

# Teaching efficient approaches to early calculation at Churchill Primary School.

Based on Number Sense Maths



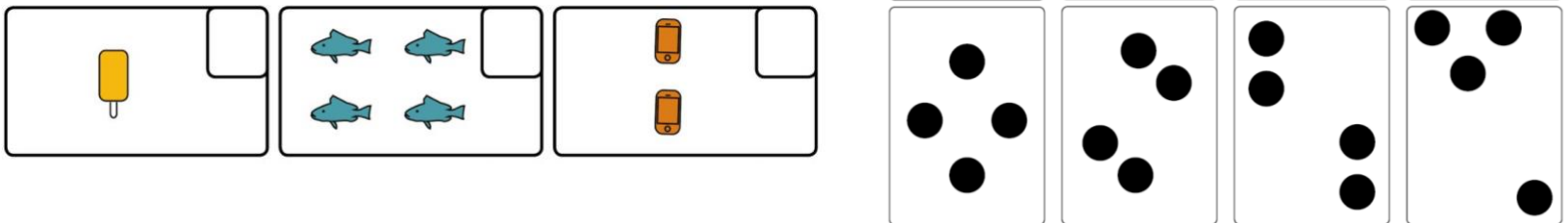
At Churchill CE Primary School we use an approach called Number Sense Maths to teach fluency in root addition and subtraction facts. These essential facts are the equivalent of times tables for addition and subtraction.

We take a systematic approach to teaching addition and subtraction facts within 20, providing the children with a range of strategies that will enable them to be successful.

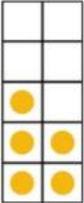
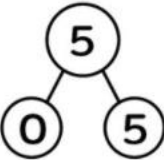
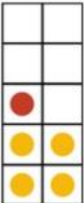
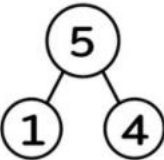
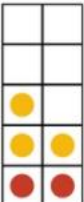
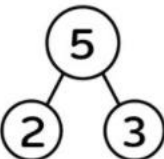
These calculation strategies collectively lead to fluency in all number facts to 20.

In EYFS and Year One children spend time developing a deep and visual understanding of the numbers 1 - 10. They practice subitising quantities up to 5, and learn to subitise quantities between 6 - 10 when presented in structured arrangements.

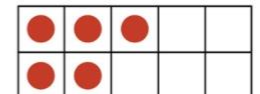
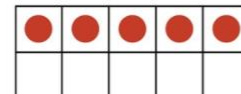
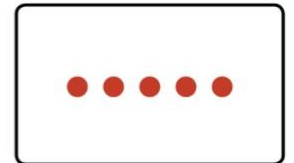
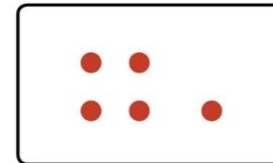
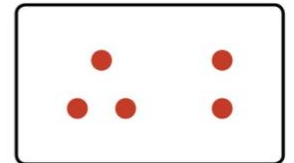
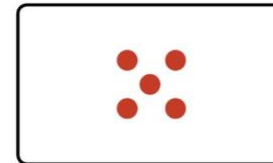
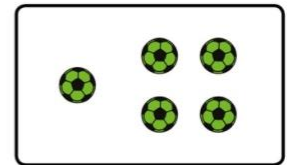
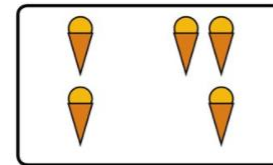
**Subitising** is the ability to instantly recall the number of objects or images without needing to count them individually and it is an important skill for young children to practise and develop.



Children also meet part part whole models and the tens frame, and learn to recognise the quantities 1 - 10 presented both twos-wise and fives-wise on the tens frame.

| Tens Frame                                                                          | Part Part Whole                                                                     | Related Equations                                        |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------|
|    |    | $5 = 0 + 5$<br>$5 = 5 + 0$<br>$5 - 0 = 5$<br>$5 - 5 = 0$ |
|    |    | $5 = 1 + 4$<br>$5 = 4 + 1$<br>$5 - 1 = 4$<br>$5 - 4 = 1$ |
|  |  | $5 = 2 + 3$<br>$5 = 3 + 2$<br>$5 - 2 = 3$<br>$5 - 3 = 2$ |

Let's spot 5. What can you see?



