Mastery in Mathematics

EYFS and Year 1 Parents' Workshop

Aims of today's workshop:

- to gain an insight into the 'Mastery in Mathematics' approach and how it is being taught in Year 1

- to give ideas for supporting maths at home – making it fun

How and why did the 'Mastery in Mathematics' approach develop?

In this country, it was suggested that:

- too many children were falling behind
- not enough children were excelling
- teaching had been focused on procedures rather than understanding
- some pupils had negative attitudes towards their ability and enjoyment of the subject

Maths Hubs

- Involved in a National Maths Mastery project
- Matrix Maths, Herts and Essex
- Linked to Ingatestone and Fryerning CEVA Junior School, supported by the lead Maths Mastery Teacher for the region
- Approach is linked to Singapore maths and Shanghai maths

'Mastery in Mathematics' – some key principles:

- The approach works on a 'depth before breadth' principle. Children work through a series of small, carefully sequenced steps, which must be mastered before pupils move to the next stage.
- Its rigorous and systematic programme is developed to ensure that every child can achieve excellence.
- Number sense and place value always come first. Pupils are constantly encouraged to make connections and look for patterns.
- Teaching provides children with a deep understanding of the subject through a concrete, pictorial and abstract approach.

More key principles:

- The large majority of pupils progress through the curriculum content at the same pace. There is little differentiation in content taught, but the questioning and scaffolding individual pupils receive in class as they work through problems will differ.
- Pupils who grasp concepts rapidly are challenged through rich and sophisticated problems, which deepen their knowledge of the same content, before any acceleration through new content.
- Pupils' difficulties and misconceptions are identified through immediate formative assessment and addressed with prompt intervention – commonly through individual or small group support later that same day.

More key principles:

- Teachers use precise questioning in class to test conceptual understanding and technical proficiency.
- Practise and consolidation play a central role. Carefully designed variation within this builds fluency and understanding of underlying mathematical concepts in tandem.
- Both class work and homework provide 'intelligent practice', which helps to develop deep and sustainable knowledge.
- The children's language and communication skills are promoted each lesson with 'talk partner' opportunities.
- A child's mindset is more important than his/her prior attainment.

Growth Mindset

In order for this approach to be as effective as possible, pupils need to:

- believe that effort creates success
- believe that skill and ability can be improved over time
- view mistakes as an opportunity to learn further
- be resilient in their learning
- think about how they learn and not just what they are learning

Why is partner work so important?

Children need to be able to articulate their learning in order to 'master' a concept/skill.

During mastery lessons, children are given the opportunity to:

- share their ideas and talk through their working
- practise new vocabulary in full sentences
- check each other's working
- give their peers simple but instant feedback
- feel successful in their learning through a series of shared, guided and independent experiences

Why do away with differentiation?

Put crudely, standard approaches to differentiation commonly used in primary school maths lessons involve some children being identified as 'mathematically weak' and being taught a reduced curriculum with 'easier' work to do, whilst others are identified as 'mathematically able' and given extension tasks. This approach is used with the best intentions: to give extra help to those who are having difficulty with maths, so they can grasp key ideas, and to challenge those who seem to grasp ideas quickly. It sounds like common sense.

However, research has shown that differentiation may be very damaging in several ways.

For the children identified as 'mathematically weak':

1. They are aware that they are being given less-demanding tasks, and this helps to fix them in a negative "I'm no good at maths' mindset that will blight their mathematical futures.
2. Because they are missing out on some of the curriculum, their access to the knowledge and understanding they need to make further progress is restricted, so they get further and further behind, which reinforces their negative view of maths and their sense of exclusion.
3. Being challenged (at a level appropriate to the individual) is a vital part of learning. With low challenge, children can get used to not thinking hard about ideas and persevering to achieve success.

For the children identified as 'mathematically able':

1.

Extension work, unless very skilfully managed, can encourage the idea that success in maths is like a race, with a constant need to rush ahead, or it can involve unfocused investigative work that contributes little to pupils' understanding. This means extension work can often result in superficial learning. Secure progress in learning maths is based on developing procedural fluency and a deep understanding of concepts in parallel, enabling connections to be made between mathematical ideas. Without deep learning that develops both of these aspects, progress cannot be sustained.

For the children identified as 'mathematically able':

2.

Being identified as 'able' can limit pupils' future progress by making them unwilling to tackle maths they find demanding because they don't want to challenge their perception of themselves as being 'clever' and therefore finding maths easy. A key finding from Carol Dweck's work on mindsets is that you should not praise children for being clever when they succeed at something, but instead should praise them for working hard. That way, they will learn to associate achievement with effort (which is something they can influence themselves – by working hard!), not 'cleverness' (a trait perceived as absolute and that they cannot change).

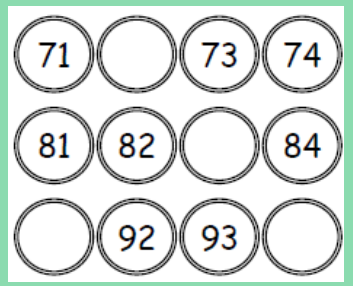
Concrete, Pictorial and Abstract

- https://www.youtube.com/watch?v=c4qUoOMcmKI

Count to and across 100, forwards and backwards, beginning with 0 or 1, or from any given number, count, read and write numbers to 100 in numerals.

Concrete

Can you make a train with Cuisenaire rods that is 100 long? Use as many different colour pieces as you can.

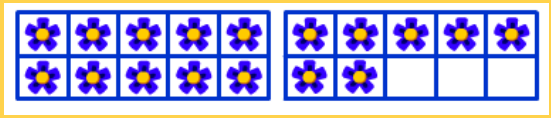


Fluency

Fill in this section of a 100 square. How did you know what to fill in the gaps?

Pictorial

How many flowers are there?
What would the number of flowers be if there were 100 more?



Reasoning

Count out loud and miss a number, can you partner guess which number you have missed out?. How do they know?
32, 31, 30, ___, 28, 27

Abstract

count forwards from 85 to 110 count backwards from 104

Problem solving

Emma was writing all the counting numbers from 1 to 30 .
She stopped because her pencil broke, after writing seventeen digits. What was the last number she wrote?

Given a number, identify 1 more and 1 less,
identify and represent numbers using objects and pictorial representations including the number line, and use the language of: equal to, more than, less than (fewer), most, least
read and write numbers from 1 to 20 in numerals and words

Concrete

Create a mini hopscotch. Count the numbers as you jump on them. Can you give a friend directions to move forward or backwards a number?

