Primary Magazine

Issue 26

National Centre
for Excellence in the
Teaching of Mathematics

Welcome to the 26th issue of the Primary Magazine – a very different issue this month! As we are now in August and you are hopefully enjoying some summer sunshine away from the classroom, we thought it might be fun to suggest things with a mathematical theme that you could spend some time doing during your holidays – if you feel so inclined! You could just 'do' them or you could consider how these ideas could be used with your class in September for some 'mathematics outside the classroom' opportunities.
You might also be interested to take a look at the Learning Maths Outside the Classroom resources for more ideas.

Also, why not take the opportunity to look at some back issues of the Primary Magazine, particularly *Focus on*, *The Art of Mathematics*, and *It's in the News!*. They might inspire you with some interesting ideas to develop in your mathematics lessons next term or alternatively give you 'mathsy' ideas to put into your topic work.

We'll be back to normal in Issue 27. Happy holidays!

10 things to do this summer:

- Mathematics in the churchyard
- 10 things to photograph in a mathematical scavenger hunt
- Can picnics be mathematical?
- We're going to the zoo – so how about you?
- The mathematics of the library
- Bowled over with mathematics
- Mathematics at the beach
- Cinemas and mathematics?
- A visit to the local park is a holiday essential. It is free for a start…
- The mathematics of eating out.

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Mathematics in the churchyard

Most cities, towns and villages have churches. If you are visiting a small village at all, the local church (particularly if it is an old one) is worth a visit. Here are some of the mathematics opportunities that you could explore or make a note of for work with your class in September.

Outside the church:

- estimate the height of the church: walk away from it until, when you bend down as in the picture, you can see its top. Mark the spot where you are standing and then measure from there to the wall of the church. Write the distance down, and then use the diagram to work out the height of the church!
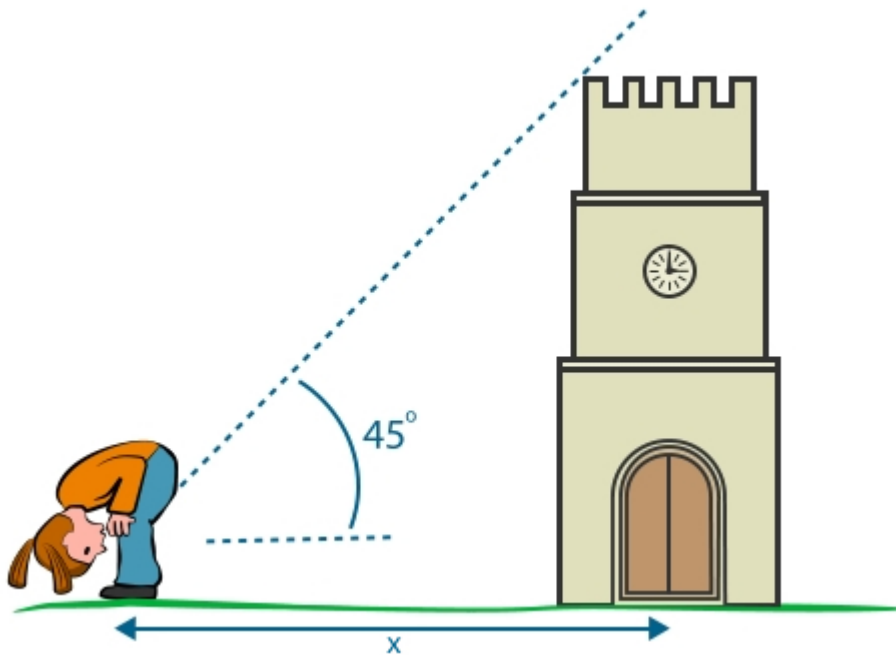

- do a survey of the people you see and what they are doing at and around the church. You could make a tally and then a pictogram, block or bar graph or pie chart
- look at any seats and railings nearby and make a note of the right angles, vertical/horizontal and perpendicular lines that you can see
- how many cars can you see parked around the church? Make a tally of colours and then a graph of some sort
- look at the car number plates – how many number plates with 3 on them? What other numbers? Odd numbers? Even numbers? Multiples of 4, 5 or 10? Biggest/smallest? Which are the newest/oldest cars?
- have a search of the shapes that are around – on the church building itself, in the area around the church
- look at the aspects of the building that show symmetry e.g. windows, entrance. Sketch some of these
- look at aspects of the building that show arrays e.g. windows

