Five Minute Diagnostic Tasks:

These tasks are designed to take 5-10 minutes to complete with each class. They will give you a very quick idea of how successful your current approaches are at dealing with the major student misconceptions about number. Please take 5 minutes to ask the questions to your class. Make sure that you aren't tempted to help or guide them in any way, but just ask the question and record their answers. It is very important to know what kids really think rather than what they have been taught.

If students in your class fail the task, use one of the tasks from earlier grades with anyone who failed. Continue moving backwards until they are successful (or you run out of time).

Be aware that these tasks assess student Understanding (what they really think) rather than Fluency (what they have memorised). They deliberately try to find what misconceptions are remaining in spite of teaching – to check how fragile the students' understanding is. Therefore the numbers in these tasks are deliberately small while the understanding targets key concepts in maths that students have difficulty with, not unlike the questions in NAPLAN tests. Classes with didactic or traditional approaches to maths often end up with 70-90% of students initially failing the task even though the content is set at a very low level.

Please answer these questions and bring the answers to the next staff meeting to discuss:

What grade are you teaching?	
Which task did you use initially?	
How many students sat the initial task?	
How many students failed the initial task?	
Did this surprise you?	
What did you do after that, and how many students were successful?	
What do you think the next step should be?	

Task A   Suitable for Foundation/ Year 1:

You will need:

- 1 opaque cup
- 10 counters
- Consider having someone video the kids as you do this so that you can pause the shot to count the kids at steps 5 and 6.

Method:

1. Sit the children on the floor in front of you. Start dropping the counters into the cup and ask the kids to count them.
2. During the process of dropping the counters in the cup try the following:
   a. Slow down or stop and see which kids keep counting on regardless. (Record names)
   b. Drop a counter onto the floor then pick it up and put it into the cup. See which kids count it twice. (Record names)
3. Once most of the kids are actually counting the counters that land in the cup, drop six counters into the cup. Make sure that the kids know that there are six counters. Get them to show you six on their fingers to check that they can make six. (Record names of kids who can't make six)
4. Explain to the kids that you are now going to shake the cup. Once you stop you want them to close their eyes and show you how many counters they think that there are now with their fingers.
5. With all of the kids watching, place your hand over the top of the cup and shake it. Ask them to close their eyes and show you how many counters there are "now". (Record names of kids who think it is no longer six)
6. Repeat step 5 three times in a row. (Record names of kids who think it is no longer six).

Successfully completing this task looks like:

The child follows the counters into the cup successfully for step 2, makes six with their fingers at step 3, and makes six every time for steps 5 and 6.

Task B   Suitable for Year 1/ Year 2:

You will need:

- A box of unifix cubes (they join together in a line)
- A strip of masking tape that goes from one end of your room to the other, so that the kids can sit on either side of it and walk along it.
- A piece of A3 paper for each child, folded lengthwise, with the number 1 at one end and the number 10 at the other end.
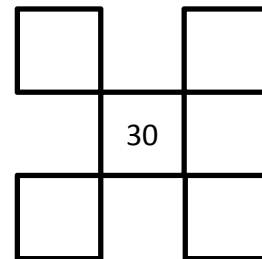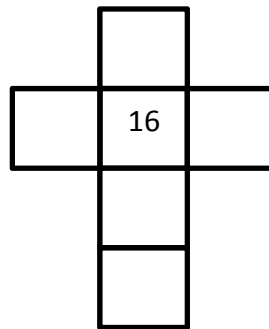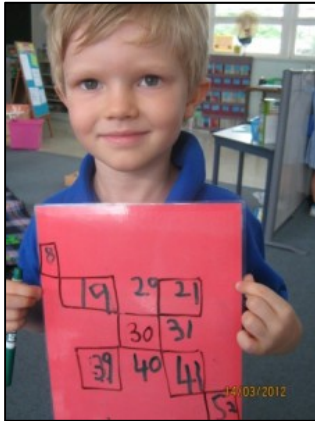
Method:

1. Place 1 unifix cube at one end of the strip, and 10 joined together at the other end.
2. Ask the students to place 2, 3 and 4 on the line. Allow them to make the number with the unifix blocks and place it on the line.
3. Now ask them to place 9, 8 and 7 on the line. Allow them to make the number with the unifix blocks and place it on the line.
4. Now ask them to place 6 then 5 on the line.
5. Ask the students "Does that look right to you?" For the students who are happy, go onto step 7. (Record names)
6. For the students who are not happy allow them to move the blocks if they want to. Do not prompt them about putting five in the middle. This task is diagnostic. Once each child is satisfied, have them go onto step 7.
7. Ask each child to draw the number line on their A3 piece of paper. Tell them to put the numbers where ever they think that they should go.