Pictorial

Draw the amount of stars that are one more and one less than this:

Abstract

True or False? I start at 2 and count in twos. I will say 19 .

Fluency

What comes next?
10+1 = 11, 11+1= 12, 12+1 = 13
Now write out these number sentences in words.

Reasoning

There are twenty-nine marbles in a tub. I am putting one more marble in the tub. How many are in there now? How did you know?
Start with a different number of marbles in the tub. Ask your partner to put another marble in or take one out and then say how many there are in the tub. How will you know if your partner is right?

Problem solving

5,6,8,9,10
What is wrong with this sequence of numbers? Can you use these words to describe it? equal to, more than, less than (fewer), most, least

Read, write and interpret mathematical statements involving addition (+), subtraction (–) and equals (=) signs

Concrete

Put out 3 blue counters and then put out 2 red counters. What addition sentence have you just made can you make any more? Write down instructions for a friend to follow.

Pictorial

Draw Olaf the snowman, Roll 2 dice and add that amount of buttons to him. How many have you altogether?

Abstract

Think of three different ways to say each of these symbols:

+ - =

Fluency

I'm thinking of a number. I've added 7 and the answer is 18. What number was I thinking of? Can you write this in a number sentence?

Reasoning

Which of these are true and which are false? Why?

6 - 2 = 4

5 - 1 = 3

2 + 3 = 4

5 + 2 = 7

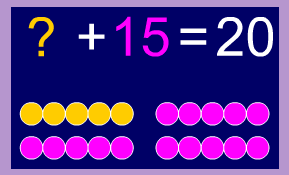
3 + 3 = 6

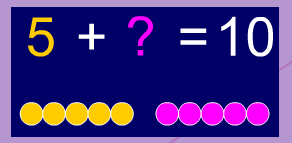
4 - 2 = 5

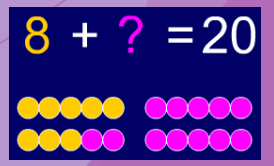
3 - 1 = 4

Problem solving

Can you solve these?







Prior Learning

The children will have already learnt:

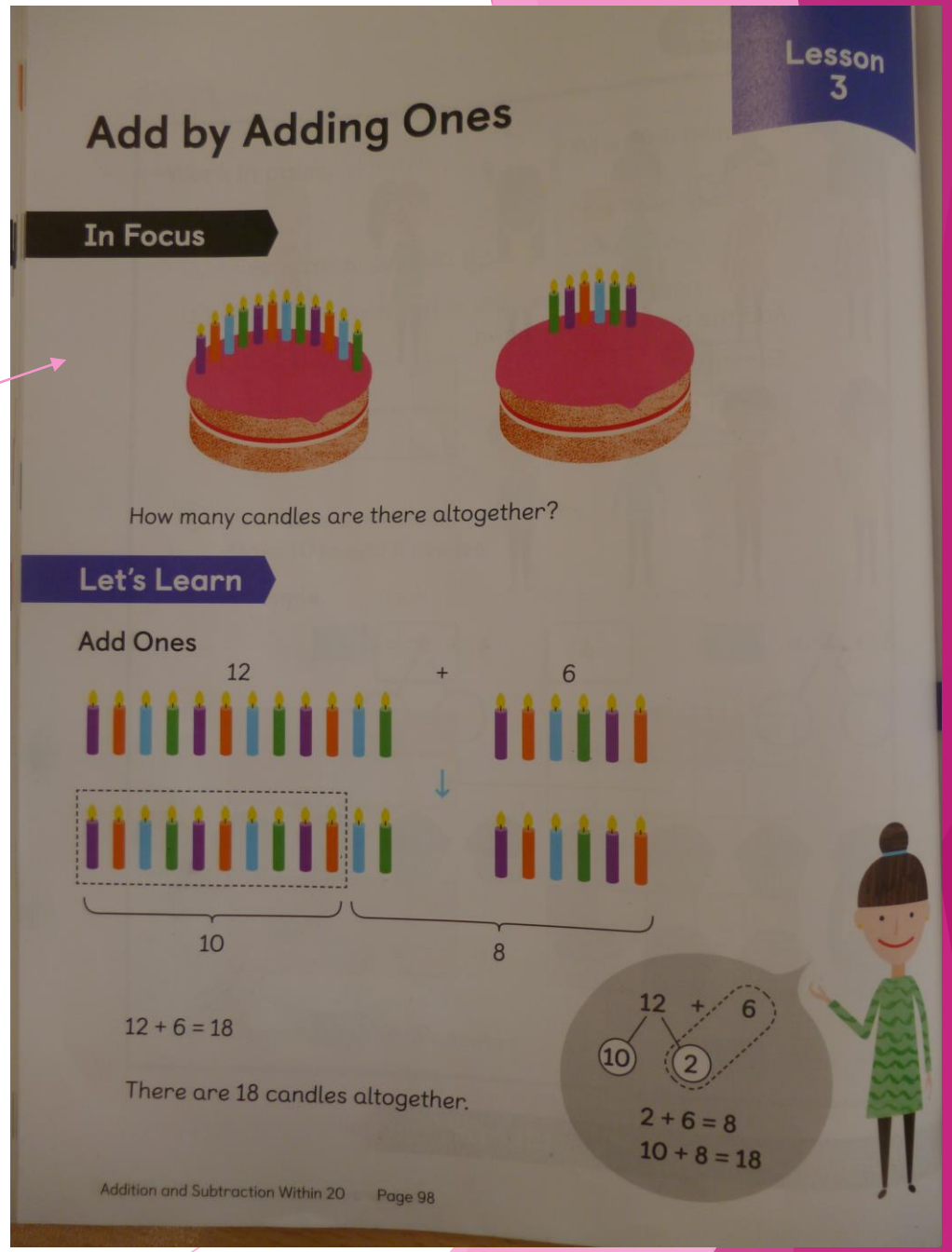
- 1:1 counting of objects to 20 accurately
- Using number lines and 100 squares
- Recognising numerals to 20.
- Recognising terminology – e.g. Less than, minus, more, is equal to, altogether
- Counting forwards and backwards
- Different strategies for adding and subtracting within 10
- Grouping by 10's
- Introduced Whole Part Part

Maths - No Problem.