-
- make some brick rubbings to cut into small pieces and make designs using repeating patterns and tessellations
- focus on the Roman numerals of the clock in the clock tower, if there are any – what number does each stand for. Back at home read A little bit of history in Issue 2 of the Primary Magazine to explore development of Roman numerals
- gravestones – how many are there in a particular area?
- look at the dates – which is the earliest one?
- list the dates seen in order
- make a survey of men/women buried, making tallies
- what ages did people die? Plot on number lines or time lines.
- who was the youngest/oldest?
- measure the heights of the grave stones and order from shortest to tallest
- what patterns are there on the grave stones?
- what else can you see e.g. flowers, stones, angels – make a list with a tally if appropriate.

Inside the church:

- look at shapes again on the walls, in any paintings and stained glass windows focussing on the different types of shape and patterns, symmetry, rotation, tessellation etc
- you could do some counting – bibles, hymn books, candles, kneelers, pews etc
- are there any numbers on the hymn board. If so, you could order them, treat them as digits and list them, how many of each, which numbers to 9 are missing? What is the largest number you can make using four/five digits, all of the digits etc.
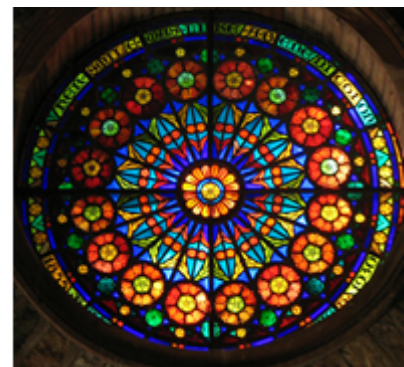
Of course, you could consider similar ideas for all places of worship that you might wish to visit.

For more ideas visit the Places of Worship and Charities section of the Learning Maths Outside the Classroom microsite.

10 things to photograph in a mathematical scavenger hunt

Wherever you spend your time this summer, don't leave your living room without a digital camera and mathematical imagination!

In scavenger-hunt style, how many of these images can you collect on your camera over the summer:

- a picture that shows three different types of triangle
- a picture of the Fibonacci sequence in nature. Have a look at Fibonacci Numbers and Nature for inspiration!
- a picture to illustrate that 4 x 5 = 20
- something with rotational symmetry of order 5
- a picture that contains at least three prime numbers
- something with exactly one line of symmetry
- a picture that shows a ratio of 3:2
- something showing a scale in imperial and metric measures
- something that shows time differences
- an 'interesting' repeating pattern and you decide what is interesting about it!

Have a look at this collection of holiday snaps and start thinking about the classroom mathematics possibilities. What mathematical concepts could they be used to investigate? What lines of enquiry could they encourage?

Go to the examples on Problem Pictures for ideas on how you might use your own pictures back in the classroom to encourage thinking skills, reasoning and explanation.

Who else can you challenge to complete the mathematical scavenger hunt? Why not make it a staff competition, and end up with a huge resource of photographs to use across the school in September?!

Can picnics be mathematical?

The summer is here, the sun is shining, and it's likely that most of you will be taking advantage of the opportunity for a picnic or two out in the open air. So where is the mathematics? Are we really suggesting that you might be solving quadratic equations whilst on a family day out? Well, no…but we do have some other suggestions.

Getting there…

- where are you planning to have your picnic? Have you looked at a map of the area? Is your 'spot' marked as a recognised picnic area? What is the grid reference for your spot? How far is it from the nearest town or city?
- how far will you be travelling to reach the picnic site? Can you estimate the number of miles? What is the equivalent number of kilometres? If the ratio of kilometres to miles is 8:5, how far do you need to travel in kilometres? What if the picnic area is 15 miles away? 11 miles away?
- how much will it cost to travel there? If your car can travel an average of 40 miles on each litre of fuel (which costs £1.20 per litre), how much will your fuel bill be?
- Maths is Fun hosts a wonderful mathematical problem focusing on people travelling to and from a picnic:

