



Problem solving unpacked

12.12.14

Fran fw279@cam.ac.uk

Charlie cfg21@cam.ac.uk

Jennie jp591@cam.ac.uk

NRICH team

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics





Aims

- To explore how to provide rich problem-solving experiences for all students.
- To understand how to plan effective and engaging lessons based on rich tasks.
- To unpack the reasoning journey and consider strategies for supporting its progression.



National Curriculum

Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding....

Key Stages 1, 2 & 3

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics





Session 1

Rich Tasks: Promoting Mathematical Learning for All

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics



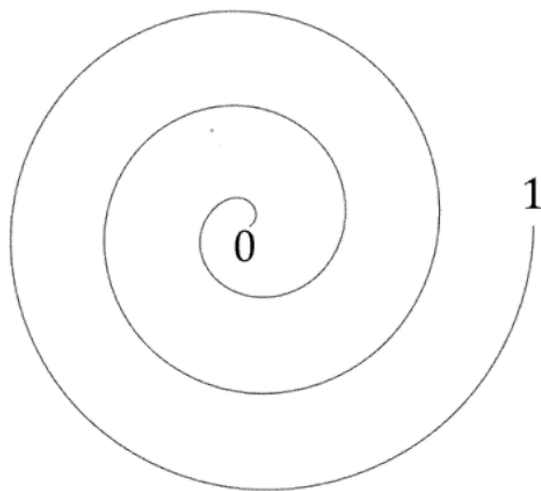


Key questions

- What's the difference between a LTHC task and a RICH task?
- What are the implications for classroom practice?
- How can we engage all learners in the problem-solving process?



Spiralling Decimals (10326)



0.5

0.25

0.75

0.3

0.35

0.9

0.99

0.999

0.1

0.01

0.05

1.79

0.64

0.32

0.54

0.865

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics



UNIVERSITY OF
CAMBRIDGE

Dice in a corner (8586)





Which Scripts? (774)

Six numbers in five different scripts.

Can you decipher the scripts?

What are the six numbers?

୧୦୦	13	୫୮	୧୩	=+୫
୧୩	୩	୨୪	83	୬୦୦
=	୫+୮	2	୬୭	-୫
୨୫	୮୩	୧୩	୨	58
25	୮୭	୨	୮+୩	୧୦
୫୮	+୩	100	୪୧	୨୫



Rich Tasks

- Have a relatively closed start but offer different responses and different approaches
- Invite own questions
- Combine fluency and reasoning
- Reveal/provoke generalisations
- Encourage collaboration and discussion
- Are intriguing
- May be accessible to all (LTHC)



Low Threshold High Ceiling

- Suitable for whole range
- Low entry point
- Lots of choices in
 - method
 - response
 - recording
- Learners can show what they CAN do, not what they can't
- High 'finish' possible

