

Building mental mathematics skills

Hamsa Venkat & Lynn Bowie

We have been doing some work across two research and development projects focused on primary mathematics in South Africa at Wits and Rhodes Universities, looking at how we might support the development of mental mathematics skills in primary schools. High school teachers often tell us that their learners take calculators out for problems that they should be able to work out mentally, and primary school teachers say that children struggle with basic facts that they should know, and then struggle with the written algorithms for the four operations as well. Here are some examples:

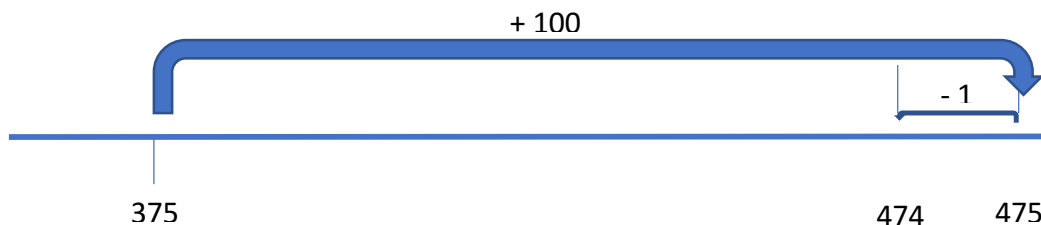
$$375 + 99$$

$$102 - 97$$

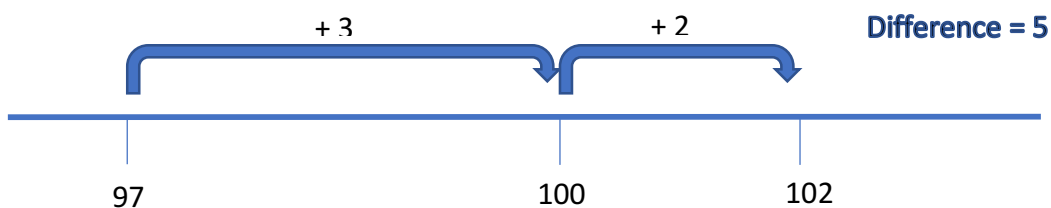
What we see when children are given problems like these (without a calculator) is that they jump into trying to work out the answers to these problems using the traditional column algorithms.

But both of the examples above can be solved much more quickly if some attention is paid to the quantities in the problems and to number relationships. In the first example, if we can stop to see that 99 is very close to 100, we can add 100 to 375 mentally – this is an easy calculation if we know how to count on in 100s from any number. This gives 475. And then we have to subtract 1 as we have jumped 1 too far forward. So the answer is 474.

This can be represented on a number line like this – and this helps us to keep track of what we are doing.



The second problem can be approached in the same way – if we think about 97 as close to a 100, then we could begin with a backward jump of 100 followed by an 'adjustment' jump of 3 forward. In the second example though, if we see that 97 is quite close to 102, we can think about the subtraction as the 'difference' between the two numbers, rather than trying to take away 97. The number line image for seeing the difference looks like this:



Our work tells us that effective and efficient strategic mental calculating like this rests on rapid recall of some early facts – for example, adding or subtracting 1, 2, 3, 4, 5, 10 and 100 to, or from, any number. Doubles of the numbers from 1-10, and bonds of these numbers are also useful to know at the level of rapid recall. Early teaching can support this by providing images to support these foundational facts – for example ‘paired’ images for doubles, and then encourage children to remember and use these facts in more difficult calculations. Here are some more examples:

$$\begin{array}{ll} 65 + 18 & \text{can be thought about as: } 65 + 20 = 85 \\ & \text{So: } 65 + 18 = 83 \end{array}$$

$$\begin{array}{ll} 86 \times 11 & \text{can be thought about as: } 86 \times 10 = 860 \\ & \text{For } 86 \times 11, \text{ we have to add another } 86 \\ & \text{So: } 860 + 86 = 860 + 40 + 46 \\ & \quad = 946 \end{array}$$

Start a Wits Maths Circle at your school!

Each month, we will set a maths problem for you to think about and try. You can try it on your own, with colleagues in your school, with your learners or with your own children. Or all of these! You can email your solutions to us and/or bring them along to a Wits Maths Circles event for primary teachers at the **Wits School of Education** that we will hold on **23 March, 3 – 5 pm, Room M4**, Wits School of Education. Our aim is to discuss different participants’ ways of thinking about the problems that we set – it will be a relaxed environment for all of us to share and discuss our different approaches.

Let us know if you want to come to the Wits Maths Circle event on 23rd March on this address: primary.maths@wits.ac.za. And you can email solutions to us through this address as well – write ‘Wits Maths Circles-January problem’ in the Subject line. Solutions and different teachers’ ways of thinking about the first three months’ problems will appear in the April issue.

Wits Maths Circles is an initiative focused on primary mathematics teacher development through building platforms and spaces for primary teachers to work on mathematics – for themselves and for their teaching – in fun, supportive and non-threatening ways. It is an initiative built on a partnership between the Wits Maths Connect – Primary project at Wits and The Teacher. The ‘ticket’ for entry to a Wits Maths Circle event is some work on one or more of the problems that have been set in The Teacher during that term.

Wits Maths Circles – March Problem

Try this problem with some friends, each choosing their own starting number. Use strategic calculating where this helps you to get the answers to the subtractions and additions more quickly.

1. Take any three-digit number where the first and last digits differ by 2 or more.
2. Reverse the digits, and subtract the smaller from the larger one.
3. Add to this result the number produced by reversing its digits.

What do you find? Is there a way of explaining what you find?

We read about this problem in a small book by John Acheson entitled: '1089 and all that: A journey into mathematics' which contains several interesting problems. There are several variations on this problem on the web.