

MATHS REASONING

EYFS & KS1



NATIONAL CURRICULUM

FLUENCY

Pupils become fluent in the fundamentals of maths, including through varied and frequent practise with increasing complexity so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.

REASONING

Pupils reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language

PROBLEM SOLVING

Pupils can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

PROGRESSION

OLD MATHS CURRICULUM



NEW MATHS CURRICULUM



MATHS IN THE EARLY YEARS

- Children are natural problem solvers
- Numbers and numerals are abstract concepts - 3 can mean very little to a young child
- Children need to build images of numbers - linking numerals to objects
- Maths in the early years is play based - the aim is to build understanding and not written methods
- Maths games, songs, rhymes and play activities help build understanding

FLUENCY

Rapid recall of number facts – times tables, doubling & halving, number bonds

Transfer of number facts into every day calculations

Using known facts to aid calculation

Clear understanding of place value

REASONING

Explain thinking and methods used – being able to say why you think an answer is right or not. How do you know?

Understanding and be able to use mathematical language

Verbalising their ideas

EXAMPLE OF REASONING ACTIVITIES

CONVINCE ME

- In my head I have two odd numbers with a difference of 2. What could they be?
- Sophie has 3 silver coins. Joshua has a £1 coin. Joshua said "I have more money than you". Is he correct?
- Jack says "All 3D shapes have at least 1 vertex". Do you agree?

EXAMPLE OF REASONING ACTIVITIES

ALWAYS, SOMETIMES, NEVER

- When you fold a square in half, you get a rectangle
- You can make £1 using an odd number of coins
- Multiples of ten are also multiples of five

EXAMPLE OF REASONING ACTIVITIES

TRUE OR FALSE?

- Four 5p coins are worth more than two 10p coins
- If I add 3 odd numbers together, the answer will always be even
- All facts in the ten times table are even

Addition and Subtraction

National Curriculum Statement	All students		
	Fluency	Reasoning	Problem Solving
<p>Add and subtract one digit and two digit numbers to 20, including zero.</p>	<ul style="list-style-type: none"> Fill in the missing gaps: $20 - \square = 10$ $\square + 13 = 19$ $\square = 17 - 13$ Alan baked 16 cookies. He gave 14 of them away. How many are left? If you know that $12 + 7 = 19$, complete: $19 = 12 + \underline{\quad}$ $12 = 19 - \underline{\quad}$ $19 - \underline{\quad} = 12$ 	<ul style="list-style-type: none"> Martin is subtracting single digits from 20. He says, "The lowest answer I can get is 11." Do you agree? Explain why. Make each line add up to 20 Explain why $20 - 10 = 10$ Sarah has 12 toy cars and Tim has 5. They want to know how many more Sarah has. They have written a number sentence to help them solve the problem. $12 + 5 = 17$ Have they done it correctly? Explain why. 	<ul style="list-style-type: none"> Look at the digit cards below. <p>How many calculations and answers can you make? How do you know you have found them all?</p> Roll two dice and add the numbers to get an answer. Use a ten frame to help if needed. What are the highest and lowest possible answers? How do you know? How many part-whole models can you make where the whole number is 40? Can you have 3 parts? The answer is 18. How many ways can you get to this answer?

Multiplication and Division

National Curriculum Statement

Solve problems involving multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts, including problems in contexts.

- Use the pictures to fill in the missing numbers.



groups of =

Addition sentence:

Multiplication sentence:

- I have five 10p coins, exactly enough to buy a chocolate bar.



I need 1 more 10p to buy bottle of pop.
How much is a bottle of pop?

