

Parents' Seminar

P3 & P4

Mathematics Sharing

18 Feb 2017

Heuristics



At the end of this session, parents will be able to:

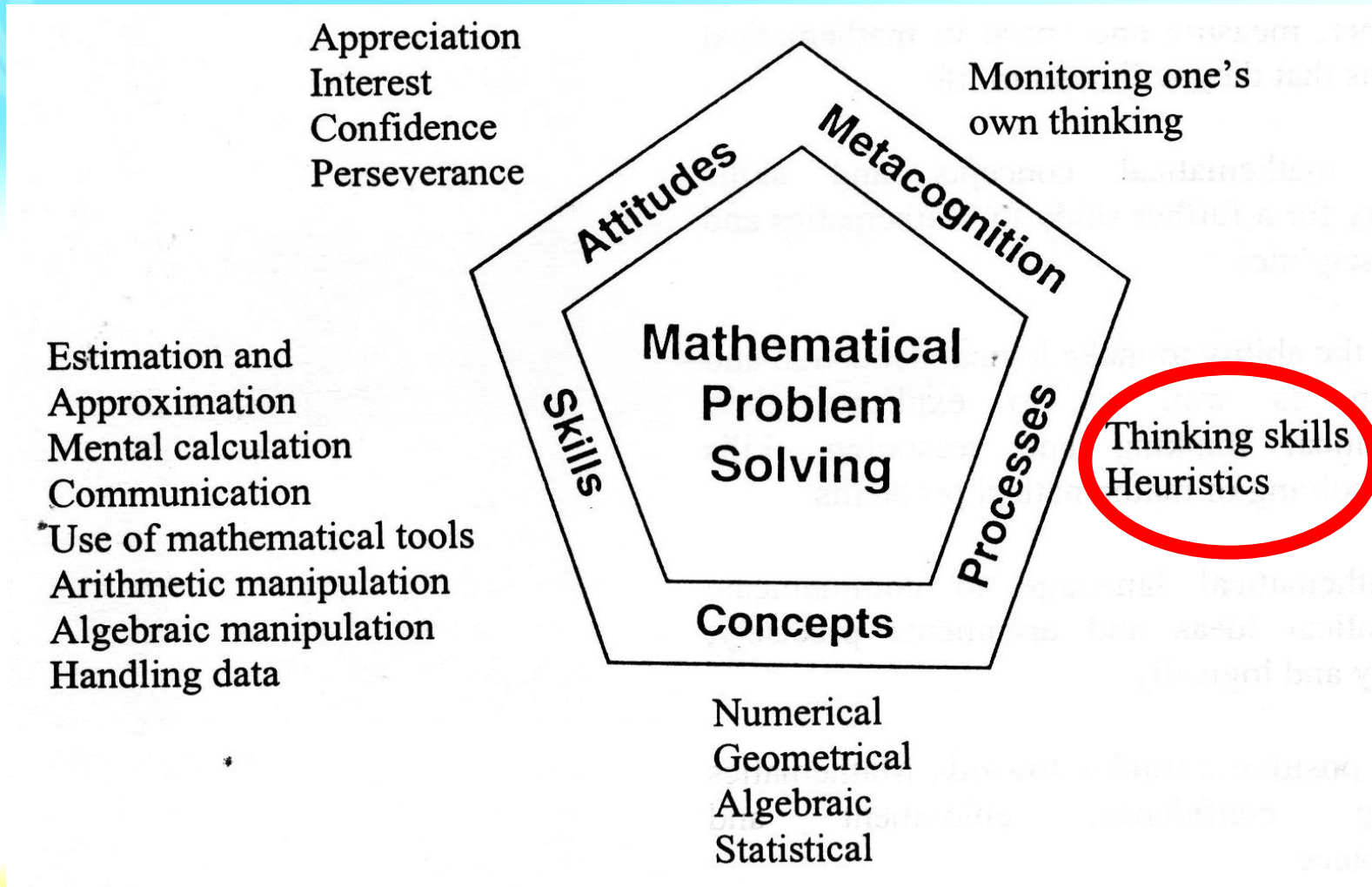
- understand the rationale of using different heuristics in solving Maths problem sums
- solve middle primary problem sums using different heuristics
- guide their child to solve problem sums using different heuristics



- **Why?** (Introduction to problem-solving process)
- **What?** (Explanation of different types of heuristics)
- **How?** (Hands-on practice with different types of heuristics)
- **How?** (Home support for your child)



Curriculum Framework



- Heuristics refers to the different strategies that we can adopt to solve unfamiliar or non-routine Maths problems
- There are different types of heuristics and they can be grouped into four categories, based on how they are being used:

