Primary Magazine

Issue 11

National Centre for Excellence in the Teaching of Mathematics

Welcome to the 11th issue of the Primary Magazine.
In **Maths to share – CPD for your school**, we are focussing on teaching and learning through problem solving with mathematical reasoning.
Our **Up2d8 maths** provides opportunities for work on number lines and data handling, including finding averages, modes and ranges within the context of *Britain's Got Talent*.

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From the editor

The Final Report of Sir Jim Rose's Curriculum Review was published on 30 April 2009. It includes the proposed programmes of learning that would make up a new curriculum and the Essentials for Learning and Life that will be developed throughout the curriculum. The Review has reduced the content of the previous curriculum so that schools have greater flexibility to devise how it is taught in order to meet the pupils' individual needs and make it relevant to them and their school situation.

These are the key features of the Review:

- recognising the continuing importance of subjects and the essential knowledge, skills and understanding they represent
- providing a stronger focus on curriculum progression
- strengthening the focus on ensuring that by the age of seven, children have a secure grasp of the literacy and numeracy skills they need to make good progress thereafter
- strengthening the teaching and learning of ICT to enable them to be independent and confident users of technology by the end of primary education
- providing a greater emphasis on personal development through a more integrated and simpler framework for schools
- building stronger links between the Early Years Foundation Stage and Key Stage 1, and between Key Stage 2 and Key Stage 3, in offering exciting opportunities for learning languages for seven- to 11-year-olds.

You can explore the Review more thoroughly, and see the curriculum area of mathematical understanding in detail. If you want to make a formal response to the consultation you can visit the QCA website.

What will this mean for teachers? Do you think this review provides enough guidance on ways to bring mathematics into the other areas of learning? Do you think this, in reality, will happen or do you think mathematics will remain a discrete subject in many schools? Do you think more specific help in making mathematics an integral part of all learning should be provided and if so, how?
Please let us know by sharing your views in the Primary Forum.

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Up2d8 maths

The annual nationwide search for talent in Britain came onto our television screens again weekly, beginning in April, in the form of Britain's Got Talent. Many people, it seems, have been showing the world what they can – or can't - do, through YouTube this year! Some acts have been incredibly good and some incredibly bad. This month's Up2d8 shows one of the better ones, in the form of Susan Boyle, and asks the children to consider how she is different to other 'stars'. It provides some great mathematical opportunities for exploring data. This resource provides ideas that you can adapt to fit your classroom and your learners as appropriate.





In addition to the ideas on the spread, here are some more that you could adapt and try:

- ask the children to research the development of ICT from the first computers and to make a timeline to show this, including the World Wide Web, Google and YouTube
- ask them to find out about Ada Lovelace and why the first computer language was named after her
- make a survey of how many children and adults in your school use YouTube, finding the reasons why they do or do not use it
- organise a class or school talent show:
    - take a survey of the acts that the children would want to do and make graphic presentations of this - eg, on a bar chart or pictogram
    - repeat the idea above for a survey of the acts that the children think would make a good talent show to watch
    - make a programme for the show
    - design and make tickets and posters
    - work out how many tickets would be needed if the whole school were to be invited
    - sell tickets at 50p each – how much will be raised?
    - you could film the performances and sell copies for £2 each. Find out how much DVDs cost and how much profit will be made on each
    - organise refreshments – types, costs and quantities
    - work out the time the show should start and finish and how long each act should have to perform and then turn this into a timetable
    - in the EYFS, the children could mark each performance out of five.
- Make a list of the finalists and then a tally to show who the children favoured most, giving them two votes each. Discuss why they made their choices. You could ask them to represent this tally as a pictogram or bar chart.
- Who would they have voted for as the winner? Did they agree with the public? Rehearse ordinal numbers by making a class winners' list: 1st, 2nd, 3rd etc.



Click here to download the Up2d8 maths resource - in PowerPoint format.

Click here to download the Up2d8 maths resource - in PDF format.