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics





Session 2

Unpacking the problem-solving process

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics

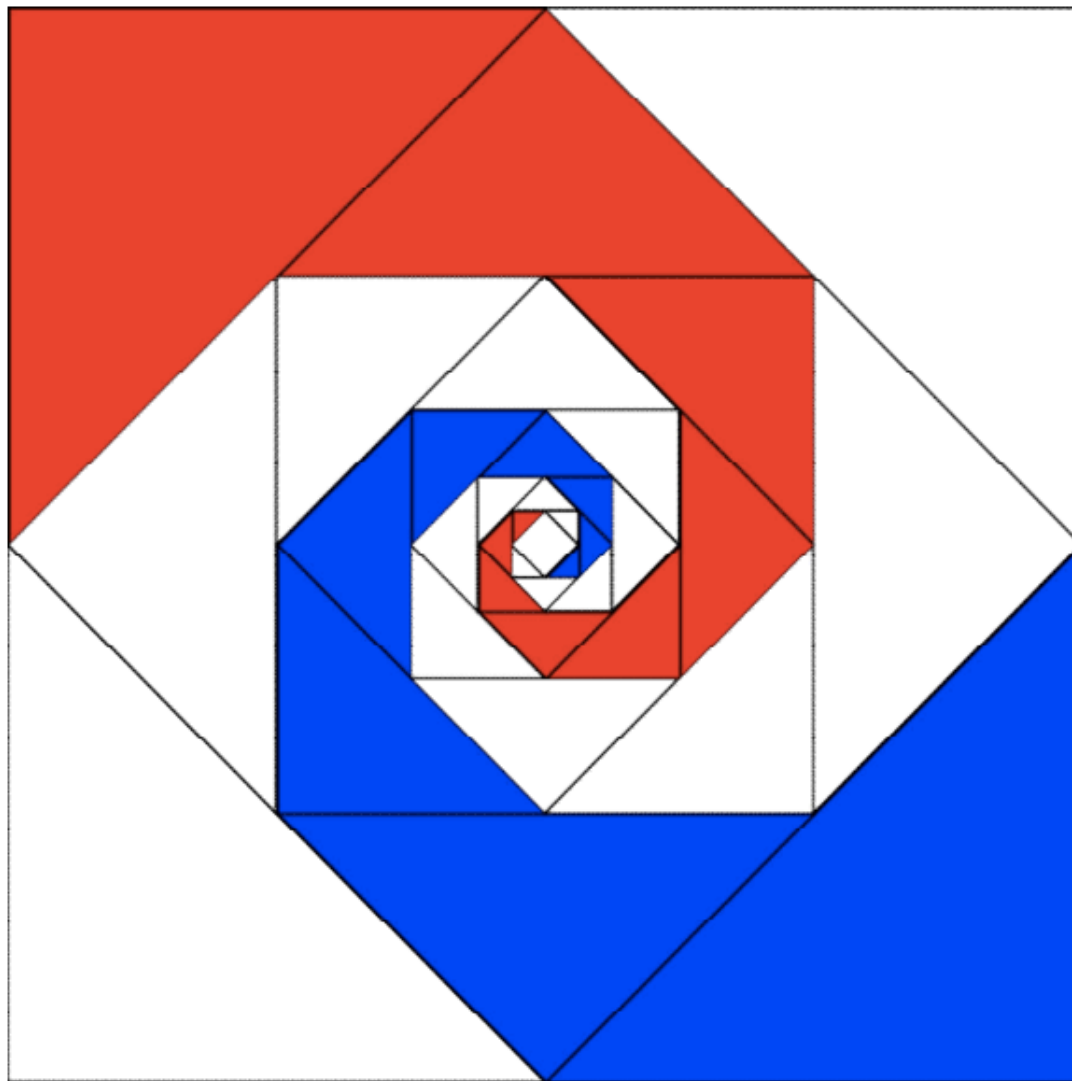




Types of Task

- Finding all possibilities
- Visual problems
- Logic problems
- Rules and patterns
- Word problems

Baravelle (6522)





Take 6 Numbered Cubes

coming soon on the website



Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics



UNIVERSITY OF
CAMBRIDGE



The Problem-solving Process

- Stage 1: Getting started
- Stage 2: Working on the problem
- Stage 3: Going further
- Stage 4: Concluding



