Mathematics Mastery

What is Mathematics Mastery?

A guide for parents and carers 2017-18

Today's Aims:

- Understand the 'mastery' approach and the changes it brings for teaching and learning in maths

- Explore the 'Mathematics Mastery' programme that we began this year to help deliver a structured, mastery approach

What is the Asian 'maths mastery' approach?

- Thousands of UK primary schools have begun to adopt a new way of teaching maths that's popular in South Asia.

- What is the Asian "maths mastery" method all about?

What is the Asian 'maths mastery' approach?

Pupils in South Asian schools are renowned for their academic ability. In 2015, Shanghai, Hong Kong, Singapore, Japan and South Korea topped the rankings for English and maths test results, while the UK languished in 23rd place. But now, primary schools in England are adopting their method of teaching maths with the hope of improving pupils' performance.

So far, 840 schools have been chosen to try out the new teaching programme starting in September2016, and over the next four years, it'll be rolled out to a total of 8,000 schools – half of all primary schools in England.

It follows a pioneering exchange programme, where English teachers spent time in Shanghai schools learning their methods of teaching maths. 'Teachers involved in the Shanghai exchange have returned to England beaming at how engaging the approach is for children,' says a Department for Education (DfE) spokesperson.

What is 'maths mastery?'

The Asian mastery approach to maths focuses on **whole-class teaching**, developing a **deep understanding** of maths.

It's a common misconception that South Asian children are simply taught by rote; while there's an element of drilling, the method is also highly interactive. 'All pupils are encouraged by the belief that by working hard at maths, they can succeed,' says the DfE's spokesperson.

A typical maths mastery lesson is led by the teacher, with all of the pupils in the class working together on the same tasks at the same time.

Children use objects and pictures to physically represent mathematical concepts (the concrete > pictorial > abstract approach), alongside numbers and symbols – for example, using Lego bricks to add and subtract numbers. This helps them visualise abstract ideas, and as they become more proficient, they will gradually stop relying on physical props.

What is 'maths mastery?'

The pace of the lessons is brisk, with teachers constantly asking questions, inviting pupils to demonstrate solutions on the board, and quizzing them about their thinking. There's a mixture of short tasks, explanation, demonstration and discussion – and a lot of practice to help reinforce children's learning.

Children are also expected to learn key maths facts like times tables and addition facts by heart to free up working memory and give them the mental space to focus on new concepts.

Maths mastery can be taught at any Key Stage, and schools will be able to decide to what extent they use it alongside current teaching methods. However, the DfE is hoping that schools will commit to a radical change to the way they teach maths, which could lead to a 'renaissance' in maths teaching.

How does maths mastery benefit children?

The maths mastery approach is intended to raise children's performance in maths. As well as South Asian countries topping the worldwide education rankings in maths, pupils in these countries are 10 per cent less likely to be 'functionally innumerate' – that is, unable to perform basic maths functions – at 15 than children in English schools. By introducing maths mastery in primary schools, the DfE is hoping to close this gap.

Teachers who took part in the Shanghai exchange are enthusiastic about the new approach. 'The teachers involved are overwhelmingly positive, and the momentum for this programme has come as much from teachers as from government,' the DfE says.

Initial research shows that the approach could lead to a radical shift in how maths is taught in primary schools, with a significant impact on pupils' achievement.

Will less able children be left behind?

If your child struggles with maths, you might well be concerned that they won't keep up with whole-class teaching. However, the DfE says that the method is suitable for children of most abilities.

'Every step of a lesson is deliberate, purposeful and precise,' the spokesperson says. **'If children are struggling with a concept, more time is spent supporting and building their understanding.'**

Those who are stronger are also catered for and are able to deepen their understanding of the principles by being given challenging questions, as well as demonstrating to the rest of the class.'

Which schools will be involved?

Initially, 700 teachers will be trained to support schools in introducing maths mastery. Schools will be able to get involved through their local maths hub: 35 school-led centres of excellence in maths teaching. The first 840 schools to take up the approach have already been chosen, but it'll be rolled out to other schools across the next four years.

What differences will you notice?

The main difference should be that you see your child's maths skills improving more dramatically.

'Parents will see their children becoming more competent mathematicians and using correct mathematical language,' says the DfE's spokesperson.

What is "Mathematics Mastery?"

Mathematics Mastery is a not-for-profit organisation.

Our vision

For every child to enjoy and succeed in mathematics, regardless of background.

Our mission

To transform mathematics education in the UK. We work in partnership to empower and equip schools to deliver world-class mathematics teaching.