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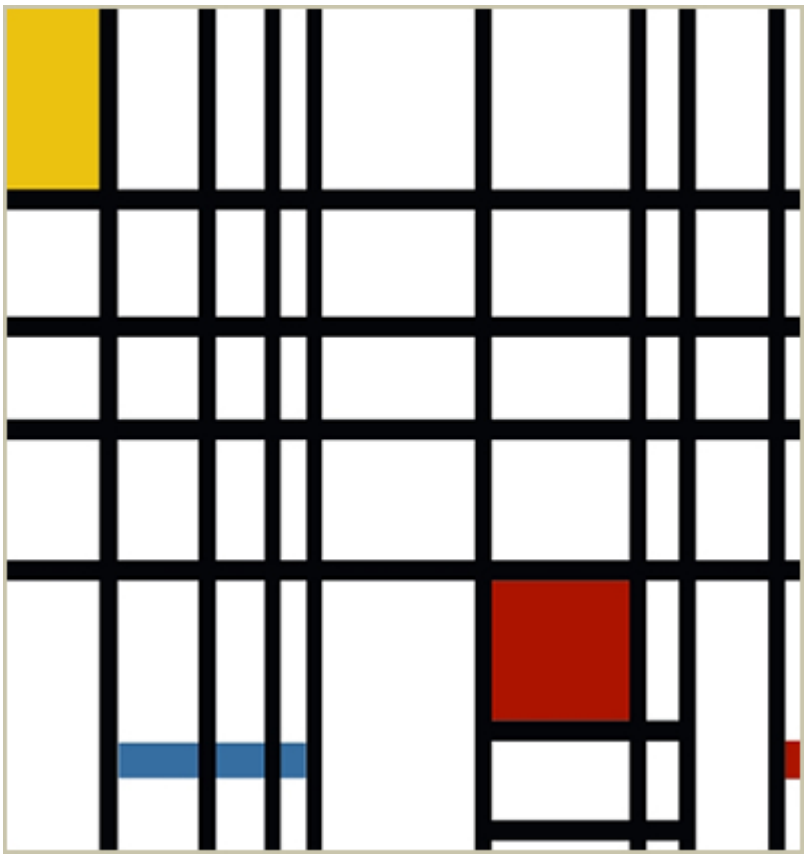
The Art of Mathematics

Piet Mondrian (1872 - 1944)

Piet Mondrian was born in 1872. He was part of a fairly large family of five children, with an older sister and three younger brothers. In 1892, he moved to Amsterdam to study at the Rijksakademie. He made his living by painting portraits, copying museum art and through the occasional commission. Mondrian submitted both still-life and landscapes to two artists' groups in Amsterdam. As time went on, he alternated between figurative and landscape work, experimenting with many different styles. In 1911, he moved to Paris where he encountered Cubism for the first time, a movement that was to lead him to produce a series of paintings featuring trees.

In 1914, Mondrian returned to Holland and continued his study of abstraction. He helped to develop a style known as Neo-Plasticism, a technique which restricted the use of shapes to rectangles and limited colours to black, white and grey, plus the primaries. Such works have a bare minimum of detail. In 1919, Mondrian again moved to Paris where he remained for 19 years. In 1931 he joined a group of abstract painters and sculptors known as Abstraction-Création. The group arranged exhibitions and published an annual of their works that usually centred on geometrical abstraction. With the outbreak of the Second World War in 1938, Mondrian moved to London and then two years later to New York. It was there that he developed a more energetic style inspired by his passion for jazz and dancing.



Mondrian is best known for his compositions using only vertical and horizontal lines at 90° angles, primary

colours and sometimes greys or black against a white background. The proportion of white increased as Mondrian continued to experiment with this style. Curved lines, three dimensions and representations are all absent from these works. His works are displayed in the Tate Gallery London, the Museum of Modern Art in New York City and in the Art Institute of Chicago and other galleries around the world.

His influence can be seen in industrial design and advertisements from the 1930s onwards. Piet Mondrian died of pneumonia in a New York hospital in 1944, aged 71.

You can find out more about Mondrian from Wikipedia.

