Maths Reasoning

Problem solving, reasoning and fluency are the key aims of the National Curriculum and we want these to be strong threads that weave together in our mathematics teaching. We need to encourage the children to reflect on how they got there and make reasoning visible through oral and written explanations.

This booklet has been made to provide you with information and activities related to reasoning to help support develop your child's maths reasoning at home.

We hope you find the information useful.

What is reasoning?

- Systematic thinking
- Enables us to make use of maths skills
- Helps us to make the links between different areas.
- It's the glue that helps mathematics make sense.

Why teach your child reasoning?

Reasoning is the magic ingredient that gives mathematics purpose, direction and depth. If a child can reason, they can justify, generalise, prove, explain and explore; in essence, they can make sense of mathematics.

- Children need to be able to justify and give a convincing argument that explains how or why a particular conclusion has been reached.
- To develop the ability to apply skills in different contexts/situations
- To become confident in mathematics they need to:

✓ Explain how you know
✓ Explain why he/she is correct
✓ Explain how this is possible

When Is Reasoning Needed?

- When logical thinking is required.
- When there is a range of possible starting points.
- When there is missing information.
- When selecting a problem solving skill (working systematically/trial and improvement/logical reasoning/spotting patterns/visualising/working backwards/conjecturing).
- When evaluating a situation in a context.
- When there is more than one solution.

Progression In Reasoning

- Describing: I can describe what I did.
- Explaining: I can offer some reasons for what I did.
- Convincing: I am confident that my reasoning is correct (even if it's not!) and can try and convince you that I'm right.
- Justifying: I can use words like, "because and so," "that leads to" to justify a correct logical argument with a complete chain of reasoning.
- Proving: I can make a watertight argument that is mathematically sound.

Questions and Prompts to Support and Guide Children's Reasoning

When tackling maths activities, try and use open ended questions to encourage children to think and explain:

- What is the same / different about . . .
- Which of these numbers/calculations are trickier? Why?
- Do you agree or disagree that . . .
- Is it always/sometimes/never true that . . .
- Give me an example of . . . and another . . .
- Spot the mistake . . . explain the mistake
- What *couldn't* it be? What *could* it be?
- Give me a silly suggestion for . . .
- Convince me that . . .
- Prove by drawing that . . .
- What comes next . . . What came before?
- The answer is . . ., what's the question?

- What's in the empty box?
- If we know . . . what else do we know?
- Spot the pattern, explain the pattern.
- Find an equivalent for . . .
- Can I change the order I do this in?
- Can you make up a story/real situation for this maths?

DON'T

- Don't give too much adult direction
- Don't give too much adult talk.

Ideas and Activities to Develop Reasoning

Below are some activities to develop your child's mathematical reasoning and some examples for each one :

Always /Sometimes/Never

You may want to start with one statement and have a discussion about whether it is true. Ask your child to think of some examples to illustrate the statement and decide whether it is always, sometimes or never true. If they decide it is sometimes true, they could think about what conditions make it true. Here are some ideas to try.

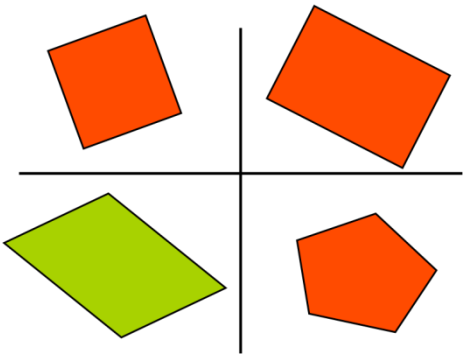
When you add 10 to a number the answer is a multiple of 10

When you cut a square in half you get a triangle.

When you add two numbers you can change the order and the answer will be the same.

Have a go at making some statements for them to test!

Which is the odd one out?



Which shape is the odd one out? Why? Is there only 1 answer?

Here are three numbers.
One of them is the odd one out.
Which one is it? Why?

9 8 12

Try some other odd one out problems about different number sentences, money, fractions etc.

Sorting Numbers/Shapes

Two sets have been mixed together. Can you sort the objects back into two sets?(The sets don't need to be the same size.)

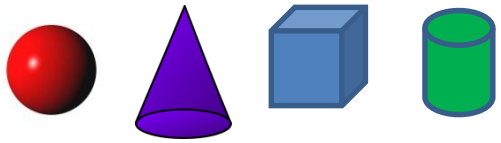
34 23 16 8 28 29 32

17p 23p 12p 25p £1.05 71p 52p

Is there more than 1 way to sort them?

Comparing/Contrasting-What is the same/different?

What is the same/different about these 3D shapes?



What's the same? What is different? 4+6=10 6+4=10

What if…? questions

Start with a simple question and then change 1 thing.(see ideas below)

Can you give me an example of pairs of numbers that have a difference of 2?
5/7….and another……and another….. etc.

What if I changed difference to total?

Can you give me a pair of numbers whose total is 2. Eg 1 and 1, 0 and 2 etc

Which is harder/easier?

What if I change 2 numbers to 3? Give me a set of 3 numbers whose total is 7?

If I know…..what else do I know?

If I know 40+60=100 what else do I know? (100- 40=60 or 100=60+40)
They can also find other facts by adjusting the first example given
41+59=100, 30+70=100
OR Use the original number sentence to find the whole Fact Family……

31+69=100, 100-69=31, 100-31=69, 69+31= 100

ENJOY MATHS WITH YOUR FAMILY

TRY REASONING USING EVERY DAY LIFE SITUATIONS:

- How can we fit this into the car in a logical way?
- I need to paint fence panels. If 1 tin covers 1 and a half panels, how many tins do we need to paint our fence etc?
- Follow recipes- increase by half. What will the new amount be?
- Travelling in the car- estimating car journey - time it and discuss difference.
- Rearrange furniture in a room. Reason about where items will fit. -Use estimating techniques. Measure with a measuring tape. Ask questions. What will happen if I……?
- **Most importantly get your child to explain why and how whilst doing these activities!**

Use Different Methods

Encourage your child to find 5 ways to solve 1 problem rather than 1 way to solve 5 problems? There needs to be an awareness that there's more than one way to reach a goal.

Example:

How many different ways can you show me 6+15=

You can use a number line, diennes money, bead string, numicon, bar model, part/whole model or picture. (These are all methods and models your child will be familiar with from school).

Discuss…what is your favourite way?

Which is the most effective way?

Encourage your child to use practical resources first to solve problems or explain. When they are ready they can record in pictorial form and finally in a more abstract way using number sentences. They need to visualise the problem first linking thinking between concrete-visual-abstract representations

REMEMBER

CONCRETE (practical) → PICTORIAL → ABSTRACT

List of Good Websites

This is a list of useful websites where you can find quality ideas for developing maths reasoning with your child.

https://nrich.maths.org/

BBC Bitesize-KS1 Maths-Reasoning
https://www.bbc.co.uk/bitesize/subjects/zjxhfg8

Education City

https://www.educationcity.com/