is it impossible to know for sure?

Dots obsession

You could give the children some plasticine or similar malleable material. They could work as a group to make a model of an installation copying the shapes made by Yayoi. If possible let them paint these with polka dot patterns.

Again, working in groups, the children could design their own installations using 3-D shapes. These could include square based pyramids, cubes, cuboids and triangular prisms. Of course their properties need exploring first in terms of shape and number of faces, number of edges and vertices. They could make these shapes out of plasticine and then visualise and sketch their nets. Once they have, they could make more accurate nets on coloured card by measuring and then make the shapes. They could draw circles on paper using the instructions in Issue 50. Once they have drawn some they colour them, cut them out and stick them onto their 3-D shapes. Next, they arrange their shapes to make their model of an installation.

Show one of the Mirrors/Infinity Rooms photographs

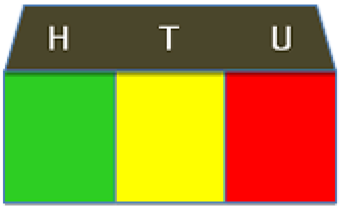
You could give the children a box, small mirrors and 'blu-tak', and ask them to make a version of one of Yayoi's. They could shine a torch onto the mirrors from different directions and describe the reflections that they will see.

The ideas here are just to give you a taster of the mathematical activities that could be involved when looking at artists such as Yayoi Kusama. We know you can think of plenty of others! If you try out any of these ideas or those of your own, please share them with us!

Explore further!

If you've enjoyed this article, don't forget you can find all the other *Art of Mathematics* features in the archive, sorted into categories: *Artists*, *Artistic styles*, and *Artistic techniques*.

Image Credits

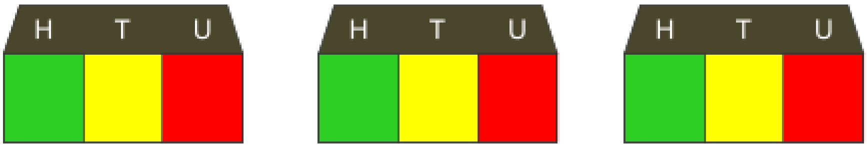


Focus on…
Do we really make the most of our wonderful number system?

In this, the second of a three-part series (the first part appeared in Issue 58), Barbara Carr outlines how to use Base 10 equipment to help children develop better conceptual understanding of how place value in our number system works.

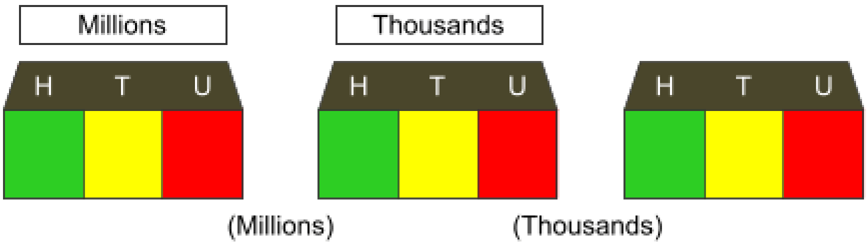
It is at this point that I would like to introduce you to the pattern of Hundreds, Tens and Ones. This is a very helpful tip and one that many of my teachers and children find useful.

I use a colour code to make this pattern more obvious:



As soon as children recognise that they can use their skill of reading a three-digit number, all they have to do is memorise the 'family name' e.g. Thousands, Millions, Billions, Trillions, Quadrillions, Quintillions, Sextillions, Septillions, Octillions, Nonillions and so on. The prefixes bi- (2), tri- (3), quad- (4), quin- (5), sex- (6), sept- (7) oct- (8), non- (9) are used in many other words and a study of these words will help children link the prefix with the number.

The spaces in between each grouping indicate when to say the name of the 'family' of groupings. In the example above the first space to the right is where we say Million, and the second space is where we say Thousand:



In English we have to learn another convention. We need to teach children when to say 'and'.