Display *Composition with Yellow, Blue and Red* and give the children plenty of time to study the image. Ask the children what they notice. If necessary, develop their observations by asking if all the lines are the same thickness. Further questions could include: How are the lines arranged? What shape are the coloured blocks? What shape are the white blocks? This painting is a good way to introduce parallel and perpendicular lines.

The New York City Provenance Research Project has further examples form this period. Draw up a list together of the common features to help the children to create their own composition.

It is the apparent simplicity of his restricted palette of shape, line and colours that makes Piet Mondrian ideal for children to work 'in the style of'. Use white paper of varying sizes. Decide how many vertical and horizontal lines to use to break up the white background into rectangles. Lines (both thick and thin) can be drawn or painted, or use strips of black paper. Using strips of paper allows you to move the lines until you are happy with them. Fill some of the resulting rectangular spaces using the primary colours; red, blue and yellow but make sure there is more white than colour. Use paint or markers, though paint gives a more even, deeper colour. Alternatively use a computer drawing package. The results are spectacular. Here is a display by Year 2 children at Bignold Primary School, in Norwich:

If your children enjoy working 'in the style of Mondrian' as much as they did, then everyone is in for a fun time!

Mondrian's painting Komposition lends itself to an interesting exploration of simple fractions for KS2. Give pairs of children a small copy of the painting and some scissors. They cut out all the pieces and find those that are ¼ of the red square, those that are half the yellow oblong, those that are ⅛ of the red square and so on. As you do this, compare the fractions and find how many of the quarters/halves/eighths will make the whole, or a half and quarter as appropriate,

so developing the basics of equivalent fractions.

You could also use this as a vehicle for estimating lengths, perimeters and areas.
Another great activity involves asking the children to cut all the pieces out and make their own 'Mondrian', using the pieces to make their own design which has one line of symmetry. You may need to let them know that the line of symmetry will need to go through the shapes that are only there once. Let them have a think first though! Once they have made their design, you could use them to develop the concepts of rotation and translation.

You can find more examples of Mondrian's work to use as a mathematical stimulus from Google.

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Focus on…two birthdays a year?

Second to wishing it could be Christmas every day, most children would dream of having more than one birthday each year. Who is lucky enough for this to be the case? *Her Majesty the Queen of the United Kingdom of Great Britain and Northern Ireland, that's who*.

The Queen has two birthdays each year. She was born on 21 April in 1926, but has another, 'official' birthday in June. It is not a universally fixed day, but occurs on either the first, second or third Saturday in June, and is decided by the Government. This year, Her Majesty's official birthday is on 13 June. The occasion is marked by a parade known as 'Trooping the Colour'. It has been held for this purpose almost every year since 1748, and reminds us of when the colours (flags) of the battalion were carried (or 'trooped') down the ranks.

The website britroyals.com has a family tree of Queen Elizabeth II, as well as a family tree of the House of Windsor. An incredible amount of using and applying mathematics and activities linked to handling data can be drawn from using family trees – and what better tree to start with than that of the royal family!

Other 'royal' facts that could provide the stimulus for mathematical conversations in the classroom include:

- for the first seven years of her reign, Queen Elizabeth II's birthday was celebrated officially on the second Thursday of June. When midweek became inconvenient it was switched to Saturdays
- on 20 November 2007, Queen Elizabeth II became the first reigning monarch to have been married for 60 years
- on 21 December 2007, the Queen became the oldest reigning British monarch, having outlived her great-great-grandmother Queen Victoria, who died 22 January 1901, aged 81 years, 7 months and 29 days
- she will have to reign until 9 September 2015, when she will be 89 years old, to better Queen Victoria, who reigned for 63 years and 216 days from 1837 – 1901
- Queen Victoria was the great-great-grandmother to both the Queen and her husband, Prince Phillip.

You can find out more about the Queen and the rest of the royal family from these websites:

- Woodlands Junior School
- Britroyals.com
- The British Monarchy

A Department for Children, Schools and Families initiative to enhance professional development across mathematics teaching

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Starter of the Month

EYFS

Provide each child with a small clothes peg and a label on which to write their name. Display a set of 'month balloons' (a track of balloon shapes, labelled with the months of the year): examples can be downloaded from the sparklebox website. Read the months aloud and encourage the children to join in the chant. Ask for pupils who know in which month their birthday falls and invite them to peg their name onto the appropriate balloon string. Support those pupils who require prompting and continue until all names have been added.