enrich Problem-solving process

1. Getting started

try a simpler case
represent with model

draw a diagram
act it out

2. Working on the problem

visualise

reason logically

work systematically

work backwards

conjecture

look for a pattern

trial and improvement

3. Going further

generalise

verify

prove

4. Concluding

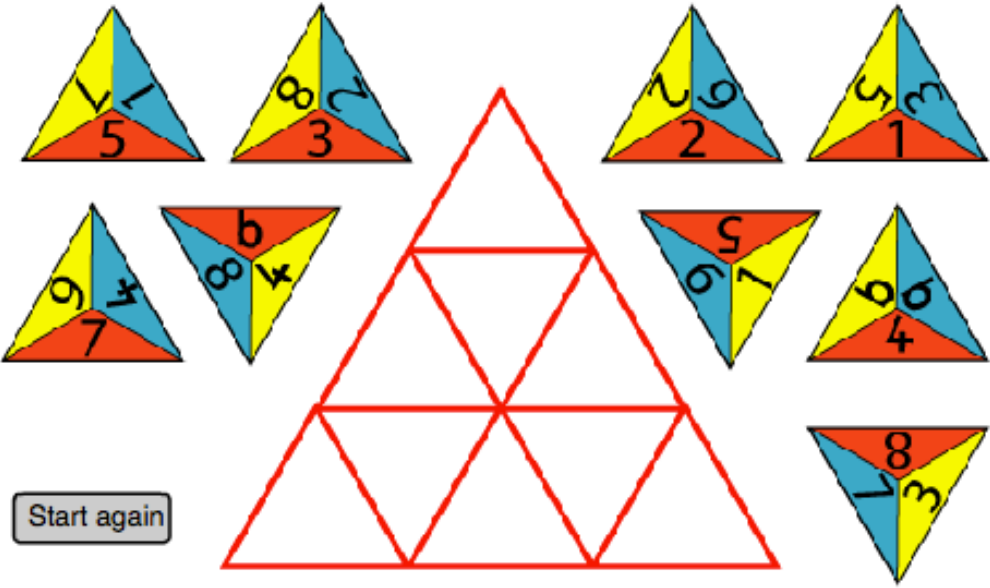
communicate findings

evaluate

One Big Triangle (192)

One Big Triangle

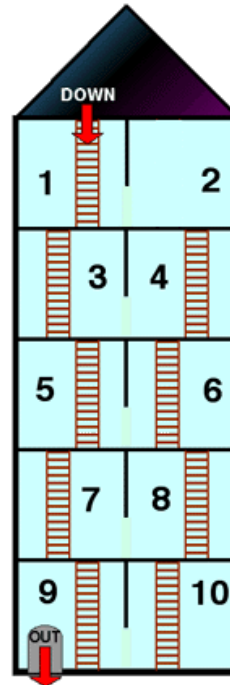
Place the 9 small triangles in the big triangle so that the numbers on the touching sides add to 10.



Start again



The Tall Tower (2354)



Which way should you go to collect the most spells?

And which way to collect as few as possible?

Can you find a route that collects exactly 35 spells?

Continuing Professional
Development
Standard

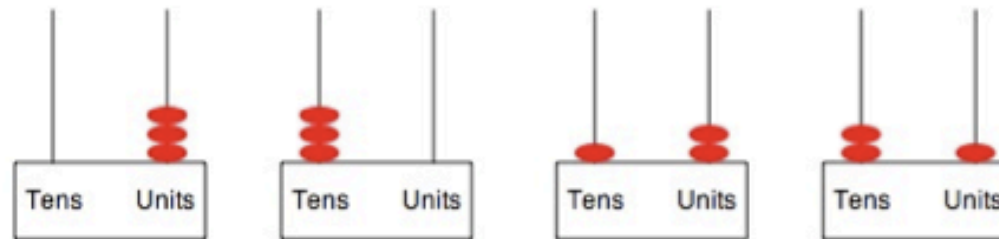
National Centre
for Excellence in the
Teaching of Mathematics



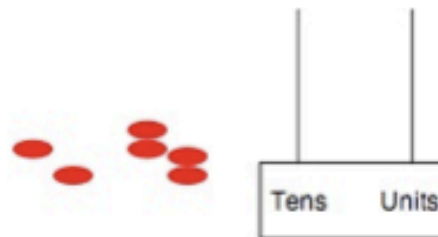


6 Beads (152)

If you put three beads onto a tens/units abacus you could make the numbers 3, 30, 12 or 21.

