

**Dyscalculia Solutions
Hobart
Day 2**

Overview

Counting

Four operations

Troublesome topics

Time

Singapore Maths



Counting Principles Activity

Work in pairs

- Write a definition for the first principle and an example; then pass to your partner
- Read the definition – is it correct? Do you both agree? If you do, tick it
- Write a definition and example for the second counting principle and then pass to your partner.
- Continue until all of the counting principles have a definition

Counting Mastery- Principles of Counting

Stable Order Principle

One-to-One Correspondence Principle

Order Irrelevance Principle

Cardinality Principle

Conservation Principle

Movement is Magnitude Principle

Abstraction Principle

Unitizing Principle

Levels of Oral Counting

Children will say numbers from a very early age.

- String level
- Unbreakable list level
- Breakable chain level
- Numerable chain level
- Bi-directional chain level

Four Operations?

Another issue with language

An act of surgery performed on a patient?

The action of functioning?

A mathematical manoeuvre to solve a problem

Four Basic Operations

Addition

Subtraction

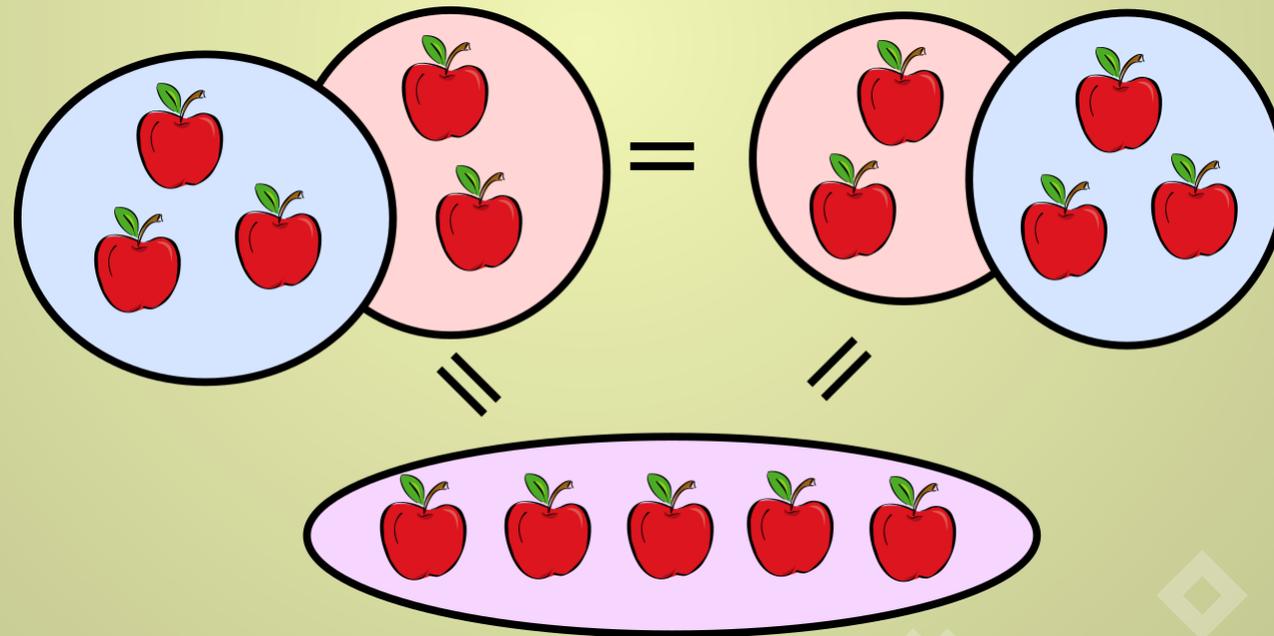
Multiplication

Division

Addition Activity Part 1

Devise some number stories for addition

$$3 + 2 = 5 = 2 + 3$$



$$5 + 3 = 8$$

Aggregation Counting all 2 groups	Augmentation Counting on 1 group
5 apples and 3 grapes How many pieces of fruit altogether?	5 children in the park and 3 more come to join them. How many children in the park?

Addition Activity part 2

What model of addition do they demonstrate?

Subtraction Activity Part 1

Devise some number stories for subtraction



$$6 - 2 = ?$$

Subtraction Model

1) Removing items- most stories are like this, because we use the language 'ten take away five'

2)Comparing sets- I had 7 pencils and you had 9 pencils. How many more pencils do you have?- can use the bar model for this.

3)Part Whole Model

11 biscuits in the tin. 9 have chocolate on them . How many don't have chocolate?

Subtraction Activity Part 2

What model of subtraction do they demonstrate?

Multiplication

Scaling: 3 times as big

Repeated addition: 3 lots of

Division $15 \div 3$

Sharing 15 between 3, 5 in each group

Grouping How many groups of 3 in 15?

Making Links



$$4+5=9$$

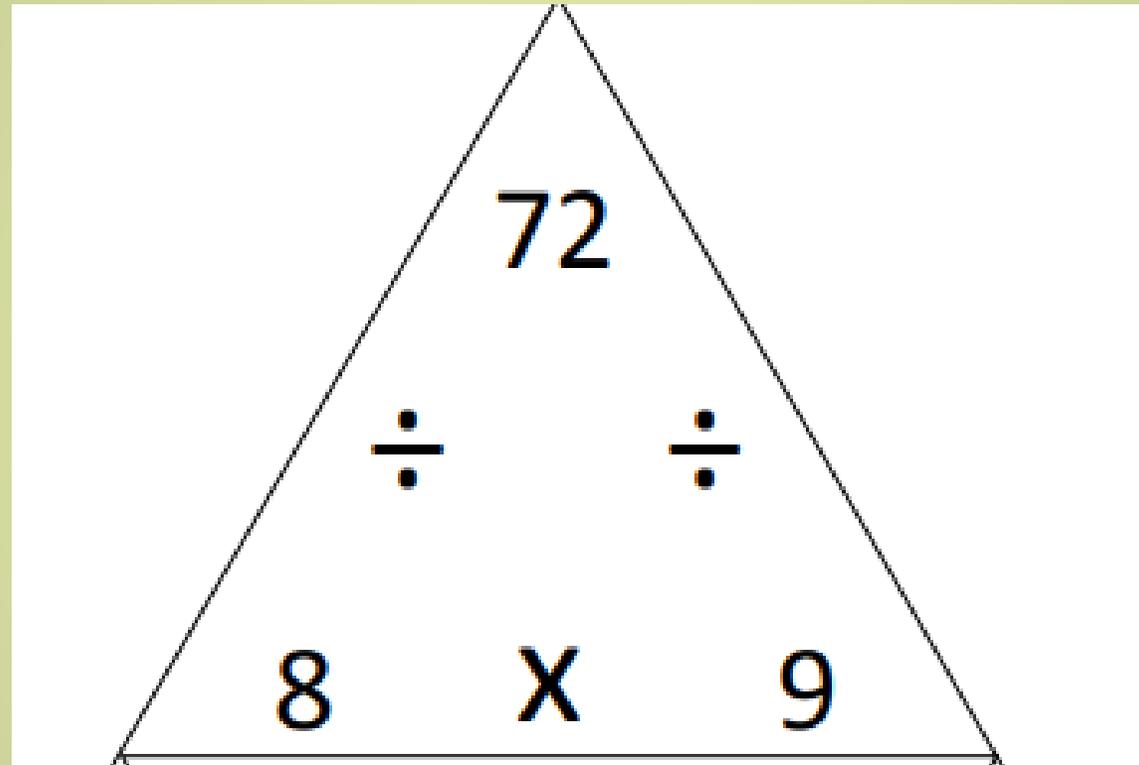
$$9-4=5$$

What are the links between 5, 4 and 9?