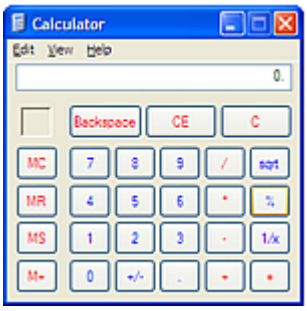
Discuss the results as a class. Which month has the most birthdays? Which month has the least? If they could have a second birthday each year (like the Queen), which month would they choose? Why?

KS1

Show children a basic fictional family tree, such as this one for 'The Simpsons'. Discuss the relationships between the different people in the tree. Ask questions such as, Who is Lisa's sister? Who is 'Herb'? or, If Bart had a new baby brother, where would he go on the tree? asking pupils to show with reference to the tree – not their general knowledge from hours of television viewing!

Now show them the blank family tree template. Explain that circles represent females and males are shown by squares. Read the clues as a class and try to fill in the other names. You may choose to partially complete the tree to simplify the task; a completed version of the family tree can be downloaded here.

KS2



Use a calculator where the display screen is visible to the whole class. This could be one designed to be used on the overhead projector, the Windows calculator (look in 'Accessories' under 'All programs' on the 'Start' menu), one built into interactive whiteboard software, or one available freely on the internet such as this one from Ambleweb.

Ask one of the children to write a birthday (day and month) on a small whiteboard and show it to the class. Do not let them show you. Without looking at the display, read the instructions below to the class, and allow the pupils to enter the steps, ensuring the '=' key is pressed after each step. When they have completed all nine of the steps, look at the display. Mentally divide the displayed number by 10, add 11, then divide by 100. The display will now show the month originally chosen, with the day after the decimal point. For example, 3.16 is 16 March. Explain that you are going to 'guess' the birthday they chose… and then amaze them when you are correct!

Provide the list of instructions for pupils, including the last three 'mental' steps, and allow them time to use their calculators and try out different dates. Does it always work? Can the instructions be adapted so that the answer reads day first, followed by the month? (swap 'day' and 'month' in the instructions!) Why does it always work? More able pupils may be able to write an algebraic expression to support their thinking.

Instructions:

- enter the number 7
- multiply by the month of your birth
- subtract 1
- multiply by 13
- add the day of your birth
- add 3
- multiply by 11
- subtract the month of your birth
- subtract the day of your birth

Mental steps:

- divide by 10
- add 11
- divide by 100
-

The starter ideas for KS1 involved family trees. If you would like to try one for KS2, you can find a good and quite challenging activity on the NRICH website.

A little bit of history

The history of weight
The complete history of weight is quite complex, so here is a potted version. For more details of what has been written, follow the web links at the end of this article.

The UK system for weighing came directly from the French. We began to adopt it in the 13th century. The world history of measuring weight, however, goes back much further. As with money and length, we go to the ancient Babylonians for our first glimpse of the introduction of weighing, particularly the introduction of standard weights.

The earliest weights seem to have been based on the objects being weighed, for example seeds and beans. These were a bit random as there was no standardisation. The Babylonians developed a standard weight for more accuracy. They compared the weights of objects with a set of stones kept specifically for this purpose. We know this because in the remains of some of their ancient cities archaeologists have found some of these stones which had clearly been finely shaped and polished.

Following the Babylonian stones as a standard weight, the Egyptians and the Greeks developed a lighter standard unit by using wheat seeds, which was very accurate for the times. This seed was known as the grain and has been used since that time until today, where it is still in use as a standard weight.

Next came the Arabs, who had small weight standards for gold, silver and precious stones. They used a small bean called a karob to weigh smaller items and this was the origin of the word carat which jewellers still use to weigh gems and precious metals – for example, gold rings that we might wear today.