Look at these numbers:

3246
103
30
1006
1200

Consider when we use the term 'and':

Three thousand, two hundred and forty six
One hundred and three
Thirty

One thousand and six
One thousand, two hundred

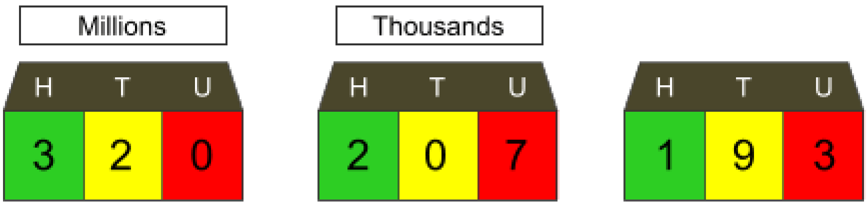
‘And’ is used as our eye passes over the H column in each ‘family’ if there is another number to follow. It is not present in words where only zeros follow as in 1 200. This is an important feature to teach children. We tend to take this for granted that children know when to use it. Relying on instinct is not good enough. We rarely write large numbers with the near extinction of writing cheques but children should leave primary school able to write large numbers.

Knowing when to say ‘and’ also helps to know where to place zeros in a large number.
10 402 009 is likely to confuse some Year 6 pupils. The guidance above should be supportive.
The number is read 10 million (first space) four hundred and two thousand (second space) and (because there is a 9 in the units column) nine.

Look at how this changes for the following number:
10 400 100
Ten million, four hundred thousand, one hundred.
No ‘ands’ are required because there are zeros following the H column within each ‘family’ grouping.

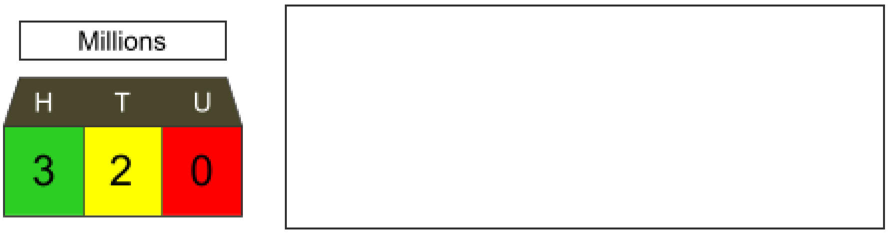
Another tip is to look at the number to establish the name of the ‘family’ furthest to the left, e.g. million
Cover up the ‘families’ to the right of this with paper.
Read that number as you would any three-digit number.
As your eye passes over the space, say the word ‘million’.
Uncover the next grouping.
Read this as you would any three-digit number.
As your eye passes over the space, say the word ‘thousand’.
Uncover the final ‘family’ and read the three-digit number.

So for this number:



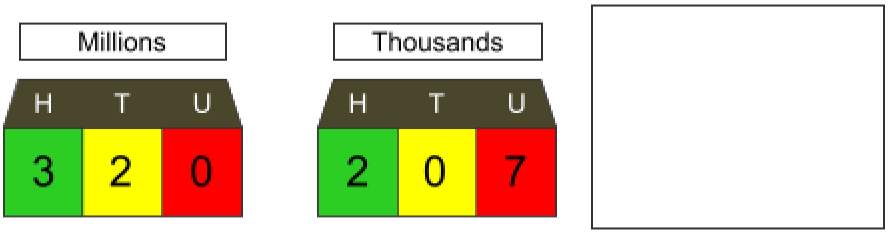
Establish that this number is in the millions.

Cover over the ‘families’ to the right:



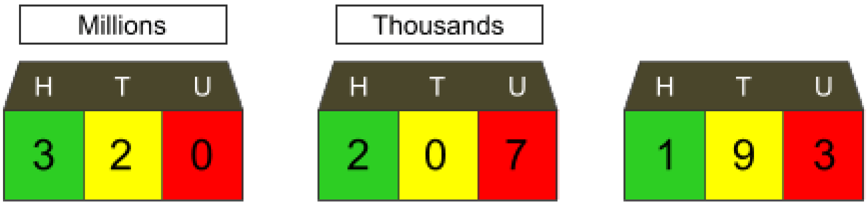
Read this number: three hundred and twenty million……

Uncover the thousands 'family':



Read the next three-digit number: two hundred and seven thousand……

Uncover the final part of the number:



Read the final three-digit number: one hundred and ninety three.