> *When they started off on the great annual picnic every wagon in town was pressed into service.*
>
> *Half way to the picnic ground ten wagons broke down, so it was necessary for each of the remaining wagons to carry one more person.*
>
> *When they started for home it was discovered that fifteen more wagons were out of commission, so on the return trip there were three persons more in each wagon than when they started out in the morning.*
>
> *Now who can tell how many people attended the great annual picnic?*

Sorting the supplies…

- how will you decide what will be included in the picnic supplies? How many people need to be catered for? Can they all be accommodated on just one picnic rug?
-

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- will each person need a plate, bowl, knife, fork, spoon and glass? How many in total?
- estimate how much each person might drink in litres – how many litres of drink will be needed in total?
- if everyone is drinking wine in the sunshine at your picnic, and the bottles contain 750ml each, how many bottles will you need for four people? Will they only drink one glass each?
- cans of fizzy drink hold 330ml. An average person will only drink 225ml. How many cans will you need for the people attending your picnic? What if there were eight people? How many people could share ten cans?
- quiches, pizzas and cakes will all need slicing into segments for everyone to enjoy. How many equal slices can you cut from your pizza? The pizza box states that the pizza is ten inches in diameter. If this is sliced into eight equal slices, what will be the area of each slice? Challenge yourself to use the formula for the area of a circle – πr^2

These are just starting points for exploring the mathematics around the 'picnic' theme. Back in the classroom in September, ask the children for their ideas. You could even make the most of the last of the sunshine by planning and holding a class picnic lunch on the school field – but don't forget the mathematics!

We're going to the zoo...how about you?

The zoo is not only a great place to visit but, believe it or not, the zoo is also a great place to do some mathematics. To find out where your nearest zoo is located just type 'zoo' into your search engine. You will see that you are spoilt for choice.

- planning your visit. Investigate the costs of planning your visit. Is it cheaper to buy a family ticket? Are there any offers in the local newspaper that will save you money? Can you buy tickets online? What is the difference between the real cost and the amount you have paid? How much did you save? What is this as a percentage?
- how far is the zoo from home or your starting location? How will you travel there? How much will it cost to travel there? If your car can travel an average of ten miles on each litre of fuel (which costs £1.20 per litre), how much will your fuel bill be? Would it be cheaper to go by train or bus?
- most zoos have a plan/map of the park. Plan your route using compass points and angles: for example, to get to the elephant enclosure, I need to turn 45° right, proceed in a north east direction, turn 90° left, proceed in a NW direction. If the map has a scale you could work out how far you need to travel between each enclosure. If not, why not pace out one small section and work out the scale for yourself. Is it consistent?
- can you work out the shortest or longest route? Can you work out a route in which you will never visit one enclosure more than once?
- take the map home. Draw a grid on it – this could be using one quadrant or you could have your point of origin in the centre and identify co-ordinates in all four quadrants. Then use the information to plan a trip round the zoo for someone else using co-ordinates/direction and angles. A map like this is a really useful resource to use in school when teaching geometry/shape.
- as you tour the zoo gather some data on the number and types of animals housed there. Convert the data into a graph when you get home. Would the data look the same or different if the weather had been different/it was a different time of day/different day of the week/feeding time?
- sort the categories of animals in various ways e.g. habitat, food eaten. Use a Venn, Carroll or tree diagram. Identify things that are the same/different.
- animal skins are varied and many reveal the most amazing patterns. Look out for patterns and shapes – look for symmetry, repeating patterns, geometric shape.

- gather some information about the animals and insects and do some calculations e.g. If you could lift the same amount as an ant could proportionally how much could you lift? The three-toed sloth is famously slow-moving, travelling at a top speed of 0.24 km/h (0.15 mph) on land, how long will it take to travel 2km? Estimate the proportion of an anteater that is its tongue?
- look for shapes/pattern/symmetry in the environment.

Don't forget that you will be able to use the information in class with the children after the holidays. If you plan early next year you could also get the children to gather their own data and compare and contrast.

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The mathematics of the library

At last, you have time to relax with a good book. Do you choose your books from the library or a bookshop? There's plenty of mathematics in both places!