All Students

Reasoning

- Compare the number sentences using $<$ $>$ or $=$

$$3 + 3 + 3 + 4 \quad \square \quad 3 \times 4 + 4$$

$$5 \times 4 + 2 + 2 \quad \square \quad 5 + 5 + 5 + 5 + 2 + 2$$

$$\triangle + \triangle + \triangle = 12$$

$$\hexagon + \hexagon = 12$$

$$\triangle = \quad \hexagon =$$

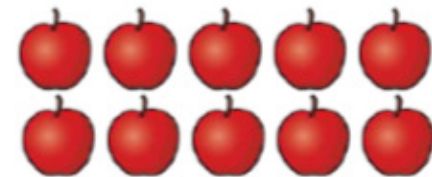
- Erik bakes 5 trays of muffins. Each tray contains 6 muffins.



He sells 16 muffins and eats 5
How many muffins does he have left?

Problem Solving

- Here are some apples.



Class 2 are asked work out the total. Here are four different ways they do it.

Fill in the missing blanks.

$$\dots + \dots = 10$$

$$\dots + \dots + \dots + \dots + \dots = 10$$

$$\dots \times \dots = 10$$

$$\dots \times \dots = 10$$

- If

$$\triangle + \triangle + \triangle = 30$$

$$\circ + \circ + \circ + \circ = 20$$

$$\hexagon + \hexagon = 4$$

Complete the addition

$$\triangle + \circ + \hexagon =$$

How do you know?

Prove it!

True or false?

If I know that ... I also know ...

Always, sometimes, never true

What is the same?
What is different?

Show me another and another ...

Visualise ..



