Primary
& Early Years
Magazine 62

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to Issue 62 of the Primary Magazine. In this issue, The Art of Mathematics features the Romanian artist Constantin Brancusi, and in A Little Bit of History we feature Queen Victoria. Focus On... begins a series on mathematics outside the classroom, and Maths to Share looks at place value.

Contents

Editor's extras

The National Curriculum

Have you visited the new National Curriculum area of our website yet? If not it is well worth exploring. You will find progression maps for each area of mathematics, useful material for all year groups from 1 to 6, videos and links to useful and appropriate parts of the NCETM website.

As part of this support we have added a further 44 videos to our existing suite of 16 videos showing teaching in primary (and some secondary) classrooms, focusing on calculation, fractions, algebra and division, and the associated skills and understanding. 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. The initial suite of 16 videos is also available on a new DVD, which gathers together, in one convenient place, all relevant video material currently on the website, together with a complementary PowerPoint presentation, containing notes to stimulate thought and discussion among teachers in CPD situations. Find out more, and details of how to order your copy, here.

The NCETM Professional Development Lead Support Programme (PDLSP)

The NCETM's Professional Development Lead Support Programme (PDLSP), in its current form, will, as planned, be changing during the 2014 summer term. Since the launch of the programme, over 800 individuals, working in schools, universities, local authorities and with private CPD providers, have been enrolled, and participated in two days of face-to-face professional development, separated by an interim PD leadership task back at their workplace. By the end of this year, the vast majority will have acquired accredited status as NCETM PD Leads.

This community of PD Leads will have a key role to play in the emerging network of Maths Hubs (see also below) across the country. The NCETM will continue to coordinate ongoing communication with, and within, this community, and work hard to broker constructive links between all PD Leads and the leadership of the hubs.

In this context, the NCETM's online community available to accredited PD Leads, and the bi-annual dedicated newsletters will continue as before, and new methods of enabling this network to continue its collaborative work are also likely to emerge.

Central to the success of the hubs over time will also be the identification and development of colleagues who will take on maths-specific CPD leadership roles in the future. To this end, acting centrally, the NCETM will work with the hubs to lead revised training and accreditation programmes for PD Leads, according to the priorities identified by the hubs.

Maths Hubs update

The Maths Hubs programme is a new initiative designed to build on the excellent practice and achievement that already exists widely - but not universally - across the school and college system. It was proposed by the NCETM, with initial funding guaranteed by the Department for Education (DfE). The Maths Hubs will provide the strategic local leadership to ensure all schools receive the tailored maths education support they need. It is a new way of harnessing all maths teaching expertise in an area, to spread excellent practice even more widely, for the benefit of all pupils and students. If you are interested in reading more about them, visit our Maths Hubs microsite.

Expressions of Interest in becoming a lead school for one of the hubs must be emailed by 5pm on Wednesday 9 April to mathshubs@ncetm.org.uk.

Applicants successful at the Expression of Interest stage will be notified in the week beginning Monday 21 April and will be required to submit their full application by Wednesday 21 May. Successful applicants will then be announced in early June.

And finally…

You might be interested in attending Practitioner research in mathematics education – a one-day event on 12 July, convened by British Educational Research Association (BERA) in collaboration with the British Society for the Research into Learning Mathematics (BSRLM).

The Art of Mathematics
Constantin Brancusi

Constantin Brancusi (19 February 1876 - 16 March 1957) was a Romanian sculptor probably best known for his sculptures *The Kiss* and *The Endless Column* (*Coloana Infinitulu*). He was considered to be a pioneer of modernism (a style of art, architecture, literature, etc, that uses ideas and methods which are very different from those used previously). He is known as the patriarch of modern sculpture.

Constantin grew up in the village of Hobita Gori near Târgu Jiu close to Romania's Carpathian Mountains. It was, and still is, an area known for its rich tradition of folk crafts, particularly woodcarving. His parents, Nicolae and Maria Brâncusi were poor peasants who worked very hard for very little money. When he was seven, Constantin began herding the family's flock of sheep. He often ran away from home because his father and older brothers bullied him. From an early age he showed a talent for carving objects out of wood.