An example of a recent year 1 lesson.

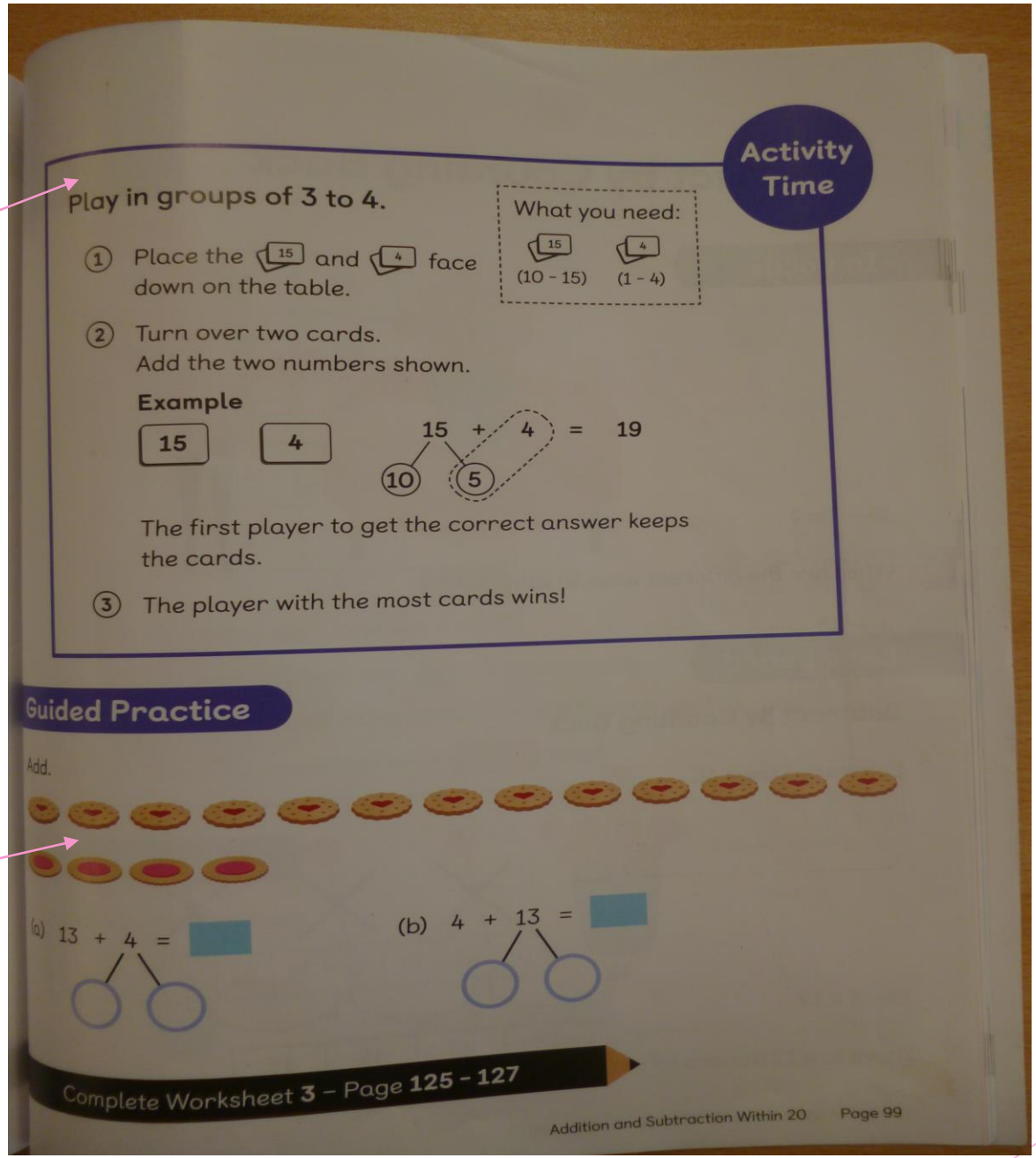
Can I add by adding ones?

Introducing topic



Concrete

Pictorial



Activity Time

Play in groups of 3 to 4.

What you need:

15 (10 - 15) 4 (1 - 4)

1. Place the 15 and 4 face down on the table.
2. Turn over two cards.
   Add the two numbers shown.

Example

15 4

15 + 4 = 19

10 5

The first player to get the correct answer keeps the cards.

3. The player with the most cards wins!

Guided Practice

Add.