Successfully completing this task looks like:

The child uses relative size to correctly position the numbers on the line. The numbers should not be squashed up at one end or the other. Five should be roughly in the middle, with equidistant spaces to the other numbers.
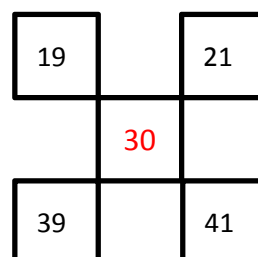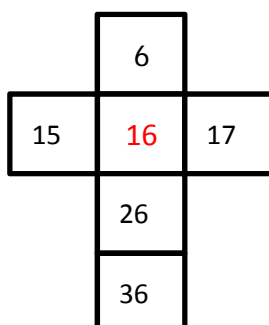
You will need:

- A piece of blank A4 paper for each child
- A felt-tip pen for each child
- Some base-ten material (e.g. bundling sticks, MAB)
- A Hundreds Chart for students to refer to – preferably a large one that the whole class can see.

Method:

1. Sit the children on the floor in front of you. Explore the hundreds chart together by:
   a. Remove/cover a few of the numbers. Ask the children which numbers are covered.
   b. Ask the children if they can see any patterns in the hundreds chart.
2. Remove the hundreds chart from view.
3. Explain that you are going to play a game called "What's missing?" You will draw some squares from the hundreds chart on the board but not all of them. The kids need to copy the shape onto their paper. One of the squares will have, and then work out what numbers are missing from the chart (e.g. what number would come above, below or beside)
4. Draw the cross-shape with the 16 (above) on the board. Have students draw the shape on their page and fill in the missing squares. Collect their responses.
5. For students who are successful, try the shape with the 30. Explain that this is a special hundreds board where the numbers can go past the ends, but keep with the same pattern (e.g. beside 20 would be 19 and 21).

Successfully completing this task looks like:

Task D   Suitable for Year 3/ Year 4:
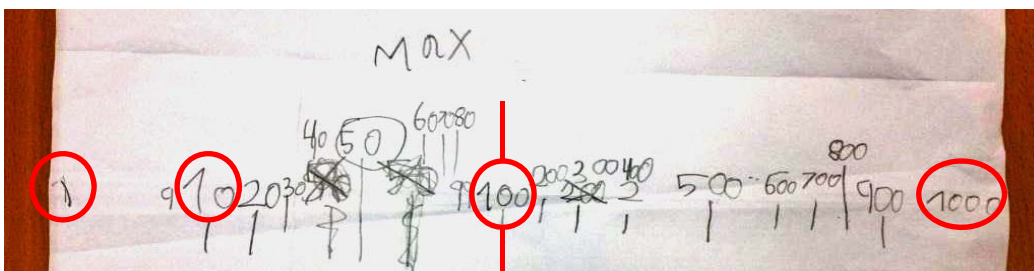
You will need:

- MAB blocks: 1 x hundred block, 1 x ten block, 1 x one/unit block, 1 x thousand block
- A strip of masking tape that goes from one end of your room to the other, so that the kids can sit on either side of it and walk along it.
- A piece of A3 paper for each child, folded lengthwise and coloured felt-tip pens for writing on the paper

Method:

1. Place 1 MAB cube at one end, and 1000 MAB cube at the other end.
2. Ask each child to draw the number line on their A3 piece of paper with the 1 and one end and the 1000 at the other. Tell them to write where 10 and 100 should go. Get them to write their names on the paper.
3. If students place 100 in the middle or up towards the 1000, flip the paper over and repeat on the back with 1 at one end, 100 up the other and just placing 10 on the line.
4. Use the blocks for students who do not like writing.