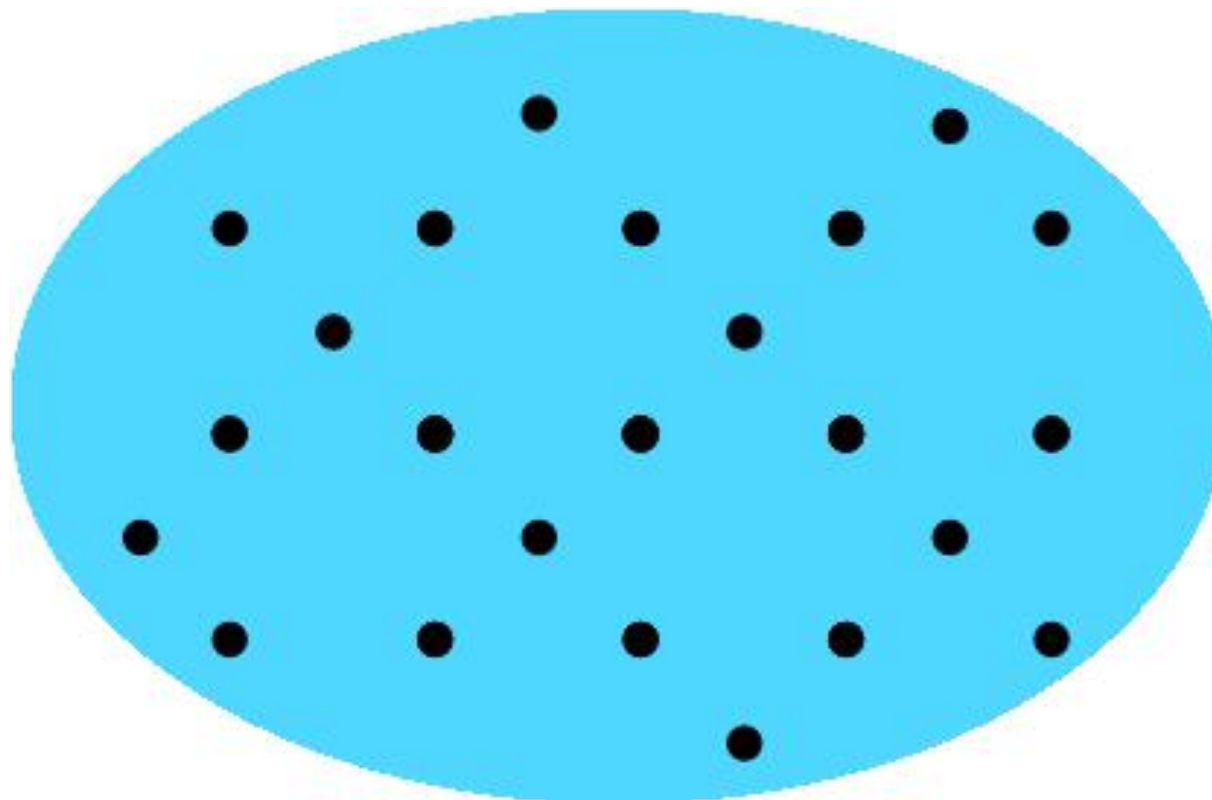


Explore the numbers you can make using six beads.





How Would We Count? (8123)



Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics





100 Square Jigsaw (5572)

Build up the 100 square

Start again

51 52 53
60 61 62
70 71
80

8 9
19
28 29
38 39
48 49
58

1 2 3
12 13
22
31 32
42

57 59
67 68 69
77 78 79
89

6 7
16 17 18
26 27
35 36

4 5
14 15
23 24 25
33
43

63 64 65 66
74 75 76
85 86

84 87 88
94 95 96 97 98 99

34 37
44 45 46 47
54 55 56

72 73
81 82 83
90 91 92 93

0
10 11
20 21
30
40 41
50



Session 3

Workshops

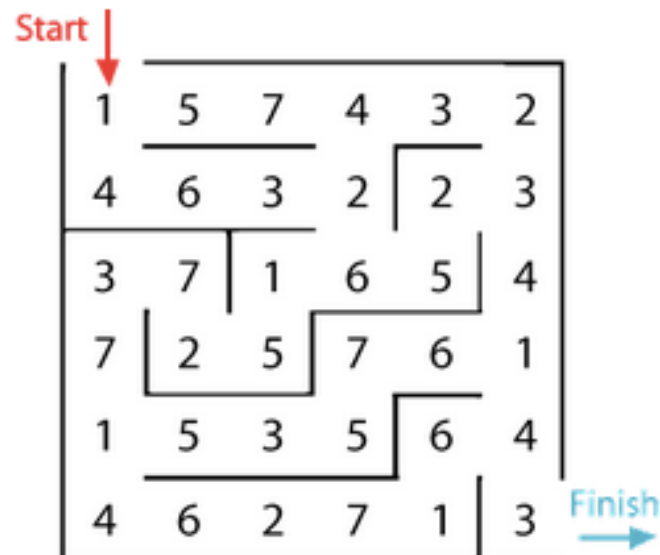
- Digging deeper into structuring a lesson
- Types of problems and problem-solving skills: how might these impact on classroom practice?



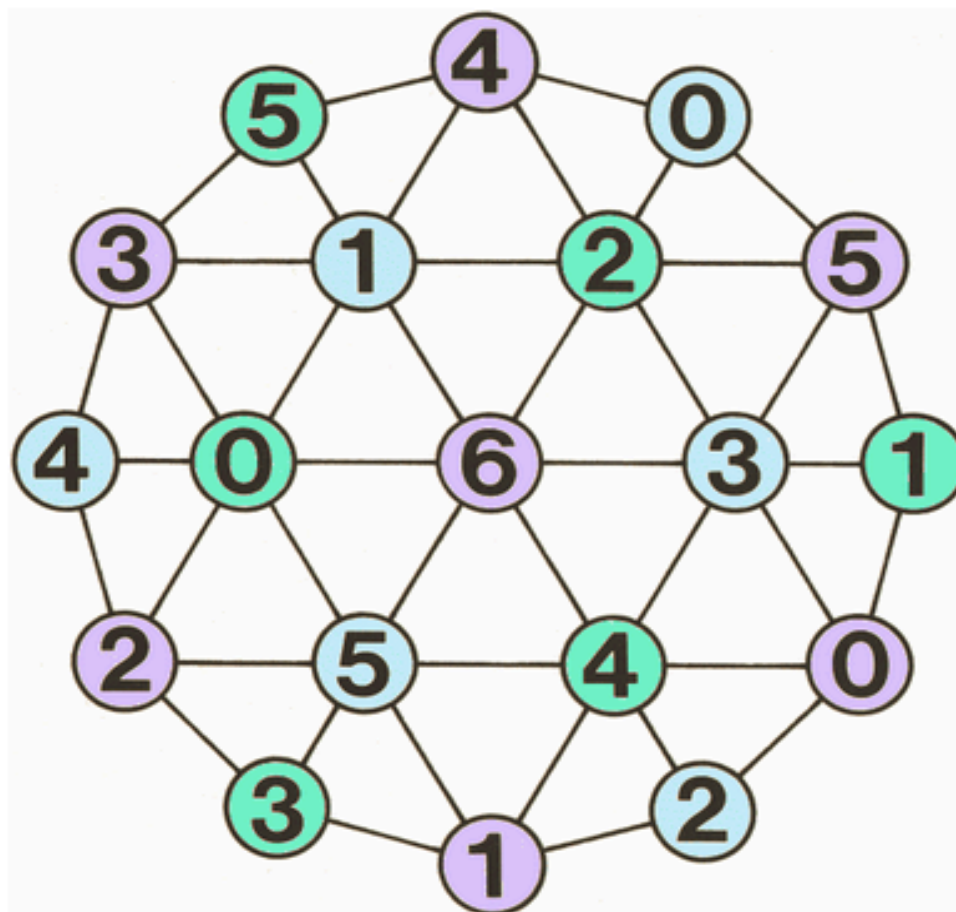
Maze 100 (91)

In this maze there are numbers in each of the cells. You go through adding all the numbers that you pass. You may not go through any cell more than once.

