MATHS HORIZONS

How do you solve a problem like “problem solving”

2nd July 2026

Purposeful Ventures

Curriculum and Assessment Review:

We believe the priority at Key Stage 2 should be ensuring all pupils build competence in multiplicative reasoning and problem-solving. Multiplicative reasoning includes secure understanding of multiplication and division scaling, repeated addition, arrays, and whole number rates. Appropriate stretch and challenge for all pupils, including the highest attainers, should come primarily through reasoning and problem solving. A strong foundation in number, combined with an expectation that all pupils have the chance to apply what they know through problem-solving and reasoning, should support transition better.

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What's great about problem solving?

- improves attainment and deepens conceptual understanding
- boosts confidence and enjoyment
- builds the capacity to apply maths flexibly and critically
- develops habits of explanation, structure-spotting, and systematic thinking
- supports essential life skills including financial reasoning, media literacy, and decision-making.

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What isn't great about problem solving?

- There is no agreed understanding of what 'problem solving' is.
- There is a persistent and damaging assumption in the sector that problem solving is reserved for:
    - The end of a topic
    - The most able
- The image often conjured when we think of 'problem solving' is a large, complicated worded problem.

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Existing language about problem solving

- There are two important distinctions that are useful (but limited) when considering what problems or tasks are suitable for pupils at any given time

- Routine problems
- Non-routine problems

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Routine Problems

- These are usually problems that are within a domain currently being taught, or one that is immediately familiar

- Their value is that they develop a pupil's ability to apply what they are learning to a variety of situations and narratives to deepen their understanding of what they are learning about.

- The approach to them tends to be transparent and well rehearsed

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Non-Routine Problems

- These are usually problems that require application of knowledge that has been learnt previously.

- The domain in which they reside is unlikely to be the domain (or exclusively the domain) that students are currently being taught.

- They are opaque.

- Their develop a pupil's ability to recognise relevant mathematical structures or to combine mathematical content from across sub-domains.

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Stylised vs Authentic

“There are *n* sweets in a bag.
6 are orange, the rest are yellow…”

“What can you determine from this data set?”

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A problem-solving framework

Characteristic 1: Structure

Questions that require pupils to identify mathematical structure in a situation

Lie at the heart of mathematical reasoning

- interpret a situation
- identify relationships and mathematical structures
- select appropriate methods

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A problem-solving framework

Characteristic 2: Working systematically
Constraining possibilities and working systematically

This can involve
- exploring cases
- identifying patterns
- eliminating impossibilities
- reasoning efficiently towards a solution

Not just for mathematics but problem solving in everyday life.

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A problem-solving framework

Characteristic 3: Justification

Questions that require pupils to explain, justify, prove or otherwise communicate their thinking

Make the reasoning and mathematical thinking **visible**

- move from doing mathematics to communicating it
- require and develop precision of language and awareness of steps taken
- reveal depth and coherence of understanding

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537
524
___ ___ ___
3 ___ ___
349

1 2 3 4 5 6

Using the digits above once per example, complete the ladder so the numbers are in ascending order.

How many ways can you find?

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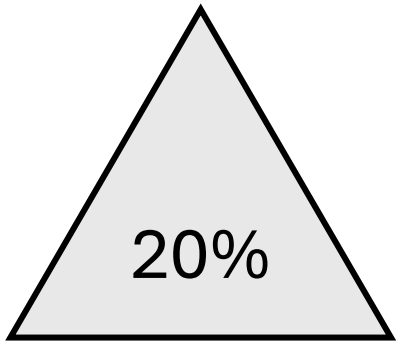
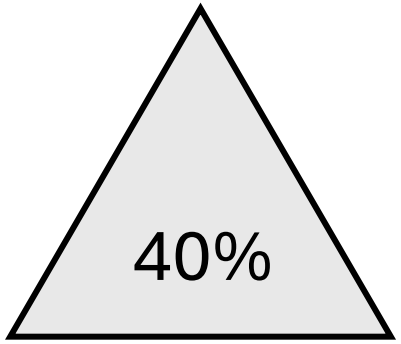
The images below show some parts of different shapes.
What might each whole shape look like?