Successfully completing this task looks like:

The child uses relative size to correctly position the numbers on the line using base-ten sizing. 100 should be one tenth of the way along the line and 10 should be one hundredth of the way along the line. Common misconceptions include: equally spacing the 10 and the 100, placing 100 in the middle, placing 100 at about one quarter of the line's length (closer to the one), and placing the 100 up near the 1000.

You will need: *Please note: this task will take 15 minutes*

- Lots of A4 paper
- Scissors, felt-tip pens
- One piece of paper for each child to record their answers

Method:

1. Ask a child to make one half of your A4 piece of paper. Cut the half and overlay both halves to prove that they are the same size.
2. Ask a child to make a different half that is still really half of the A4 paper. Repeat the checking process.
3. Repeat step 2 until you have at least 4 differently shaped halves as per diagrams below. Challenge the kids to make the weirdest half that they can. (See photo above for challenging idea.)


4. Label each half with a letter (e.g. half A might be the long thin rectangle, half B the short fat rectangle)
5. Ask the children to imagine that the paper is actually chocolate cake, and they will get to pick which piece they would want to eat.
6. Ask students to write down the letter of which half they think is the biggest. If they comment "but all of them are the same" or ask if they can vote for more than one then explain that they can vote for as many as they want.
7. If they say "They are all the same", then ask in a sneaky voice, "ok, but if they aren't all the same, then which one do you think is the biggest?" The aim is to see if they are just responding by ROTE or if they really believe that the halves are all the same size.
8. Repeat, making thirds or quarters instead of halves (use thirds for years 5/6/7).

Successfully completing this task looks like:

Students strongly believe that all of the halves are the same size. Same for thirds/quarters.

Task F   Suitable for Year 5 /Year 6/ Year 7:
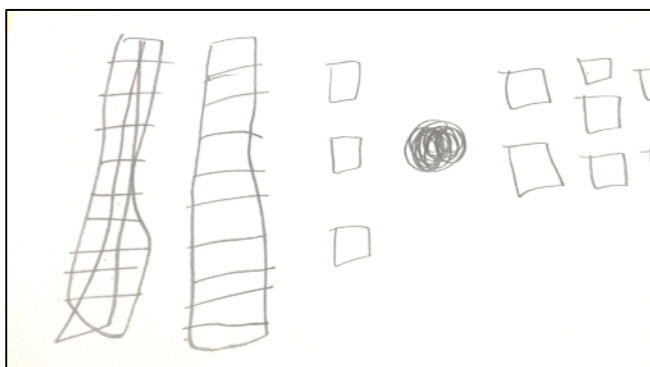
You will need: *Please note: this task will take 15 minutes*

- Lots of tens and ones MAB, a few hundreds and one thousand
- Paper and felt-tip pens

Method:

1. Sit the class in a circle on the floor so that everyone can see what you make out of blocks.
2. Ask on child to make 23 from the blocks. They will probably use 2 tens and 3 ones. Repeat, asking if there is another way to make 23. Continue until you have 23 ones, and also 1 ten and 13 ones.
3. Take the 2 tens and 3 ones. Model each of the following situations and ask the kids to confirm if it is still 23. Watch out for kids who get stuck.
   a. Spread the blocks out
   b. Pile them all up on each other
   c. Move the blocks around so that the tens and ones are separated
4. Say, "Now I want you to make 23.7 using this 23. If you can't make it using the blocks, then you can draw it instead." Watch for students who seem confused, and ask them if they could do it if you gave them scissors. Hopefully they will want to cut a one block up into 10 parts to make tenths and then use 7 of the tenths. However, many students simply make 23 then draw a dot and then make another 7 (see drawing above). Separating 30 blocks is not the same as 23.7. Some also want to cut the blocks into halves, quarters or sevenths. Decimal numbers are about relative size, not about a dot.
5. Do not allow students to simply up-scale. Make them use the 23 blocks as 23. This is because lots of kids do not understand up-scaling, but just learn to do it by ROTE.

Successfully completing this task looks like:

Students firstly work out that it is not possible to build 23.7 using the existing blocks.
Secondly, they work out to cut one block into 10 equal parts and use 7 of those 10 parts to model the 0.7.