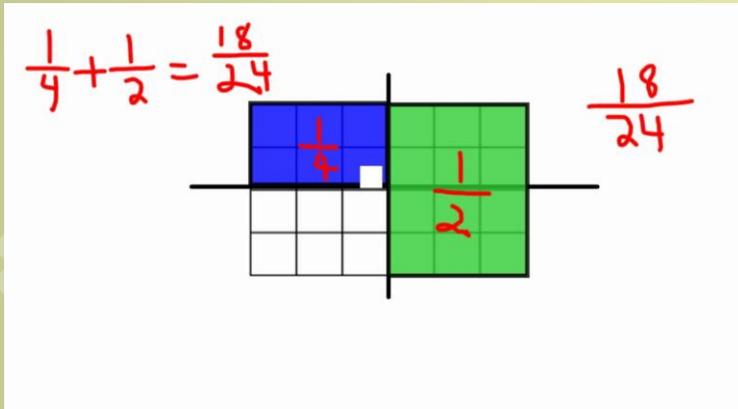
$$5+4=9$$

$$9-5=4$$

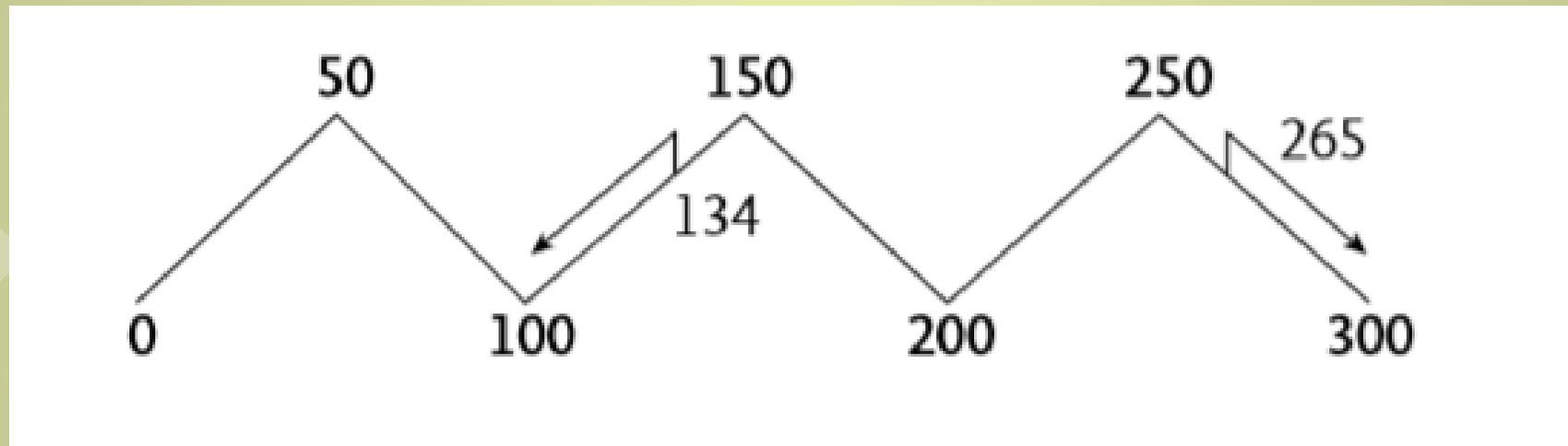




Troublesome topics



Rounding up and down

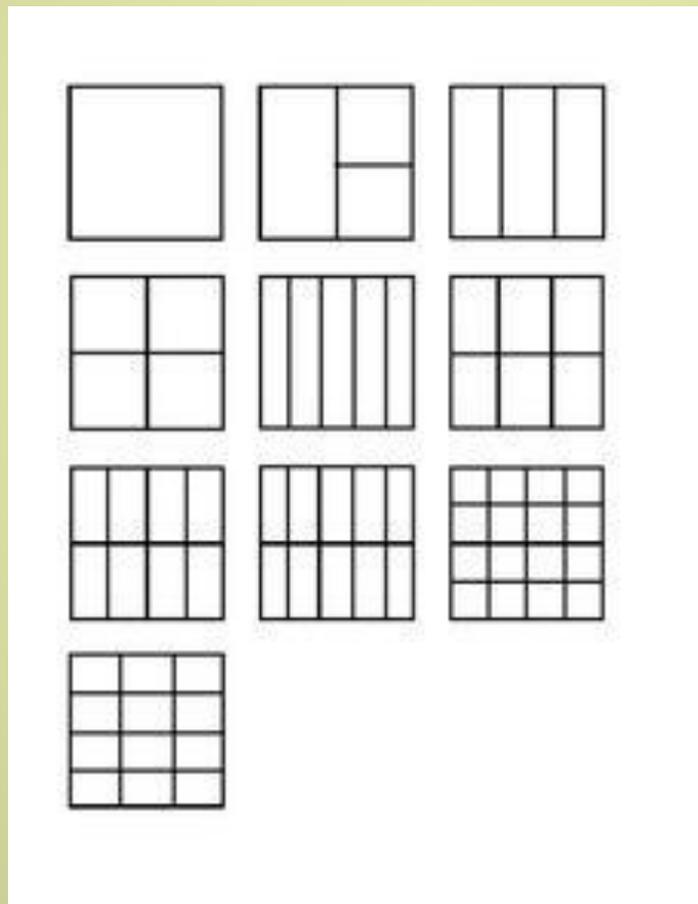


Fractions

In pairs, define a fraction

Fractions

Model with square or rectangular paper



Fundamental fractions

After halves and quarters, develop thirds, fifths etc(CPA).
Develop from there.

Link to a number line

Link halves and quarters to circles to help with time

Use manipulatives and diagrams incessantly

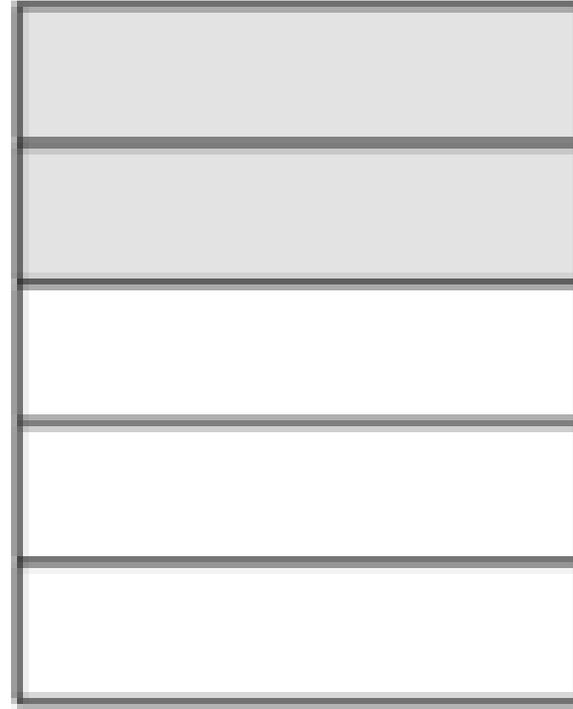
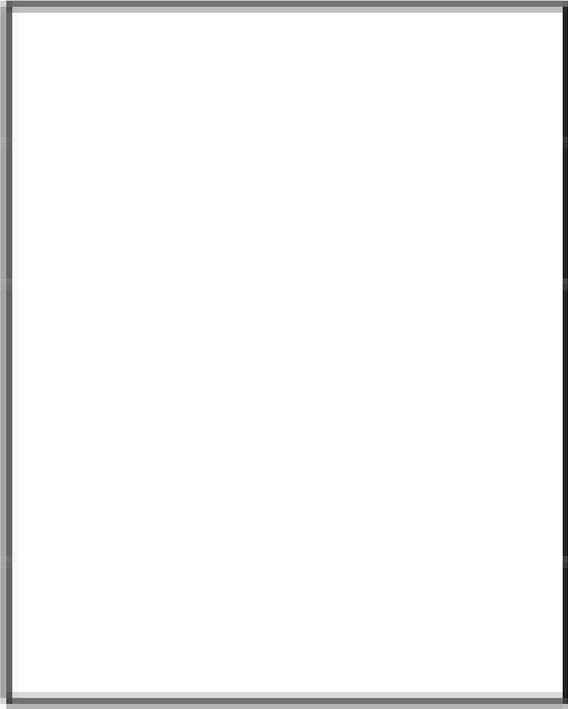
Language

One fifth plus one fifth

One over five plus one over five

But

$$\frac{2}{3} \times \frac{3}{5} = \frac{6}{15} = \frac{2}{5}$$



Fractions Example

$$\frac{2}{3} \times \frac{4}{5} = \frac{8}{15}$$

Instrumental Understanding:

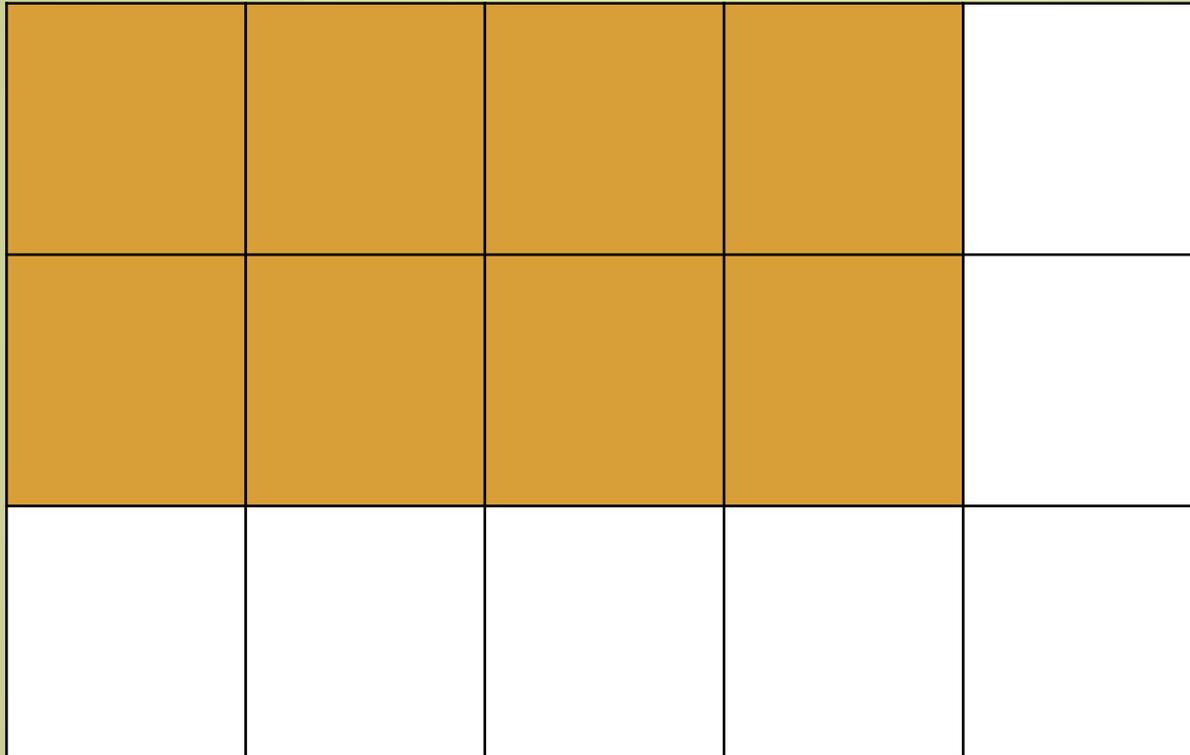
“multiply the two numerators together to make the numerator of the product and multiply the two denominators to make the product’s denominator”

Relational Understanding:

What would this look like?

$4/5$

$2/3$



Further fractions

Equivalent fractions. Do they know what equivalent means in English?

Simplifying fractions. Why is it simpler?

Multiplying fractions is easier than adding...

Crossing the tens- both ways

Coins and Symbols

Base ten materials and symbols

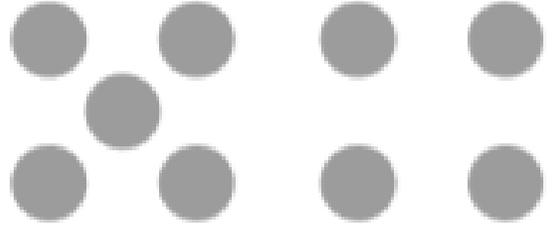
Symbols only

Questioning

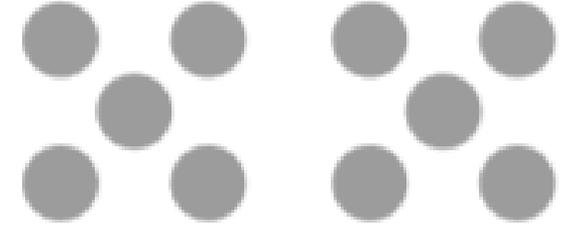
Can you explain what is happening with the coins / base ten when we are looking at the sequence 18, 19, 20, 21, 22?



