


# Mathematics Progression Maps Extract from draft

Handout 2.5

Equations formulae and identities			
Learning steps	Examples of what pupils should know and be able to do	Probing Questions	What if pupils find this a barrier?
<p>Step 1</p> <p>Understand division and recognise that division is the inverse of multiplication.</p>	<p>Understand that multiplication can be done in any order, for example <math>5 \times 8 = 8 \times 5</math>.</p> <p>FTM(P) Y123 p.49</p>	<p>Can you make up a problem that means you need to work out <math>20 \div 5</math> to solve it?</p> <p>Can you tell me some numbers that will divide exactly by 2? by 5?</p> <p>by 10? How do you know?</p> <p>Make use of multiplication facts that pupils are unlikely to know to probe understanding. For example:</p> <ul style="list-style-type: none"> <li>- If <math>7 \times 9 = 63</math>, what is <math>63 \div 7</math>? What other facts do you know?</li> <li>- If <math>121 \div 11 = 11</math>, what is the answer to <math>11 \times 11</math>?</li> <li>- If I multiply a number by 2 and then divide the answer by 2, what happens?</li> <li>- If I divide a number by 4 and then multiply the answer by 4, what happens?</li> <li>- Is <math>2 \div 4</math> the same as <math>4 \div 2</math>? Why not?</li> </ul>	<p>Give pupils a set of numbers that are related by multiplication and division facts along with the multiplication, division and equals signs.</p> <p>Ask them to form some multiplication and division statements. Ask them to match the ones that are linked in some way and to explain why.</p> <p>Unit 9 Yr 3 Autumn term</p> <p>2 lots of 4 are equal to ...</p> <p>Record this as a repeated addition sentence:</p> $2 + 2 + 2 + 2 = 8$ <p>and then as a multiplication sentence:</p> $2 \times 4 = 8$ <p><b>Q</b> How many hops of 6 do you think will be equal to 18?</p>  <p>Use the number line to establish:</p> $3 \times 6 = 18, 6 \times 3 = 18, 18 \div 3 = 6, 18 \div 6 = 3.$ <p>Explore with other sets of related facts.</p> <p>TL4Y7 Algebra 3 A3.1 and A3.2</p>
<p>Step 2</p> <p>Understand the principles of the commutative, associative and distributive laws as they apply to multiplication.</p>	<p>Use the commutative, associative and distributive laws in flexible approaches to calculations, e.g.</p> $(6 \times 2) \times 5 = 6 \times (2 \times 5) = 6 \times 10 = 60$ <p>(example of associative law)</p> <p>FTM(P) Y456 p.52</p>	<p>How could you use counters to show me that <math>3 \times 8</math> has the same answer as <math>8 \times 3</math>? etc.</p> <p>How could you use counters to show me that <math>4 \times (5 + 2)</math> has the same answer as <math>4 \times 5 + 4 \times 2</math>? etc.</p>	<p>Lay out 3 rows of 5 counters and explain that this is the same as <math>3 \times 5</math> and <math>5 \times 3</math>.</p> <p>Show by grouping of counters that <math>(3 \times 4) \times 5</math> is the same as <math>3 \times (4 \times 5)</math>.</p> <p>Use grid method to illustrate that <math>3 \times 24</math> is the same as <math>(3 \times 20) + (3 \times 4)</math>.</p> <p>Teaching mental calculation strategies to level 5 p.38-39</p>

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Step 3 Explain a generalised relationship (formula) in words.	Explain how to find the number of days in any number of weeks. Describe a short way to work out the perimeter of a rectangle. A sequence starts 1, 4, 7, 10... Explain in words the rule for the sequence. FTM(P) Y456 p.80 1999 test P1 Q5 (L4)	How do you know when two things are linked by a rule? What clues do you look for? How do you go about finding the rule?	TL4Y7 Algebra 4 A4.1	
Step 4 Understand and use the relationships between the four operations, and principles of the arithmetic laws. Use brackets.	Pupils have flexible approaches to calculations, e.g. $46 \times 98 = 46 \times (100 - 2)$ $= (46 \times 100) - (46 \times 2)$ $= 4600 - 92$ $= 4508$ Pupils can use brackets and know that they determine the order of operations, and that their contents are worked out first. FTM(P) Y456 p.53 and 55 FTM(S) Y789 p.82, 84 FTM(S) Y789 p.86-87 1999 test P1 Q10 (L5)	What's a good way to work out the answer to $46 \times 98$ ? Would $46 \times (90 + 8)$ give you the same answer? Why is this not such a good way? Is $(7 \times 3) + 4$ the same as $7 \times (3 + 4)$ ? Explain.	Focus on efficient methods in mental calculation. Ask pupils to explain their methods.  Teaching mental calculation strategies to level 5 p.20-21, 38-39 Springboard 7 unit 15 p.487-489 TL4Y7 Algebra 2 A2.1	
Step 5 Construct and solve linear equations with positive integer coefficients (with unknown on one side only) using appropriate methods	Construct equations derived from statements such as 'I think of a number ...' FTM(S) Y789 p.122-123	Given a list of linear equations as described in the objective, ask: Which of these are easy to solve? Which are difficult and why?	$5a + 12 = 27$ Ask pupils to explain why the solution to this equation is $a = 3$ . Ask pupils to construct a different equation with the same solution. How did you go about it? TL5Y8 lessons 8A2.1, 8A4.1. Arithmagons FTM(S) Y789 p.124 T5 stinger 10	