- visit your local library. What are the Dewey Decimal Classification numbers of the first and last books on the shelves? Find the difference. What is the mid-point of the classification numbers? Find those books. Are they in the centre of the library? Why not?
- write down three numbers between zero and 1 000. Find the matching sections in the library – pick a book from one of the classifications to read. Broaden your mind! Special summer offer, if you like the first section you visit, don't bother with the other two!
- what is the Dewey Decimal Classification number for the book you are currently reading? What type of book has a classification of 100 more? How about 100 less?
- estimate how many books are in your local library. Start with a ballpark figure, then count the books on one shelf, how many shelves on one unit, how many units… and do a quick calculation. Check with the librarian. How close were you?
- for five fascinating facts about books, take a look at Issue 3 of the Primary Magazine, Focus on…Children's Book Week 6 – 12 October
- the smallest book in the world is called Chemin de la Croix. It has 119 pages. It is 5 cm (2 inches) high and 3.3 cm (1 1/3 inches) wide. How deep is it? Cut out 119 pages the correct size, or count out 119 sheets of A4 paper and measure their height. Add another 2 mm for the cover.
- imagine you are stocking up on books. You have chosen two at £6.99, two at £7.99, two at £9.99, two at £10.99, two at £12.99 and two at £13.99. The shop operates several different offers including three for the price of two; buy one get one half price; 20% off full price items and any two books under £10 each for £12. Which combination of offers will cost you the least? What is the most you could pay? Each offer can only be used twice in any one transaction!
- how many words are there in your current book? Estimate, then count the words on three random pages, average the total and multiply by the number of pages in the book. How close were you? If you read 100 words per minute, how many minutes will it take you to read the book? If you started reading the book today and read for 30 minutes a day during the week and an hour a day at the weekend, on what day of the week will you finish the book?
- a book buyer is offering to buy any book for 10% of its cover price. How much would it cost to buy all the books on your bookshelves?
- Ladybird books have become well known for their unique 56 page 'pocket-sized' mini-hardbacks. The year 2000 was a very special one for Ladybird children's books, as it marked 60 years since they published their first book. Sales around the world exceed 30 million each year. Approximately how many Ladybird mini-hardbacks have been sold?

I'm sure you can think of many more book- or library-related questions. Or you could just relax with a good book…

Bowled over with mathematics?

So you're going ten-pin bowling…whether the intention is to entertain young children on a wet afternoon, to enjoy this leisurely sport with friends, or to sharpen those skills and beat your current 'strike' record – there's always an opportunity for some mathematics!

Preparing for the game…

- there are usually special offers available to lower the cost of bowling. What offers is your alley currently promoting? Which will save you the most money? Is it cheaper to have two games for £6 and then pay the regular rate for the third game, or to pay the regular rate for the first two and then have your third game free?
- do they have an off-peak rate? How long would you need to wait to pay off-peak prices?
- unless you're a 'regular', it is likely that you will need to hire bowling shoes when you arrive at the alley. The shoes are stored in a grid of pigeon holes, labelled in size order. If the columns of the grid were labelled A, B, C… from the left, and rows were labelled 1, 2, 3… from the bottom, what would be the coordinate of the hole your shoes are taken from?
- how many people will be bowling on your bowling lane? Their names are entered on the display screen in the order in which they will bowl. How many different ways could the names be ordered? If you bowl in age order, starting with the youngest, when will you have your turn?

Get bowling…

- most bowling alleys have 'house balls' for players to use. These are labelled with numbers ranging from six to 16. What do these numbers mean? Which number ball will you use? Why? Look at the balls being used by other players on the surrounding lanes. Which size of ball is being used the most? Are there any sizes not being used? Why do you think this is?
- if the balls were placed in order according to their number, what colour would the third ball be? The penultimate ball?
- players bowl two balls in each of their ten 'frames', in an attempt to knock down ten 'pins'. What is the maximum score any player can score?
- if you play the whole game and only roll 11 balls, what will the minimum score be?