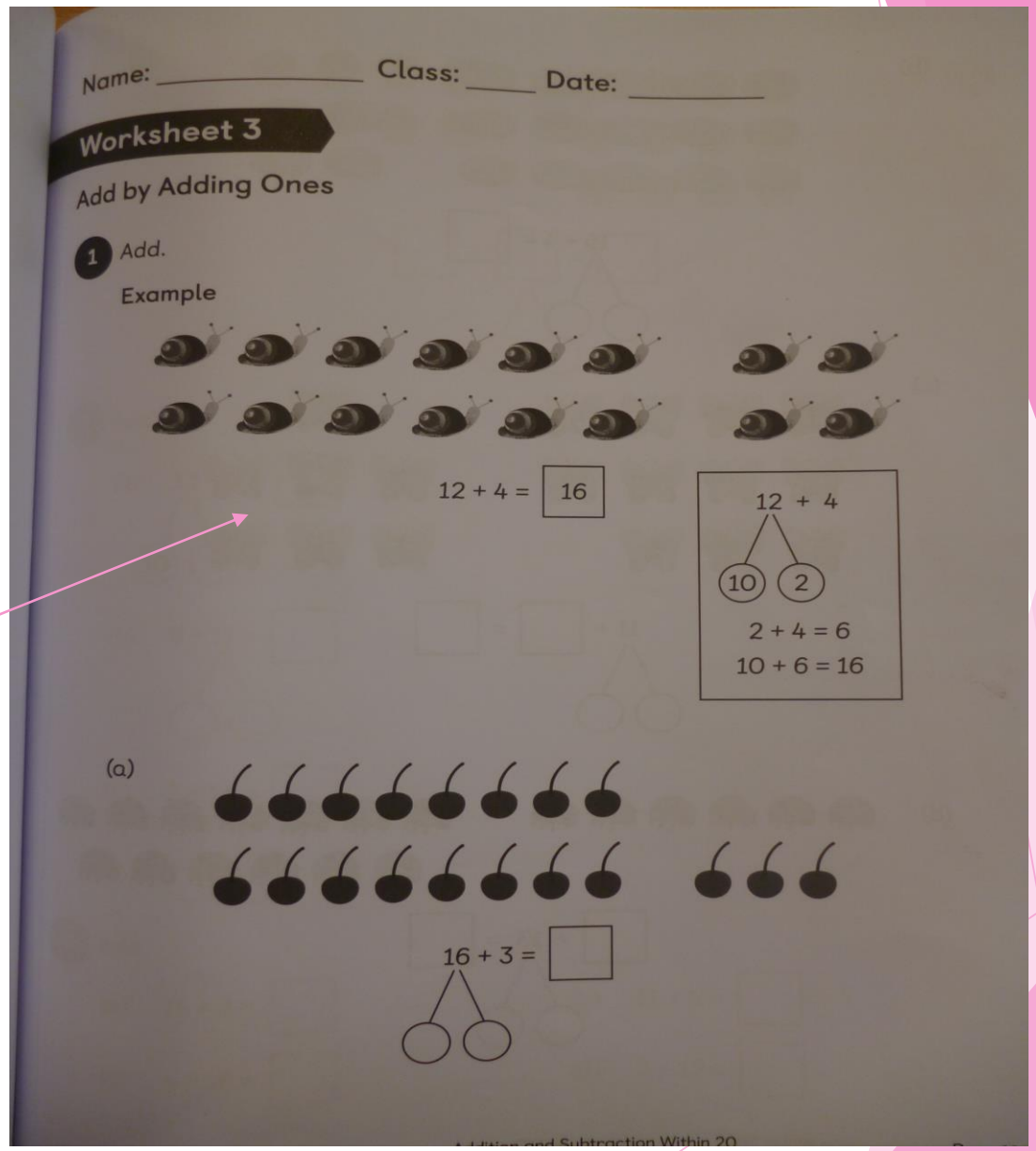
(a) 13 + 4 =

(b) 4 + 13 =

Complete Worksheet 3 – Page 125 - 127

Worksheets for children to independently complete.