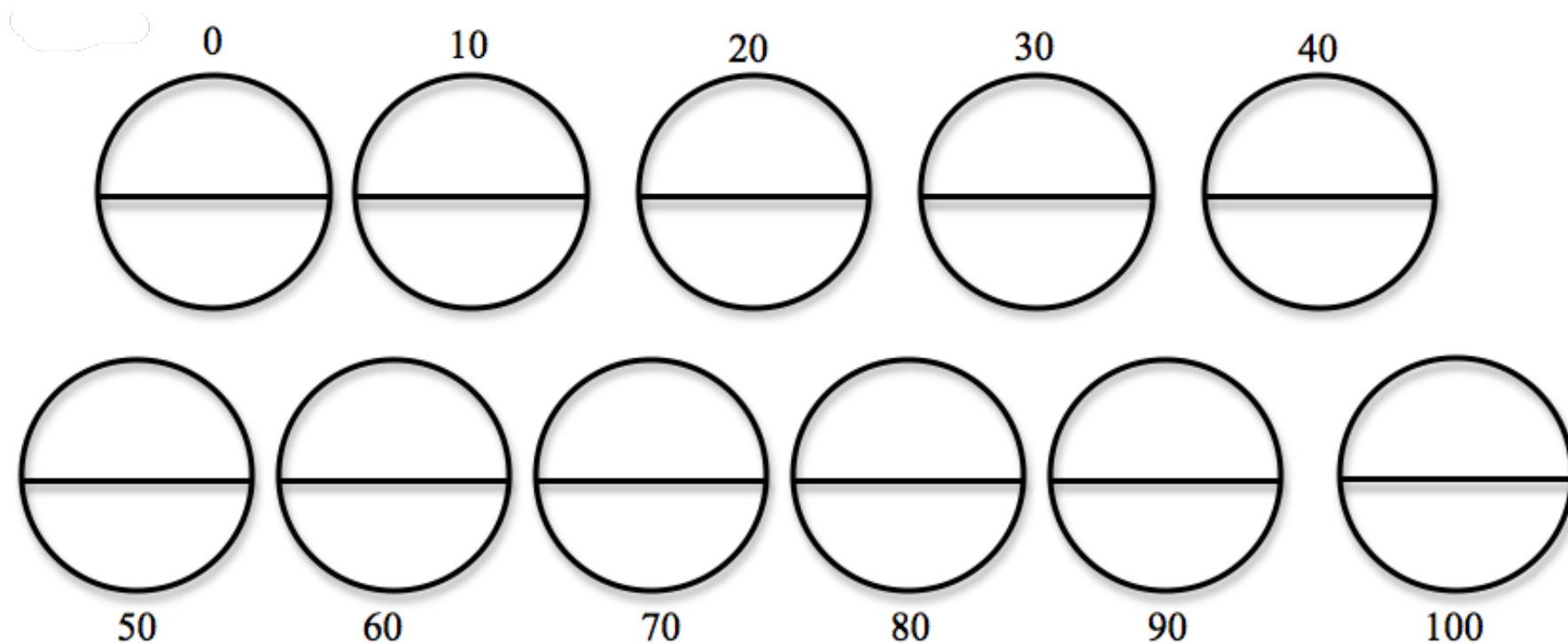
Can you find a way through in which the numbers add to exactly 100?



Totality (1216)



Reasoned Rounding (10945)





NRICH Support

Problem Solving Feature (Primary)

<http://nrich.maths.org/10334>

Roadshow activities by Key Stage

<http://nrich.maths.org/11351>

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics





Session 4 Reasoning

Progression in reasoning:

- Describing
- Explaining
- Convincing
- Justifying
- Proving

Continuing Professional
Development
Standard

National Centre
for Excellence in the
Teaching of Mathematics





Sealed Solution 1177

A set of ten cards, each showing one of the digits from 0 to 9, is divided up between five envelopes so that there are two cards in each envelope. The sum of the two numbers inside it is written on each envelope:



What numbers could be inside the "8" envelope?



Embedding a Problem-solving Approach

- What could you do relatively quickly?
- What needs more thought?
- Where do you hope to be by Easter?