At the age of nine, Constantin left his village to work in the nearest large town. At 11 he went into the service of a grocer in Slatina and then he became a domestic in a public house in Craiova where he remained for several years. When he was 18, Constantin created a violin by hand with materials he found around his workplace. Impressed by his talent for carving, a local man suggested that he enrolled into the Craiova School of Arts and Crafts. He did and pursued his love for woodworking. He graduated with honours in 1898. He then went to the Bucharest School of Fine Art where he received training in sculpture. He worked hard while there and very quickly showed his talent. One of his earliest works was a statue of a man with his skin removed to show the muscles underneath. This began his style of revealing the essence of the subjects he sculpted rather than just copying their outward appearance.

In 1903, Constantin travelled to Munich, and then to France, where he worked for two years in the workshop of Antonin Mercie of the École des Beaux-Arts in Paris. He was then asked to work with Augusta Rodin which he did for just a few months. He admired Rodin hugely but felt that working with him wouldn't be beneficial to his career in the long term. After leaving Rodin, Constantin began developing the style that he became known for. He also began doing more carving and by 1908 he worked almost exclusively by carving. His work became popular in France, Romania and the United States.

Endless Column

By 1933 he had achieved worldwide fame which brought him various commissions including the World War I ensemble in Târgu-Jiu the town close to where he grew up. *Table of Silence*, *The Gate of the Kiss* and *Endless Column* commemorate the courage and sacrifice of Romanian civilians who fought off a German invasion in 1916. These proved to be the climax of his career. In the remaining 19 years of his life, he created a few pieces, but most of these were reworks of earlier sculptures.

As his fame grew, he began to withdraw from public life. Although he left Romania when he was young, he never forgot his roots. He always dressed in the simple ways Romanian peasants did. His studio looked like a Romanian peasant's house. There was a slab of rock as a table and all the other furniture was carved, by him, out of wood. He cooked traditional Romanian food. He was interested in many things from science to music. He was a good violinist and would sing Romanian folk songs. He had many friends, some from the Romanian community in Paris. He was often homesick but never considered moving back to Romania. He enjoyed cigarettes, good wine and the company of women. He never married but had one child, John Moore, whom he never acknowledged.

He was cared for in his later years by a Romanian refugee couple and became a French citizen in order to make them his heirs.

Information sourced from:

- Wikipedia.

Now for some mathematics!

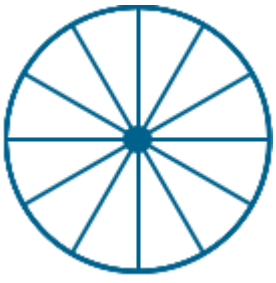
Constantin's sculptures lend themselves to geometry, so make sure you have lots of shape equipment, paper, plasticine, interlocking cubes and so on available!

Show Fish (Poisson)

This sculpture is 934mm x 502mm x 502mm in size. Ask the children to convert these measurements to centimetres and millimetres and then just centimetres. Can they visualise the height of the sculpture? You could ask them to measure it exactly using one or more rulers. Ask the children to round the dimensions to the nearest 100mm. They then scale them down by dividing each measurement by 10. They could sketch a drawing of the sculpture to this size on paper to get a feel for the size. Can they make a box that it could be put into? This would be a good opportunity to explore nets of cuboids with some accurate measuring. You could first ask the children to make a cuboid out of plasticine and to imagine pulling the sides down to open it up, sketch what they see and then draw a net to the size they think is necessary for their box.

What shapes can they see on the sculpture? Can they see the ellipse, circle, cylinder? What can they tell you about an ellipse? How many lines of symmetry does one have? What about a circle? What are the properties of a cylinder?

They could draw a circle by drawing lines of equal length through a central point, ensuring that the point is always half way along each line:



Alternatively, they could use a pair of compasses or they could draw their circle by tying a piece of string round a pencil and pinning the other end of the string to paper (for the centre) and then take the pencil for 'a walk'. They could draw an ellipse in a similar way but use two pins that are about four centimetres apart. They loop the string around these and put the pencil in the loop, make the string taut and then 'walk' the pencil.

The children could then use modelling clay to make a copy of the sculpture scaling down the dimensions in whatever way they choose. They could use their circles as templates to make thin card cylinders for the top and base of the sculpture. Encourage them to make a 3D shape such as a square based pyramid out of card for the 'fish'. Of course they would need to create its net first!