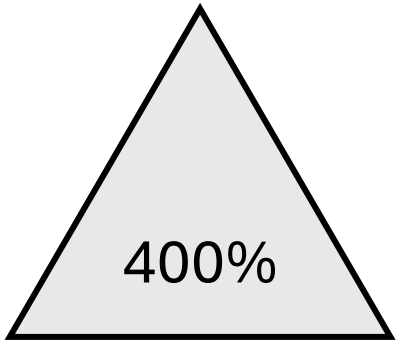
a)



b)



c)



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The accessibility problem

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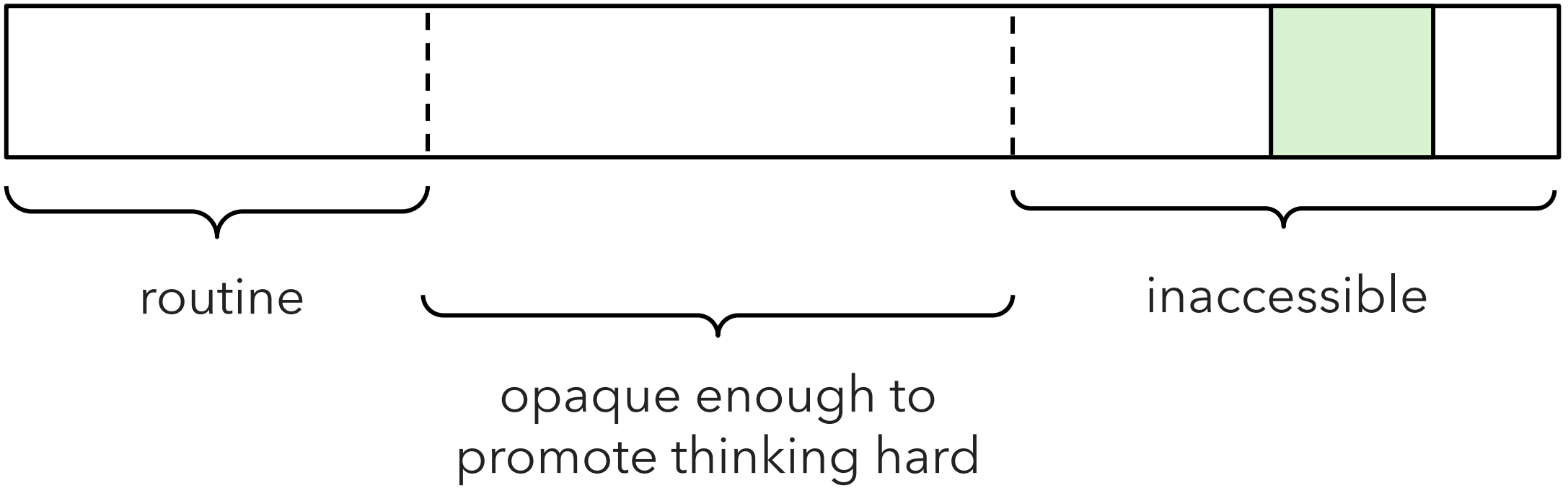
A problem-solving framework



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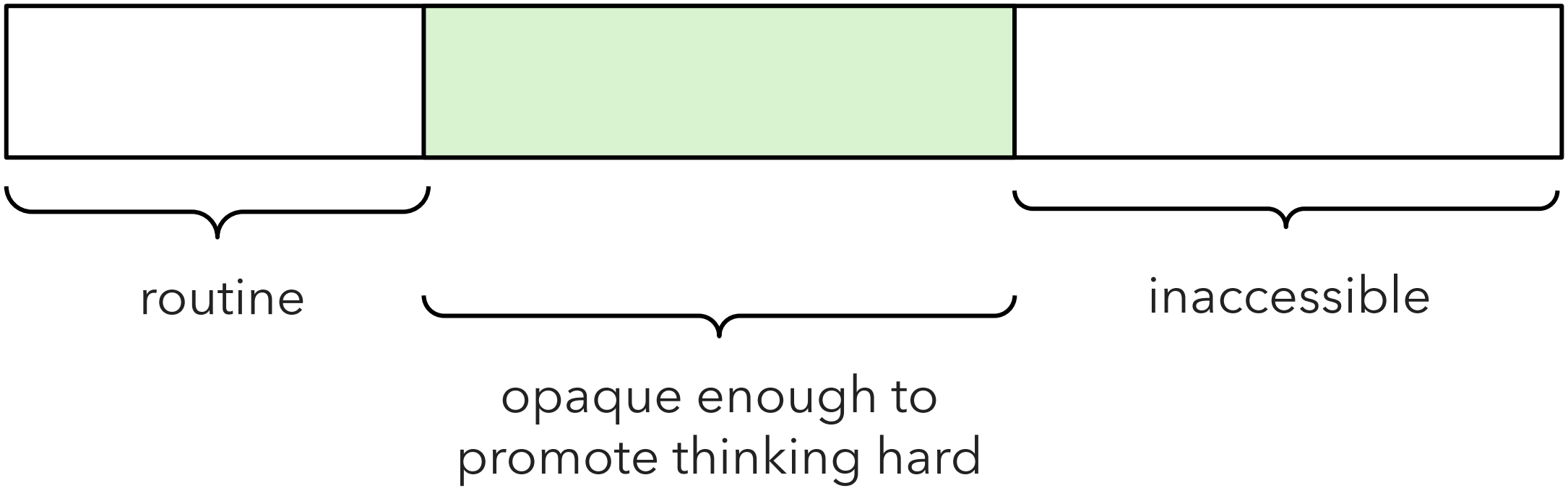
A problem-solving framework