Over the years, due to trading between different peoples from different countries, these methods for measuring weights mixed together. The Romans, through their trading routes, spread this throughout the known world at that time, adding some standard weights of their own. The pound, for example, originated as a Roman unit used throughout the Roman Empire. This pound was divided into 12 ounces, but many European merchants preferred to use a larger pound of 16 ounces, which eventually became the norm.

As far as the British system of weight is concerned, the oldest one dates back to Saxon times where a 12-ounce troy pound was used for weighing gold and silver coins. This system is still used today for gold and silver in financial markets. Our system has gone through many changes to get where it is now and some of the different units, for example ounces and pounds, have had different values over the last 1 000 years. There has only been one constant weight throughout the years and that is the basic unit, called the 'grain', which originated from those used by the Ancient Egyptians and Greeks. It has now become known as the troy grain.

Did you know…

- in 960, during the reign of Edgar the Peaceful, it was decreed that all weights must agree with those kept in London and Winchester
- in 1215, during the reign of King John, there was an agreement to have a national standard of weights and measures incorporated into the Magna Carta
- in 1266, during the reign of Henry III, an act was passed to establish more standard weights:
    - one penny in money should weigh the same as 32 grains of wheat
    - 20 pennies should make one ounce

-
  - 12 ounces should make one pound
  - eight pounds should be the weight of a gallon of wine.
- in 1352, during the reign of Edward III, 14 pounds became one stone, a value that is still in common use today
- in 1532, during the reign of Henry VIII, there was an act to say that butchers should sell their meat by 'haver du pois' weight, which is where we get our 'avoirdupois' the measurement system we have used ever since, courtesy of the French!
- cities in England had official standard weights and measures like these, dated 1754, which can be seen today in the Manchester Museum of Science and Industry:

Merchants' weights and measures would be checked against these to make sure they weren't trying to cheat their customers. You can find more photos of old weights we used to use here.

- in 1826, during the reign of George IV, the weights and measures act came into force, which established the imperial system we have used ever since
- during the 19th century there was a disagreement between the British and Americans concerning the larger weight units. The Americans weren't very impressed with the history of the British units and redefined their hundredweight to equal exactly 100 pounds, instead of our 112 pounds.

At one time we used the weights in this table:

avoirdupois weights	
16 drams	= 1 ounce
16 ounces	= 1 pound
7 pounds	= 1 clove
14 pounds	= 1 stone
28 pounds	= 1 tod
112 pounds	= 1 hundredweight
364 pounds	= 1 sack
2240 pounds	= 1 ton
2 stones	= 1 quarter
4 quarters	= 1 hundredweight
20 hundredweight	= 1 ton

Can you imagine teaching measures in those days?!

Old-fashioned scales, like these, would have been used as a means of weighing. They had metal weights which were balanced against the item being weighed.

In 1971 the UK went metric and it was expected at that time that all imperial measures would gradually disappear. That hasn't happened, because many British people wanted to keep their imperial weights. The European Commission has recently tired of waiting for us to give them up, and now says we can use some of them for as long we want – for example, the pound and the ounce can be used alongside kilogram and gram measurements for goods sold loose and the troy ounce can be used for transactions in precious metals.

Up2d8 maths in Issue 5 of the Primary Magazine has an interesting spread on disagreements over metric and imperial weights.

Useful websites from which this information came, and from where you can find out more about the history of weighing:

- Brainbank
- Sizes.com
- University of North Carolina
- English Weights and Measures
- Jo Edkins Units

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Maths to share – CPD for your school

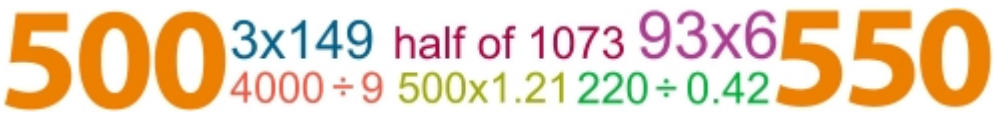
Teaching and Learning through problem solving – encouraging mathematical reasoning
Before the session, ask teachers to read the article Teaching and Learning Through Problem Solving (ATM, 2007) by Mike Ollerton.