To give a representation	To make a calculated guess	To go through the process	To change the problem
<ul style="list-style-type: none">• Draw a diagram/bar model• Make a list• Use equations	<ul style="list-style-type: none">• Guess and check• Look for patterns• Make suppositions	<ul style="list-style-type: none">• Act it out• Work backwards• Before-after	<ul style="list-style-type: none">• Restate the problem• Simplify the problem• Solve part of the problem

- Thinking skills are skills that can be used in a thinking process, such as
 - classifying
 - comparing
 - analysing parts and whole
 - identifying patterns and relationships
 - induction
 - deduction
 - generalising
 - spatial visualisation

- **Step 1 – Study the Problem**
 - Read the problem a couple of times to fully understand it
 - Ask questions like
 - What do I know?
 - Who is involved?
 - What do I not know?
 - What is the problem asking for?
 - Highlight and connect the information



- **Step 2 – Think of a Plan**

- Think about the different strategies that could be used
- Ask questions like
 - Which strategy should I use?
 - Have I solved similar questions before?
- Keep track of strategies tried unsuccessfully so as not to repeat them on similar type of problem

- **Step 3 – Solve the problem**
 - Represent the content in the form of i.e. model, diagram, table, etc while solving the problem
 - Ensure approach is systematic
 - If “stuck”, repeat Step 1



- **Step 4 - Reflecting**

- Ask questions like:

- Does my answer make sense?
- Is there a better alternative?
- Have I answered the question?

- Feed the answer derived back into the question to get back the original set of knowns

- Extend the solution to other problems



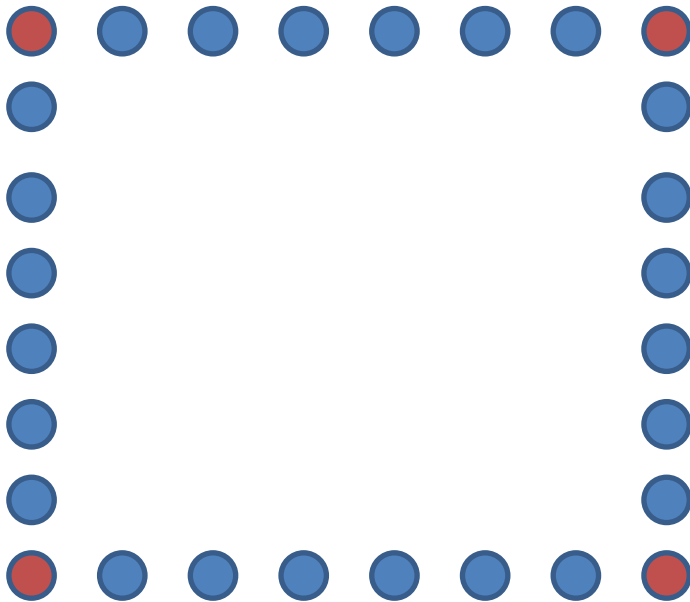
Draw a Diagram

- Draw a picture to reveal aspects of the problem that may not be apparent at first
- Use a line or dots to symbolise objects
- Show relations between knowns in the question
- Organize the information so as to simplify the question



Draw a Diagram

The children built a log playhouse in a square shape.
They used 8 vertical posts on each side of the playhouse.
How many posts did they use altogether?



Method A

$$8 + 8 = 16$$

$$6 + 6 = 12$$

$$16 + 12 = \underline{28}$$

Method B

$$6 \times 4 = 24$$

$$24 + 4 = \underline{28}$$

Draw a Diagram

The children built a log playhouse in a square shape.
They used 24 vertical posts altogether.
How many vertical posts were there on each side of the playhouse?

$$24 - 4 = 20$$

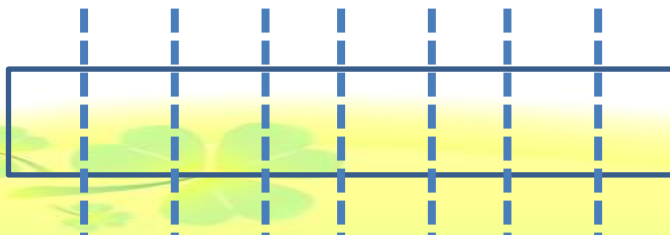
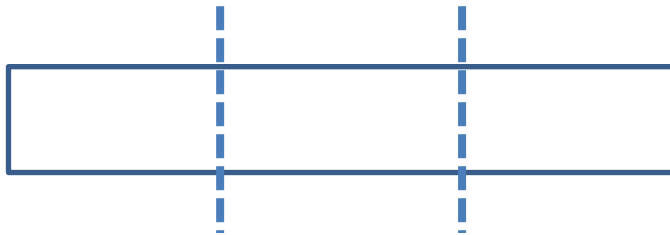
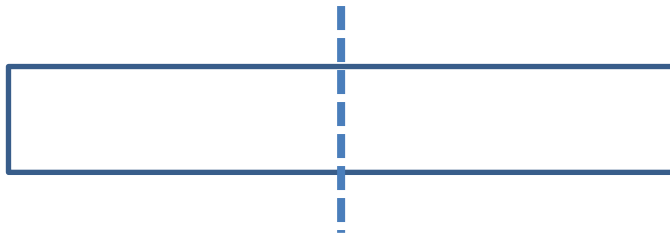
$$20 \div 4 = 5$$

$$5 + 1 + 1 = \underline{7}$$



Draw a Diagram

A piece of thick log has to be cut into smaller pieces.
It takes 30 seconds for one cut.
How long will it take to cut the log into 8 pieces?



