

**Clover Hill**  
**Primary School**



**Mental & Written**  
**Calculation Policy**

This document recommends an approach for developing progression in the conceptual and procedural aspects of calculation across Key Stages 1 & 2. It takes into account the mathematics programme of study and non statutory guidance for the National Curriculum 2014.

The document covers:

- \* Calculations that can be done wholly or partially by mental methods, based on fluency with number facts and understanding of place value and number operations and sometimes using horizontally presented number sentences or empty number lines to show steps in thinking.
- \* The use of expanded or informal written methods to support understanding of compact, formal written methods and
- \* Developing fluency in the use of formal written methods by the end of Key Stage 2.

**Children should work towards being able to use, by the end of Key Stage 2:**

- \* A range of strategies for mental calculations appropriate to the numbers involved.
- \* One formal written method (for each number operation) for calculations that cannot be done mentally.

**Progression in mental calculation skills can be supported by:**

- \* The ability to quickly recall a range of number facts and an understanding of how to use them to derive other related facts.
- \* Understanding how numbers and calculations can be represented by materials and images such as arrays, ten frames Numicon shapes.



An understanding of the number system (order and relative position of numbers, place value, etc.) the four number operations and the laws of arithmetic associated with them.

Understanding of how symbols are used to record calculations especially the equals sign. Care should be taken that the equals sign is used correctly

⇒ Eg.  $42+35=$  might be calculated by partitioning the second number to add the tens followed by the units. This could be recorded as:

$$42+30=70$$

$$70+5 = 75$$

But not as  $42+ 30= 72+5 =77$  as this involves incorrect use of the first equal sign.

⇒ An understanding of how calculations can be represented on empty number lines. They will need to work with numbered tracks and lines first before they are confident to rely on empty lines alone.

⇒ To make good use of empty lines children need to be able to:

- Move forward and back confidently on the number line.
- Make jumps of different sizes.
- Recognise landmark numbers such as multiples of 10.
- Know and use number complements to 10 and how these relate to multiples of 10.



⇒ Partition and recombine numbers in appropriate ways eg  $7+5$  as  $7 + 3 + 2$  or  $28+9$  as  $28+10-1$

Teachers should demonstrate the use of number sentences and number lines to model steps in calculations. Children should be encouraged to record the steps in their mental calculations some of the time. Recording is useful when explaining methods to others and to show which strategy has been used. It is not necessary to always record, especially for those children who have efficient mental methods. Teachers should use their judgement about when recording is necessary.

Progression to fluency with a formal written method for each number operation can be made by:

- ⇒ The appropriate use of informal or expanded written methods that build on mental methods continue to highlight understanding of the number system and number operations.
- ⇒ Linking of these expanded methods to the formal written method when it is first introduced to highlight steps that may be concealed, and therefore not understood, in the procedural execution of the formal written method.
- ⇒ Appropriate levels of practice of formal written methods to develop fluency.

Children should continue to develop their mental calculation skills with larger numbers once written methods are introduced and should be given opportunities to identify which calculations might be done mentally, with reference to the **nature** rather than the **magnitude** of the numbers involved. They should use mental calculation skills to estimate the likely magnitude of the answer when performing a calculation using a formal method and hence identify answers that are unreasonable and indicate errors to execution of the method.



Teachers need to judge when children are ready to move from mental to written calculations. The following lists offer some guidance:

### **Addition and Subtraction**

Can pupils:

- recall addition and subtraction facts to 20?
- understand place value and partition numbers?
- add three single digit numbers mentally?
- add or subtract any pair of two digit numbers mentally?
- explain their mental strategies orally and record them using horizontal number sentences or an empty number line?

### **Multiplication and Division**

Can pupils:

- quickly recall multiplication and division facts for 2, 3, 4, 5 and 10 times tables?
- understand what happens when a number is multiplied by 0 or 1?
- understand 0 as a place holder?
- multiply two- and three-digit numbers mentally by 10 and 100?
- demonstrate understanding of the commutative, distributive and associative laws (though not necessarily know the names)?
- double and halve two-digit numbers mentally?
- explain mental strategies orally and with recording?



This document considers addition and subtraction together followed by multiplication and division. Links between number operations should be emphasised regularly. A year by year approach has been taken in line with the format of the National Curriculum 2014 programmes of study but teachers should have regard to other year group expectations when planning for different abilities.



Clover Hill  
Primary School  
Reception



Mental & Written  
Calculation Policy

In mathematics we aim for Reception children to;

- Develop a strong grounding in number so that they develop the necessary building blocks to excel mathematically.
- Count confidently.
- Develop a deep understanding of the numbers to 10, the relationships between them and the patterns within those numbers.
- Engage in practical opportunities to build and apply understanding of numbers to 10.
- Develop a secure base of knowledge and vocabulary from which mastery of mathematics is built.
- Develop their spatial reasoning skills across all areas of mathematics including shape, space and measures.
- Develop positive attitudes and interests in mathematics.
- Look for patterns and relationships, to spot connections and to 'have a go'.
- Talk to adults and peers about what they notice and not be afraid to make mistakes.