Core belief

Mathematics Mastery schools want to ensure that their aspirations for every child's mathematics success become reality

- Success in mathematics for every child **is possible**

- Mathematical ability is not innate, and is **increased through effort**

Key principles

- Fewer topics in greater depth
- Mastery for all pupils
- Number sense and place value come first
- Problem solving is central

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What does the National Curriculum say?

- "Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content."

- "Those who are not sufficiently fluent should consolidate their understanding, including through additional practice, before moving on."

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What is mastery?

"In mathematics, you know you've mastered something when you can apply it to a totally new problem in an unfamiliar situation."

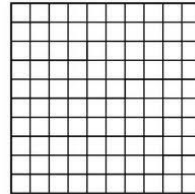Dr. Helen Drury, Director of Mathematics Mastery

What are concrete resources?
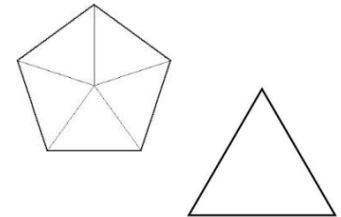
Bead strings

Bar models

Fraction towers

100 grids

Number lines

Cuisenaire rods

Shapes

Dienes blocks

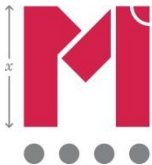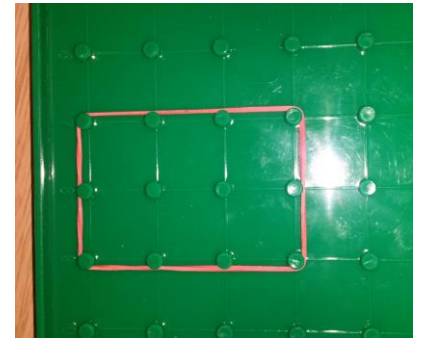Multilink cubes

# Your turn!

- Using the resources available, can you show the number 6?

6

Mathematical language

Mathematics Mastery lessons provide opportunities for pupils to communicate and develop mathematical language through:

- Sharing essential vocabulary at the beginning of every lesson and insisting on its use throughout

- Modelling clear sentence structures using mathematical language

- Paired language development activities, known as Talk Tasks.

- Plenaries which give a further opportunity to assess understanding through pupil explanations.

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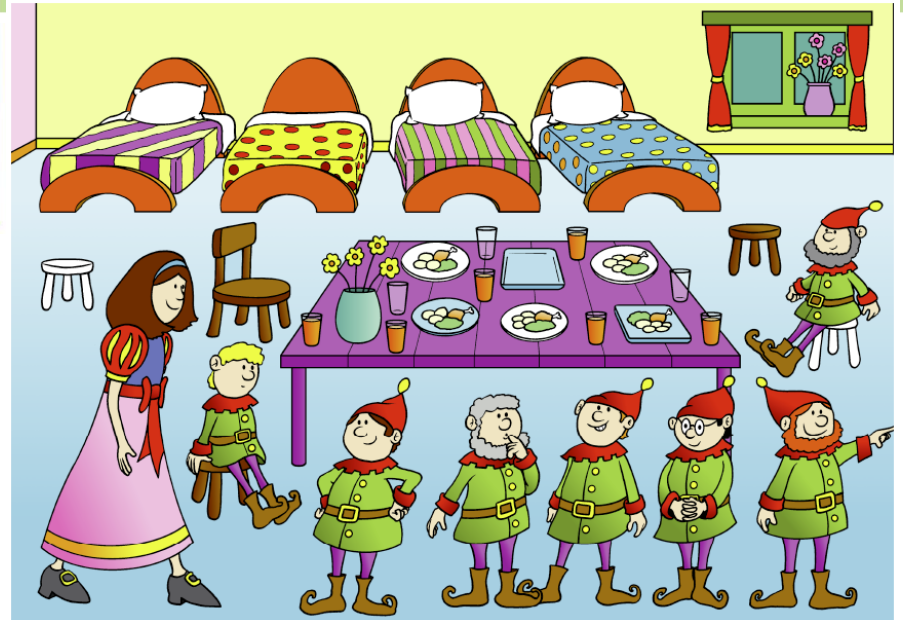
What do these words and phrases mean?