Show Adam and Eve (Adam et Eve)

This sculpture measures 238.8cm x 47.6cm x 46.4cm. Ask the children to convert these measurements to metres, centimetres and millimetres and then round to the nearest centimetre and convert to metres. Ask them to work out how much taller it is than the 'The Fish'. Which unit will they need to use to compare easily? They could scale the measurements down and sketch it.

What 3D and 2D shapes can they see? Use this as an opportunity to explore the properties of a cuboid and a hemisphere. Do this in terms of numbers of plane faces/curved surfaces, edges, vertices and the shapes of the faces. What would the children be able to make if they had two identical hemispheres and put them together circular face to circular face? Discuss where they would see these things in real life. What do they think the shape that looks a little like a cake with a slice cut out of it might be if it was complete? Agree that it could be a circular prism. Demonstrate that a prism has the same shaped cross-section and it does at both ends. Ask the children to find other prisms around the classroom. This could lead into an exploration of triangular prisms, cubes, cuboids, pentagonal and hexagonal pyramids. The children could describe their properties and make some.

You could give them this investigation:

Give the children actual prisms or ask them to visualise beginning with a triangular one. How many faces does it have? (5) How many edges? (9) How many vertices? (6). Repeat for a cube or cuboid: 6 faces, 12 edges, 8 vertices. Repeat for a pentagonal prism: 7 faces, 15 edges, 10 vertices. Finally repeat for a hexagonal prism: 8 faces, 18 edges, 12 vertices. Ask them to look for a pattern in their results and to use this to work out the number of faces, edges and vertices on an octagonal prism and then a 100 sided prism. You could finish the investigation by asking them to work out the formula for an 'n' sided shape. Hopefully some will notice that the number of faces is two more than the sides on one face, the number of edges is three times and the number of vertices is twice the number of sides on one face. The formula for an 'n' sided shape is therefore: faces = n+2, edges = 3n and vertices = 2n.

What markings can the children see on the sculpture? Can they see the parallel lines? Discuss what 2D shapes have parallel sides? Ask them to draw a square and a rectangle. Next discuss why it is not possible for triangles to have parallel sides. What regular shapes have parallel sides? Can they make a generalisation? Ask them to draw a selection of irregular shapes with at least one pair of parallel sides.

The children could make a model of the sculpture from modelling clay and mark it in the same way as Constantin did on his sculpture.

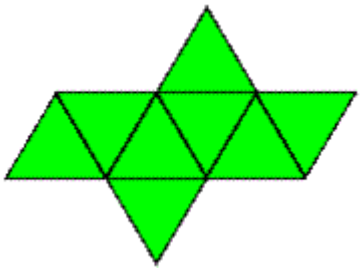
Show Endless Column

Endless Column measures 203.2cm x 25.1cm x 24.5cm. You could repeat the measuring activities for the other two sculptures. A version of this sculpture was part of the World War I ensemble in Târgu-Jiu. You could show a picture of this from the internet. Ask the children to research its dimensions.

What shape do they think could have been used to make this? Agree that it could have been an octahedron. What two shapes could be put together to make an octahedron? Give the children some plasticine and ask them to make a square based pyramid. They then put their pyramid with the one made by a partner to make an octahedron. Did it work? If not, why do they think this is? Agree that the pyramids need to be the same size. You could give the children the opportunity to make two square based

pyramids the same size and stick them together to make an octahedron. They could work in small groups, decide what to do to fix their octahedrons together to make a sculpture like 'Endless Column'. You could have a competition to see which group can make the tallest. They could then order their results. The class could estimate and measure how tall each is. They could then work out the differences in their heights and what the total height would be if all the sculptures were stuck together.

Can the children work out the net of an octahedron? First establish that these shapes have eight triangular faces. Let them explore this idea and see if they can come up with several options and then make them. There are 11 in total. Here is an example:



They could make octahedrons out of other materials such as straws and hang them in the classroom.

The ideas here are just to give you a taster of the mathematical activities that could be involved when looking at artists such as Constantin Brancusi. 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*.

Focus on…
Maths and Geography - making connections

We recently had a request from a reader for an article or series of articles on mathematics outside the classroom for the EYFS. So, as the weather is gradually beginning to improve, we are doing just that! The Mathematical Association (MA) has kindly given us permission to reproduce some of the articles written for their publications. In this issue, look at one from *Primary Mathematics*, Summer 2010 (Volume 14, Issue 2) which makes connections between mathematics and geography - outside the classroom. In her article, Jane Whittle describes activities that can be carried out by all children in the EYFS, KS1 and KS2.