Pictorial



Name: _____ Class: _____ Date: _____

Worksheet 3

Add by Adding Ones

1 Add.

Example

12 + 4 = 16

12 + 4

10 2

2 + 4 = 6

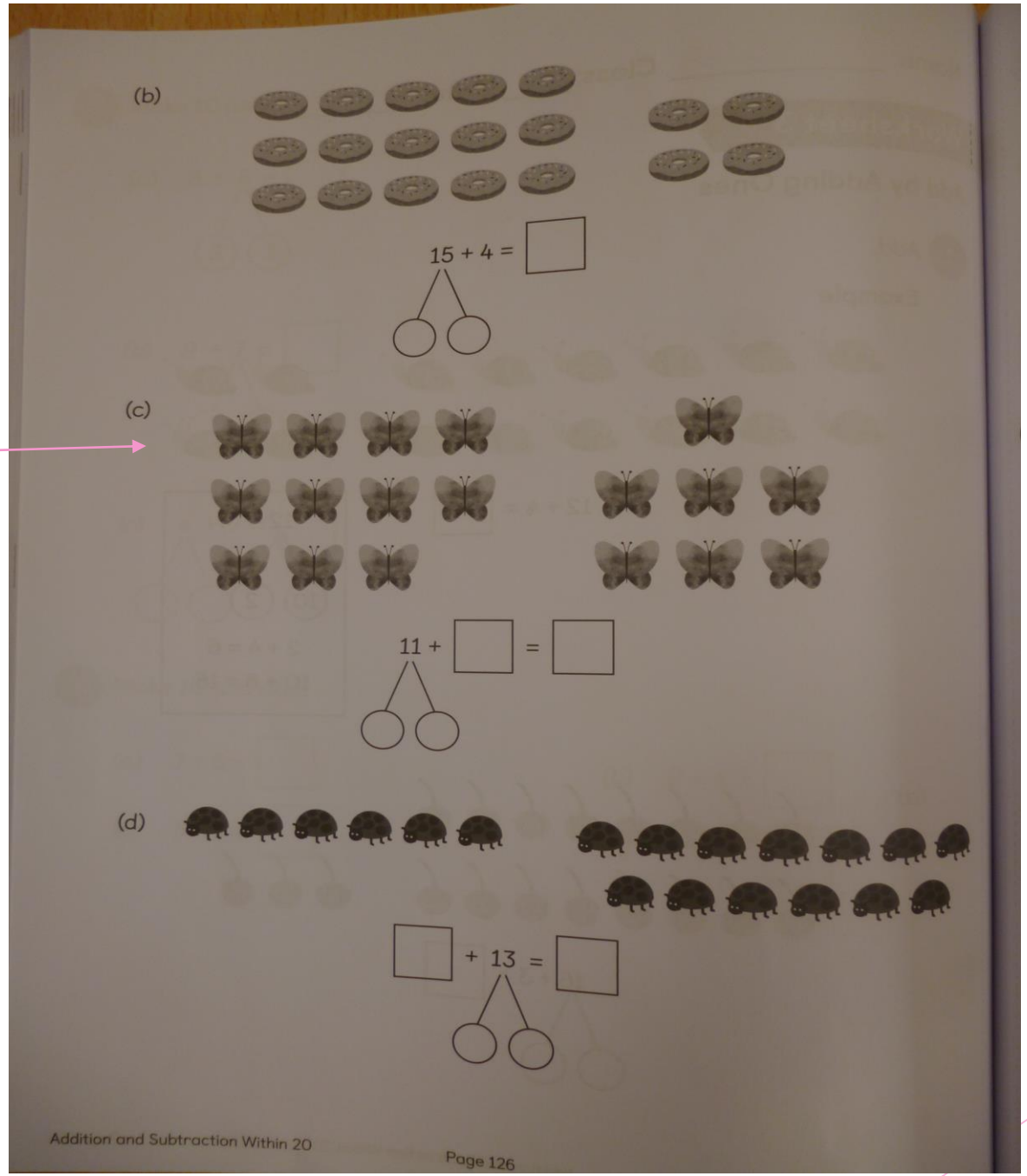
10 + 6 = 16

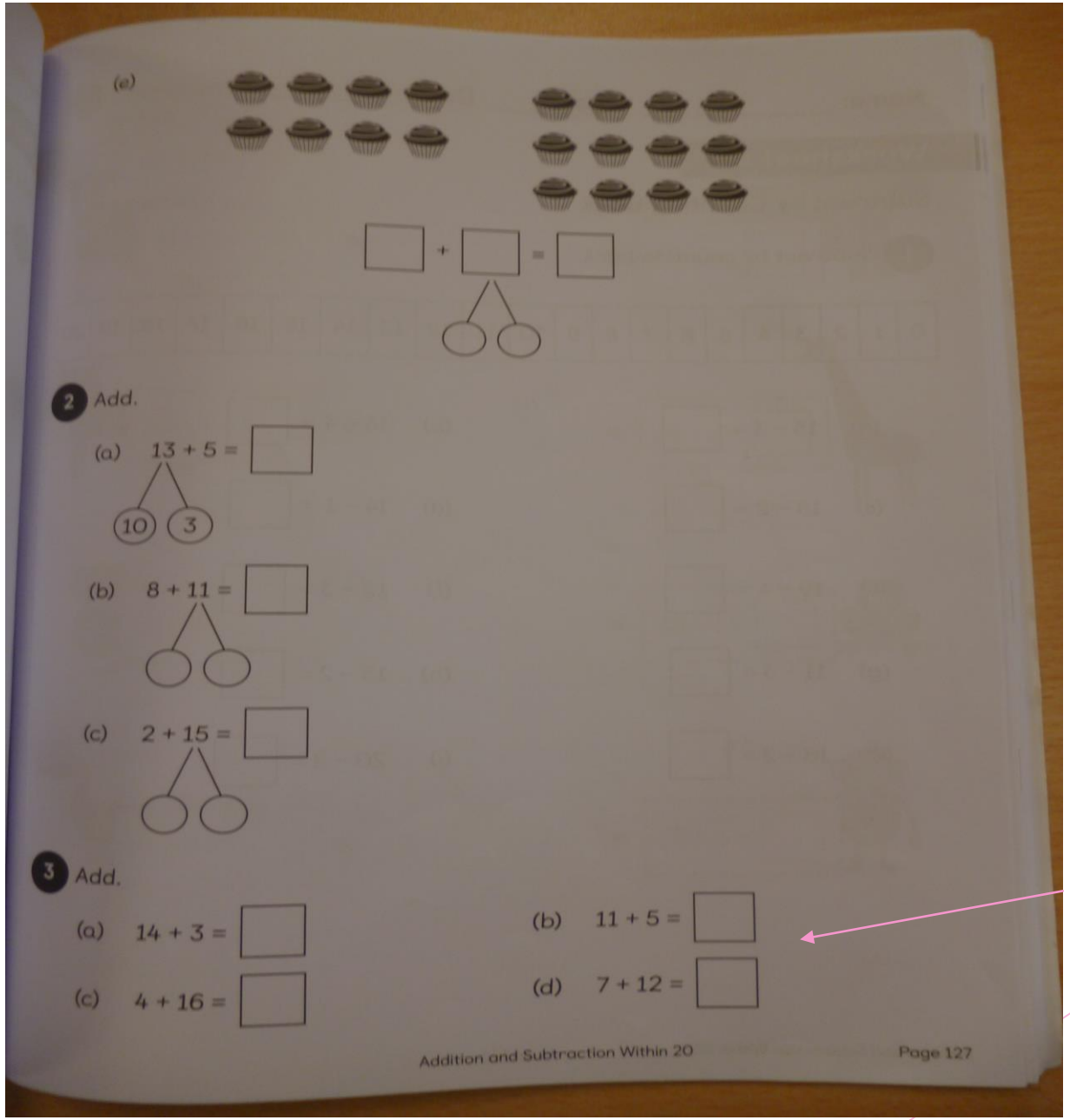
(a)

