

The Language of Mathematical Problem Solving, Reasoning and Fluency

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Tower Hamlets CPD Centre

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2018-19 Project Overview

Developing mathematical language
through the three aims.

13 Nov and 13 Dec – Problem Solving
29 Jan, 26 Feb and 2 Apr – Reasoning
25 June – Fluency

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Tasks to talk about

One Big Triangle (**192**)
Two-digit Targets (**6343**)
Six Beads (**152**)
How Would We Count? (**8123**)
Which Scripts? (**774**)
Totality (**1216**)
Possible Pieces (**13882**)



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Through the lens of...

the NRICH articles you were asked to
read:

- Using NRICH Tasks to Develop Key Problem-solving Skills (**11082**)
- Developing Good Team-working Skills in Primary Schools (**8277**)



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Reflecting on classroom experiences

- What went well?
- Were there any surprises?
- What would you do differently next time, or what additional guidance would you give to a colleague?



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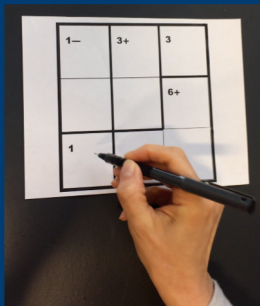
Please consider the differences between thinking and reasoning

Answers on a post-it (or post-its)...



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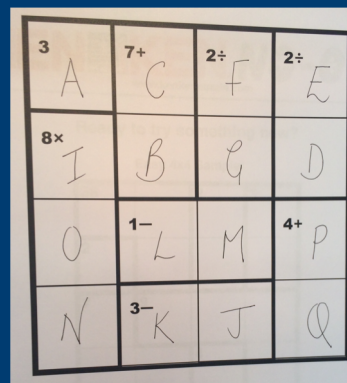
Ken Ken



- Can you describe what was going on?
- Can you explain why?
- What might you do differently?



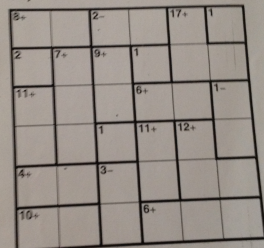
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63

Easy



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No-op Ken Ken



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Thinking and reasoning

Reasoning is thinking, but it is thinking in a logical, purposeful and goal-directed way.

Borthwick, A. and Cross, A. (2018)



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Key findings on mathematical reasoning

- Children's ability to reason mathematically is a strong predictor of their mathematics achievement in KS2 and 3 assessments.
- Calculation skills contributed to mathematics achievement independently of mathematical reasoning.

Nunes et al (2009)



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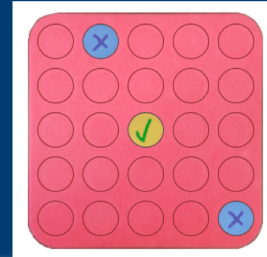
Progression in reasoning

Describing
Explaining
Convincing
Justifying
Proving



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Poly Plug Rectangles (7511)



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Reflect on the differences between playing Poly Plug Rectangle 'solo' compared with playing with a partner.

Was there any specific language/vocabulary which helped you articulate your reasoning in either case?



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Sentence starters

I think this because...
If this is true then...
I know that the next one is ... because...
This can't work because...
When I tried... I noticed that...
The pattern looks like...
All the numbers begin with...
Because... then I think...
It will never work because...



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Poly Plug videos

Whilst watching, please consider the following questions:

- What do you notice?
- What would you ask these children if they were in your class?



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Bingo boards

Primary Curriculum (1248) Mapping Documents, Curriculum Aims, Features and Collections	Articles (9405) PD Articles for the classroom	Games (9279) Online interactivities and classroom versions
Posters (posters) Printable colour A3 posters (primary & secondary)	Curriculum Mapping Documents (12662) Link curriculum objectives to NRICH tasks	Past Features (8885) Previous half-termly featured tasks and articles
PD () At all levels: EYFS, primary, secondary, FE & HE	Student Solutions (7542) What we're looking for in submitted solutions and ways to take it further	Mathematical Habits of Mind (11664) Developing curiosity, resourcefulness, collaboration and resilience



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The Remainders Game (6402)

The Remainders Game

I've thought of a number between 1 and 100
Can you work out what it is?

Divide it by: 2 3 4 5 6 7 8 9 10

Total score: 0 from 0 attempts

Clues	Points
1	12
2	12
3	11
4	9
5	6
6	3
7+	1

Wrong answer: -15 point

Want to visualise the problem?
Open the modulator

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Pick a new partner to play The Remainders Game with and then analyse your working...

Could you have used fewer clues to maximise your points?

Once both of you are convinced, rehearse your justification ready to share with another pair.

'Cross pollinate' justifications, remembering to be a friendly sceptic

"convince yourself, convince a friend, convince an enemy/sceptic"

(Mason, J., Burton, L. and Stacey, K., 1982)

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Take a moment to identify one aspect of working with someone new that you found **beneficial** and one aspect that you found **challenging**

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What's It Worth? (1053)

Each symbol has a numerical value. The total for the symbols is written at the end of each row and column.

Can you find the missing total that should go where the question mark has been put?

▲	■	■	▲	28
●	■	●	■	30
●	▲	●	●	18
●	■	●	●	20
?	30	23	22	

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Suggested plan for dissemination

After	Trialling NRICH tasks with:
Day 1	Your own class
Day 2	Your own class + 1 other
Day 3 (and before Day 5)	Colleagues (staff meeting input + feedback/reflections)
Day 5	TBC for feedback on Day 6

Don't forget to share published solutions from NRICH site with your children

Why not submit your children's solutions to our live tasks?

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Teacher takeaway

- Try a task from today in your setting, invite a colleague to do so too and then talk about the outcomes
- Try out the reasoning sentence starters with your class
- Go on a reasoning walk around your school to collect evidence of reasoning
- Begin to plan for a contribution towards a staff meeting before April 2

Please be prepared to discuss all the above on Day 4

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References

Borthwick, A. and Cross, A. (2018). *Reasons to reason in primary maths and science*. London: Sage.

Mason, J., Burton, L. & Stacey, K. (1982/2010). *Thinking Mathematically* (Second Extended Edition). Harlow: Prentice Hall (Pearson).

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