Children explore the different ways that every number to 10 can be broken into parts and put back together and start to remember some facts, introducing simple addition and subtraction equations.

Join the picture to a matching part part whole.

Example

Complete the equations.

|   |   |   |  |  |
|---|---|---|--|--|
| ● | ● |   |  |  |
| ● | ● | ● |  |  |

Example

$4 + 1 = 5$   
 $1 + 4 = 5$   
 $5 - 1 = \square$   
 $5 - 4 = \square$

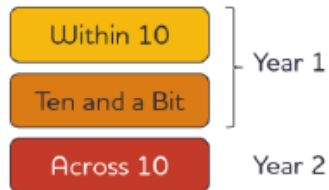
$3 + 2 = \square$   
 $2 + 3 = \square$   
 $5 - 3 = \square$   
 $5 - 2 = \square$



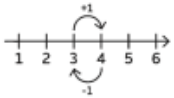

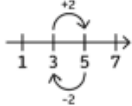
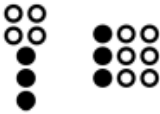
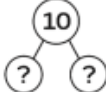
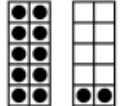

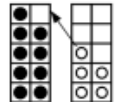

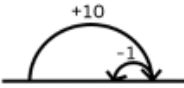


# At the heart of NSM Number Facts are the Addition and Subtraction Fact Grids...

| +  | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10    |
|----|------|------|------|------|------|------|------|------|------|------|-------|
| 0  | 0+0  | 0+1  | 0+2  | 0+3  | 0+4  | 0+5  | 0+6  | 0+7  | 0+8  | 0+9  | 0+10  |
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|----|------|------|------|------|------|------|------|------|------|------|-------|
| 0  | 0-0  |      |      |      |      |      |      |      |      |      |       |
| 1  | 1-0  | 1-1  |      |      |      |      |      |      |      |      |       |
| 2  | 2-0  | 2-1  | 2-2  |      |      |      |      |      |      |      |       |
| 3  | 3-0  | 3-1  | 3-2  | 3-3  |      |      |      |      |      |      |       |
| 4  | 4-0  | 4-1  | 4-2  | 4-3  | 4-4  |      |      |      |      |      |       |
| 5  | 5-0  | 5-1  | 5-2  | 5-3  | 5-4  | 5-5  |      |      |      |      |       |
| 6  | 6-0  | 6-1  | 6-2  | 6-3  | 6-4  | 6-5  | 6-6  |      |      |      |       |
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| 19 |      |      |      |      |      |      |      |      |      | 19-9 | 19-10 |
| 20 |      |      |      |      |      |      |      |      |      |      | 20-10 |