Maths Talk

Key Questions

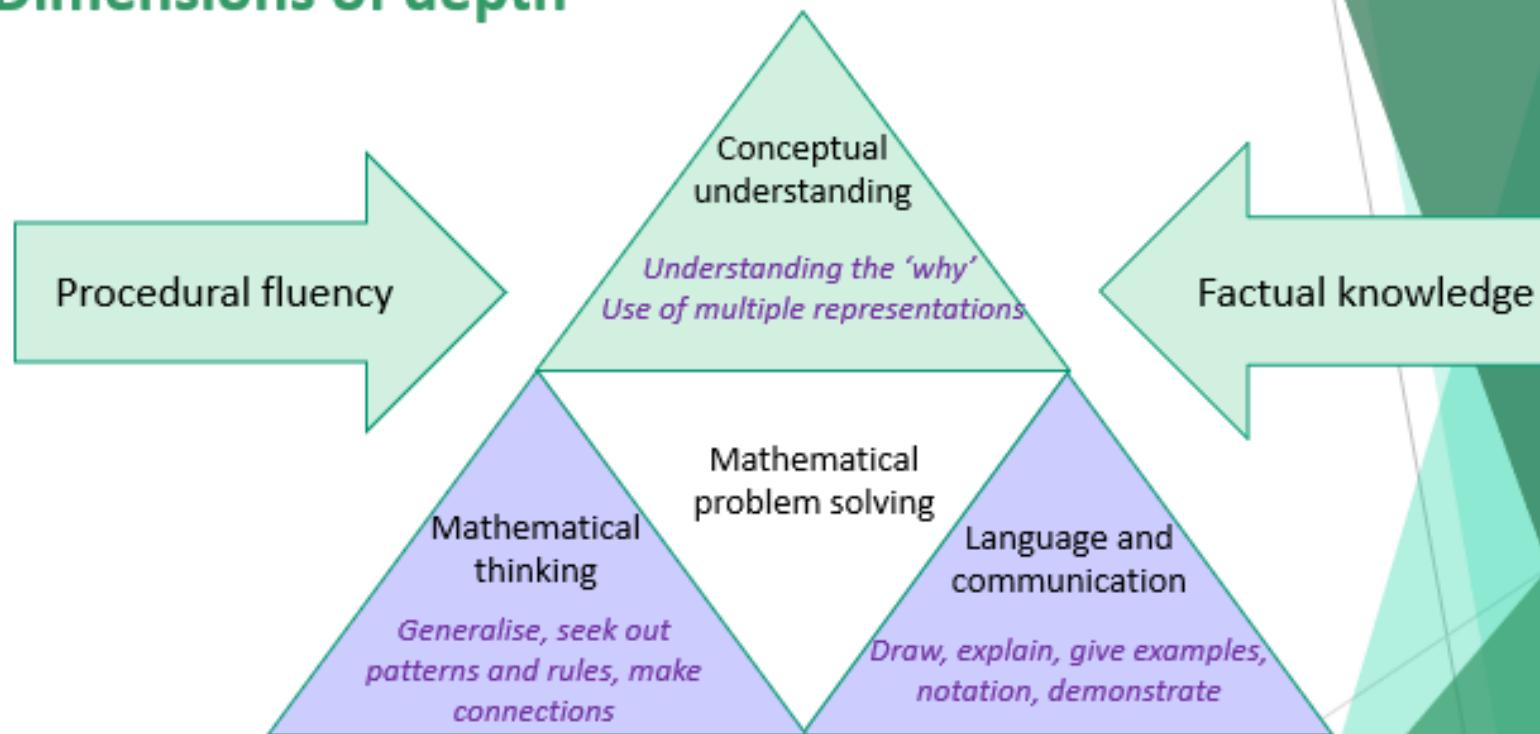


Math Talk

Sentence Starters



Dimensions of depth



Mastering Mathematics, Helen Drury, 2014

I have 8 cakes in my box. If I put 5 cakes on one plate and 3 cakes on another, my box will be empty!



CPA

Concrete - there are 8 cakes and Sid ate 3.
How many are left?

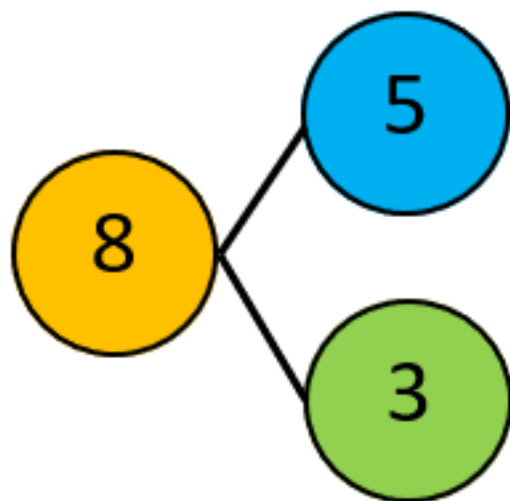


Pictorial – represent this using models



Abstract – $8 - 3 = 5$

Multiple representations



$$5 + 3 = 8$$

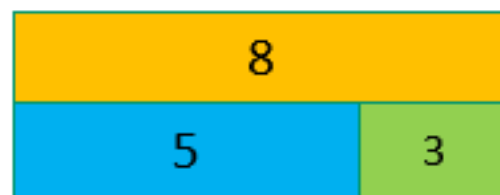
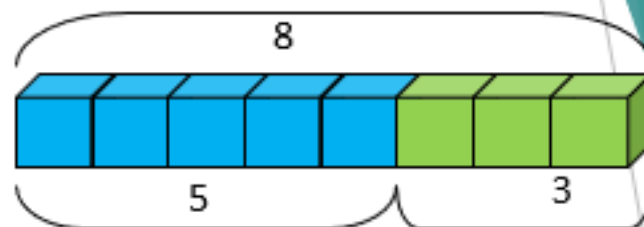
“3 more than 5 is 8”

“5 less than 8 is 3”

“The difference between 8 and 3 is 5”

$$8 - 5 = 3$$

Part-part-whole model and bar model





GUESS THE DOMINOES



WHAT ARE YOU AIMING TO DO?

The team has to find the rule on the ruler's card, using the minimum number of tests. A test is asking whether a particular domino obeys the rule.

AS A TEAM:

- Finding out what others think
- Giving reasons for ideas
- Being concise
- Reflecting on what has been said
- Allowing everyone to contribute.

GETTING STARTED

Make teams of 4 or 5. Choose one person to be the "Ruler".