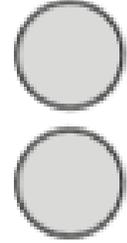
1



9



2



0

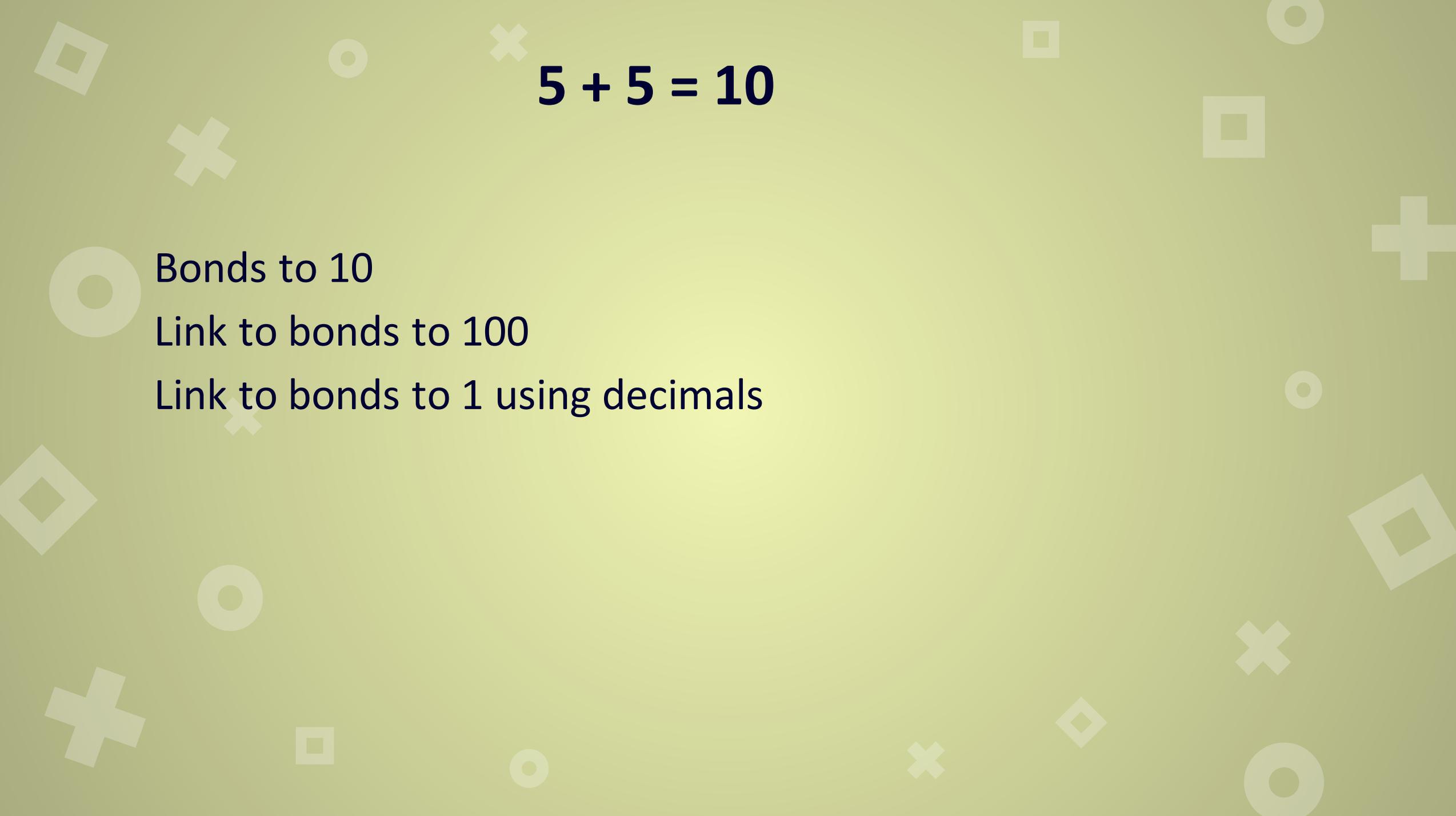
Useful addition and subtraction facts to know

Number bonds to 10

Doubles and near doubles

10 plus a single digit

Bonds to numbers up to 10

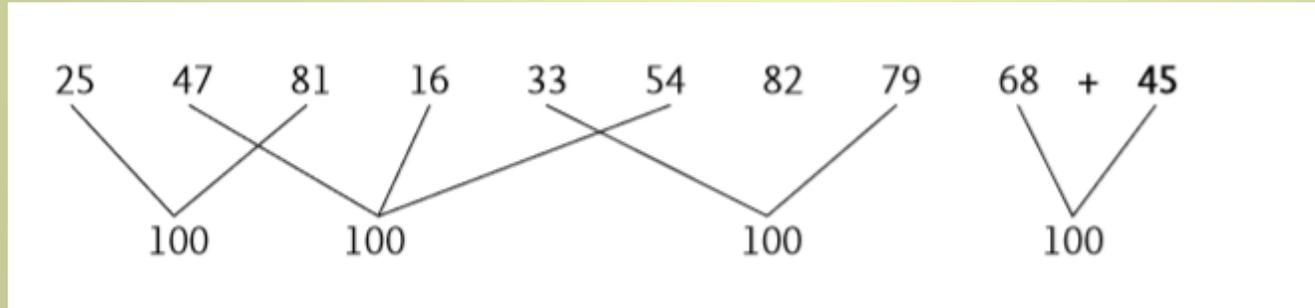
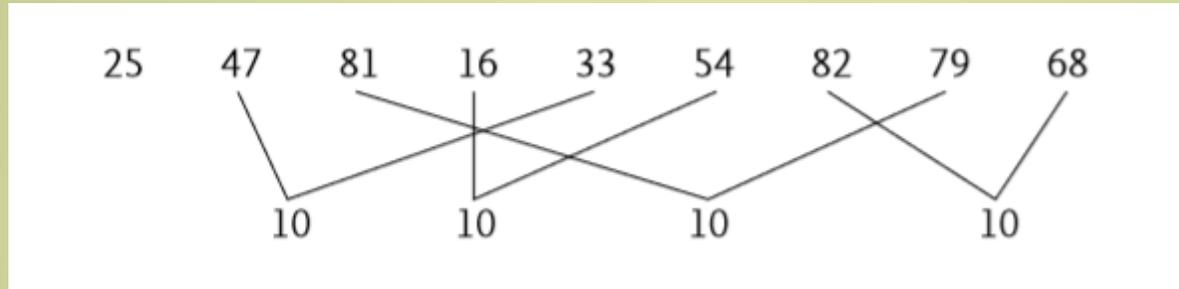

$$5 + 5 = 10$$

Bonds to 10

Link to bonds to 100

Link to bonds to 1 using decimals

Making 10 Casting out strategy



Multiplication

$$32 \div 8 = 4$$

$$32 \div 4 = 8$$

$$32 \div 2 = 16$$

$$32 \div 1 = 32$$

$$32 \div \frac{1}{2} = 64$$

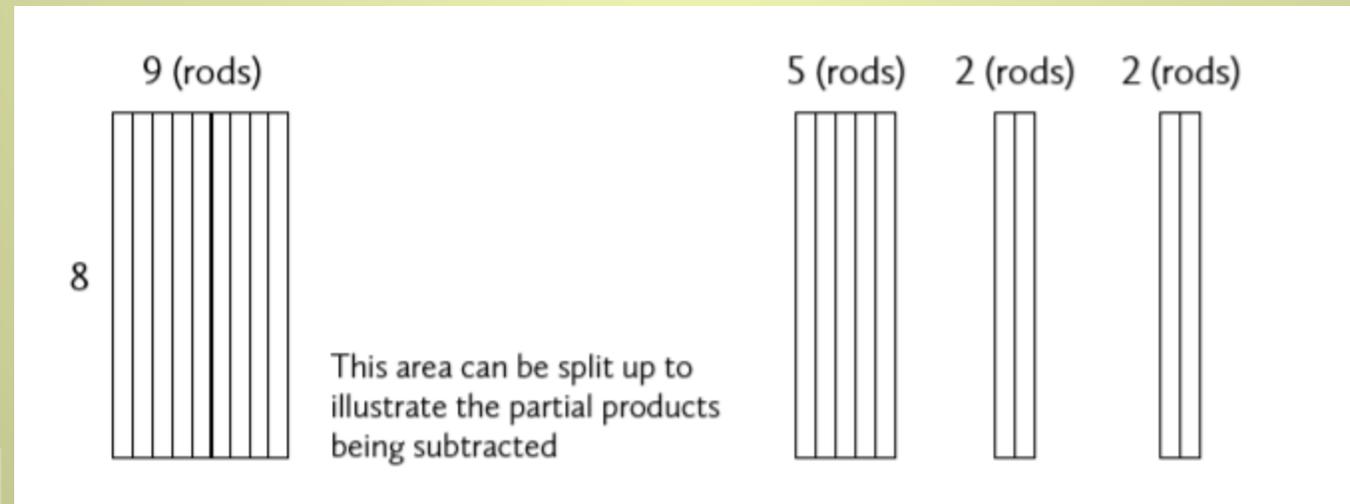
$$32 \div \frac{1}{4} = 128$$

Learning tables

Self voice echo (Lane and Chinn 1986)

Recorded in your own voice with a matching visual image

Partial products – using key facts



Pairs games

One side tables facts other side key facts

$$7 \times 9$$

$$5 \times 9 \quad 2 \times 9$$

Error analysis

37

42

73

+68

40???