# ...and a defined set of Calculation Strategies

|                                                                                                                                              |                                                                                                                                                                                                                                                 |                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><b>One More, One Less</b></p>                            | <p>When we add one, we get the next counting number. When we subtract one, we get the previous counting number (e.g. <math>5 - 1 = 4</math>).</p>                                                                                               | <p><b>Number Neighbours:<br/>Spot the Difference</b></p>  | <p>Adjacent numbers have a difference of 1. Adjacent odds and evens have a difference of 2.</p> <p>Spot number neighbours (adjacent, odds or evens) to solve subtractions of adjacent numbers (e.g. <math>5 - 4 = 1</math>), of adjacent odds (e.g. <math>9 - 7 = 2</math>) or adjacent evens (e.g. <math>6 - 4 = 2</math>)</p> |
| <p><b>Two More, Two Less:<br/>Think Odds and Evens</b></p>  | <p>If we add two to a number, we go from odd to next odd or even to next even. If we subtract two from a number, we go from odd to previous odd or even to previous even.</p>                                                                   | <p><b>7 Tree and 9 Square</b></p>                        | <p>Use these visual images to remember addition and subtractions fact families that children can find tricky. For example, visualising the 7 tree helps remember that <math>7 - 3 = 4</math>. Visualising the 9 square helps remember that <math>3 + 6 = 9</math>.</p>                                                          |
| <p><b>Number 10 Fact Families</b></p>                       | <p>Go beyond just recalling the pairs of numbers that add to 10. Make sure that we can also spot additions and subtractions which we can use number bonds to 10 to solve.</p>                                                                   | <p><b>Ten and A Bit</b></p>                              | <p>The numbers 11 – 20 are made up of 'Ten and a Bit'. Recognising and understanding the 'Ten and a Bit' structure of these numbers enables addition and subtraction facts involving their constituent parts (e.g. <math>3 + 10 = 13</math>, <math>17 - 7 = 10</math>, <math>12 - 10 = 2</math>).</p>                           |
| <p><b>Five and A Bit</b></p>                                | <p>The numbers 6, 7, 8 and 9 are made up of 'five and a bit'. This can be shown on hands, and supports decomposition of these numbers into their five and a bit parts (e.g. <math>5 + 3 = 8</math>, <math>9 - 5 = 4</math>).</p>                | <p><b>Make Ten and Then...</b></p>                       | <p>Additions which cross the 10 boundary can be calculated by 'Making Ten' first, and then adding on the remaining amount (e.g. <math>8 + 6</math> can be calculated by thinking '<math>8 + 2 = 10</math> and 4 more makes 14'). The same strategy can be applied to subtractions through 10.</p>                               |
| <p><b>Know about 0</b></p>                                 | <p>When we add 0 to or subtract 0 from another number, the total remains the same. If we subtract a number from itself, the difference is 0.</p>                                                                                                | <p><b>Adjust It</b></p>                                 | <p>Any addition and subtraction can be calculated by adjusting from a fact you know already, (e.g. <math>6 + 9</math> is one less than <math>6 + 10</math>).</p>                                                                                                                                                                |
| <p><b>Doubles and Near Doubles</b></p>                    | <p>Memorise doubles of numbers to 10, using a visual approach. Then use these known double facts to calculate near doubles and hidden doubles. Once we know <math>6 + 6 = 12</math> then <math>6 + 7</math> and <math>5 + 7</math> is easy.</p> | <p><b>Swap It</b></p>                                  | <p>When the order of two numbers being added (addends) is exchanged the total remains the same. E.g. <math>1 + 8 = 8 + 1</math>. Sometimes reversing the order of the two addends makes addition easier to think about conceptually.</p>                                                                                        |

# The calculation strategies collectively lead to fluency in all the grid facts

| +  | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10    |
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One More, One Less

Two More, Two Less: Think Odds and Evens

Number 10 Fact Families

Five and A Bit

Know About Zero

Doubles and Near Doubles

7 Tree 9 Square

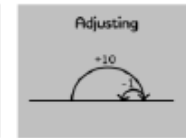
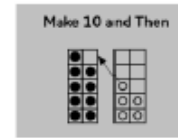
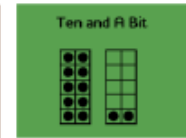
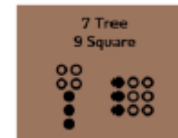
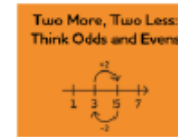
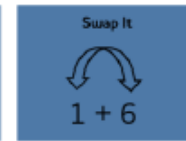
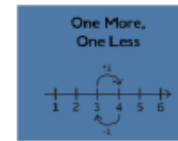
Ten and A Bit

Make 10 and Then

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| 20 |      |      |      |      |      |      |      |      |      |      | 20-10 |

# Subtraction Grid Facts

## Calculation Strategies



In Year 1, children should have learnt to add and subtract fluently within 10. However, some pupils may not still be fluent by the beginning of year 2, so this fluency must now be secured and maintained.

Pupils should practise their addition and subtraction facts within 10 until they have **automatic recall**.