YOU WILL NEED:

- The set of domino rule cards
- A piece of coloured paper (the box)
- A set of dominoes

TACKLING THE PROBLEM

- The team has the dominoes
- The ruler selects a rule card from the pack and keeps it hidden from the rest of the team
- Before deciding on a domino to present to the ruler for testing - the team must discuss and agree as a team why they think it would make a good test case
- If the domino obeys the rule then the ruler puts it in the box, if it does not obey the rule it is placed outside the box.
- If someone thinks they know the rule, they must share their reasoning with the rest of the team, who discuss and check their reasoning before deciding to guess the rule.
- The ruler then reveals the rule.
- If the team is right the task can start again with a different ruler. If they are wrong, they discuss where their error in reasoning may have been before moving on

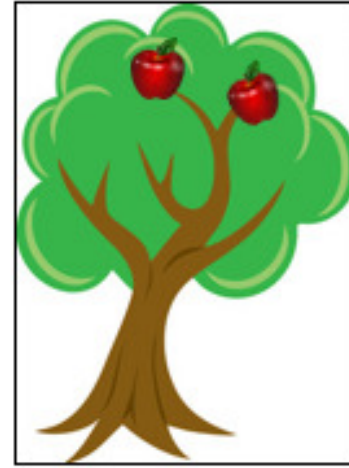
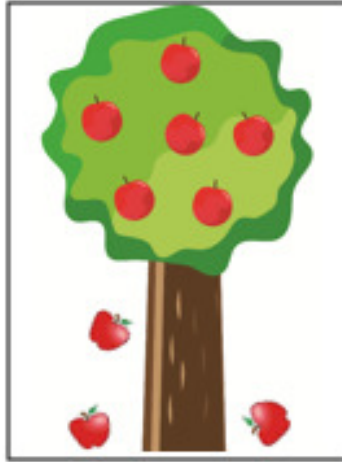
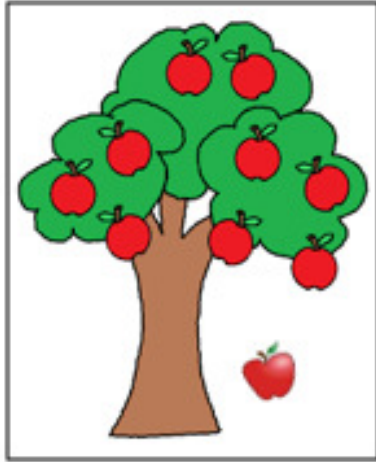
KEY QUESTIONS

- **Was there a choice of domino to test that was particularly useful? Why?**
- **Were there any ideas that proved really helpful?**
- **How well did you listen to others in your group?**
- **How did you ensure that everyone had a chance to contribute?**

Language and communication

Tell me a story about the apples

How many apples are growing on the trees?



How many ways could you represent the apples on the 2nd tree?

Using what we have learnt so far...

Spaceship

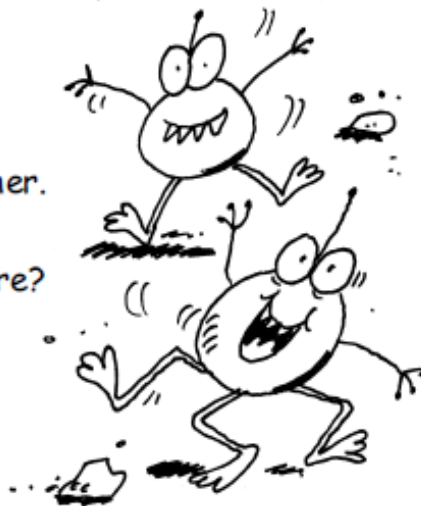


Some Tripods and Bipods flew from planet Zeno.
There were at least two of each of them.

Tripods have 3 legs.
Bipods have 2 legs.
There were 23 legs altogether.

How many Tripods were there?
How many Bipods?

Find two different answers.



Can you count in twos to 23?

Can you count in threes to 23?

Think about the number 23 ... what do you know about it? What is it made up of? (tens and ones)

How does this help you?

**Is it possible to have two Tripods?
Why?**

If I know I also know