Multiplication and Division

$$\begin{array}{r} 71 \\ 6 \overline{)426} \end{array}$$

$$6 \boxed{426}^{71}$$

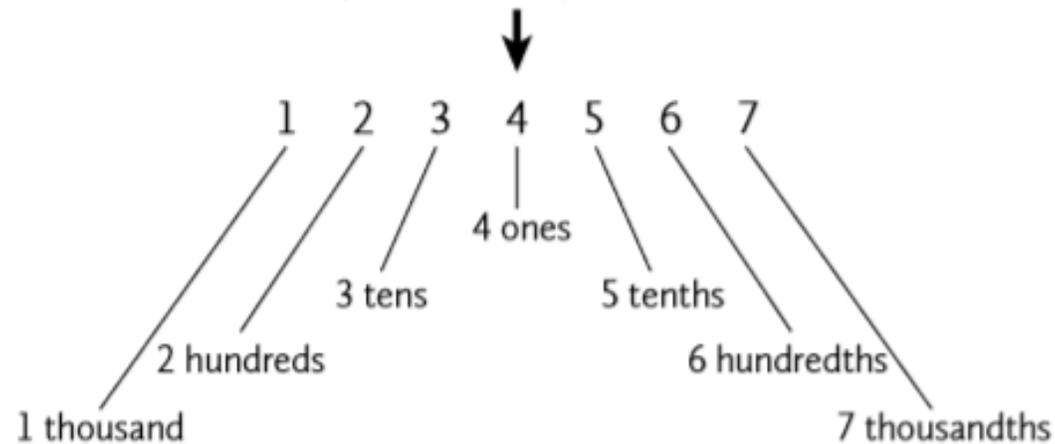
$$\begin{array}{l} \text{width} \\ \text{height} \end{array} \boxed{\text{area}}$$

The three versions of the relationship are:

area	= width × height	426 = 71 × 6
width	= area ÷ height	71 = 426 ÷ 6
height	= area ÷ width	6 = 426 ÷ 71

Decimals

The centre of symmetry in place value is the ones



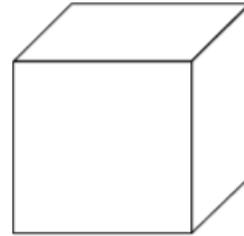
Each consecutive 'place' is 10 times smaller in this direction.



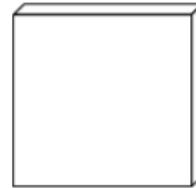
Each consecutive 'place' is 10 times bigger in this direction.

Decimals – using base ten

One 1



One tenth $\frac{1}{10}$
0.1



One hundredth $\frac{1}{100}$
0.01



One thousandth $\frac{1}{1000}$
0.001



The Concept of Time

Particularly difficult for dyscalculic children.

Develop concept without technical time units

Start by relating events to benchmarks such as *after* breakfast, *before* bath time.

Also use words like soon, wait, later.

The Concept of Time

Initially try discussing morning events only and introduce afternoon and evening subsequently.

Next introduce yesterday, today and tomorrow in a similar way.

A short video clip of them doing something they did yesterday can help them understand the concept of yesterday.

Time

Learning to tell the time is notoriously difficult

<http://www.youtube.com/watch?v=0QVPUIRGthI>

Times of My Day

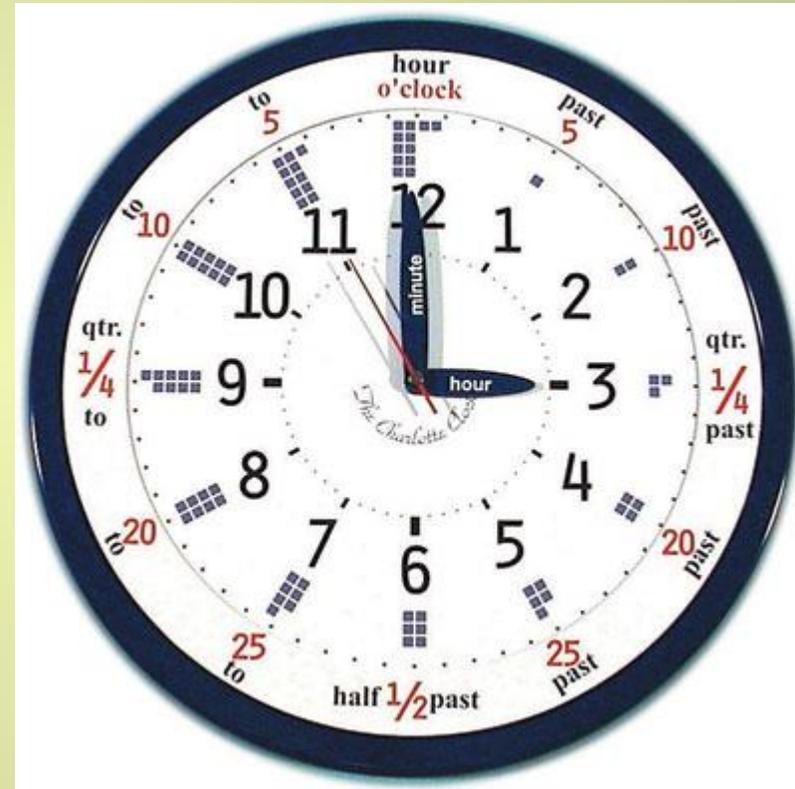
Their personal event only time line (about five or six significant times of day for the pupil).

Their same personal time line with simple o'clock or half past times.

An advanced time line incorporating "past" and "to".

Show these personal times on an analogue clock

Teaching Clocks



Some tricky time issues

Time difference

The importance of 12

Minutes

Time Language

Time difference

- × The clock uses base 12 rather than the base 10 that we use for our number system
- × The numbers are arranged in a circle (rather than a line)
- × The same circle, the clock face, represents three different aspects of time , hours, minutes and seconds

The importance of 12

Once an understanding of am and pm has been established-
emphasise the role of 12

Focus on the hours initially

Then look at half past and link this to fraction work

Move on to quarter past- and link to fractions

Use symmetry to link the 'past' and 'to' times

Practice counting in 5's

Minutes

To understand this fully requires knowledge of the 5 times table up to 60

$$1 \times 5 = 5$$

$$2 \times 5 = 10$$

Highlight (*in YOUR colour coded clock colours*)

as above to show the link between 1 and 5, 2

and 10 etc . This will help to associate a 2 on a clock face with ten minutes etc

Time language

We see 7:10 on a digital clock but we say ten past seven

We see 6:30 on a digital clock but then say half past six – (the half only makes sense in terms of the visual image of an analogue clock)