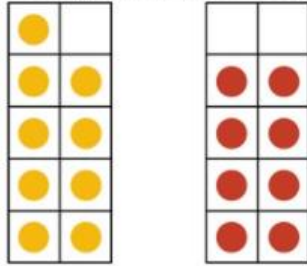
Fluency in these facts is required for pupils to succeed with addition and subtraction **across 10** and for additive calculation with larger numbers.

Within Year Two children begin to focus on strategies to help them succeed with addition and subtraction across 10. These include 'Make 10 and then', 'Doubling and near doubling' and 'Adjusting'.

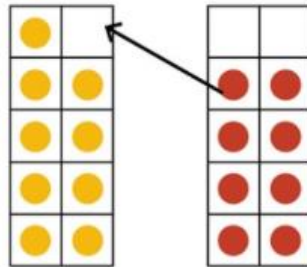
# Make 10 and then (Addition)

For example:  $9 + 8$

Step 1: Lay out the numbers 9 and 8 using different coloured counters on two tens frames.

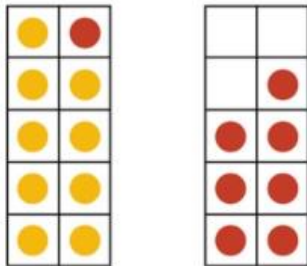


Step 2: Move enough red counters (1) to make 10 on the left hand tens frame.



$$9 + 1 = 10$$

Step 3: Then, add what's left on the right hand tens frame to the full 10 on the left hand tens frame. Children should not need to count at this stage. They should just see what is there and add using their Ten and A Bit facts.



$$10 + 7 = 17$$

So,  $9 + 8 = 17$

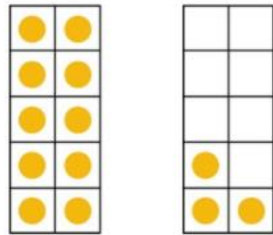
$$\begin{array}{c} 7 \\ \swarrow \searrow \\ \textcircled{6} \quad \textcircled{1} \end{array} + 9 = \boxed{16}$$

$$7 + 6 = 7 + 3 + 3$$

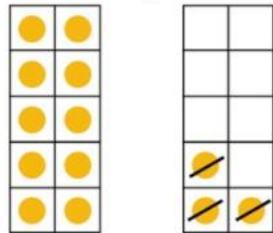
# Make 10 and then (Subtraction)

For example:  $13 - 5$

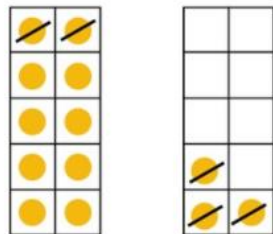
Step 1: Lay out the number 13 on two tens frames in its 'Ten and A Bit' format. (You can use any every day object, such as pasta pieces, to show the number on the tens frame).



Step 2: Subtract the 'Bit' in the starting number to Make 10. The 'Bit' is 3.



Step 3: Then, subtract what's left of the 5. What's left is 2.



$$13 - 5 = 13 - 3 - 2$$

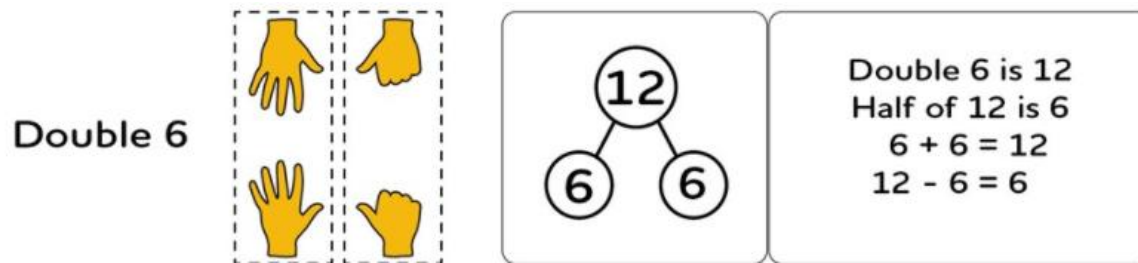
$$16 - 8$$

So,

$$16 - 8 = 16 - 6 - 2 \\ = 8$$

## Doubling and near doubling.

Children need to learn doubles of number 6 to 10 off by heart. To support memorising these doubles the five and a bit hands structure below is helpful.