This is a tried and tested method that works. Work through it yourself before trying to teach this. Too many children in both Year 6 and in KS3 struggle with place value and reading large numbers (as do many adults I teach).

Again, many thanks to Barbara for sharing the second part of her article with us. In Part 3, which will appear in Issue 60, Barbara will be discussing our system of measurement.

You might be interested in exploring in more depth the ancient number systems which were written about in early issues of the Primary Magazine. They can all be found in the NCETM Essentials.

Explore further!
If you've enjoyed this article, don't forget you can find all previous *Focus on...* features in our archive.

A little bit of history – the calculator

This month's piece of classroom equipment is the calculator. Did you know that the oldest calculating aid is the abacus, which was first used several thousand years ago and is still in use today? It consists of movable counters placed on a marked board or strung on pieces of wire.

In 1620 an early form of slide rule was developed by the English mathematician Edmund Gunter. It was originally used to multiply or divide numbers by adding or subtracting their logarithms. Logarithms were first introduced in the early 17th century by mathematician John Napier. He didn't invent them but he made up logarithm tables which were designed to ease the process of multiplying and dividing large numbers. As the years went by, slide rules became more sophisticated and were thought of as the first type of analogue calculator.

The mechanical calculator was developed in the 17th century in parallel with the early analogue computers.

Vintage Casio Pocket-Mini

Pocket-sized calculators became available in the 1970s. This was due to the invention of the microprocessor which was developed by Intel for a Japanese calculator company.

Modern electronic calculators vary from cheap, give-away, credit-card sized models to desktop models with built-in printers. They became popular in the mid-1970s, as developments in their production made both their size and cost small. By the end of the decade, calculator prices had reduced to a point where a basic calculator was affordable to most people and they became common in schools.

In addition to general purpose calculators, there are those designed for specific markets: for example, scientific and graphing calculators. Some calculators even have the ability to do computer algebra.

Basic modern electronic calculators have a keyboard which houses the buttons for digits and arithmetical operations. Some have buttons for 00 and 000 to make large numbers easier to key in. Fractions are displayed as decimal approximations. However many scientific calculators are able to work in proper or mixed fractions and have keys that can perform multi-functions. All calculators have the ability to store numbers into their memory. Basic ones are able to store one number but others are able to store many numbers which are represented in variables which can be used to create formulae.

Calculators can be powered in a variety of ways, for example, using batteries, electricity and solar cells.

Over the years, in England, there has been much debate about whether children should be allowed to use calculators in their mathematics lessons. It was feared at one time that the ability to calculate mentally would be effected if calculators were used. Some people believe that calculators should not be used until a certain level of arithmetic proficiency has been achieved. Others argue that calculators can be used effectively for teaching estimation techniques and problem solving and therefore should be used. What do you think?

Information sourced from:

- Kids Britannica
- Wikipedia.

Now for some maths...for which the children WILL need a calculator!

As we know there will no longer be a calculator paper in the end of Key Stage tests in Year 6, but this doesn't mean that we should never use them. Below are some suggestions for EYFS through to Year 6 which should enhance the learning of mathematics and that don't involve using them for straightforward calculations.

You could print and cut out these pictures of calculators through the years (without the year they were introduced). Make a note of when these were in use, but don't tell the children! Ask them to sort them according to their age and make a timeline, justifying their decisions. You could then give them a copy to look at with the dates and ask them to find out how close they were.

TI Calculator Spread

You could also give them this timeline of the calculator. You could cut these up (with dates this time) and give them to the children to order.

The children could compare the calculators that they own and others that are in the classroom. They could sort them according to various criteria, such as colour and size.

They could measure the perimeter of the top of a calculator (with the display and keyboard), they could also work out the area in square centimetres using a formula. They could then order the calculators in ascending or descending order according to one or both of these measurements.

They could compare costs of similar calculators from different suppliers on the internet. Which is the cheapest/most expensive? You could set problems relating to multiplication and division according to the following prices: a teacher bought a class set of calculators for 30 children. He spent £135. How much was each calculator? You could ask similar problems that involve percentage discounts, buy one get one free and other offers.

For children in the EYFS and Year 1, a calculator is a great resource for practising number recognition - one more/one fewer than and also to explore number pairs for all numbers up to ten.

