# Learning time tables

## The trick to remembering time tables lies in understanding them, as well as practising them

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In our experience of working with grade eight and nine mathematics learners we have noticed that many of them don't know their time tables fluently. This really hampers their ability to engage with the new mathematics they are trying to learn. Their teachers often ask: "Why are they not teaching children their time tables at primary school?"

We know that at most primary schools there is a lot of time tables practicing taking place, so what is going wrong? This question was asked to Dr Ban Har Yeap, a mathematics education expert from Singapore, on his recent visit to South Africa.

> "The problem is we try to drill learners to memorise the times tables without doing the necessary work which allows them to understand multiplication, and reason about how multiplication facts are related."

His answer was as follows: "The problem is that we try to drill learners to memorise the time tables without doing the necessary work which allows them to understand multiplication, and reason about how multiplication facts are related."

Yeap does not deny that lots of practice with multiplication facts is necessary to become fluent in the time tables, but he argues that learners are far more likely to be successful in learning them if that practice is built on a meaningful understanding of connections between multiplication facts.

Below is a suggested series of activities for reasoning about multiplication facts using the example of the six time table.

### Visual images of multiplication

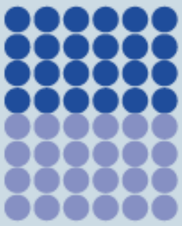
It is very helpful to have a mental image of multiplication as an array. For example, if children can see 2 × 6 as two rows of six circles, then it is easy to see that 2 × 6 is the same as 6 + 6.

### Using visual images along with known facts to derive new facts

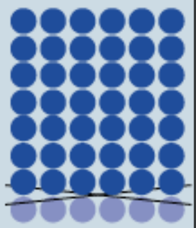
Following some discussion of the visual image for 2 × 6, we can ask learners if they can figure out how to adapt this image to figure out what 4 × 6 is.

As teachers, we are listening for reasoning that if two rows of six are 12, then 4 × 6 is just two rows of six and another two rows of six, so it is double 12, which is 24.

And from there, 8 × 6 is easy to see as four rows of six, plus another four rows of six i.e. 24 + 24 = 48.



And from there learners might be able to reason that 7 × 6 is those eight rows of six, take away one row of six i.e. 48 – 6 = 42.



### Using a clue board

Once learners have a strong visual image of multiplication and have played with using that image to figure out how to derive new multiplication facts from known ones, it is often helpful to progress to getting learners to draw up "clue" boards. They can then work with these boards in class discussions to reinforce how they can be used to derive all the facts related to the first 10 or 12 multiples in the 1-10 time table.

Learners can fill in the clue board for the six time table using doubling:

| | ×6 |
|---|---|
| 1 | 6 |
| 2 | |
| 4 | |
| 8 | |
| 10 | |

Step 1: We know 1 × 6 is 6
Step 2: Since we know 1 × 6 = 6 we can double this to get 2 × 6 = 12
Step 3: Since we know 2 × 6 = 12 we can double this to get 4 × 6 = 24
Step 4: Since we know 4 × 6 = 24 we can double this to get 8 × 6 = 48
Step 5: We know 10 × 6 = 60

So the completed table looks like this:

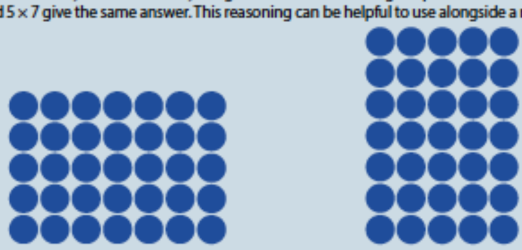
| | ×6 |
|---|---|
| 1 | 6 |
| 2 | 12 |
| 4 | 24 |
| 8 | 48 |
| 10 | 60 |

Now with that clue board in front of them, ask learners how they might use the clue board to figure out what 7 × 6 is.

Give learners time to think and discuss, and encourage different ideas from the class. Some might use the idea of saying 48 – 6 = 42 since if you have eight lots of six, and take away one lot of six you'll get even lots of six. Others might say 6 + 12 + 24 = 42, since one lot of six plus two lots of six plus four lots of six gives seven lots of six. Similarly, 9 × 6 can easily be derived using 60 – 6 (10 × 6 – 1 × 6) or 48 + 6 (8 × 6 + 1 × 6).

**Lots of practice and pattern spotting**

And then there is just a need for practice; but that practice will yield better results if the reasoning part is constantly reinforced. Array images can be turned through a quarter turn to show that 7 × 5 and 5 × 7 give the same answer. This reasoning can be helpful to use alongside a reminder:



Or a learner who is stumped by 12 × 9 might need to be asked about how to construct 12 groups of 9 as (10 × 9) + (2 × 9), and that this provides a way of figuring the answer out quickly. Similarly, noticing that the six times table is double the three times table makes the six times table easier to learn.

Lots of practice does help children to learn their times tables "off by heart", but if it is done together with reasoning about multiplication and making connections between the different facts it will be more effective and help to ensure that learners have efficient strategies for figuring out the multiplication results quickly — even if they have forgotten individual facts.

**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 March 23 from 3pm-5pm, in 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 March 23 on this address: *primary.maths@wits.ac.za*. And you can email solutions to us through this address as well – just 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 doing some work on one or more of the problems that have been set in *the Teacher* during that term.

**Wits Maths Circles – February Problem**

The problem below is from the NRICH website — a really good source of interesting maths problems. *http://nrich.maths.org/730*

In the multiplication below, some of the digits have been replaced by letters and others by asterisks. Where a digit has been replaced by a letter, the same letter represents that same digit and different letters represent different digits. (e.g. if A = 1 in the first line, then A = 1 in the second line. And A and B must be different digits). Asterisks can stand for any digit and can be the same or different, and can also be the same as A, B or C.
Can you reconstruct the original multiplication?

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      A B C
      B A C
    -------
    * * * *
    * * A
* * * B
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* * * * * *
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