16 + 3 = ☐

Addition and Subtraction Within 20

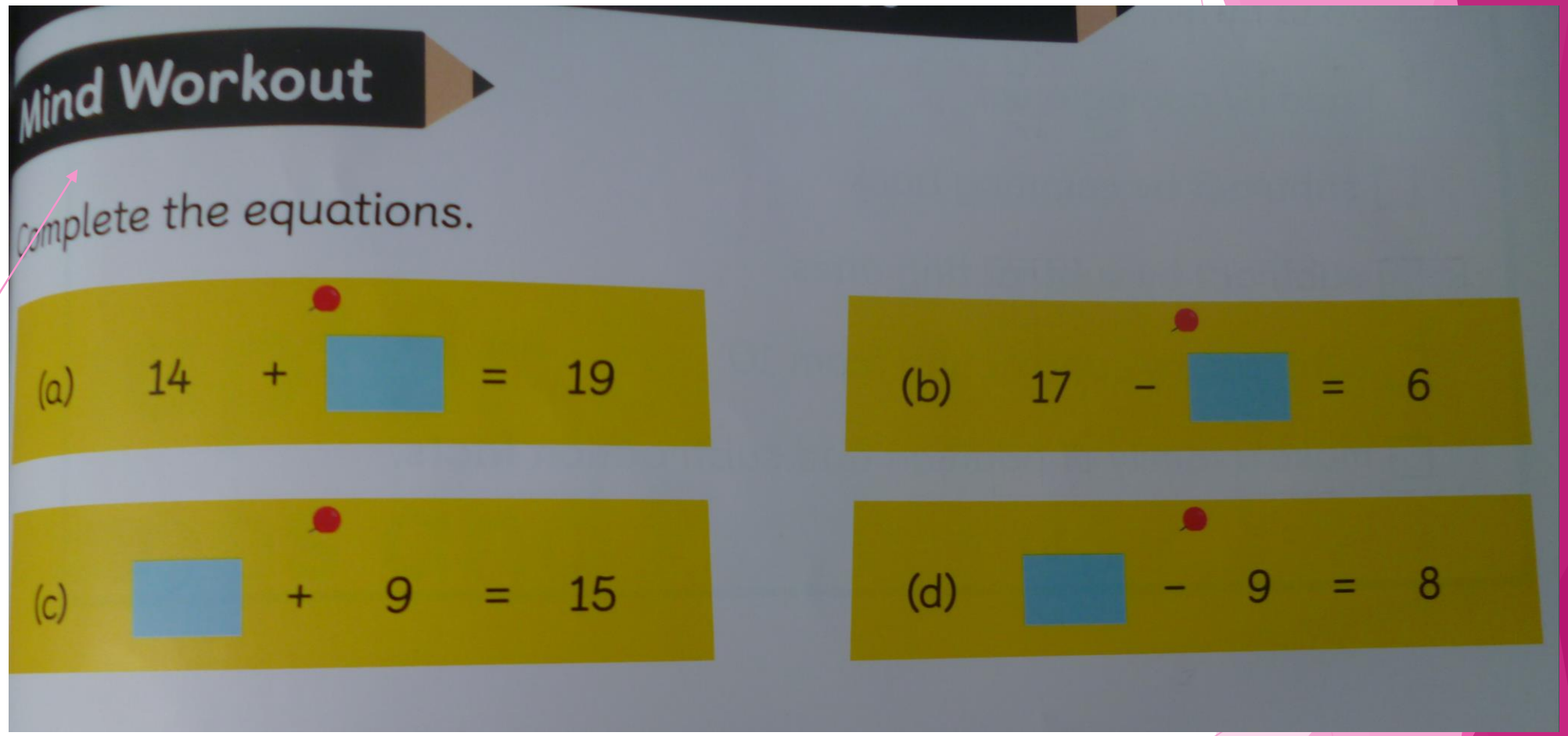
Pictorial





This section is *abstract learning*.
At this stage the children are encouraged to explain their methods to a talk partner.