- read Maths and Geography - making connections

We hope that you found this article helpful. Many thanks to the MA for allowing us to make use of Jane's article. You might be interested in finding out more about the MA and other mathematics subject associations. If so, we have information about all of them and the benefits of joining. You might also be interested in exploring our Learning Maths outside the Classroom microsite: some of the articles here will feature in future issues of *Focus on...*

We hope that you found the series interesting. If you have anything you would like to share with us, please let us know.

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 programmes of study for history in the national curriculum suggest that children in KS1 should be taught about:

- *events beyond living memory that are significant nationally or globally [for example, the Great Fire of London, the first aeroplane flight or events commemorated through festivals or anniversaries]*
- *the lives of significant individuals in the past who have contributed to national and international achievements. Some should be used to compare aspects of life in different periods [for example, Elizabeth I and Queen Victoria, Christopher Columbus and Neil Armstrong, William Caxton and Tim Berners-Lee, Pieter Bruegel the Elder and LS Lowry, Rosa Parks and Emily Davison, Mary Seacole and/or Florence Nightingale and Edith Cavell]*

A little bit of history has featured articles on The Great Fire of London, Christopher Columbus, Florence Nightingale and Mary Seacole, and Neil Armstrong.

The Art of Mathematics has featured articles on Pieter Bruegel the Elder and L S Lowry.

You might be interested in these: they consist of a brief history of the person or event, followed by suggestions for mathematical links that you can make.

In this issue, we begin a series looking at some of the other historical topics that are included in the history programmes of study. We begin with a brief look at Queen Victoria: this will link well with our feature on The Victorians from Issue 31.

Queen Victoria was born on 24 May 1819 and was the queen of the UK and all of Ireland from 1 May 1837 until her death on 22 January 1901.

Ask the children to work out for how long Queen Victoria reigned. They could do this approximately in years or more precisely in years, months and days. They could then compare their answer with the number of years Queen Elizabeth II has been on the throne and work out how many years she has to reign to be queen for the same length of time. You could ask them to work out at what age Victoria become queen?

As well as the title of Queen she also had the title of Empress of India.

You could ask the children to find out where India is using a map or atlas. They could make a mathematical fact file about India that includes information about population, rainfall, temperature and currency. They could make conversion table showing how many rupees are the same as different numbers of pounds, e.g.100 rupees is about £1 so 200 rupees is about £2. This would be a good way to rehearse scaling.

Queen Victoria was the daughter of Prince Edward, Duke of Kent and Strathearn, the fourth son of King George III. Both her father and King George III died in 1820, and Victoria was raised under the close supervision of her German born mother. She inherited the throne after her father's three elder brothers had all died.

You could print out the House of Hanover part of the King Alfred's family tree and ask the children to find Victoria's father, George III and other kings from that House. They could do some mathematics around the birth and death dates of some of the people listed using a counting on strategy along a number line. Can they find out from this family tree who Victoria married and how many children they had?

Victoria and Prince Albert were married in 1840 and were together until he died from typhoid fever in 1861. After his death, Victoria went into mourning and avoided public appearances. She became known as the Widow of Windsor. As a result of her seclusion, republicanism (a movement to remove the monarchy) gained strength. In the latter half of her reign her popularity recovered, and her Golden and Diamond Jubilees were times of great public celebration.

Queen Victoria's Diamond Jubilee, 1837 - 1897

Ask the children to work out when Queen Victoria's Golden and Diamond Jubilees occurred from the knowledge of when she began her reign.

Victoria's reign was longer than any other British monarch and the longest of any female in history. This period of history became known as the Victorian era.

You could print out the whole of the Royal family tree from the time of King Alfred and ask the children to find out how long the reigns of all the kings and queens of England were and compare these with the reign of Victoria.

Victoria described her childhood as 'rather melancholy'. Her mother was extremely protective, and devised a set of rules which meant she was mostly isolated from other children. These rules were known as the 'Kensington System'. Under them she was also prevented from meeting people her mother decided were undesirable. These people included most of her father's family. Victoria's mother and her friend Conroy appeared to want Victoria to be weak and dependent on them. Victoria shared a bedroom with her mother every night. She studied with private tutors, her lessons included French, German, Italian and Latin. She spent her free time with her dolls and her King Charles spaniel, Dash. For five consecutive years she was also made to take trips around England and Wales to make public appearances which she really disliked.