We refer to time past the hour and time to come until the next hour

Singapore Maths

Core Elements

Visualisation

Metacognition

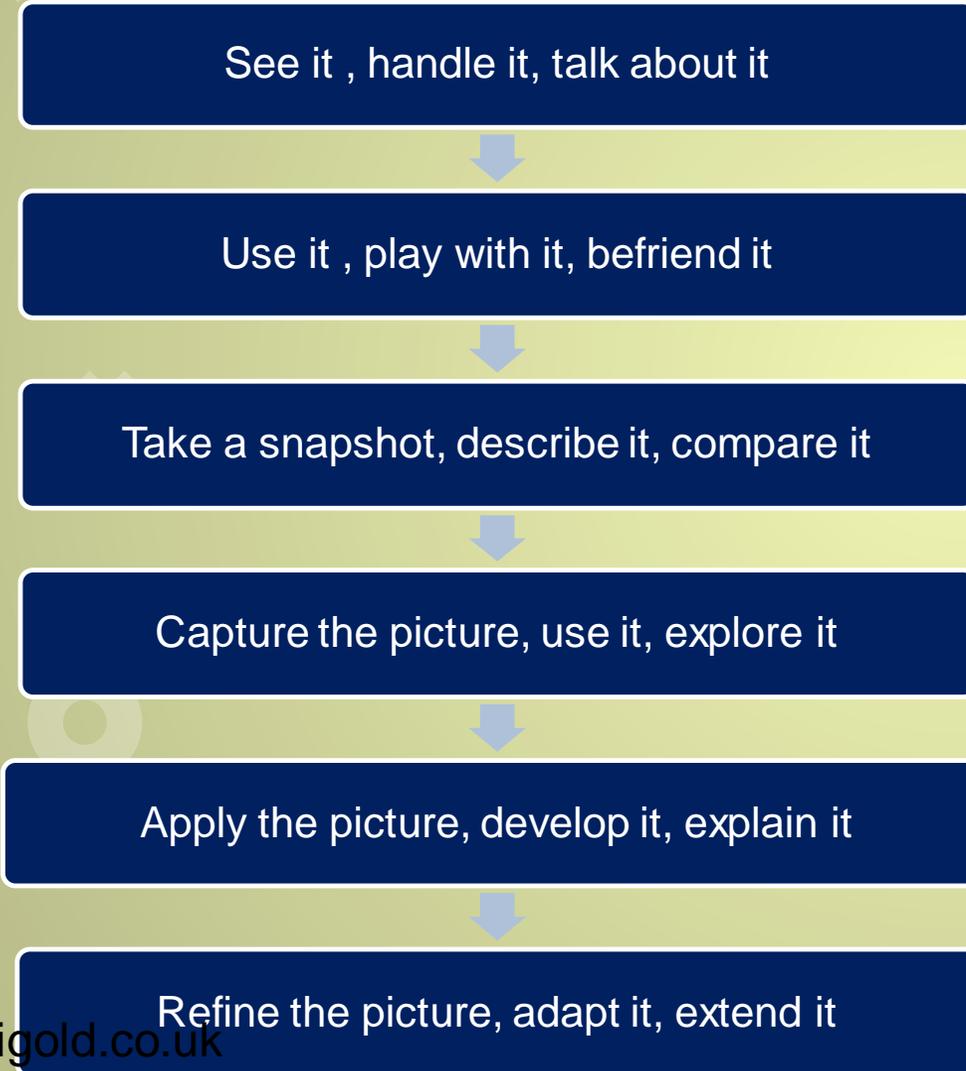
Generalisation

Number Sense

Communication

Concrete Pictorial Abstract approach

Progression in Visualisation



Concrete



Abstract

How to teach visualisation

It starts to develop through play before school

Use concrete materials : Children need texture to connect to the brain

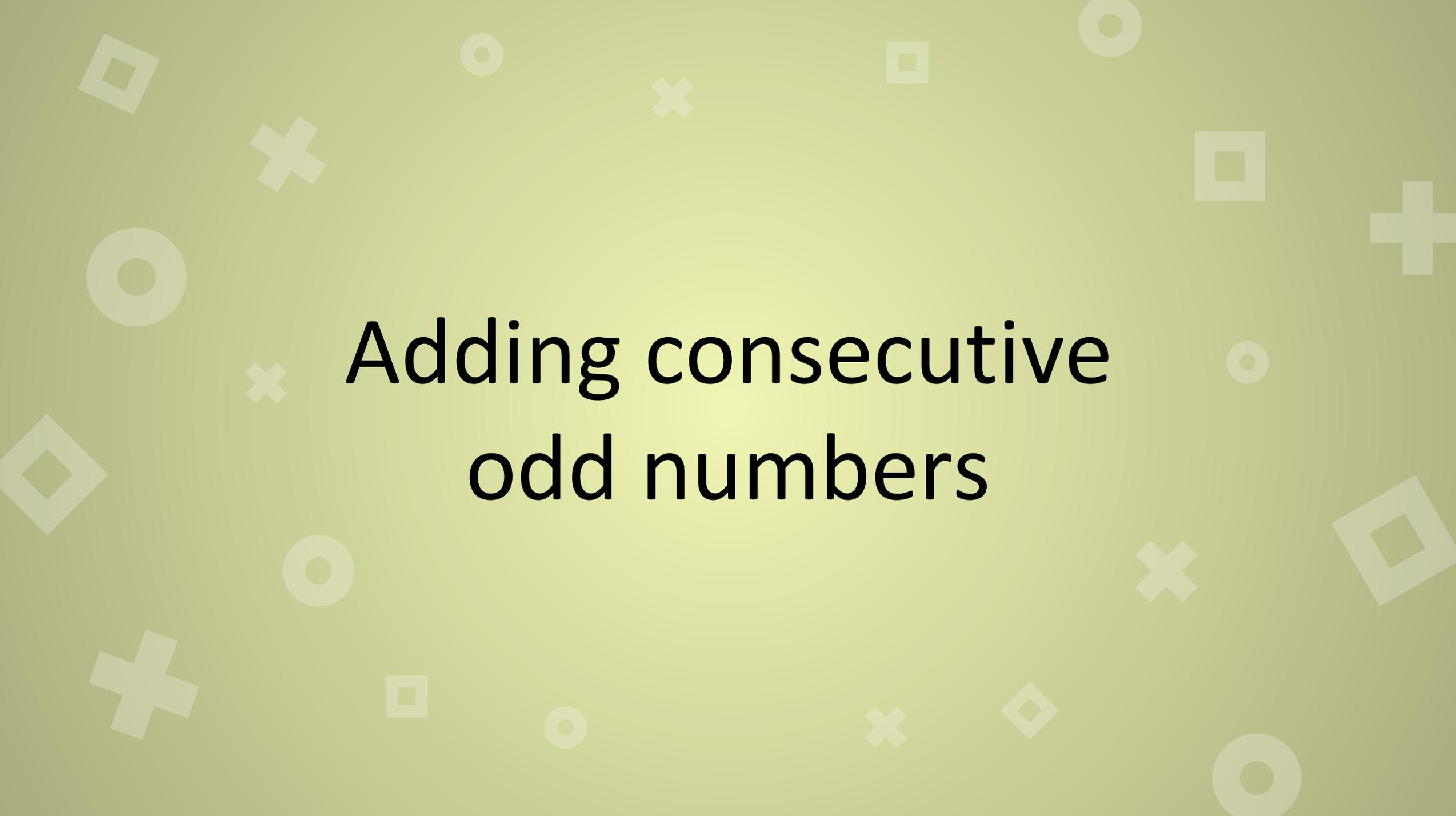
Boys versus Girls? (Ramful and Lowrie 2015)

Mediate- Can you imagine?

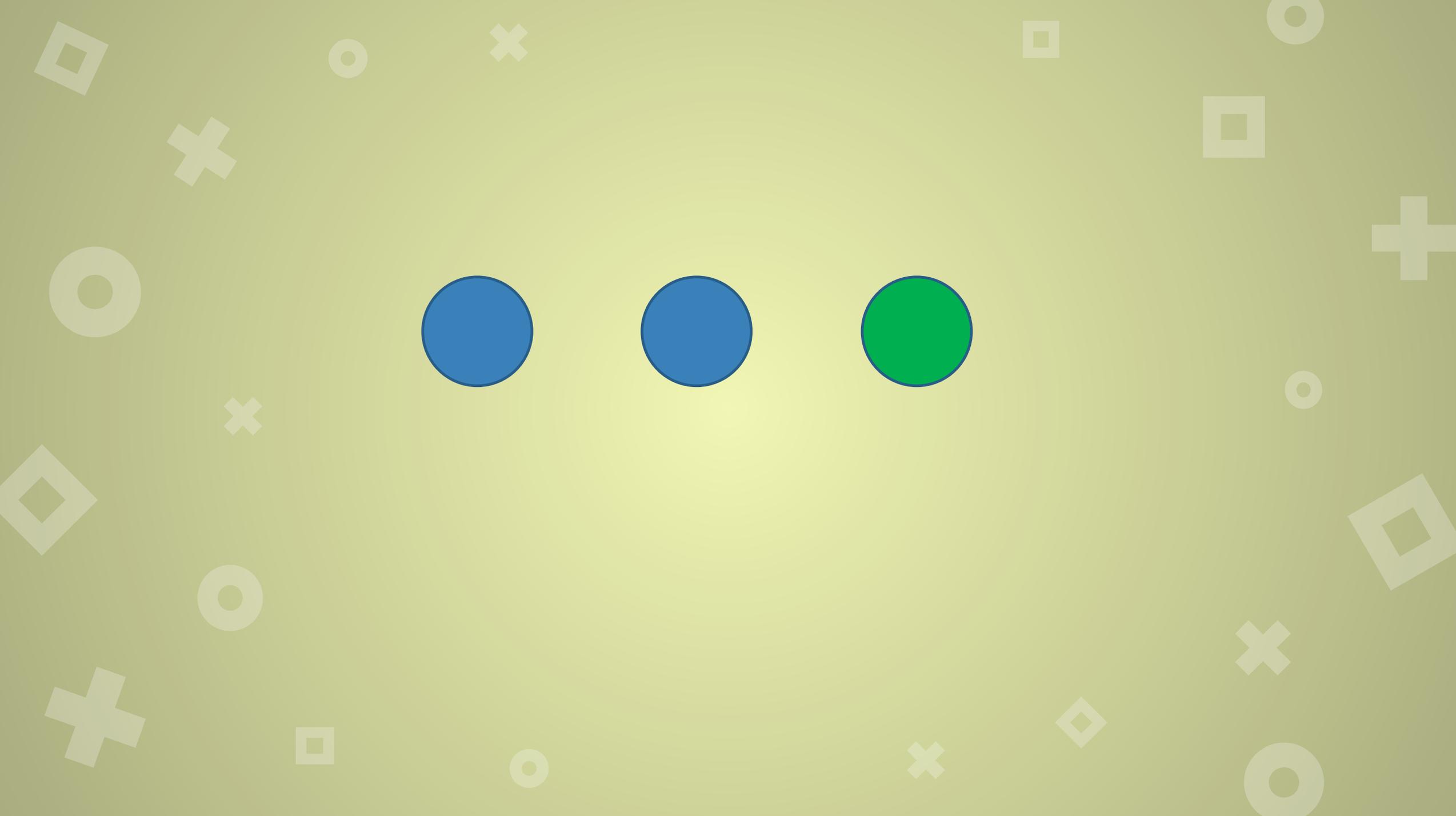
Can you picture ?

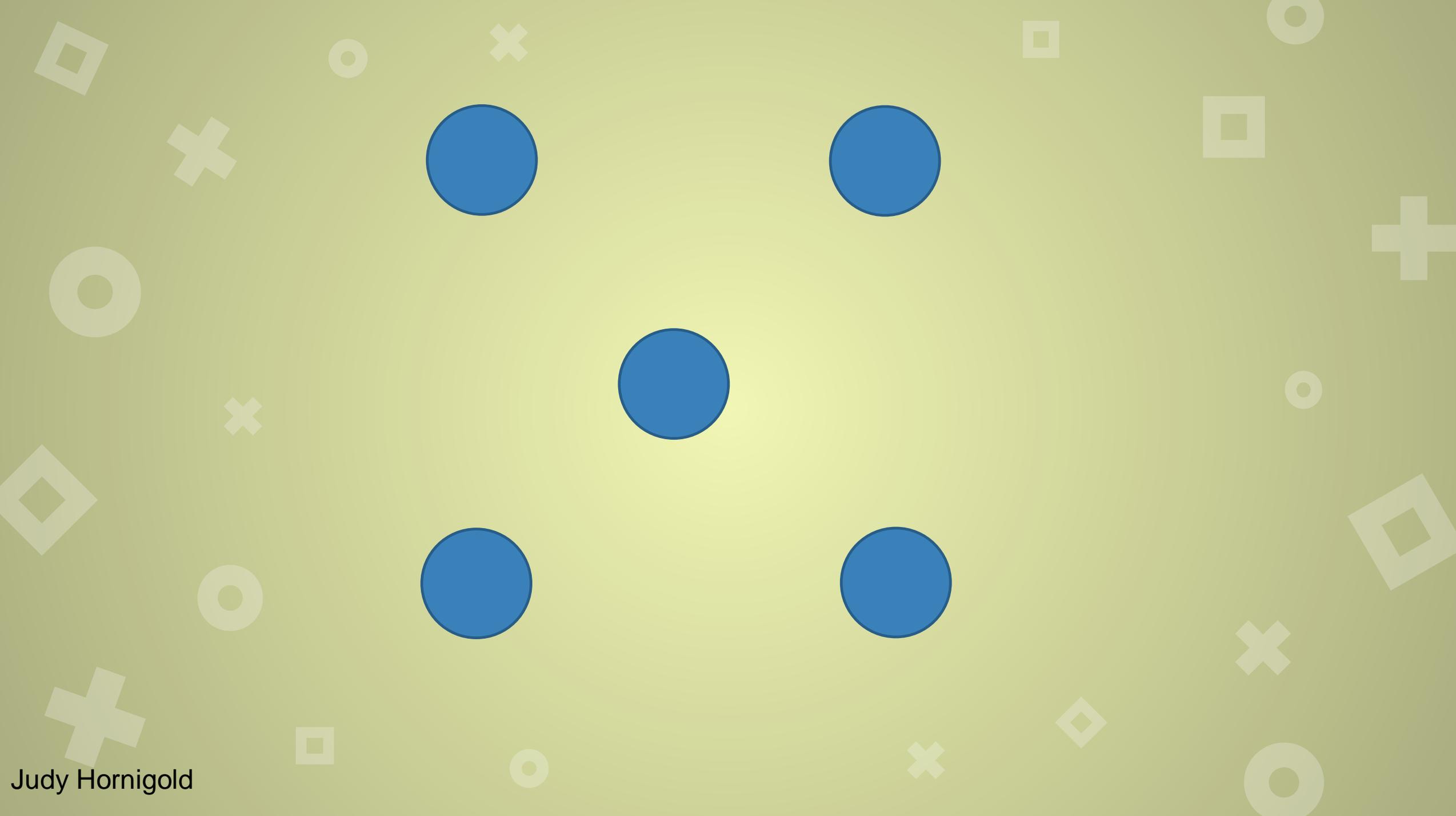
Can you see a 6 hiding in a 10?