- Vertex/vertices
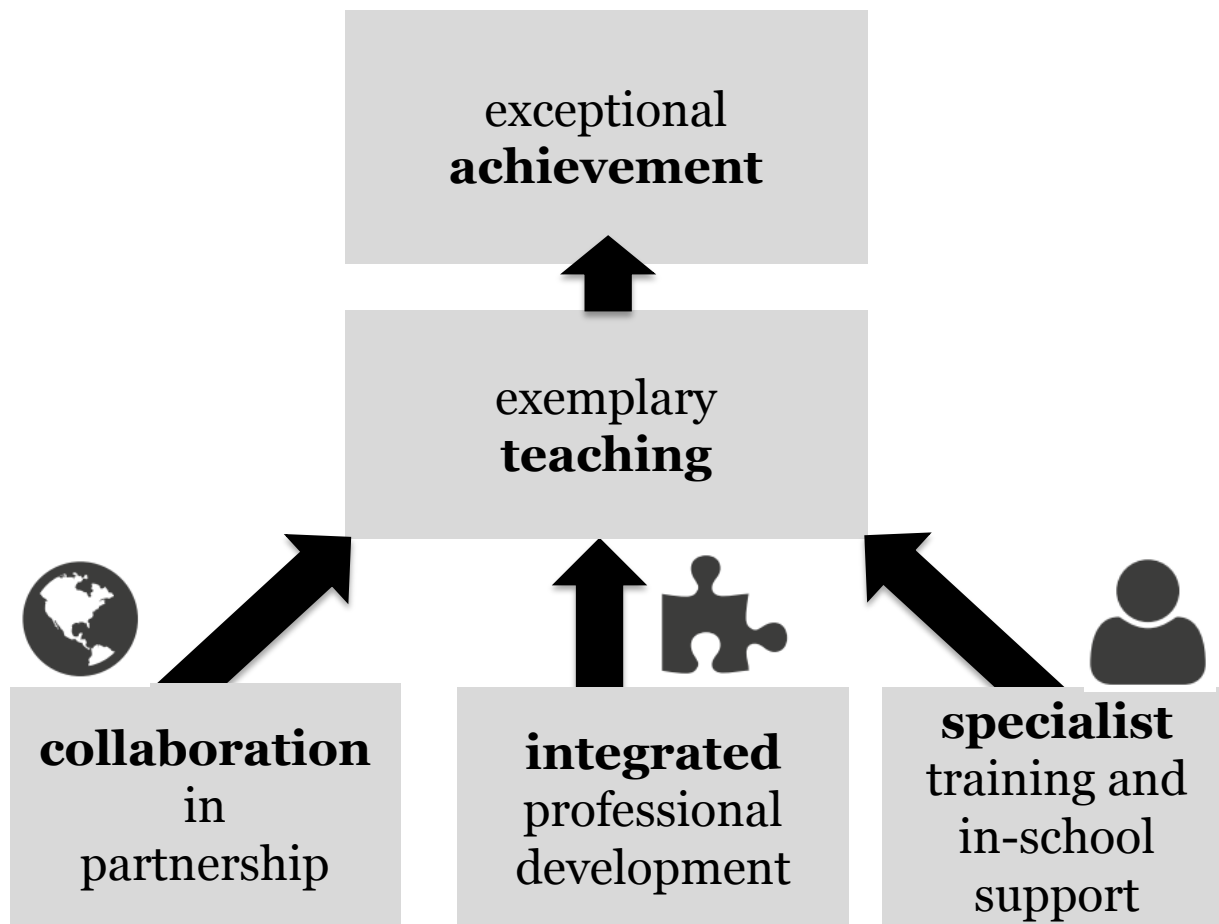- Is equal to
- Tens and ones
- Fewer/less

Try these!

I have fewer/less apples than Harry.

I have fewer/less money than Amrick.
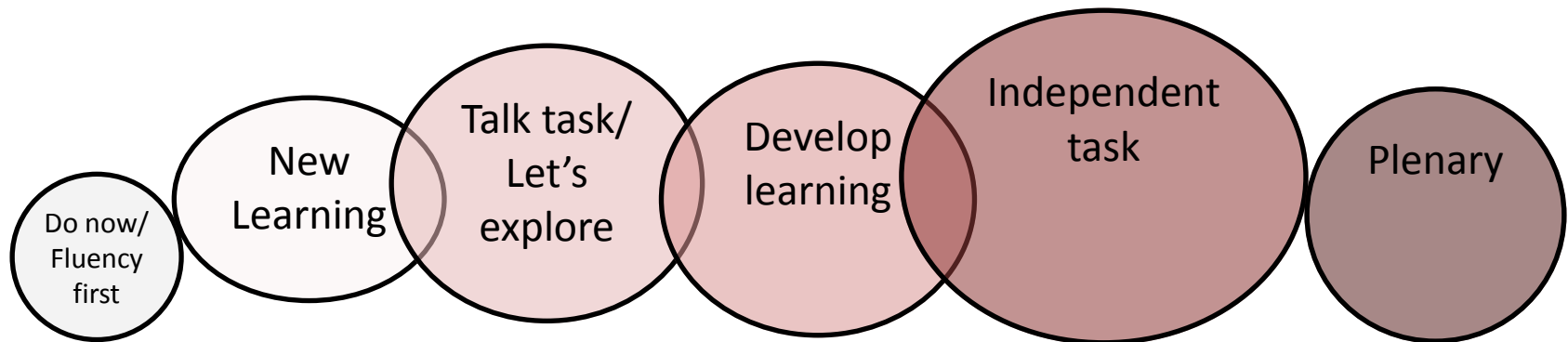
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How will children's work be recorded?