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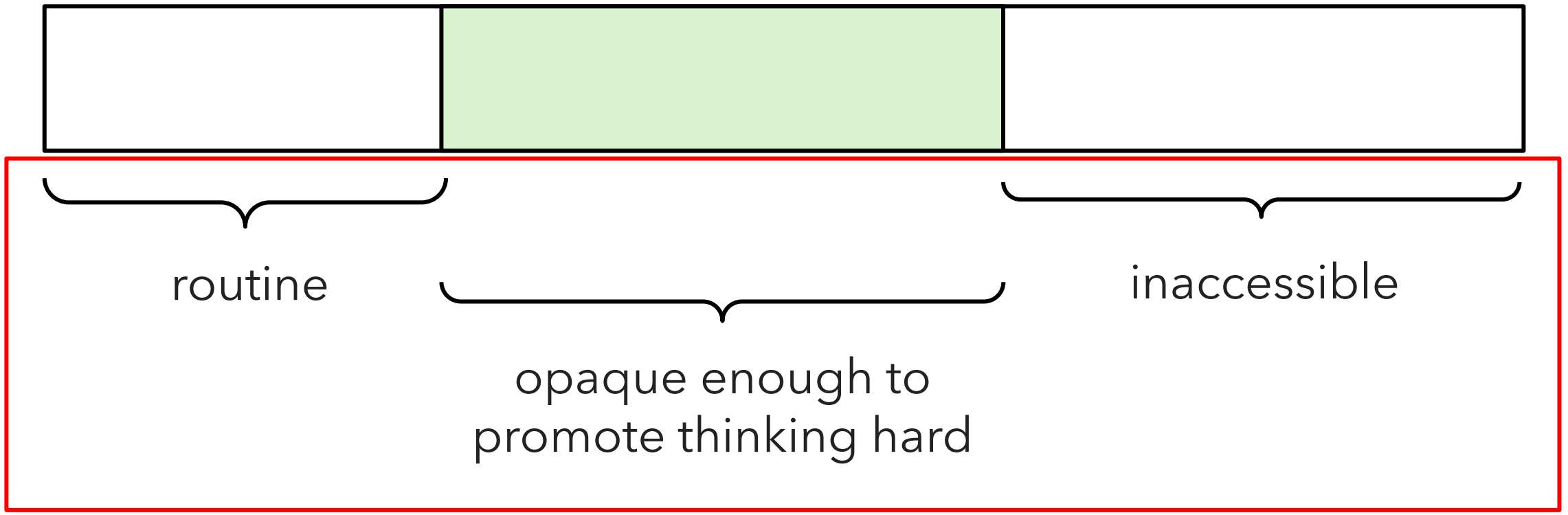
A problem-solving framework



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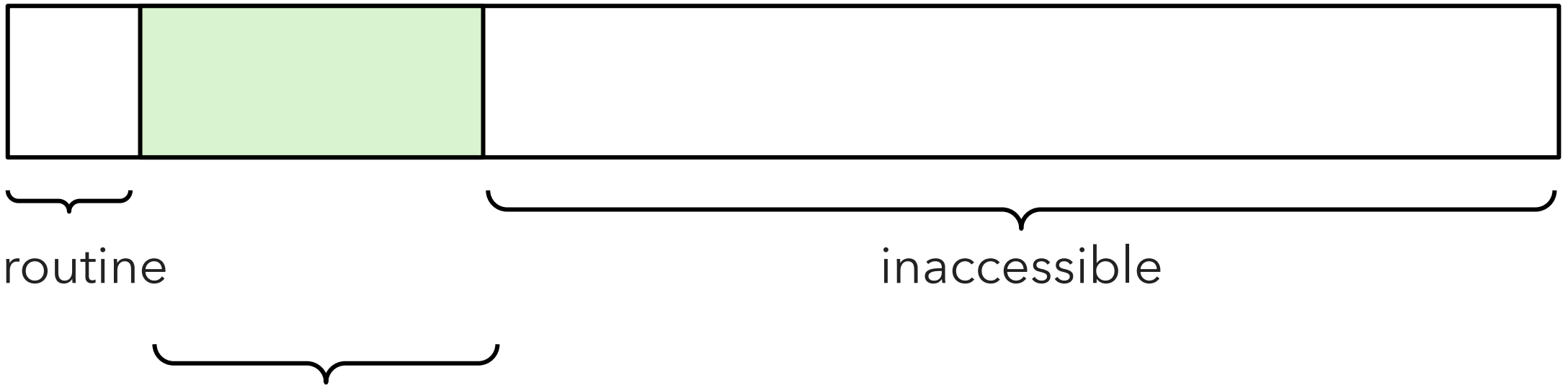
A problem-solving framework