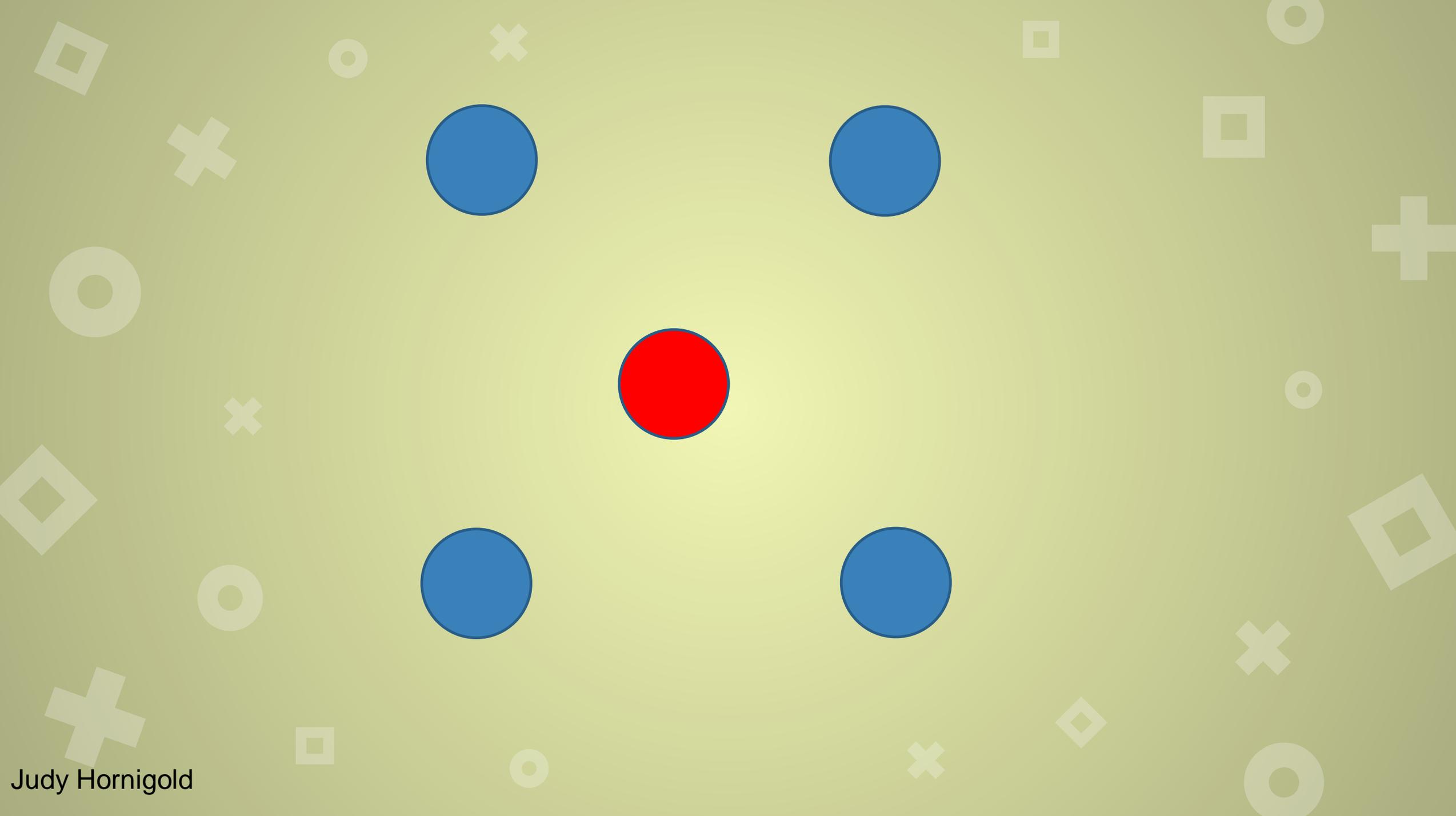
Are you sure?