- Task sheets
- Books
- Videos
- Photographs

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Our partnership approach to transforming achievement

What does Mathematics Mastery lesson look like?

- Mathematics Mastery lessons follow a 6-part structure. This keeps the lesson pacy, gives flow and allows more opportunities to teach creatively, give feedback and assess learning.

- Pupils have access to plenty of concrete materials such as bead strings and place value counters so that they have time to fully explore mathematics.

Do now/ Fluency first · New Learning · Talk task/ Let's explore · Develop learning · Independent task · Plenary

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Lesson Structure – Six parts

The Mathematics Mastery six-part lesson includes:

Do Now
This is a quick task to introduce the maths lesson. All pupils should be able to access the activity without any teacher input and we recommend this segment lasts no longer than five minutes.

New Learning
This segment introduces the main mathematical concepts for the day's lesson.

Talk Task
This segment focuses on practising the new learning by talking about the maths using key vocabulary.

Develop Learning
This segment builds on the New Learning content and helps pupils deepen their understanding of the concepts.

Independent Task
This segment enables pupils to practise their learning independently.

Plenary
The closing segment enables you to recap on the lesson, checking understanding and celebrating success.

Mastery

Unit 1: Numbers and number bonds to 10
Lesson 1: Counting from zero to ten
Key learning: To count sets of objects within ten

Lesson overview

Count sets of objects.

Represent the number of objects on a ten frame.

Use the term 'same'.

Find sets that have the same number of objects.

Key vocabulary

there is, there are, count, count up to, how many?

number, zero, one, two, three, four, five, six, seven, eight, nine, ten

equal, is equal to, the same number as, as many

Sentence structures

There are ___ bears.

There is ___ glass.

The number of ___ is equal to the number of ___ .

Resources

objects to count

cubes

Resource 1 (ten frame)

Task sheet 1a (1)

Task sheet 1a (2)

Task sheet 1b

By the end of this lesson ALL pupils must be able to:

count a set of objects (within 10) accurately.

Do now

Practising transitions

For the first term, use the 'do now' part of the lesson to practise transitions.

Transition: Plan as appropriate.

New learning

Counting objects up to 10

Put a selection of bears on the carpet and ask, "How many bears are there?"

Count the numbers of bears together and model pointing to each object while counting.

Model the sentence structure by saying, "There are _ bears."

Repeat this with several examples within 10 to model the use of language using concrete objects on the carpet. Make sure that all pupils participate in counting and saying the full sentence.

Invite pupils to point to each object as they count and say in a full sentence how many there are.

Show a ten frame and model counting out the same number of cubes as bears. "There are 7 bears. One, two, three, four, five six, seven."

Place cubes one by one on the ten frame as you count.

Repeat the ten frame activity for other sets of objects.

Model the talk task.

Possible misconceptions

Pupils may miss objects if not using one-to-one correspondence when counting.

Transition: Plan as appropriate.

Unit 1: Numbers and number bonds to 10
Lesson 1: Counting from zero to ten
Key learning: To count sets of objects within ten

Talk task

Representing the number of objects on a ten frame

Show Task Sheet 1a and a ten frame.

Model pointing to an object and counting aloud. Model placing the same number of cubes on a ten frame. Invite two pupils to model the activity.
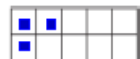
Pupil A will point to each object and count aloud.
Pupil B will place the same amount of cubes on a ten frame.
They will then swap roles for the next example.
The pupils will take it in turns to work with the ten frame, and to count and say the sentence.

How many rabbits are there?

One, two, three. There are three rabbits.

How many flowers are there?

One, two, three, four. There are four flowers.

Transition: Plan as appropriate.

Develop learning

Counting sets of objects and using the term 'same'

Present pupils with two sets of four objects on the carpet.

Ask pupils, "How many objects are in each set?"

Including pupil participation, point to each object, count together and label.

Invite a pupil to count out the same number of cubes for each set of objects using a different colour for each set. Build each set of cubes into a tower. Put the two towers next to each other to introduce the term 'same'. Model the sentence and ask pupils to repeat.