On 20 June 1837, William IV died at the age of 71, and Victoria became Queen of the United Kingdom. In her diary she wrote:

> 'I was awoke at 6 o'clock by Mamma, who told me the Archbishop of Canterbury and Lord Conyngham were here and wished to see me. I got out of bed and went into my sitting-room (only in my dressing gown) and alone, and saw them. Lord Conyngham then acquainted me that my poor Uncle, the King, was no more, and had expired at 12 minutes past 2 this morning, and consequently that I am Queen.'

Queen Victoria

Her coronation took place on 28 June 1838, and she became the first sovereign to take up residence in Buckingham Palace. Although she was queen, Victoria was also an unmarried young woman and was therefore required by social convention to live with her mother. Victoria was not happy about that because of the Kensington System routine, so she gave her mother to a remote apartment in Buckingham Palace, and Victoria often refused to meet her. The only way out of this predicament was to marry. When Victoria was 17 she had been introduced to Albert and had liked him, but wasn't ready to marry. Eventually, on 15 October 1839, possibly because of the predicament with her mother, she proposed to him! They were married on 10 February 1840. Victoria was by then besotted with him. She spent the evening after their wedding lying down with a headache, and wrote this in her diary:

> 'I never, never spent such an evening!!! My dearest dearest dear Albert ... his excessive love & affection gave me feelings of heavenly love & happiness I never could have hoped to have felt before! He clasped me in his arms, & we kissed each other again & again! His beauty, his sweetness & gentleness – really how can I ever be thankful enough to have

such a husband! ... to be called by names of tenderness, I have never yet heard used to me before – was bliss beyond belief! Oh! This was the happiest day of my life!'

Albert became Victoria's political adviser as well as her companion. Her mother was evicted from the palace. In later years through Albert's mediation, relations between Victoria and her mother slowly improved. After her mother died In March 1861, Victoria read some of her papers and discovered that she had loved Victoria deeply. She was heart-broken, blaming Conroy for estranging her from her mother. During this time of her mourning, Albert took on most of her duties despite being ill with chronic stomach trouble.

Victoria and Albert began their family shortly after they married. Despite hating being pregnant, viewing breastfeeding with disgust and thinking that new born babies were ugly, she had nine children: Victoria, (b. 1840), Albert Edward, Prince of Wales (b. 1841), Alice (b. 1843), Alfred (b. 1844), Helena (b. 1846), Louise (b. 1848), Arthur (b. 1850), Leopold (b. 1853) and Beatrice (b. 1857). When Victoria gave birth to Leopold she was given a new anaesthetic, chloroform, which took most of the pain away. She used it again when she had Beatrice. The church disapproved as they believed this was against biblical teaching and the medical profession also disapproved because they thought it was dangerous! It is thought that she may have suffered from post-natal depression.

Many events happened during her reign including:

- several attempts at her assassination
- the potato blight in Ireland which labelled her as the 'Famine Queen'
- the Crimean War.

During her reign she had many Prime Ministers:

Year	Prime Minister
1835	Viscount Melbourne
1841	Sir Robert Peel
1846	Lord John Russell
1852 (Feb)	Earl of Derby
1852 (Dec)	Earl of Aberdeen
1855	Viscount Palmerston
1858	Earl of Derby
1859	Viscount Palmerston
1865	Earl Russell
1866	Earl of Derby
1868 (Feb)	Benjamin Disraeli
1868 (Dec)	William Gladstone
1874	Benjamin Disraeli
1880	William Gladstone
1885	Marquess of Salisbury
1886 (Feb)	William Gladstone
1886 (July)	Marquess of Salisbury
1892	William Gladstone
1894	Earl of Rosebery
1895	Marquess of Salisbury

You could print out the list above, give it to the children and ask them to find out how many times some of these men were Prime Minister, and how many years in total each was in power.

During a revolutionary scare in the United Kingdom in April 1848, Victoria and her family left London for Osborne House, a private estate on the Isle of Wight that they had purchased in 1845 and redeveloped.

You could ask the children to look on the internet and find any mathematical facts that they can about Osborne House and the Isle of Wight.