This is another example of an abstract task

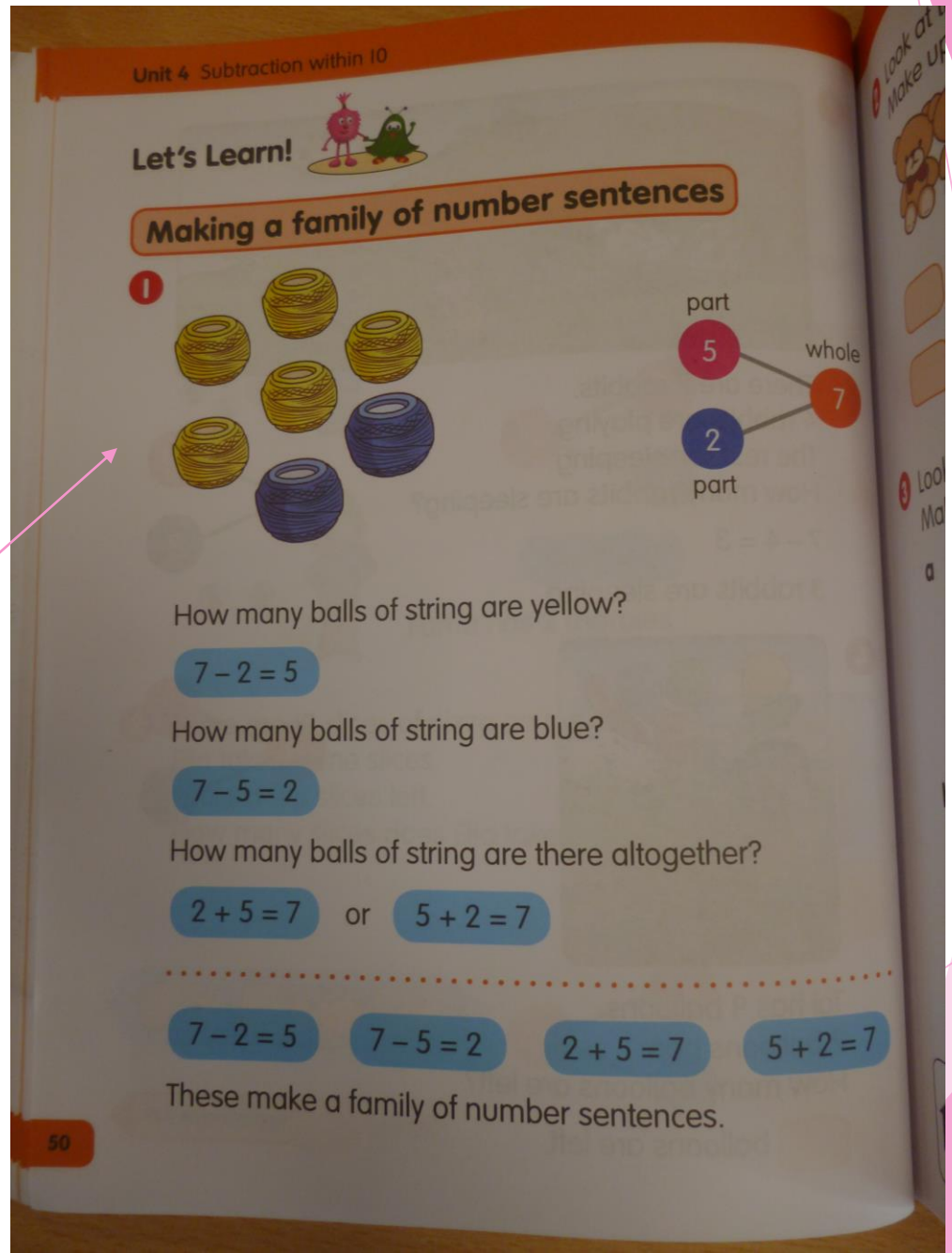


Inspire Maths

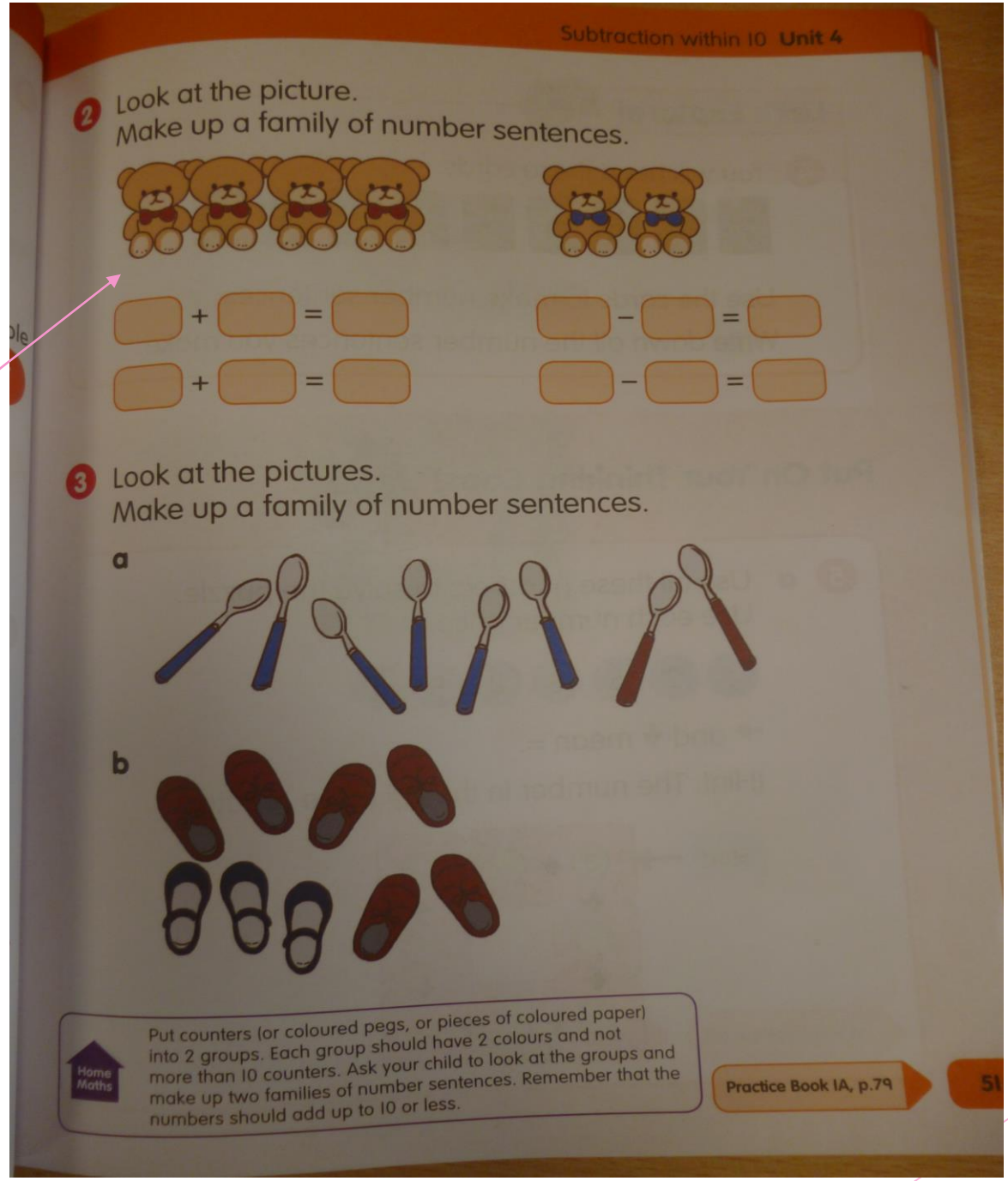
An example of a recent year 1 lesson.

Can I make a family of number sentences?

Introduction to topic



Pictorial



Subtraction within 10 **Unit 4**

2 Look at the picture.
Make up a family of number sentences.

□ + □ = □
□ + □ = □

□ − □ = □
□ − □ = □

3 Look at the pictures.
Make up a family of number sentences.

a

b

Home Maths

Put counters (or coloured pegs, or pieces of coloured paper) into 2 groups. Each group should have 2 colours and not more than 10 counters. Ask your child to look at the groups and make up two families of number sentences. Remember that the numbers should add up to 10 or less.