"The number of ____ is the same as the number of ____."

Repeat with more examples from the images on the IWB. Ensure that all pupils are counting. Have pupils build the towers of cubes and place the towers together to show the number of objects is the same. Pupils must repeat the full sentence, "The number of ____ is the same as the number of ____."

Model the independent task.

How many apples are there? How many sandwiches are there?

Can you find two sets with the same number of objects?

How do you know that the number of butterflies is the same as the number of bees?

There is one apple. There is one sandwich.

The number of butterflies is the same as the number of bees.

I made a tower of three cubes for the butterflies and a tower of three cubes for the bees. When I put the towers together, I could see that there was the same number of cubes.

Transition: Plan as appropriate.

Unit 1: Numbers and number bonds to 10
Lesson 1: Counting from zero to ten
Key learning: To count sets of objects within ten

Independent task

Finding sets that have the same number of objects

Pupils will count the objects in each set, placing cubes on top of each image. Pupils will then build the cubes into a tower for each set. Pupils can predict which sets will have an equal number. They will check by placing the towers side by side. If they are correct, they will stick sets with an equal number of objects next to each other in pairs.

This activity will be completed in pairs and pupils will practise saying sentences about the pairs, for example, "The number of bees is the same as the number of butterflies."
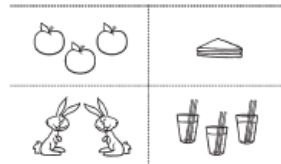
Transition: Plan as appropriate.

Plenary

Celebrating success and addressing misconceptions

The plenary should celebrate pupils' success, address any misconceptions or prepare pupils for another lesson.

Teachers should plan the plenary based on the lesson to address any misconceptions.

Reinforce that success comes from working hard and trying your best.

Possible adaptations

Count objects in the classroom or on the table and find sets of objects that have the same number (e.g. pencils, pens).

Take away some of the paired cards and replace them with blank cards. Can the pupils create their own cards with the right amount of objects?

Suggested consolidation task

Roll a 1 to 9 spotted die and count out the same number of objects.

Play a game of snap or pairs with the cards.

Transitions related to this lesson

Count from any number within ten forwards and backwards.

Counting rhymes.

Clap a number.

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Does it work?

The study shows that children who were taught through the Singaporean 'maths mastery' approach learn faster than their classmates

RICHARD GARNER [+] EDUCATION EDITOR Thursday 18 June 2015

f SHARE   y TWEET   g+ SHARE   REDDIT   in SHARE

THE INDEPENDENT

The first conclusive proof that Far Eastern teaching methods can improve UK pupils' maths performance is revealed in research just published.

A study, by UCL Institute of Education and Cambridge University, shows that children who were taught through the Singaporean "maths mastery" approach learn faster than their classmates - making, on average, an extra month of progress in a calendar year.