For children in Year 2 and all the way through to Year 6, calculators provide a great resource for exploring place value. With Year 2 you could ask them to key in a small 2-digit number, e.g. 24 and then to make the '2' read '3', the '4' read '7', make the '3' read '1' and so on. The children need to do this by adding or subtracting ones or tens numbers etc. You could progress to adding/subtracting hundreds numbers.

In KS2, the children could change the digits in the hundreds/tens/ones thousands as well as the hundreds, tens and ones by considering the position of the digit you want them to change and then to add or subtract the correct value.

The calculator is a good resource for exploring what happens when you multiply or divide by 10/100/100 and also for doubling.

On some calculators, if you key in a number and then, for example, +4 and repeatedly press equals, the number will increase by 4 each time. You could ask the children to predict the next number or what the number will be after you have pressed the equals sign 5 times. This also works for subtraction, so giving opportunities for predicting and exploring numbers below zero.

You could give the children a 'Broken Key Puzzle', for example:

> 'Most of the keys on my calculator are broken. The only keys that work are 9, +, -, x, ÷ and =. What numbers can I make between 0 and 100?'
>
> 'The 6 key in my calculator doesn't work. How can I solve these: 48 x 6, 126 – 58, 32 + 16, 147 ÷ 6 and 263 ÷ 62?'

You could adapt this 'Three in a Line' game and ask the children to play in pairs. Each pair need a calculator, counters in two different colours and 2 dice. They take it in turns to throw both dice and try to make one of the numbers in the grid below using any operation they can, for example, throw 2 and 3, 2 – 3 =-1. The children can use calculators to explore divisions If they can, they cover the number with one of their counters. The winner is the first player to place three counters in a line horizontally, vertically or diagonally:

11	**3**	**2**	**-1**	**0.25**
7	**10**	**1.5**	**0.5**	**11**
15	**0**	**0.8**	**5**	**12**
1.25	**8**	**0.75**	**1**	**-2**
-4	**6**	**20**	**2.5**	**9**

Download table as a PDF

You might like to browse the Calculator Activities for lower and upper KS2.

We hope that this article has inspired you to make a mathematical use of your classroom calculators that doesn't involve calculating! If there is any area of history that you would like us to make mathematical links to, please let us know.

Explore further!
If you've enjoyed this article, don't forget you can find all previous *A little bit of history* features in our archive, sorted into categories: *Ancient Number Systems*, *History of our measurements*, *Famous mathematicians*, and *Topical history*.

Image credits
Page header (adapted) by Crispin Semmens, some rights reserved
Vintage Casio Pocket-Mini (adapted) by Joe Haupt, some rights reserved
TI Calculator Spread by ajmexico, some rights reserved

Maths to share – CPD for your school

This is the second of our series of four explorations of ways in which you can help your children to develop their conceptual understanding of the four operations. In Issue 58 we looked at addition, and in this issue we explore subtraction. For more about this operation see Issue 24, which explores the basics of this concept. In this issue we will focus on the development of the written columnar method.

As we mentioned in the last issue, the National Curriculum requires teachers to teach addition and subtraction of numbers with up to 3 digits, using formal written methods of columnar addition and subtraction from Year 3.

For the meeting you will need equipment such as straws and base ten equipment. If you have them, place value counters would be helpful or simply sets of three different coloured counters to represent hundreds, tens and ones.

Begin your staff meeting by writing these calculations on the board:

167 - 145

267 - 259

378 - 199

3241 - 2167

Give colleagues a few minutes to discuss ways to solve each calculation. Take feedback, discussing the different strategies they have used.

There are several ways to answer these calculations, including some efficient mental calculation strategies. It might be worth highlighting the more obvious methods, such as:

167 - 145: sequencing by keeping 167 whole and partitioning the second number to subtract 100, then 40 and finally 5

267 - 259: counting on from 259 to 267

378 - 199: subtracting 200 and adjusting

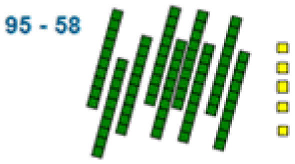
3241 - 2167: this may best be answered using the column method

Ideally, we would all want our children to develop the ability to look at a calculation and decide which method is the appropriate one to use for subtracting the numbers. Sometimes it might be that a mental calculation strategy is the most efficient - sometimes it might be the column method. Remind colleagues that this means teaching mental calculation strategies remains important. In the notes and guidance section of the National Curriculum for each year group there is an expectation that children use mental calculation strategies. For example, in Year 6 it states that 'they undertake mental calculations with increasingly large numbers and more complex calculations'.