When the difference between two numbers being added is 1 ie they are next door number neighbours, we can use the near double strategy to solve the equation. We start with the double we know and then adjust by one.

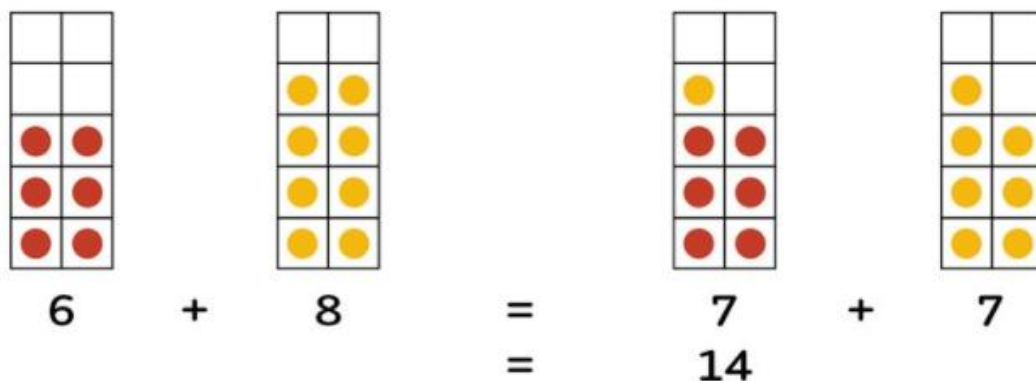
Example:  $8 + 7$

$$\begin{array}{rcc} 1 & & \\ \text{more} & \left( & 7 + 7 = 14 \\ & \searrow & \\ & & 8 + 7 = 15 \\ & & \left( & 1 \\ & & \text{more} & \end{array}$$

We know  $7 + 7$  is double 7, which is 14. We know  $8 + 7$  is 1 more than  $7 + 7$ . So we know  $8 + 7$  is 1 more than 14.  $8 + 7$  is 15.

When the difference between the two numbers being added is 2, i.e. next door evens, or next door odds, we have a hidden double. We can use the known double of the number in the middle to solve the equation.

Example:  $6 + 8$



6 and 8 have a difference of 2.  $6 + 8$  is equivalent to double the number between them, i.e. double 7. Double 7 is 14. So,  $6 + 8 = 14$





Alongside learning these calculation strategies, children in Key Stage One are given accounts and password to use Numbots, an online game which, when played little and often, will significantly improve children's recall and understanding of number bonds and addition and subtraction facts.

As children are taught and practise new calculation strategies which are regularly recapped and revised, they work towards achieving their **maths challenges**.

Success in achieving challenges are celebrated at the end of term in our Celebration Service and recorded in reading records to share with parents.

**Bridging Challenge**

Name: \_\_\_\_\_

|                    |                    |                    |                       |                    |
|--------------------|--------------------|--------------------|-----------------------|--------------------|
| $8 + 3 =$          | $3 + 9 =$          | $7 + \square = 16$ | $4 + 8 = 8 + \square$ |                    |
| $2 + \square = 11$ | $7 + 4 =$          | $18 = 9 + \square$ | $5 + 9 =$             | $9 + 5 =$          |
| $16 = 7 + \square$ | $8 + 5 =$          | $9 + 4 =$          | $19 + \square = 12$   | $5 + 8 =$          |
| $6 + 5 =$          | $17 = \square + 6$ | $8 + 6 =$          | $7 + 6 =$             | $15 = 6 + \square$ |

Score: \_\_\_\_\_

Time: \_\_\_\_\_

Before children begin work on columnar addition and subtraction, it is essential that children have automatic recall of addition and subtraction facts within and across 10. These facts are required for calculation within the columns in columnar addition and subtraction.