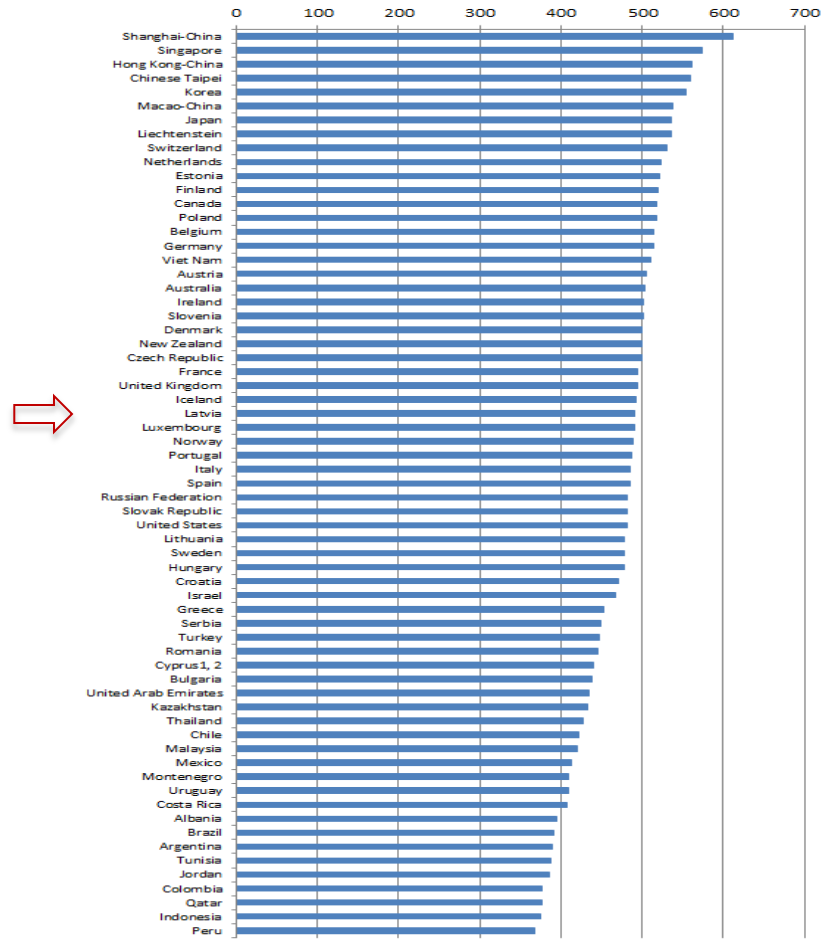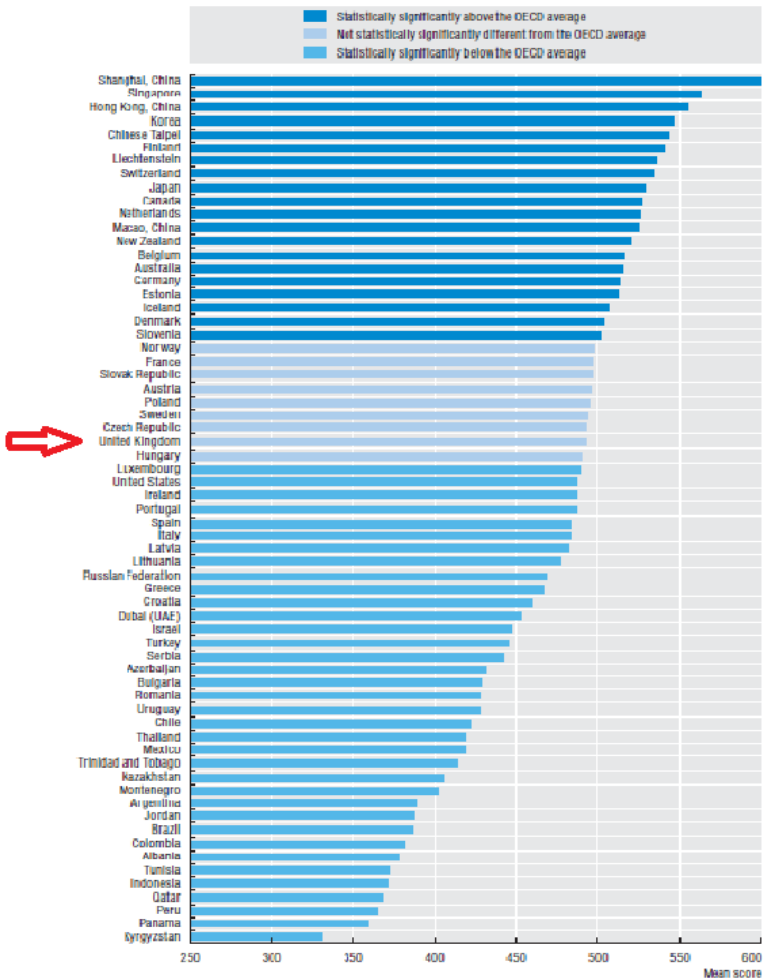Farm

theguardian
Winner of the Pulitzer prize 2014

English pupils' maths scores improve under east Asian approach

Study shows 'maths mastery' experiment improved children's scores in English schools after just one year

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How can I become involved?

- Talk to your child about their learning, what they learn in their maths lessons each day.

- Discuss numbers all around you: door numbers, bus numbers etc.

- Encourage your child to predict what number will come next in a sequence of door numbers – are they odd or even?

- Cooking and shopping with your child, getting them to weigh ingredients, using language such as "more" and "less/fewer".

Mastery questions you may have...

- **How will my child be challenged?**
- **How will my child be supported if they are struggling?**
- **What does 'deepening' look like in the classroom? What sorts of tasks/activities will my child be doing? How is their thinking being challenged?**

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Differentiation – a different picture

The New Curriculum sets higher expectations for pupil achievement and *the expectation is that the majority of pupils will move through the programmes of study at broadly the same pace.*

To achieve fluency, reasoning and problem solving.

Mastery is about keeping children together and not moving on at an over rapid pace

The premise of mastery teaching is that children are kept together on one focused learning objective.

"So teaching mu~~st~~ ~~...~~ ~~beca~~use you don't differenti~~...~~

"So dif~~...~~~~...~~ion doesn't exist anymore?"

