

Critical and Creative Thinking in the Mathematics Classroom Conference

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 1. To promote Reasoning and Fluency through Problem Solving tasks that I can apply to my classroom.

• 2. To encourage mathematical dialogue in the classroom that will assist in the development of student **Understanding**.



JO BOALER FOREWORD BY CAROL DWECK

MATHEMATICAL NINJDSETS

Unleashing Students' POTENTIAL Through Creative Math, Inspiring Messages and INNOVATIVE TEACHING



TASKS - Design of Tasks (Boaler, 2016)

- 1. Can you open the task to encourage multiple methods and representations?
- 2. Can you make it an inquiry task?
- 3. Can you ask the problem before teaching the method?
- 4. Can you add a visual component?
- 5. Can you make it 'low floor and high ceiling'?
- 6. Can you add the requirement to convince and reason?



1. Can you open the task to encourage multiple methods and representations?

• Think about the answer to 18 X 5.

• Draw a diagram that shows your thinking.

Share your thinking and diagram with the person next to you.

Half and half – single digit multiplication facts





Double and halving strategy





Standard place value partition





Round up to nearest ten and subtract





Non standard place value partition





Additive split or partition





2. Can you make it an inquiry task?

Instead of asking,
Find the area of a
10 by 2 rectangle?

Ask,

How many rectangles can you find with an area of 20?





Four Fours

Using only four 4's and any operation, make the numbers 1 to 20, inclusive.

1=	2=
3=	4=
5=	6=
7=	8=
9=	10=
11=	12=
13=	14=
15=	16=
17=	18=
19=	20=

Find four solutions on your own.

Turn and talk to a neighbour and share your solutions.

Together, continue to find more solutions.



Write some sentences that have 5 words, with an average of four letters per word.

There are no four letter words in the sentences.





Fractions and Slices – can you draw your solution?

A person is on a diet and goes into a shop to buy some turkey slices. They are given 3 slices that together weigh 1/3 of a kilogram, but the diet says that they are allowed to eat only ¼ of a kilogram.

How much of the 3 slices they brought can they eat while staying true to their diet?









Choose four different digits from 1 - 9 and put one in each box.



Sum the four 2-digit numbers by reading across the 1st row, the 2nd row, down the 1st column and down the 2nd column. What is your total?

- Check your total with a partner.
- Who got the higher total?
- Why?





- Arrange the four digits to get the highest, lowest,..., Reach 100.
- How many ways can you reach 100?
 - (Source: nrich.maths.org Reach 100)



6. Can you add the requirement to convince and reason?

Convince yourself Convince a friend Convince a sceptic

To promote mathematical reasoning, students will need the necessary vocabulary and practice to develop this skill.



Create an argument as to why the picture shows fourths





Askew (2012), refers to -

- Tasks
- Tools and
- Talk

as the 'teaching tripod'.







Private talk in pairs or small groups and Public conversation as a class.

Some private talk methods:

- paired calculations
- solver recorder
- clue problems





A pair of students have a piece of paper and a pen between them.

One student is the 'solver' and figures out the problem, whilst the partner records what the 'solver' explains. The recorder cannot take over and explain.

Roles are swapped for new problems.



Cooperative Group Learning Tasks



New Series books:

Pre-Primary, Years I & 2, Years 3 & 4, Years 5 & 6 and Secondary



Rich Tasks? The 5 'C' s of Maths Engagement

- Curiosity
- Connection Making
- Challenge
- Creativity
- -> Through Collaboration (Boaler p.57)