- if the pins were numbered as shown in this diagram…

⑦   ⑧   ⑨   ⑩

④   ⑤   ⑥

②   ③

①
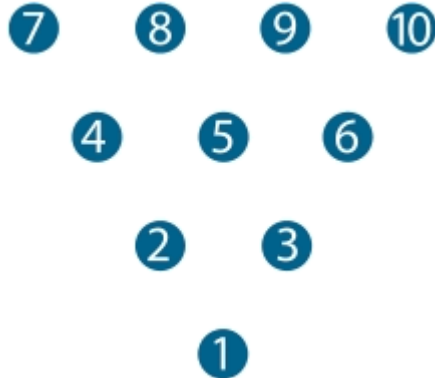
…and I knock down nine 'pins' with my two balls, what possible score can I get? What can my maximum score be if I knock down only five pins?
- the bowling lane is 18 m long (from the foul line to the first pin) and 105 cm wide. How many square metres of maple and pine wood would be needed to resurface it?
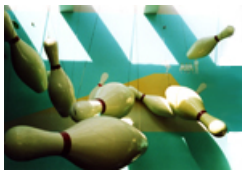
Answers…
- *the maximum score in any game is 300, known as a 'perfect' game. This would need strikes on all nine balls from the first nine frames, and three strikes on the tenth frame*
- *the minimum score from playing a whole game with only eleven balls is 240 (this will be nine 'strikes' and an open frame remaining).*

Mathematics at the beach!

Summer's here, with long, lazy, sunny (hopefully!) days. Fancy a day on the beach? Do you remember Issue 14 of the Primary Magazine? The (then) Up2d8 Maths feature was all about city beaches. If that whetted your appetite, here are some more beach ideas:

- which beach will you visit? Have you had a look at a map? If this is a beach you visit regularly, then plan a different route. Is it longer or shorter than your usual route? How far away is it, in both kilometres and miles? Remember, the ratio of kilometres to miles is 8:5. Is it actually your nearest beach?
- how much will it cost to get there? If you normally manage an average of 40 miles to the gallon (7.06 litres/100km), how much fuel will you need for the round-trip? How much do you usually pay per litre? Calculate your fuel bill.
- if you could get there by bus or train, which method of travel is the cheapest? Is that still true if four people are going?
- take another look at the map. Can you find a beach as near as possible to 20, 50, 100 miles from home?
- almost everyone wants an ice-cream at the beach, but how much profit are the ice-cream manufacturers making? Flick through a cookery book and find a recipe you like the look of. Take the list of ingredients on your next visit to the supermarket and cost each item. Double the total to allow for overheads. How much does one portion cost? How much does an ordinary, medium cornet cost? Assume that the commercial ice-cream costs the same to make. How much profit is the ice-cream manufacturer making?
- when you visit the beach, take a gardening glove or grabber and a thick carrier bag with you. Walk along the beach and fill your bag with rubbish. Before you dispose of it, do a quick sort. What have you found most and least of? Is this what you expected? You could draw a block graph of what you found too. Compare graphs for visits at different times of the year. What do you notice?
- how long is the bathing season? In England and Wales, it is considered to be from mid May to September, and from June to September in Scotland and Northern Ireland. How many days are there in the season for the different regions? Why is it different in different parts of the UK?
- The Independent listed the 20 best beaches in the UK in July 2007. Carry out an internet search to find the current 20 best beaches. Compare the two lists. Which beaches are 'out' of the top 20? Which beaches are new on the list? Which of the top 20 beaches is nearest to you? Has your nearest top 20 beach changed? If so, how much further or closer is it?
- if it rains, a beach hut would be useful. Take a look at the premium listings on beach-huts.com. Where is your perfect beach hut? How far are you prepared to walk from the car park or to the toilets or showers? How much will it cost you to hire the beach hut for a week? Where are the cheapest huts? Where are the most expensive?
- draw the beach safety flags. Check if you were correct at the RNLI website, Shorething!

Sand in your sandwiches? Have a look at Can picnics be mathematical?

Cinemas and mathematics?

Cinema snacking

Pick 'n' mix in the cinema is otherwise known as the Russian roulette of sweet indulgence. How do you fancy your chances in pulling out the sweet of your choice in the dark? Or more importantly, not picking out the one you dread! Test your luck before you go by considering this probability problem.

There are three different sweets that feel identical in the pick 'n' mix bag:

- chocolate-covered honeycomb
- chocolate-covered toffee
- chocolate-covered Turkish delight.

The sweets have been thoroughly mixed in the bag. You put your hand in and pull out the first sweet that you touch. What is the probability of pulling out your favourite in the dark cinema? What is the probability of pulling out last the one you like least? You might start with five of each sweet, what chance do you have of the first five you pull out being the type you most like?