It does exist – but it is very different

Year 3 – Place value of 3 digit numbers – how it may have looked previously

Red
1) 3<u>4</u>
2) 8<u>5</u>
3) <u>9</u>2
4) <u>6</u>3
5) 4<u>3</u>
<u>Ext:</u>
<u>3</u>45

Orange
1) 23<u>4</u>
2) 8<u>5</u>4
3) 4<u>9</u>2
4) 6<u>4</u>3
5) <u>3</u>42
<u>Ext:</u>
<u>7</u>548

Green
1) 253<u>4</u>
2) 8<u>5</u>44
3) 4<u>9</u>22
4) 6<u>4</u>55
5) <u>3</u>455
<u>Ext:</u>
<u>7</u>5485

674 is made of 6 hundreds, 7 tens and 4 ones.

674 is also made of 67 tens and 4 ones.

674 is also made of 6 hundreds and 74 ones.

Find different ways of expressing:

- 630
- 704
- 867

1) 23<u>4</u>

2) 8<u>5</u>4

3) 4<u>9</u>2

4) 6<u>4</u>3

5) <u>3</u>42

611

Hundreds	Tens	Ones
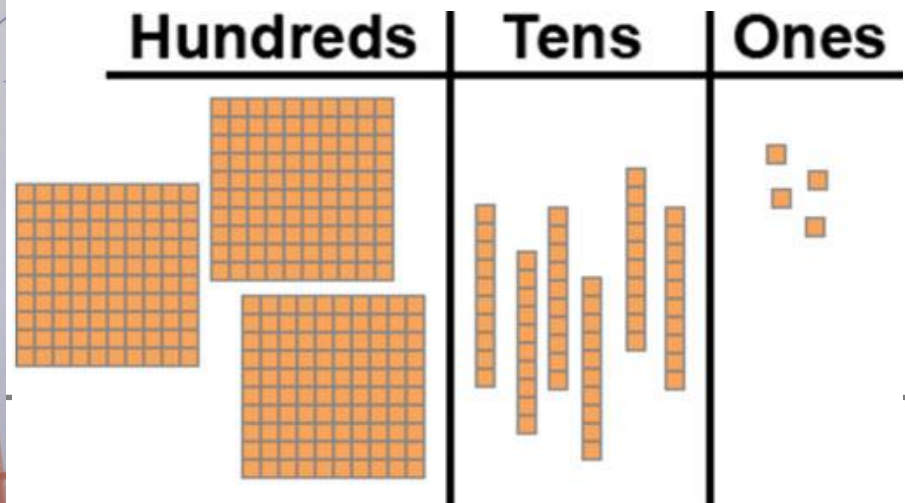
Multiply by 10,100 and 1000

Red

4 x 10

5 x 100

Orange

32 x 100

45 x 10

Green

4.3 x 10

100 x 5.65

Multiply by 10,100 and 1000

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Multiply by 10,100 and 1000 – this year

"The digits stay the same but the place value changes."

Task 1: Answer

1) 4.5 x 100

2) 10 x 87

Task 2: fill in the blanks

1) □.8□ x 1000 = 3850

2) 100 x 2.□ = □50

Task 3 (what's gone wrong? Please explain)

1) 1.47 x 1000 = 147

2) 3.4 x 10 = 340

Mastery challenge

Chesterton PRIMARY SCHOOL

0.25 x 1000 = _____ x 25

Can you explain how you solved this?

Can you write your own similar problem?

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Examples of Tasks

- Varied Fluency
- Problem Solving
- Reasoning

Part Whole Model

Notes and Guidance

Before beginning to add numbers and look at number bonds, children need to understand that a number can be partitioned into two or more parts.

Here, we introduce the part whole model to show this concept clearly.

Children should understand the language part, part, whole.

Mathematical Talk
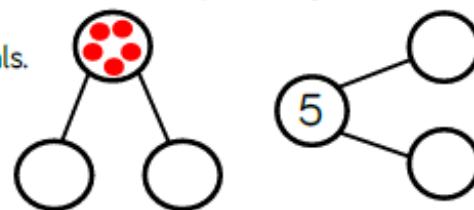
Which number is the whole?

Which numbers are the parts?

Can we partition a number into more than two parts?

Have you included zero?

Can you prove that you have found all the possible answers?

Varied Fluency

1　Complete the part whole models by drawing the counters then writing the numerals.

2　Here are seven pieces of fruit.

Put the fruit into a part whole model.
Complete the sentences.
………… is the whole.
………… is a part, ………… is a part and ………… is a part.
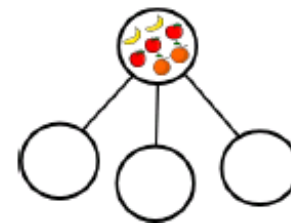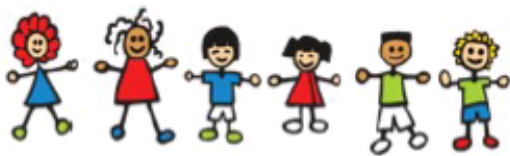
3　4 is the whole.
Complete all the part whole models using different numbers for the parts each time.