Practice Book 1A, p.79

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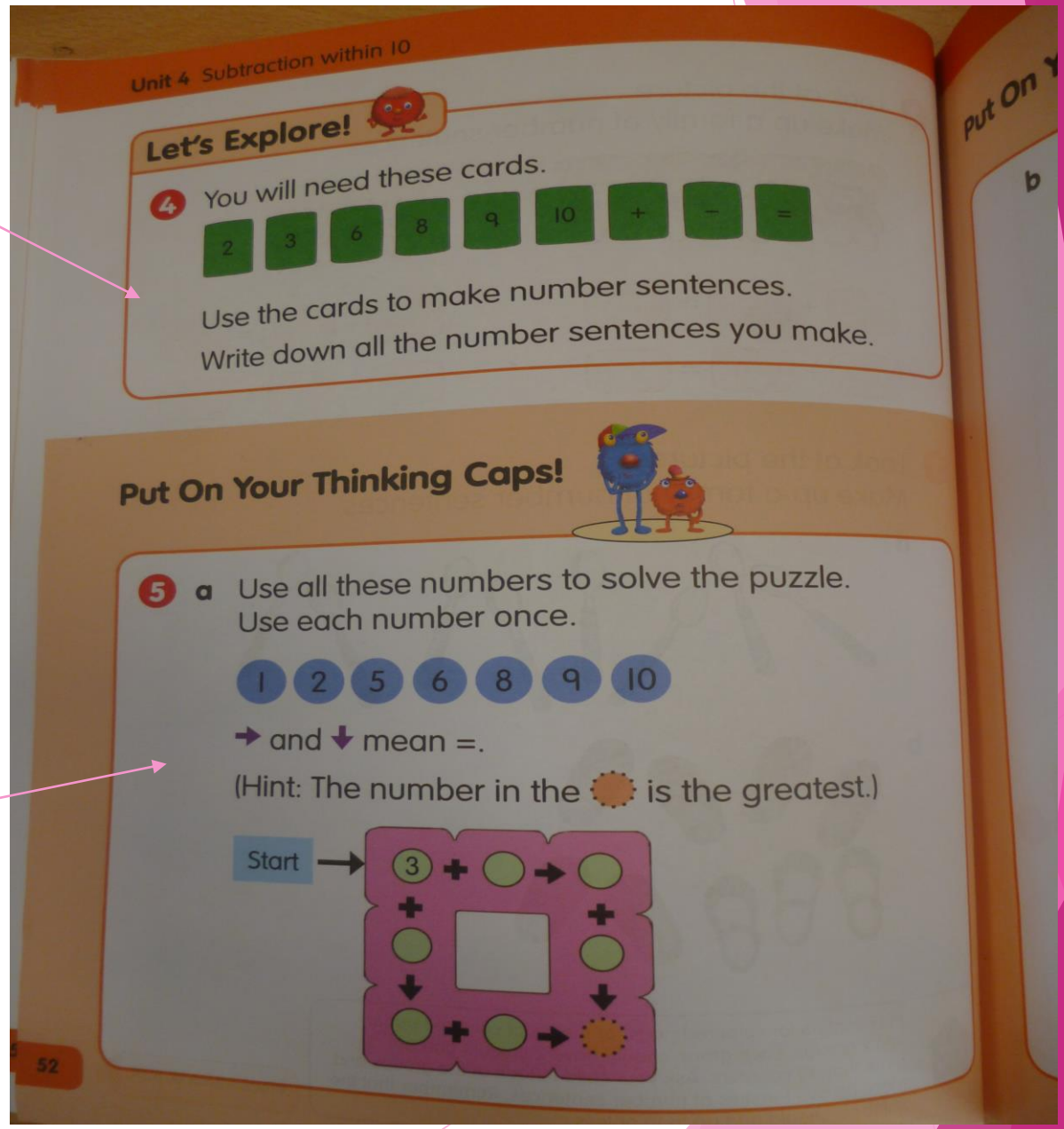
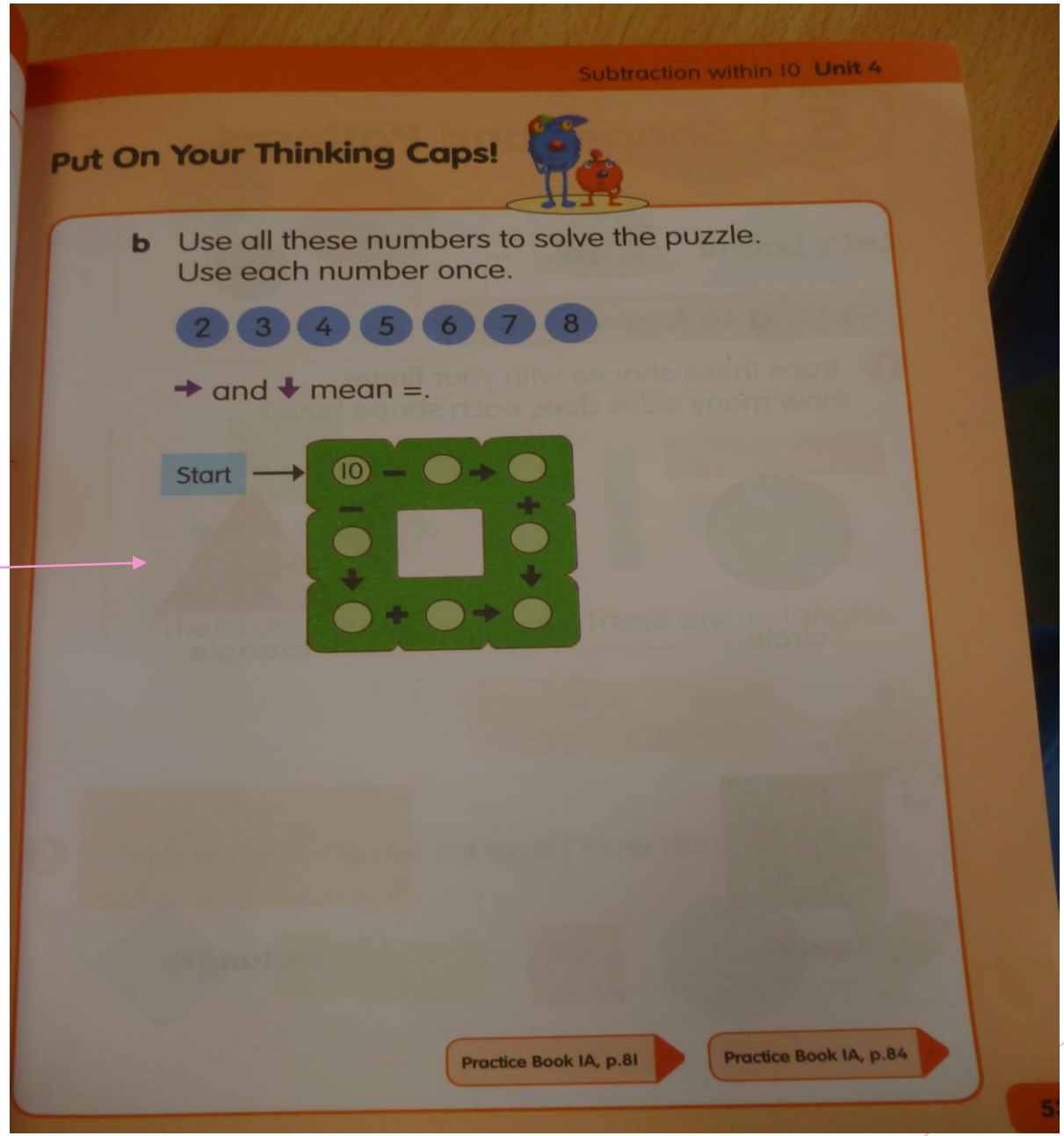
Reasoning activities to apply and embed learning.

Concrete

Abstract



Abstract


Subtraction within 10 Unit 4
Put On Your Thinking Caps!
b Use all these numbers to solve the puzzle.
Use each number once.
2 3 4 5 6 7 8
→ and ↓ mean =.
Start
10
Practice Book 1A, p.81
Practice Book 1A, p.84

'Mastery' and 'Mastery with Greater Depth'

MASTERY:

A pupil really understands a mathematical concept when he/she can:

- describe it in his/her own words
- represent it in a variety of ways (using concrete materials, pictures and symbols)
- explain it to someone else
- make up his/her own examples and non examples of it
- see connections between it and other facts and ideas
- recognise it in new situations and contexts
- make use of it in various ways, including in new situations

MASTER WITH GREATER DEPTH:

Is characterised by those who can:

- solve problems of greater complexity (ie. where the approach is not immediately obvious), demonstrating creativity and imagination
- independently explore and investigate mathematical contexts and structures, communicate results clearly and systematically explain and generalise the mathematics

How can you support your child at home?

- Ensure your child completes his/her homework each week.
- Use every opportunity to ask your child questions and encourage them to explain their reasoning to you. Use words like "Prove it!" and "Convince me!"
- Look for maths around you. This might include: telling the time, discussing the days of the week, talking about money or the coins needed to pay for items, looking at how long it takes for things to cook, spotting different shapes, using positional language and ordinal numbers, measuring length, weight and capacity etc.
- Practise number bonds to 10 and 20 with your child through quick fire games and rehearse counting forwards and backwards in 2s, 5s, 10s etc. Reinforce mathematical language.