While you're thinking about cinema snacks remember to ask for a selection of different sized cups and popcorn boxes to compare volume and capacity. Is it true that the larger containers are better value? What is the cost per 100ml, or 100g of different-sized, filled containers?

Cinema seating

Compare these two cinema seating plans. Dark blue shows the more expensive seating. Consider what is similar or different about them and how you could persuade someone which is the best seating formation.
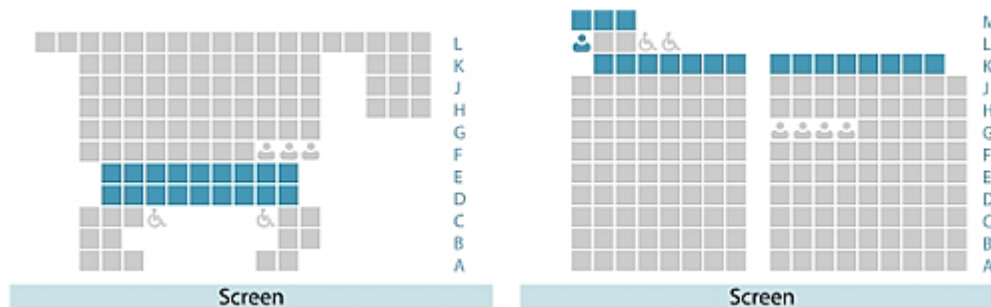
Where do you think is the best seat in the house? Find the seats on the plan that would best suit a different customer's requirements.

How does the cinema make sure that the most seats can be filled? Try this 'Fill your cinema' game of strategy and luck, using the seat plans above.

Choose one of the seating plans (available to download as a PDF here) and give a copy to each player. Throw two dice. The number shown on each dice is the number in a party that wishes to book tickets. A party must always be seated together in a horizontal row. All the players cross the seats off their plan to show that those seats have been sold. Keep throwing the dice and crossing off seats. A player is out once they cannot fit a party sitting together into the cinema. The winner is the last player in the game.

When you are in the cinema, estimate the number of seats there are in the room, the angle the rows of seats are arranged in from the front. Can you work out the best angle of seating to make sure that everyone can see, using the least amount of room height?

Cinema statistics

There are some big numbers to play with around the stories of how much films cost to make, how much they take on the first weekend, and how much they gross. The UK film council publishes up-to-date figures about takings after each weekend. How can these big numbers be represented and compared effectively using data handling? What conclusions can be drawn from the film studios' statistics published in newspapers this summer?

Collect some data about favourite films or film characters. How could you present the data? Can you put the favourite films in order of time from when they were released?

Cinema sequels

The latest sequels for the very popular *Toy Story* and *Shrek* films are in the cinema this summer. Whether or not you see the films yourself, you may want to consider harnessing the enjoyment and familiarity of the context of these film series in your lessons in September. There will also be all sorts of merchandise available that can be used to illustrate mathematical problems, or make displays or interactive areas more enticing. For ideas on how to use these films and others in your lessons you could visit the Essex Mathematics Team Maths at the Movies page.

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A visit to the local park is a holiday essential. It's free for a start...

- the most obvious thing to do is some data collection. Make a tally of the types of birds/trees/activities/age of people that are in the park. Convert the data into a graph when you get home. Would the data look the same or different if the weather had been different/it was a different time of day/different day of the week?

- look at the trees – can you find the tallest/smallest/widest. Estimate how tall/small/wide? Use shadows to help you measure how tall a tree is. Wait until the tree casts a shadow then measure the length of the shadow. Stand next to the tree and have someone measure your shadow. Be sure to do it as soon as you can after you measure the tree shadow! Measure your height to find out how tall you are. Divide the length of the tree's shadow by the length of your shadow. Then multiply the answer by your height. This will tell you how tall the tree is! (Tree's Shadow / Your Shadow) x Your Height = Tree's Height. Can you see why this works? Why not have a go? (from NRICH History of Measurement)

- as you travel around, look at bricks and tiles watch for different shapes of bricks. What shape do most bricks appear to be? This is one face of a 3-D solid, what properties does the whole shape have? Keep your eyes open, you will probably be able to find bricks/tiles that are not oblong. Do they still tessellate? See if you can find a place where rings of bricks are laid in a circular pattern. Good places to look are around statues and fountains. How does the number of bricks in each ring change as the rings get larger? Try to come up with a rule to describe the pattern

- most parks have a fountain or a decorative water feature – try to work out how much water it contains. Using what you know about calculating volumes and measurement skills, estimate how many litres of water are in the pool or fountain

- look at the ornamental features around the park and look for geometric shapes (is there one shape that is more frequent?), repeating patterns/lines of symmetry in the designs and what angles are apparent

- look at the park railings. How far apart are the holes for the hoops to pass through? How wide are the hoops? How many hoops would you need to make a railing 1 metre long?