Part Whole Model

Reasoning and Problem Solving

There are 6 children.

How many different ways can you sort the children?

Complete a part whole model for each way.

Can you partition the children into more than 2 groups?

Possible answers:

Children sorted into boys and girls.

Children sorted into wearing white, wearing red.

Children sorted into children with white shoes and children with non-white shoes.

Work in groups of up to eight children.

Can you split yourselves into different groups?

Think of different ways to group yourselves: hair colour, eye colour, gender, shoe size etc.

Can you partition into more than 2 groups?

Children may split themselves into groups in many different ways.

E.g. hair colour, month of birth, shoe size, gender etc.

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10 More and 10 Less

Notes and Guidance

Teaching needs to focus on the importance of the tens digit.
Using a 100 square, explore with the children what happens to the numbers in the columns.
Draw attention to the idea that the tens digit changes while the ones digit remains the same.
Children will need to see how the number changes with concrete materials before moving onto more abstract ideas.

Mathematical Talk

What's the same?

What's different?

Varied Fluency

1 Continue the number tracks below.

10	20	30			

			35	45	55			

2 Using a 100 square, circle the number that is 10 more than 27.
Circle the number that is 10 less.
Repeat in different colours for different numbers.

3 Using apparatus, complete the missing boxes.

10 less		10 more
	$|$:	$||$:
2	12	22
	$|||$ :::.	
	37	

10 More and 10 Less

Reasoning and Problem Solving

SALE

15p   22p   35p   68p

Each piece of fruit is reduced by 10p.

What are the new prices?

Red Apple 5p

Green Apple 12p

Banana 25p

Lemon 58p

Tomas says, "I know that 10 more than 72 is 82 because I only have to look at the tens digit."
Is he correct?
Explain your reasoning.

Molly is counting backwards in 10s. She says forty nine, thirty nine, twenty nine and then stops.
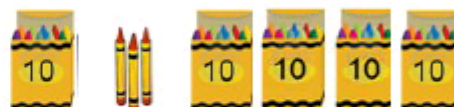What numbers comes next and why?

Yes because when you add ten you aren't adding ones.

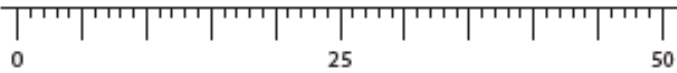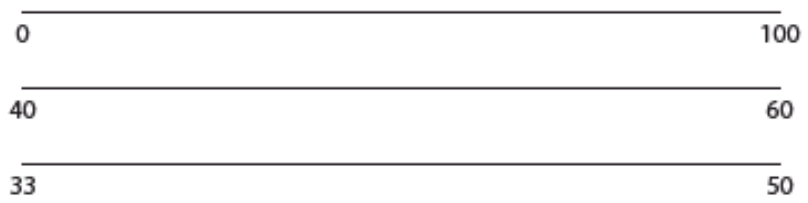19 because you take one ten away from 29

Class 3 gives one of their full packets of crayons away.

How many crayons do they have left?

Explain your reasoning.

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They will have four full packs left which is four tens, and thee crayon which represents three ones.

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Mastery	Mastery with Greater Depth
Think of an even number that is more than 30 and less than 50. And another. Can you find them all? How many are there? Explain your reasoning.	Amy thinks of a number. Her number: ■ is an even number ■ is between 20 and 25 ■ has two different digits. What is her number? Explain your reasoning.
Steve says, 'My number has two tens and five ones.' What is Steve's number? Amy has two more tens than Steve. What is her number? Sam says, 'My number has five tens.' What numbers **can** it be? What numbers **can't** it be?	Captain Conjecture says, 'When I count in tens from any number the units digit stays the same.' Do you agree? Explain your reasoning.
Place these numbers on the number line: 10, 48, 30 0 25 50	Place 47 on each of these empty number lines. 0 100 40 60 33 50
Use < > and = signs to make these number sentences correct. 3 tens ☐ 30 ones 2 tens ☐ 9 ones 4 tens ☐ 33 ones	Use < > and = signs to make these number sentences correct. 3 tens and 2 ones ☐ 2 tens 12 ones 4 tens and 3 ones ☐ 3 tens 14 ones 5 tens and 4 ones ☐ 4 tens 11 ones