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The problem with routine and non-routine

Designing a problem requires *positioning*

That positioning involves perceived difficulty

Perceived difficulty is dependent upon more variables:
people / place / experience

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Manipulating the characteristics - Variants

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Variance

- We tasked authors with creating variants of a problem by:
  - thinking about making a characteristic more, or less dominant
  - or changing the accessibility of the problem whilst maintaining the balance of characteristics.

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Hannah has these coins.

How many different totals can she make using only 2 coins?

Hannah has these coins.

How many different totals can she make using only **3 coins**?

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Hannah has these coins.

How many totals can she make **greater than 8 p** using only 3 coins?

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Hannah has these coins.

She gives you two coins that sum to an even number. What could they be?

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Hannah has these coins.

How many different totals can she make using only 2 coins?

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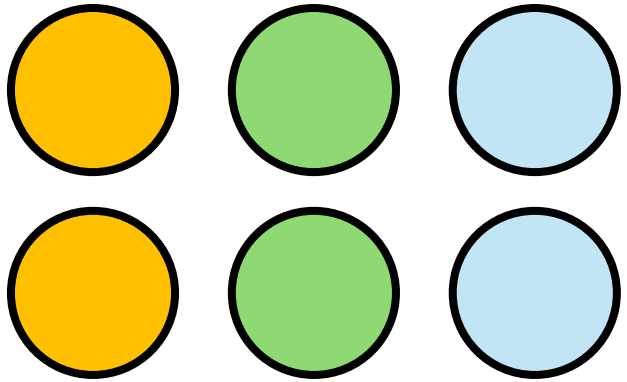
Hannah has these counters.



How many different pairs can she make?

You try!

The mean average of the data set below is 7

4, 7, ___, ___, ___

What could the missing values be?

Can the missing values all be the same?

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You try!

The mean average of the data set below is 10

9, 10, 11, ___,

What is the missing value?

Is there only one answer?

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You try!

Five positive integers have a mean average of 7

Two of the numbers are the same.

What could the five numbers be?

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You try!

Kamal spends $\frac{1}{5}$ of his workday in meetings. How long is Kamal's workday?

Kamal has a lunch break of $\frac{3}{4}$ hour. Show this on his bar model.

You try!

Kamal represents his workday as a bar model. He spends 60 minutes in meetings.

How long is Kamal's workday?

Kamal has a lunch break of $\frac{1}{2}$ an hour. Show this on his bar model.

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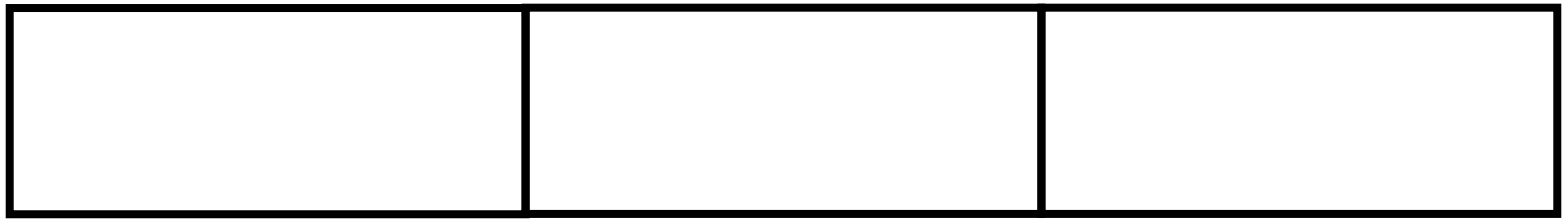
You try!



Kamal represents his workday as a bar model. He spends a third of the day in meetings.

Two fifths of those meetings are online and last a total of 50 minutes

How long is Kamal's workday?

We want to hear from you

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