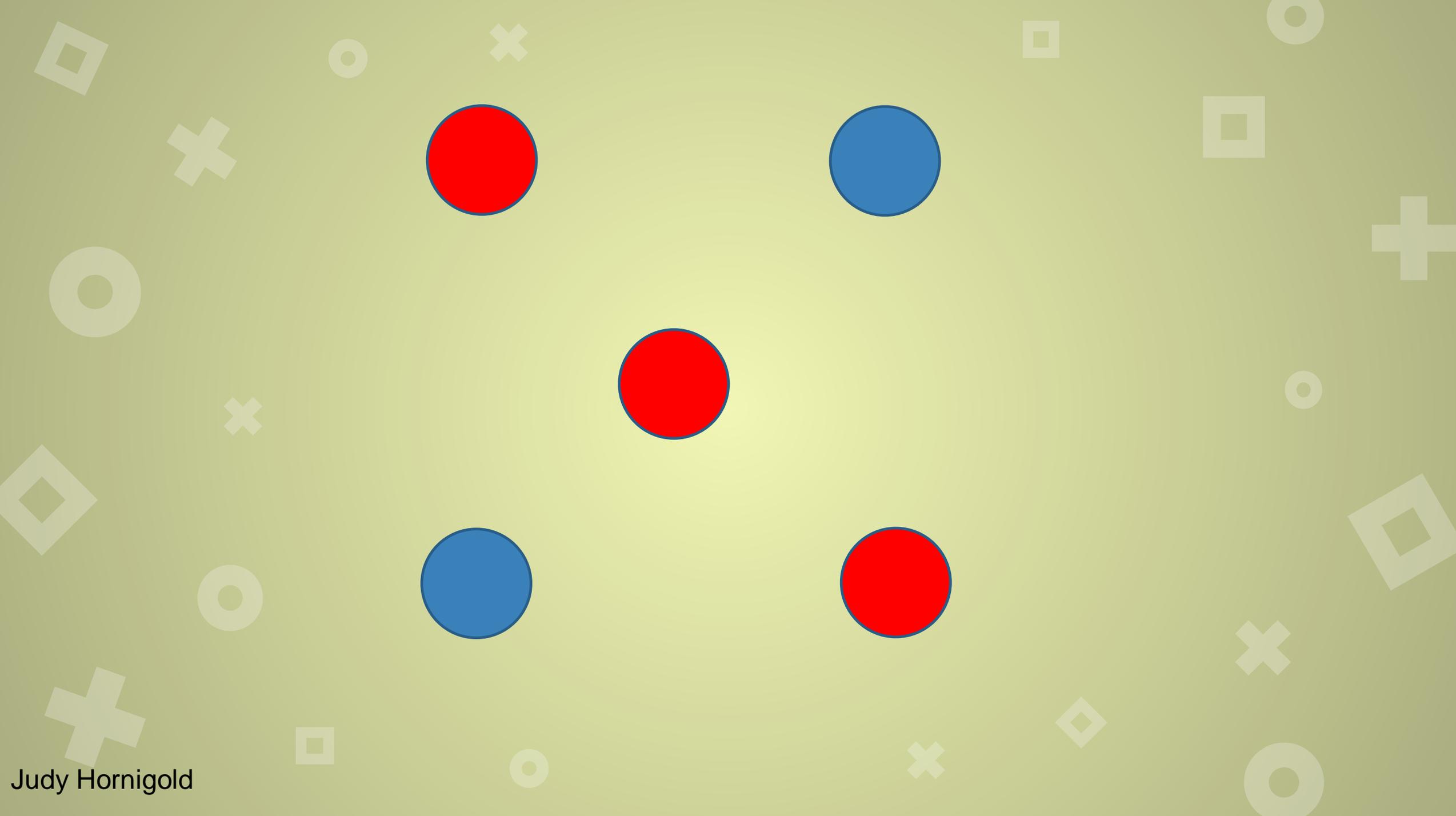


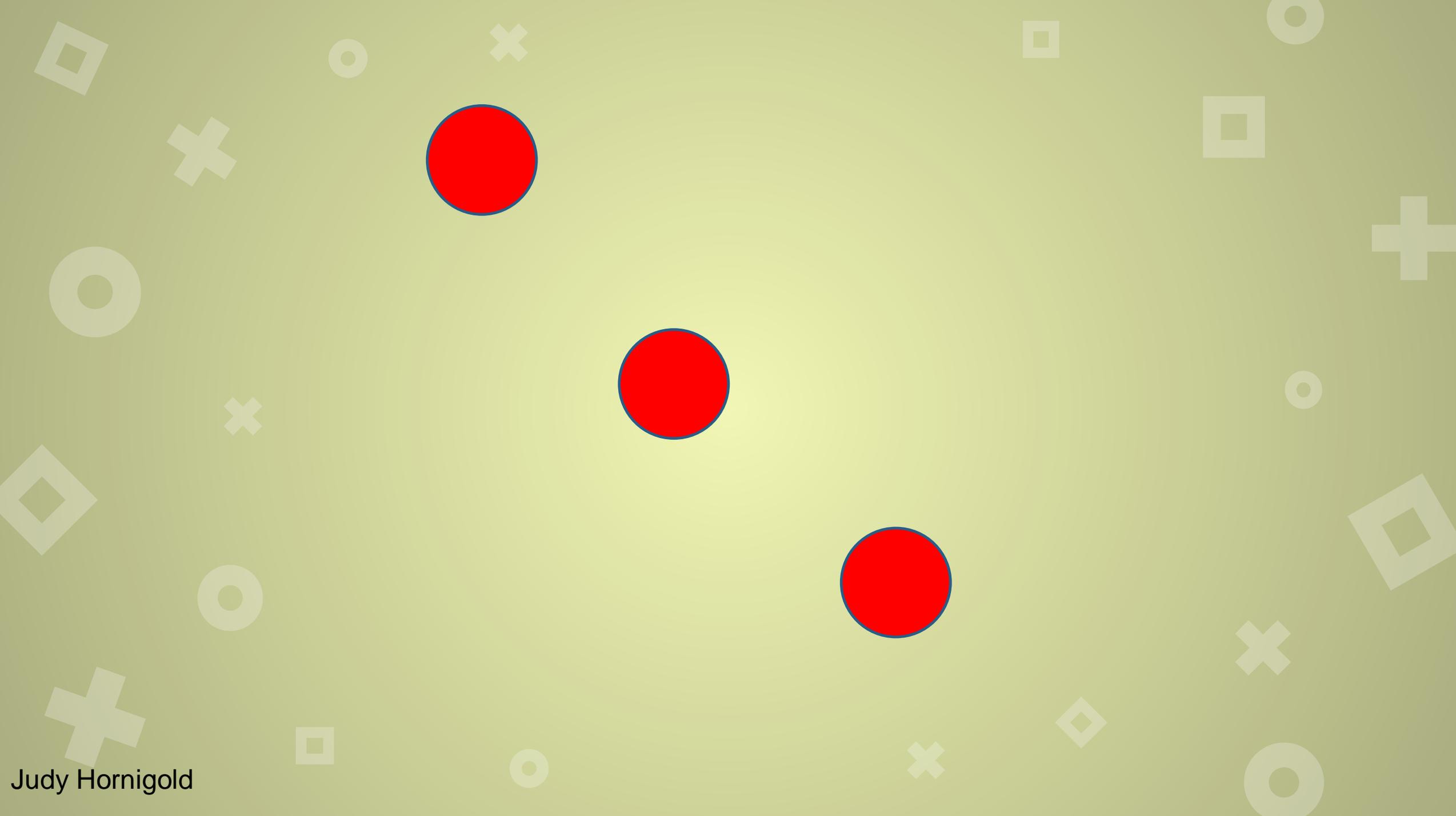
Adding consecutive odd numbers

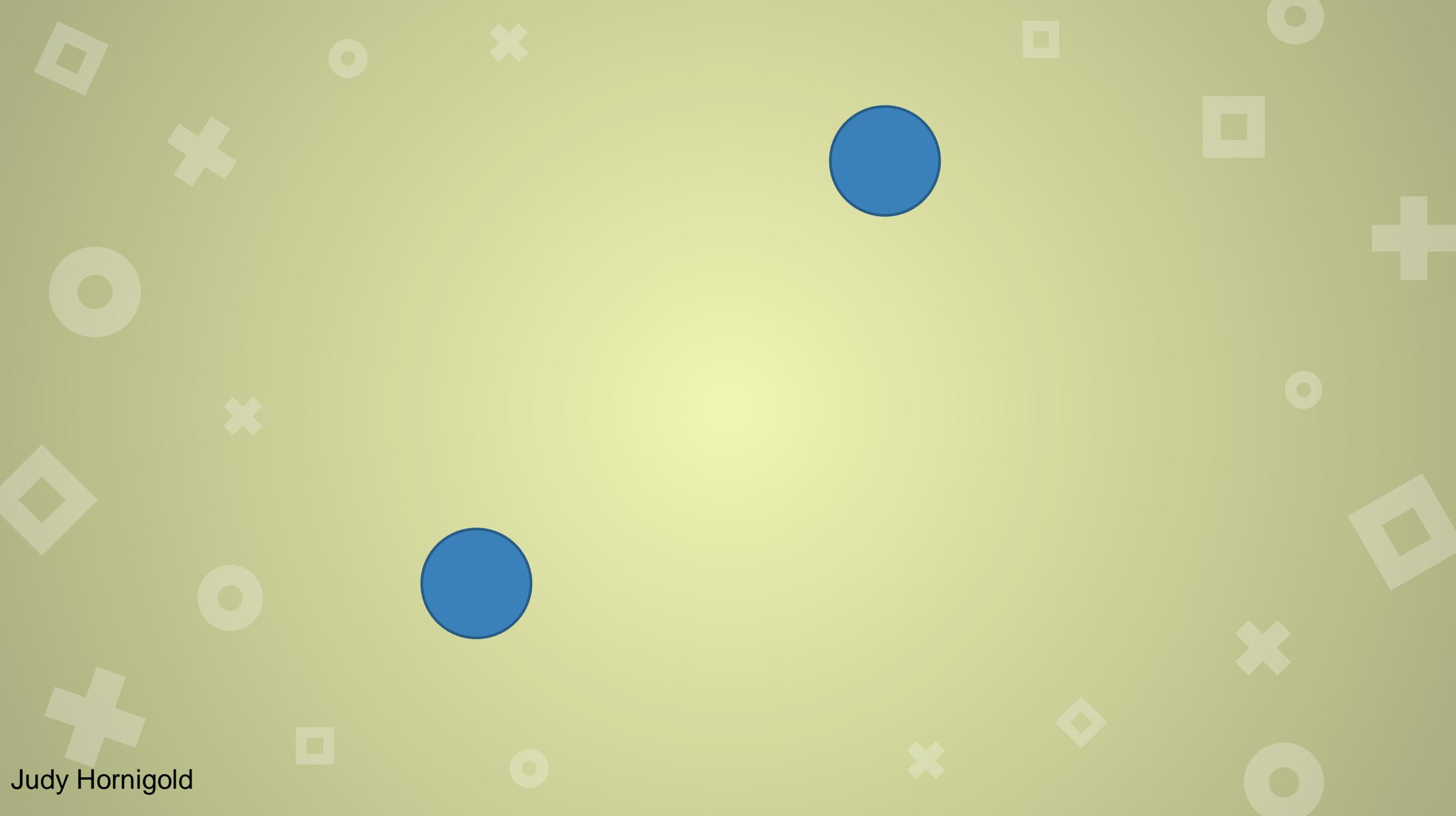












Coincidence or connection?

$$6 \times 2 = 12$$

$$3 \times 4 = 12$$

Metacognition- 'Thinking about thinking'

Metacognition is about understanding the way that we learn. This can help children to learn more efficiently and can also have a positive impact on their working memory function



Before the task

- × When you are *developing* the plan of action, ask yourself:
- × What prior knowledge can I use to help me with this task?
- × What should I do first?
- × What methods should I use?
- × How much time do I have to complete the task?

During the task

When you are *maintaining/monitoring* the plan of action, ask yourself:

- × How am I doing?
- × Am I on the right track?
- × How should I proceed?
- × What information is important to remember?
- × Should I move in a different direction?
- × Should I adjust the pace depending on the difficulty?
- × What do I need to do if I do not understand?

After the task

When you are *evaluating* the plan of action ask yourself:

How well did I do?

Did my particular course of thinking produce more or less than I had expected?

What could I have done differently?

How might I apply this line of thinking to other problems?

Do I need to go back through the task to fill in any "blanks" in my understanding?

Tips

Get your children into learning mode.

Talk more about what they need to do for finishing the task.

Listen carefully to their ideas and thoughts.

Ask them how they are going to work on the task. Let them write down those steps or methods.

Examples of tasks that provide both cognitive and meta-cognitive challenges

Provide puzzling tasks that offer more than one solution or provide a multitude of solutions.

Provide tasks that include cognitive conflicts such as debates and discussions.

Let children make groups among themselves and having each one of them to teach other members of the team= reciprocal teaching

The background is a light green gradient with scattered mathematical symbols: squares, circles, and crosses. The symbols are in a light green color, matching the background, and are of various sizes and orientations. The text "Four Fours" is centered in a bold, black, sans-serif font.

Four Fours

Generalisation

Key Facts and Derived
Facts

Patterns

Connections

Number Sense



What is Number Sense?

“Number sense is an emerging construct that refers to a child’s fluidity and **flexibility** with numbers, the **sense** of what numbers mean and an ability to perform **mental** mathematics and to look at the world and make comparisons.”

Russell Gersten, David Chard

The background is a light green gradient with scattered mathematical symbols: squares, circles, and crosses. Some symbols are solid, while others are hollow. The symbols are distributed across the page, with a higher density on the left side.

Communication

Developing Mathematical
Language

Mathematical language

Two distinct aspects to consider

The complexities of mathematical language

The ability to use mathematical language to aid understanding

The complexities of Mathematical Language

How our language affects counting

English words make learning maths harder

Many maths words have multiple meanings

Problems with English (just some of them!)