Share thoughts about problem solving being broken down into specific sections by the DCSF [formerly DfES].
Are there any advantages/disadvantages to this approach?
Does the group agree with Mike Ollerton's criteria for setting up problem solving situations? Share any examples of activities.
Does the Primary Framework support the discrete approach, or is it more in line with Mike Ollerton's view?

The five themes of using and applying as set out on the Primary Framework (2006):

1. solving problems
2. representing – analyse, record, do, check, confirm
3. enquiring – plan, decide, organise, interpret, reason, justify
4. reasoning – create, deduce, apply, explore, predict, hypothesise, test
5. communicating – explain methods and solutions, choices, decisions, reasoning.

These themes relate directly to the three subdivisions of 'using and applying' in the National Curriculum programmes of study.



Give colleagues this activity to work on in pairs. Allow three or four minutes.
Without doing the calculations, they should decide whether each answer lies between 500 and 550.
In each case, they should be prepared to share with the rest of the group how they decided:
3 x 149
500 x 1.21
Half of 1073
93 x 6
4000 ÷ 9
220 ÷ 0.42

When they have completed the task, ask the pairs to write under each of the headings below, some verbs to describe what they did.

For example, the following might be written under reasoning:

- predict: 3 x 149 will not lie between 500 and 550
- deduct: it does not lie between 500 and 550 three lots of 150 totals 450, 149 is less than 150 therefore the answer to this is less than 450.

Now ask them to further consider the vocabulary that they used, e.g.

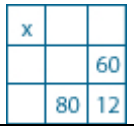
- it could/could not be because…
- it will/won't work because…
- it would only work if…
- so…

What prompts could we use to guide children's reasoning? Ask colleagues to consider and then discuss the use of prompting and probing questions such as:

- what can you work out (from the information)?
- if you know that, what else do you know?
- can you tell me what your thinking is?
- shall we test that?
- does it work?
- do you still think it is...?
- do you agree that...?
- why is that bit important?
- so, what must it be?

Another approach to improving children's reasoning skills, is to build in problem solving activities throughout each unit of work, rather than 'bolting' them on at the end of the unit. You may want to ask colleagues at this point if they think the Primary Framework supports this. Does the categorising of problems help or hinder this?

How can we build in more problem solving and opportunities for reasoning? Discuss the use of opening out questions.

From	To this
Find the answer to this calculation: $324 \div 4$	Use the digits 0, 1, 2, 3, 4, 5. Make three-digit numbers that have no remainder when divided by 4. (e.g. $324 \div 4$, $124 \div 4$)
Find the perimeter of this rectangle: 	Construct some rectangles with the same perimeter as this one.
Copy and complete this multiplication table: 	Investigate the possible ways of completing this multiplication table: 

These examples have been taken from the National Strategies Mathematical vocabulary book.

Finally, ask colleagues to share what a good problem should be. Ask them to reflect on their own learning and teaching strategies and ask them to consider specifically:

- Opportunities for pupils to be able to reason:
  - highlighting relevant vocabulary
  - questioning pupils in ways that focus their attention and stimulate their thinking
  - asking pupils to present their reasoning to different audiences
  - showing pupils examples of well-explained, well-presented reasoning
- Provision of open tasks.

Colleagues would find it helpful to read the Guidance paper: Using and applying mathematics from the National Strategies website.

You could ask colleagues to answer the problems below from the National Strategies' download Mathematical challenges for able pupils and consider the reasoning that they used to solve them.

Birthdays (21)

Mum and Paul are talking about birthdays.
They take Paul's age and double it.
Then they add 5
The answer is 35.
Mum says this is her age.
How old is Paul?

Make up more problems like this.
Try to use some of these words: double, halve, add, subtract.

Age-old problems (65)

1. My age this year is a multiple of 8.
   Next year it will be a multiple of 7.
   How old am I?

2. Last year my age was a square number.
   Next year it will be a cube number.
   How old am I?
   How long must I wait until my age is both a square number and a cube?

3. My Mum was 27 when I was born.
   8 years ago she was twice as old as I shall be in 5 years' time.
   How old am I now?