To cut the log into 8 pieces, I need 7 cut.

$$7 \times 30 = \underline{210}$$

- Organize the information in a tabulated form, especially if there are many layers of information in the question
- Look out for the relationships between the information within the table
- Find out which are the missing or needful information in the table



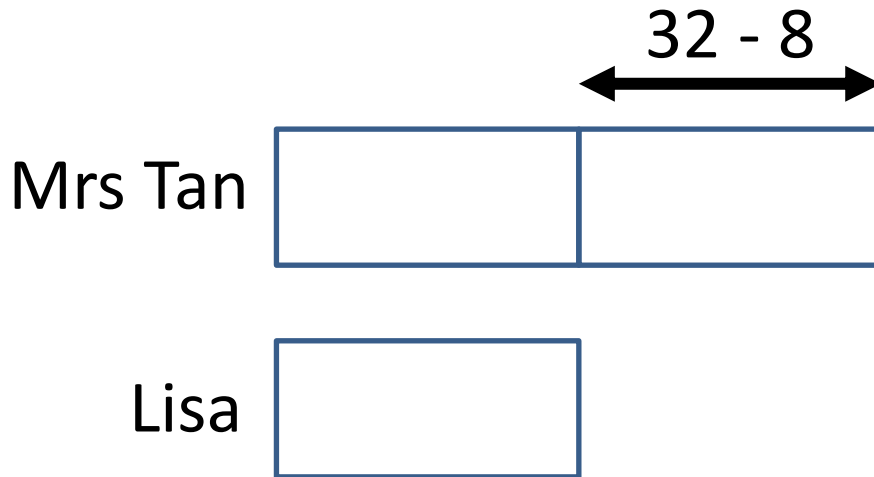
There are 10 animals in a farm. Some of them are chickens and the rest are cows. There are 36 legs altogether. How many chickens and cows are there?

Chickens		Cows		
No.	Legs	No.	Legs	Total Legs
5	10	5	20	30
4	8	6	24	32
3	6	7	28	34
<u>2</u>	4	<u>8</u>	32	36

Mrs Tan is 32 years old. Her daughter, Lisa, is 8 years old.
How old will Mrs Tan be when Lisa is half her age?

Mrs Tan	Lisa
32	8
33	9
34	10
35	11
36	12
...	...
<u>48</u>	24

Mrs Tan is 32 years old. Her daughter, Lisa, is 8 years old.
How old will Mrs Tan be when Lisa is half her age?



$$32 - 8 = 24$$
$$24 \times 2 = \underline{48}$$

- Most children are kinaesthetic learners and learn best when they are able to use their senses to become part of the problem
- Concrete objects can be used to represent the knowns in the question, e.g. stationery
- This is especially useful if the question involves movement



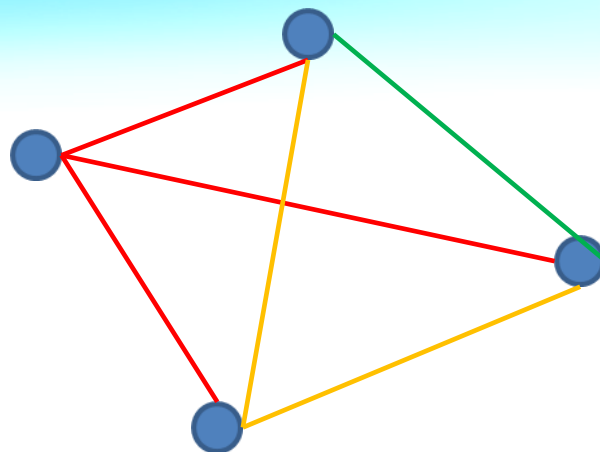
There were 4 children in the classroom, i.e. Alex, Ben, Carl and Daniel. Each child shook hands with the other 3. How many handshakes were there altogether?