All mental calculation depend on these facts.

| Identifying core number facts:<br>columnar addition                                                                                                    | Identifying core number facts:<br>columnar subtraction                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| $\begin{array}{r} 465 \\ + 429 \\ \hline 894 \\ \hline 1 \end{array}$ <p data-bbox="1155 425 1503 442">Figure 11: columnar addition of 465 and 429</p> | $\begin{array}{r} 61 \\ \cancel{7} 49 \\ - 286 \\ \hline 463 \end{array}$ <p data-bbox="1574 425 1883 464">Figure 12: columnar subtraction of 286 from 749</p> |
| <p data-bbox="1139 482 1381 499">Within-column calculations:</p> $5 + 9 = 14$ $6 + 2 + 1 = 9$ $4 + 4 = 8$                                              | <p data-bbox="1535 482 1777 499">Within-column calculations:</p> $9 - 6 = 3$ $7 - 1 = 6$ $14 - 8 = 6$ $6 - 2 = 4$                                              |

Children must practise until they achieve **automaticity**. Automaticity is when a child can recall something almost instantly without any conscious thought. Without this practice many children are likely to still be reliant on counting on their fingers to solve within-column calculations in columnar addition and subtraction. An over reliance on counting, means that a child has less capacity to focus on and understand new mathematical learning.

|   | Stage                            | Teaching Step                    |                                          |                                          |                           |                               |                             |                                        |                                    |                             |  |
|---|----------------------------------|----------------------------------|------------------------------------------|------------------------------------------|---------------------------|-------------------------------|-----------------------------|----------------------------------------|------------------------------------|-----------------------------|--|
| 1 | Visual Number Foundations        | Subitising<br>1-5                | Subitising<br>6-10                       | Subitising<br>1-10                       |                           |                               |                             |                                        |                                    |                             |  |
| 2 | Make and Break Numbers to 10     | Make and Break<br>5              | Make and Break<br>4,3&2                  | Make and Break<br>10                     | Make and Break<br>6       | Make and Break<br>7           | Make and Break<br>8         | Make and Break<br>9                    |                                    |                             |  |
| 3 | Facts and Strategies Within 10   | One More, One Less               | Two More, Two Less: Think Odds and Evens | Number 10 Fact Families                  | Five and A Bit            | Know About Zero               | Doubles and Near Doubles    | Number Neighbours: Spot the Difference | 7 Tree and 9 Square                | Strategy Selection Practice |  |
| 4 | Ten and A Bit Facts and Strategy | Ten and A Bit                    |                                          |                                          |                           |                               |                             |                                        |                                    |                             |  |
| 5 | Facts and Strategies Across 10   | Make 10 and Then: Addition       | Make 10 and Then: Subtraction            | More Doubles and Near Doubles            | Adjusting                 | Strategy Selection Practice   |                             |                                        |                                    |                             |  |
| 6 | Extending Facts and Strategies   | Calculating with Multiples of 10 | Two-Digit Numbers: Calculating with Ones | Two-Digit Numbers: Calculating with Tens | Make the Next 10 and Then | Make the Previous 10 and Then | Strategy Selection Practice | Preparation for Column Addition        | Preparation for Column Subtraction |                             |  |

# Factual Fluency Progression

|                                | Year 1                              | Year 2                              | Year 3                                                                                                    | Year 4                                                                         | Year 5                                                                                                                  |
|--------------------------------|-------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| Additive factual fluency       | Addition and subtraction within 10. | Addition and subtraction across 10. | Secure and maintain fluency in addition and subtraction within and across 10, through continued practice. |                                                                                |                                                                                                                         |
| Multiplicative factual fluency |                                     |                                     | Recall the 10 and 5 multiplication tables, and corresponding division facts.                              | Recall the 3, 6 and 9 multiplication tables, and corresponding division facts. | Secure and maintain fluency in all multiplication tables, and corresponding division facts, through continued practice. |
|                                |                                     |                                     | Recall the 2, 4 and 8 multiplication tables, and corresponding division facts.                            | Recall the 7 multiplication table, and corresponding division facts.           |                                                                                                                         |
|                                |                                     |                                     |                                                                                                           | Recall the 11 and 12 multiplication tables, and corresponding division facts.  |                                                                                                                         |