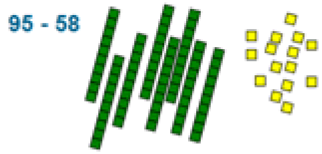
You might like to follow some of the suggestions for oral and mental starter activities from Issue 47 to recap and rehearse some of the strategies the children need to learn

As with addition, when teaching the column method it is probably wise to begin with a simple calculation, such as 95 – 58, and model the approach in a similar way to this…

Ask colleagues to make 95 using the equipment that you have available. If possible they should explore this with straws, base ten and counters. If you are using different coloured counters assign a different place value to each and tell colleagues what each colour represents.



Now ask them to subtract 58 from the 95 beginning with the ones. Agree that there are not sufficient ones to do this so a ten must be exchanged. Ask colleagues to take a ten and exchange it for ten ones and then continue the subtraction. Explain that after exchanging the number 95 has been re-partitioned into 80 15.



You could lead a discussion on how this links with the partitioning method:

90	5	80	15
-50	8	-50	8

Next, model the column method using the manipulatives and ask colleagues to consider how each of the models above link to this method:

$$\begin{array}{r} {}^{8}\not{9}\,{}^{1}5 \\ 5\ 8 \\ \hline 3\ 7 \end{array}$$

Ask colleagues to tell you what is the same and what is different about these methods. This is a great question to ask the children, helping to develop their reasoning skills. It is important to stress that the children's recording needs to be developed alongside the kinaesthetic manipulation of whatever resources they use.

You could play this game to show colleagues how to introduce the idea of exchange to their children:

Try this with place value counters or Dienes:
Make 50 using tens counters or Dienes sticks
Throw the dice
Subtract that number of ones (they will need to exchange)
Keep going exchanging every time you need to
First person to get rid of all their counters is the winner

Lead a discussion on which manipulatives to use in which year group. Is there a progression? It might be that straws are best used in KS1 so that children can see and feel the actual numbers they are working with. Dienes might come next as it is a representation that can be linked easily to hundreds, tens and ones by the divisions on the pieces of equipment. Place value counters could be used when the children have an understanding of the size of hundreds, tens and ones and can cope with a more abstract representation.

You might like to show these two video clips that have been produced by the NCETM.

'Developing the column method' shows a Year 4 class using base ten apparatus to develop their understanding of exchange for subtraction.

'Column subtraction' shows a Year 6 class developing their conceptual understanding of the column method through their exploration of the similarities and differences between this method and partitioning and the use of place value counters.

Finish the meeting by asking colleagues to use the different manipulatives to solve these problems:

- Sophie scored 227 points on the computer game. Nafisat scored 158. How many more points did Sophie score?
- Ben had 364 stamps in his stamp collection. Adnaan had 276. How many more stamps did Ben have?

As they solve the problems ask colleague to consider

- How well can the manipulatives help children to solve the problems?
- How well do the manipulatives help to move pupils towards written methods?

Encourage colleagues in KS1 to use straw bundles to take away a smaller number that involves exchanging a bundle of 10 for ones. Encourage colleagues in Years 3 and 4 to use manipulatives for moving from the more informal methods to the column method. For older children who currently use the column method for subtraction, encourage colleagues to give them manipulatives in order to explain how their written method works. This is a good assessment opportunity to find out if they really understand the procedure that they use.

Ask colleagues to be prepared to share what happened at a future meeting.

If you decide to use it for staff professional development, please let us know - we'd love to hear what you did.

Explore further!
If you've enjoyed this article, don't forget you can find all previous *Maths to share* features in our archive, sorted into categories, including *Calculation*, *Exploring reports and research*, and *Pedagogy*.

Image credit
Page header by Ludovico Sinz, some rights reserved