- on a sunny day – observe the shadows. What do you notice? How much longer does the shadow get for each minute/hour that passes? Is there a pattern? Can you predict how long the shadow will be in two hours' time? When you get home investigate why this happens?

- why not look for numbers in the park – you will be surprised how many you find – make a list. Remember not to look for the Hindu-Arabic number system alone

- make a plan of the park to share with someone else. This could even be done to scale if you want to pace it out!

Take a look at Learning Mathematics Outside the Classroom for more fun ideas to do in the natural environment.

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The mathematics of eating out

Ever thought of the mathematics involved in going out to eat? Clearly money is an obvious mathematics link…but there are others. Try exploring these ideas:

First you need to choose your restaurant, which involves some of those important thinking skills – reasoning, for example. Our high streets are full of restaurants of different types. So have a think about the cuisine you wish to sample – of course, you will need to discuss this with whoever you might be going with. Among the most popular are: Chinese, Italian, Indian, Thai, French, English, Bengali, Mongolian, Turkish, fish, vegetarian and gastropub. Of course there are others to choose from as well.

Try making a tally of everyone's choices to find the most popular.

Locate your choice on a map and work out the distance you will need to travel from your home to your chosen restaurant. Will you walk, drive, take the train or a taxi or bus? How much will this cost you in petrol or fares? You will need to factor that in when working out the cost of your meal! If you are driving, you will need to consider the cost of petrol per litre, how much your car is likely to use per mile and the distance you will have to travel. From these pieces of information work out the approximate cost of the petrol and add on a bit for wear and tear and, if appropriate, the cost of parking!

You will also need to work out the time at which you need to leave home to get to your restaurant at the allotted time. Maybe you will need to add on time for walking to the restaurant from the railway station or bus stop, or allow time for possible traffic hold ups if you are driving. Will you be going out for lunch, an evening meal or something in the late afternoon?

Once there, you will need to have a browse at the menu and make your choice of food. Will you have two or three courses? If two, will you go for a starter and main, main and desert or a starter and a desert? What possible combinations could you have? If the company you are with is a little dull, you could spend some time working them all out!! Does each main meal come with side dishes – of vegetables, for example – included, or do you have to pay extra for those?

You may wish to consider the fat content, the number of calories and the price. Have you set a financial limit or are you open to spend whatever it costs? If, like me, you are always on a diet, you may need to mentally estimate and total the calories in your choice! Will they be within your daily allowance? Don't forget to add on those for other food you might have eaten during the day!

Then there is the drink. What will you choose? How much will you have? A bottle of wine is likely to be 75cl, a can of soft drink or beer 440ml. What is the difference in capacity between the two amounts? How much extra will your drink be on the bill? If you are sharing drinks, work out the quantity you will have and then the cost per glass.

At the end of the bill there is the service charge. Is it included or will you have to pay extra? If the service was good you may choose to give 10% of the final bill, if not you might go for a lower percentage.

Once you have been, eaten and come home, work out how much your meal cost you in total including the cost of travel.

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Some restaurants offer special loyalty vouchers. Current ones can be found on moneysavingexpert.com. What offers will save you most money? Locate the nearest restaurant where you could use the vouchers.

How far away are they from where you live? Will that affect the value of the saving you make from the vouchers?

Phew – hard work eating out!!

This is an activity you could try out with your class, adapting as appropriate. Eating out is a real-life activity which uses several mathematics skills. You could also consider take-aways. Give the children copies of those take-away menus that come through the letter box at regular intervals. Can they plan a meal for two, three, four etc. within a set budget? Don't forget the drinks and desserts. Often there are offers on these menus which involve percentages or fractions, or buy one and get one half price. These could be considered, if appropriate, by some of your children.