Alex	Ben	Carl	Daniel
Ben	Carl	Daniel	
Carl	Daniel		
Daniel			

$$3 + 2 + 1 = \underline{6}$$



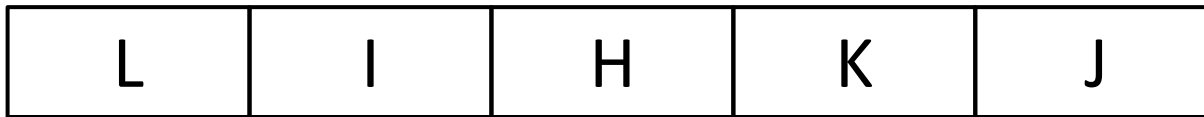
Draw a diagram



$$3 + 2 + 1 = \underline{6}$$



There are 5 blocks, labelled H, I, J, K and L.
Block H is immediately to the right of Block I.
Block J is to the right of Block K.
Block I is between Block L and Block H.
Block H is in the middle of all the blocks.
Where is Block K?



Block K is the 2nd block from the right.



Guess and Check

- Start with an educated and calculated guess
- Check guess against the information given in the question
- Ensure all conditions are met
- Can be rather tedious and there is room for careless mistakes to be made



There are 10 animals in a farm. Some of them are chickens and the rest are cows. There are 36 legs altogether. How many chickens and cows are there?

Chickens		Cows		
No.	Legs	No.	Legs	Total Legs
9	18	1	4	22
8	16	2	8	24
...
<u>2</u>	4	<u>8</u>	32	36

There are 10 animals in a farm. Some of them are chickens and the rest are cows. There are 36 legs altogether.

How many chickens and cows are there?

Assuming there are 10 cows,

$$4 \times 10 = 40$$

$$40 - 36 = 4$$

There are 4 legs too many in my assumption.

Every time I exchange a cow for a chicken, I can get rid of 2 legs.

$$4 \div 2 = \underline{2}$$

$$10 - 2 = \underline{8}$$

Create an Organized List

- Similar to “Make a Table” but used when there is a greater amount of information which requires a systematic collation
- Need to follow a procedure or sequence to ensure all answers are covered
- There is often a pattern to be uncovered after filling in the gaps



Create an Organized List

A pair of dice is rolled.

The 2 rolled numbers are then added together.

How many different ways can you roll a total of 6?

Die 1	Die 2
1	5
2	4
3	3
4	2
5	1

There are 5 ways altogether.

Create an Organized List

Use the numbers below to form 4-digit numbers that can be divided by 2 exactly (without remainder).

The 4 digits are : 3, 2, 0 and 5

If none of the digits are repeated, how many different 4-digit numbers can be formed? (P4 TM p38)

Start with 5	Start with 3	Start with 2
5320	3520	2530
5302	3502	2350
5230	3250	
5032	3052	

↔ 10 numbers ↔

Look for a Pattern

- Mathematics is often referred to the science of patterns
- Once a pattern is established, it can be analysed, extended and re-created
- The following skills are needful
 - Creating and continuing a pattern
 - Spatial patterns (highlighters)
 - Finding a pattern in a table
 - Always link it to the pattern number if possible



Look for a Pattern

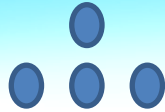
Mrs Lim is on a fitness programme. On the first day, she cycled around her estate 3 times. On the second day, she cycled around it 7 times and on the third day, 11 times. How many days must she exercise before reaching her goal of cycling her estate 31 times?

Day	No of Times	Pattern
1	3	$1 \times 3 + 0$
2	7	$2 \times 3 + 1$
3	11	$3 \times 3 + 2$
...
8	<u>31</u>	<u>$8 \times 3 + 7 = 31$</u>

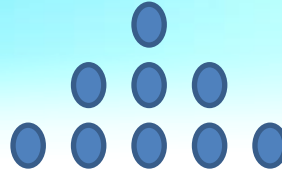
How many dots are there in Pattern 10?



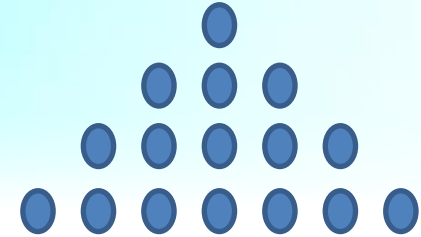
Pattern 1



Pattern 2



Pattern 3



Pattern 4

Pattern	Total no. of dots
1	1
2	4
3	9
4	16
...	...
10	<u>100</u>

Look for a Pattern

1 st row:			1		
2 nd row:			2	4	
3 rd row:		3	6	9	
4 th row:		4	8	12	16
5 th row:	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

What are the missing numbers in the 5th row? (P3 TM p42)



Now it is your turn. :)



What makes problem-solving difficult?

- Knowledge Factors
 - Conceptual knowledge
 - Linguistic knowledge
 - Algorithmic knowledge
 - Schematic knowledge

What makes problem-solving difficult?

- Affective Factors
 - Interest
 - Motivation
 - Confidence
 - Perseverance

Thank You