After Albert's death, Victoria relied increasingly on John Brown, a manservant from Scotland. Rumours of a romantic connection and even a secret marriage appeared in print, and the Queen was referred to as 'Mrs Brown'. The story of their relationship was the subject of the 1997 film Mrs Brown. Queen Victoria outlived her husband, some of her children and John Brown. She died on 22 January 1901 at the age of 81. She was succeeded by her eldest son King Edward VII.


Full length portrait of Her Majesty Queen Victoria

Around the world, places and memorials have been dedicated to her, especially in the Commonwealth nations, including the capital of the Seychelles, Africa's largest lake, Victoria Falls, the capitals of British Columbia and Saskatchewan and two Australian States (Victoria and Queensland). The Victoria Cross was introduced in 1856 to reward acts of valour during the Crimean War and it remains the highest British, Canadian, Australian, and New Zealand award for bravery. Victoria Day is a Canadian statutory holiday and a local public holiday in parts of Scotland celebrated on the last Monday before or on 24 May, Queen Victoria's birthday.

Information sourced from Wikipedia.

If you would like to find out more about Queen Victoria, you could visit the website of the British Monarchy and the BBC History website.

We hope that this article will be helpful if you study Queen Victoria with your children. 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*.

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Full length portrait of Her Majesty Queen Victoria by LibraryArchives, some rights reserved

3000	4000	5000	6000	7000
300	400	500	600	700
30	40	50	60	70
3	4	5	6	7
0.3	0.4	0.5	0.6	0.7
0.03	0.04	0.05	0.06	0.07
0.003	0.004	0.005	0.006	0.007

Maths to share – CPD for your school

Place value

In this issue of *Maths to Share* we look at the importance of gaining a conceptual understanding of place value and give ideas on how this can be achieved. During the meeting colleagues will need copies of the Number and Place Value strand of the national curriculum for mathematics.

Ask colleagues to explore the Numbers and Place Value strand of the national curriculum document and highlight area that involve the teaching of place value. After a few minutes to explore take feedback and highlight the following:

Year 1

Although nothing is specifically mentioned in the requirements for Year 1, the notes and guidance state that:

> *Pupils begin to recognise place value in numbers beyond 20 by reading, writing, counting and comparing numbers up to 100, supported by objects and pictorial representations.*

Year 2

In Year 2 the requirements state that pupils should be taught to:

- recognise the place value of each digit in a two-digit number (10s, 1s)
- compare and order numbers from 0 up to 100; use <, > and = signs

The notes and guidance suggest that they should also begin to understand 0 as a place holder.

Year 3

In Year 3 the requirements say that teachers should teach children to:

- recognise the place value of each digit in a 3-digit number (100s, 10s, 1s)
- compare and order numbers up to 1,000
- identify, represent and estimate numbers using different representations

Year 4

In Year 4 the requirements say that teachers should teach children to:

- find 1,000 more or less than a given number
- recognise the place value of each digit in a four-digit number (1,000s, 100s, 10s, and 1s)
- order and compare numbers beyond 1,000
- round any number to the nearest 10, 100 or 1,000
- solve number and practical problems that involve all of the above and with increasingly large positive numbers

Year 5

In Year 5 children should be taught to:

- read, write, order and compare numbers to at least 1 000 000 and determine the value of each digit
- round any number up to 1 000 000 to the nearest 10, 100, 1,000, 10 000 and 100 000
- solve number problems and practical problems that involve all of the above

Year 6

In Year 6 children should be taught to:

- read, write, order and compare numbers up to 10 000 000 and determine the value of each digit
- round any whole number to a required degree of accuracy
- solve number and practical problems that involve all of the above

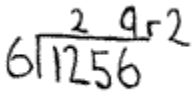
Discuss the importance of place value:

- is there more to place value than simply partitioning and recombining numbers?
- in which areas of mathematics is it crucial that children have a good understanding of this?

Agree that place value is important for all four operations, for estimating and rounding, for multiplying and dividing by powers of 10 and that there is far more to it than partitioning and recombining numbers.