Ten has three forms: ten , teen, ty

Eleven and twelve fit no pattern

×

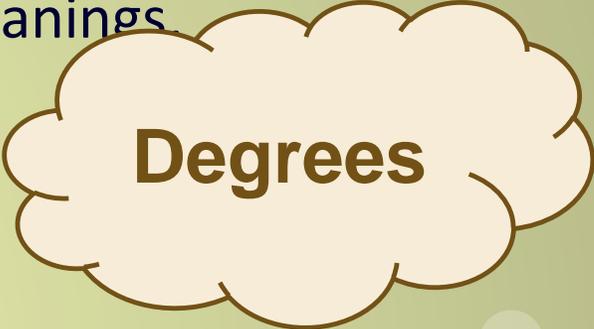
In the teen numbers the ones come before the tens in speech

What is the difference between 13 and 31?

How many fewer than double 10 is half a dozen?

The Language of maths

Many words in the English language have multiple meanings
For example:



Degrees

Does this refer to:

The three degrees

a singing group?

The third degree

intense questioning?

To a great degree

to a great extent?

By degrees

little by little?

Degrees

from university?

Degrees

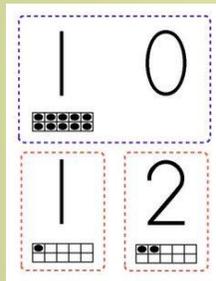
measure of temperature?

Degrees

measure of an angle?

Strategies to help

Teen numbers- use arrow/ place value cards and base ten materials to clarify



Multiple meanings- be explicit , use several different ways of saying the same thing, check understanding

Activity

Make up a word problem for $9-4=5$

✕ Now:

If the answer is 24 then what could the question be?

$$42 \div 5$$

a) 2

b) 8

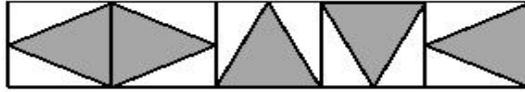
c) 8.4

d) $8 \frac{2}{5}$

e) 9

VISUAL PERCEPTION
Drawing triangles from a pattern of cubes

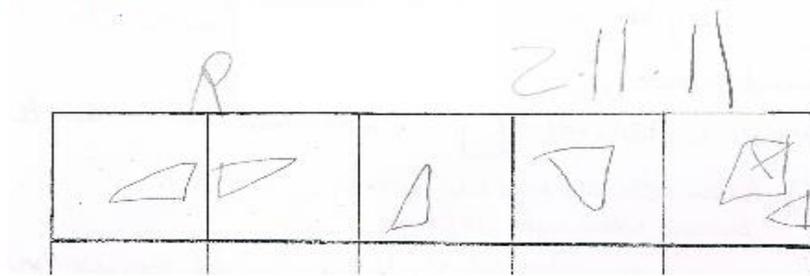
Diagram of pattern to be copied



Copy pattern using Mozi blocks

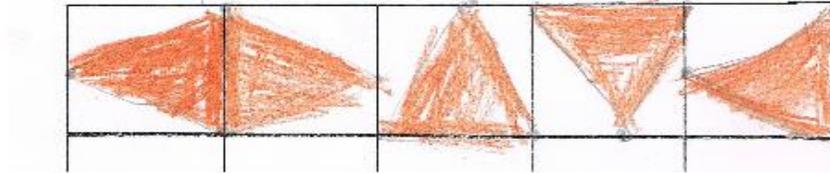


Draw diagram from block pattern
First attempt



Second attempt 30 minutes later

Pupil describes the shapes in each square before drawing, including using directional language to explain where the corners of the triangle are in relation to the square.



Bar Modelling :Four Groups Problem

There are four groups of students in the hall. In each group there are twice as many boys as girls.

In group A there are 12 girls. How many boys are there in group A?

In group B there are 12 boys. How many students are there in group B?

In group C there are 12 students . How many girls are there in group C?

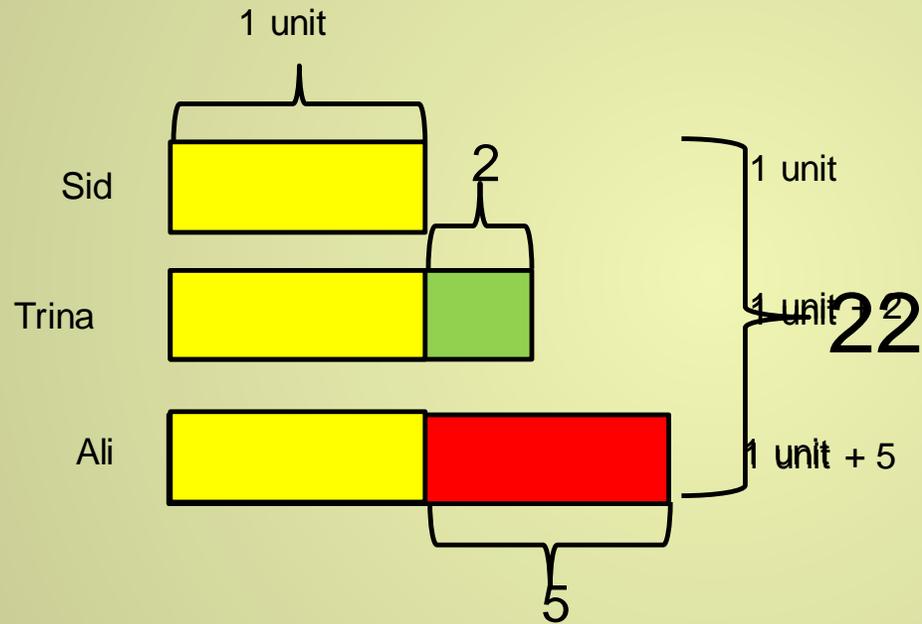
In group D there are 12 more boys than girls. How many students are there in group D?

Comparison Model

Bar Modelling

Additive Comparison Model

Ali has £5 more than Sid. Trina has £3 less than Ali. The three of them have £22 in all. Find the amount of money each of them has.



Sid has £ 5, Trina has £ 7, Ali has £ 10

Key Stage 2 SATs 2012

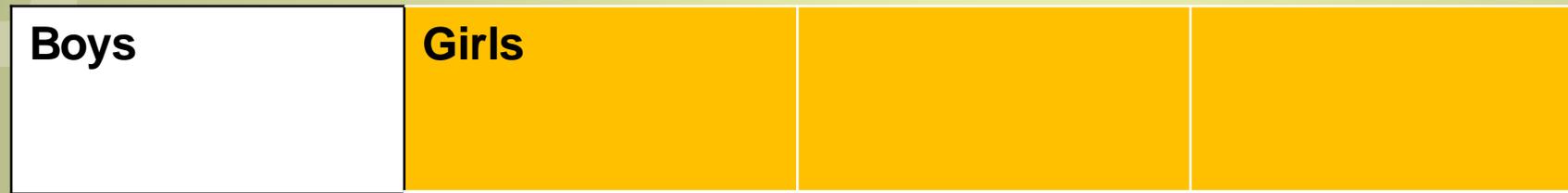
In a class, 18 of the children are girls.

A quarter of the children in the class are boys

Altogether , how many children are there in the class?

Model

We know that $\frac{1}{4}$ of the class are boys



So the remaining $\frac{3}{4}$ must be girls

We know there are 18 girls

$$18 \text{ girls} = \frac{3}{4}$$

$$\frac{1}{4} = 6$$

So there are 24 children in the class



Ralph posts 40 letters, some of which are first class, and some are second.

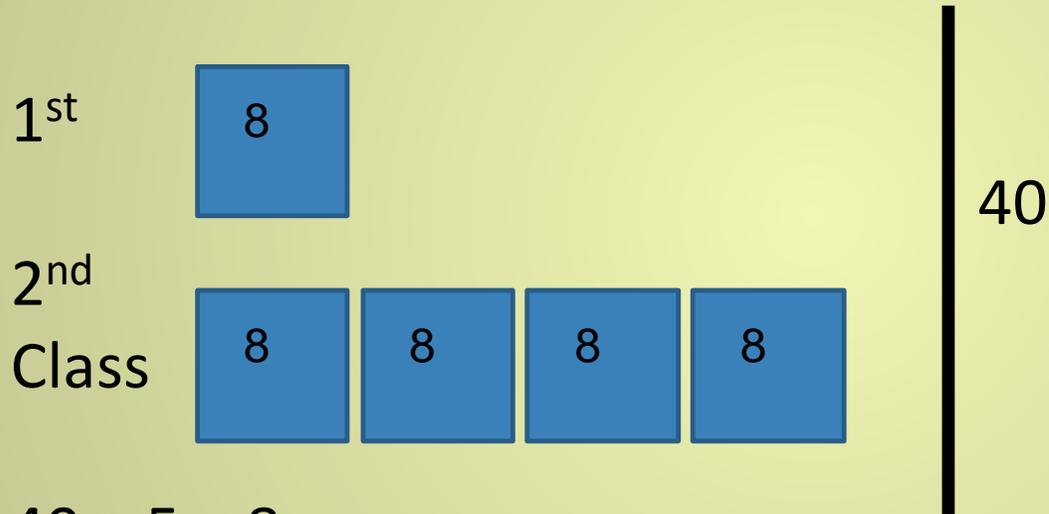
✕ He posts four times as many second class letters as first.

○ How many of each class of letter does he post?

40 letters

He posts four times as many second class letters as first.

How many of each class of letter does he post?



$$40 \div 5 = 8$$

$$8 \times 4 = 32$$

1st Class 8 letters

2nd Class 32 letters



GCSE higher paper 2012!

Ralph posts 40 letters, some of which are first class, and some are second.

✕ He posts four times as many second class letters as first.

○ How many of each class of letter does he post?

Mia Shopping problem

Mia saved up some money for shopping. Her mother gave her \$150 more. At a shop, Mia spend \$80 on a bag and half of the remaining money on a pair of shoes. She was then left with \$55. How much money did she save up?

?	150	
80	55	55

Hidden Maths Activity

Think of an activity that your learners like to do- maybe football or a computer game

How much hidden maths is involved in this game?

How can you capitalise on this?

ICT

Dynamo maths

<http://www.dynamomaths.co.uk/>

Number shark

<http://www.wordshark.co.uk/numbershark.aspx>

Thinking blocks- ipad apps

<http://www.mathplayground.com/>

Any Questions?