You could inform colleagues of a piece of research carried out and published in 2010 by the National Strategies: primary, entitled 'Children who get 'stuck' at level 2C'. The researchers found that children who achieved a 2C at the end of Year 2 were unlikely to achieve a secure Level 4 by the end of primary school which meant that they were unlikely to achieve a good grade at GCSE and this in turn would have a 'profound impact on their future life choices'. A common area of difficulty with children working at this level was their lack of understanding of place value.

You could also share this example from research by Julia Anghileri, Meindert Beishuizen and Kees Van Putten (2001) from Informal Strategies to Structured Procedures: MIND THE GAP! *Educational Studies in Mathematics 49: 149–170, 2002* which clearly shows a lack of understanding of place value. Ask colleagues to work out what the child knows and what they don't understand.



You could ask staff to think of examples of calculations that children have made errors with due to lack of understanding of place value. Alternatively, you could share these:

36	45	35	248
+ 47	-37	x3	x25
101	12	915	1240
3			496
			1736

Ask colleagues to work out what the children have done wrong.

Sharon Ross in her article 'Place value: Problem solving and written assessment' published in Teaching Children Mathematics, March 2002 says 'Elementary school children have traditionally found place value to be difficult to learn, and their teachers have found it difficult to teach. Understanding place value requires a child to make connections among and sense of a highly complex system for symbolizing quantities.'

She suggests that there are four key properties that children need to understand:

- positional property
- multiplicative property
- additive property
- base-ten property.

Give colleagues a few minutes to talk to each other about what they think each property actually is.

Go through each using this number:

1000	100	10	1
7	5	6	8

Positional property: the values represented by individual digits in the whole number i.e. the 7 is in the thousands position, the 5 is in the hundreds, the 6 is in the tens and the 8 in the ones.

Multiplicative property: the value of an individual number which is found by multiplying the face value of the digit by its position i.e. 7 x 1000 is 7000, 5 x 500 is 500, 6 x 10 is 60 and 8 x 1 is 8

Additive property: the quantity represented by adding the individual numbers together i.e. 7000 + 500 + 60 + 8 = 7568.

Base-ten property: the values of the positions increase in powers of ten from right to left.

Ask colleagues to reflect on their teaching of place value. Do they give frequent opportunities for their children to rehearse all these properties or is the main focus of their teaching the additive property?

Spend a few minutes considering mental and formal written methods for calculation. Ask colleagues to answer 2456 + 1582 using sequencing (2456 + 1000 + 500 + 80 + 2). Then ask them to solve the calculation using the formal written method for addition. Repeat for subtraction (2456 - 1582) in the same way. Ask them to answer 359 x 7 using the grid method and then the formal written method. Finally ask them to answer 8952 ÷ 8 using grouping (beginning with the greatest multiple of 8 as possible) and then the formal written method.

Which properties do the mental calculation strategies focus on? What about the formal written methods? Most mental calculation strategies focus on the multiplicative properties of place value and the formal written methods focus on the positional properties. So children need to be confident in both to be successful in both.

Do any children refer to multiplying by ten as adding a zero? Discuss why this is not helpful with particular reference to the base-ten property and decimals, for example, if teachers allow children to

think that when they multiply by 10, they add zero when they come to multiply decimals by 10, for example, 1.5 x 10 they will get the same number with a zero at the end!

So, what can we do to support children in developing their understanding of place value?

Here are a few ideas:

- we could make sure that we show quantities, for example, 56 using manipulatives such as bundles of 10 straws and ones or base-ten equipment. We could then show the appropriate partitioning cards, explaining that there are five tens which is 50 and six ones which is 6. Add these together to make 56
- we could give each child a Gattegno place value chart and ask them to take their finger for a walk, for example: put your finger on 6, add 3, multiply by 10, take away 50, divide by 100. Where are you? You could demonstrate this with colleagues. Simpler place value charts with tens and ones and then hundreds, tens and ones rows are suitable for children in Year 1 and Year 2
- give children a powers of ten grid and a set of digit cards with extra zeroes. Ask them to make 32 and place it in the grid. They then, for example, multiply it by ten, move the cards to the appropriate position and add zero. They could then multiply this by ten again and then divide by 1000.

Finish the session by discussing what needs to be put in place in school, and possibly into your calculation policy - to ensure that all children are given opportunities to explore the properties of place value discussed to enable them to develop a conceptual understanding of this really important area of mathematics.

We hope that you have found this article helpful. If you decide to use it for staff professional development, please let us know - we'd love to hear what you did.

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