We spend time each day fostering an interest in mathematics and weave mathematical concepts throughout many of our daily activities. We have developed our mathematics curriculum by using the BBC Numberblocks series alongside supporting resources produced by NCETM as its core, (see appendix 1). *Numberblocks* is a BBC television series aimed at introducing children to early number. The Numberblock characters combine with engaging storylines to gently introduce concepts of number to support early mathematical understanding. The NCETM supporting resources use each episode as a launch pad. These resources enable practitioners to confidently move on from an episode, helping children to bring the numbers and ideas to life in the world around them. They highlight and develop the key mathematical ideas that are embedded in the programmes. We ensure that we have high quality and open ended mathematics resources readily accessible in our indoor and outdoor environments to enable children to lead their own learning and to develop their mathematical knowledge. We also ensure we provide relevant and stimulating resources in our provision that will further support the aspects of mathematics that we are focussed on in any one week; this includes five and ten frames and whole part models. We encourage children to explore and work out mathematical problems using signs and strategies of their own choice including (where appropriate) standard numer-



It is our aim that by the end of Reception children achieve their Early Learning Goals for both strands of mathematics; number and numerical patterns. It is our aim for all children to have solid foundations instilled and to be fully equipped with the skills required to continue their mathematics education in Key Stage One, following the National Curriculum.

### **Number ELG**

Children at the expected level of development will;

- Have a deep understanding of number to 10, including the composition of each number
- Subitise (recognise quantities without counting) up to 5
- Automatically recall (without reference to rhymes, counting or other aids) number bonds up to 5 (including subtraction facts) and some number bonds to 10, including double facts.

### **Numerical Patterns ELG**

Children at the expected level of development will:

- Verbally count beyond 20, recognising the pattern of the counting system
- Compare quantities up to 10 in different contexts, recognising when one quantity is greater than, less than or the same as the other quantity
- Explore and represent patterns within numbers up to 10, including evens and odds, double facts and how quantities can be distributed equally.



Assessment is based primarily on our knowledge of children. This knowledge is gained predominantly from observation and interaction in a range of daily activities and events. Examples of what these observations may look like are below;

Jonathan counted out 10 raisins; he counted down as he ate them...10, 9, 8, 7, 6, 5, 4, 3, 2, 1.

Kate proudly showed a spider she had made. "Oh no! It's got 7 legs now. One must have fallen off. I'm going to glue another leg so that it's got 8 again."

Hatty and Emily were preparing a teddy bears picnic in the outdoor area. They agreed that they would ask the other children if they would like to come to their picnic. They counted 5 seats and Emily said that they had room for 3 more people.

Christopher sorted the carrots and apples for snack time. "We have 17 apples and 14 carrots. There are more apples."

Hannah made a tally chart of the children outside. She listed how many girls and how many boys were outside. "There are 5 girls and 4 boys, that's 9 altogether."

When counting the vegetarian lunches Thomas counted in 2s, "2, 4, 8, 10... 10 that's even because you can count in 2s".

When playing with the number sticks Jane put 6 and 4 together, "Look 6 and 4, that makes 10".

When playing snakes and ladders Molly and James took turns to roll the die and were both able to subitise and quickly call out the number that they had rolled.

When playing a game Hannah rolled the die, subitised then quickly doubled the number, "3...6".

Jack found 10 golden coins in the sand, he shared his coins between two treasure chests, "Five coins each!"

Ella placed 7 counters on a 10 frame, "7 is 5 and 2."

When exploring ways of making 8 using a whole part model, George placed 8 buttons in the whole then moved them down into the parts, "Look 5 and 3 make 8". He moved the buttons again, "4 and 4 makes 8".

What can parents and carers do to support their child's learning?

- Count everything! Add more or take some away and recount!
- Sing number rhymes; Five little ducks, 1, 2, 3, 4, 5 Once I caught a fish alive.
- Point out numbers on doors, buses, car number plates etc.
- Share things out and see if it is fair.
- Sort out different coloured sweets; are there more or less yellow ones?
- Cook - weigh/measure ingredients, set the timer etc.
- Play shops; count and play with real money - 1p and 2p coins to begin with.
- Notice important times; 7 o'clock - bedtime!
- Look for and talk about the maths in stories.
- Set the table; how many people for tea? Count out how many plates etc. are needed.
- Pouring and filling in the bath; how many cups will fill the jug?



Clover Hill  
Primary School  
Year 1



Mental & Written  
Calculation Policy

## Addition and Subtraction

### Children in Year 1 should:

- Use concrete objects and pictorial representations, including number lines, to support their solution of addition and subtraction problems.
- Represent and use number bonds and related subtraction facts within 20, memorising and reasoning with these bonds.
- Add and subtract one-digit and two-digit numbers to 20, including zero (and realise the effect of adding or subtracting zero to establish the relationship between these operations).
- Read, write and interpret mathematical statements involving addition (+), subtraction (-) and (=) signs in a range of formats e.g.  $\Delta + 5 = 12$  or  $7 = \diamond - 9$ .

## Multiplication and Division

### Children in Year 1 should:

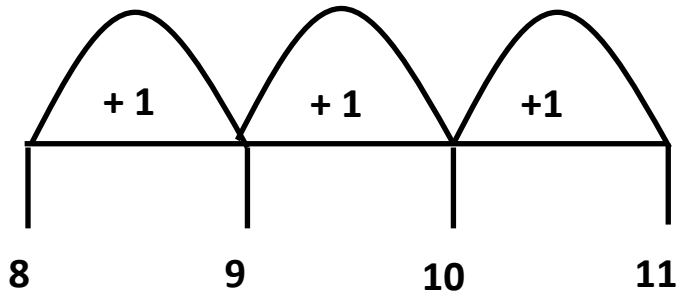
- Solve one step problems involving multiplication and division, by calculating the answer using concrete objects, pictorial representations and arrays with the support of the teacher.
- Through grouping and sharing small quantities, pupils begin to understand: multiplication and division; doubling numbers and quantities; and finding simple fractions of numbers and quantities
- Pupils make connections between arrays, number patterns and counting in twos, fives and tens.



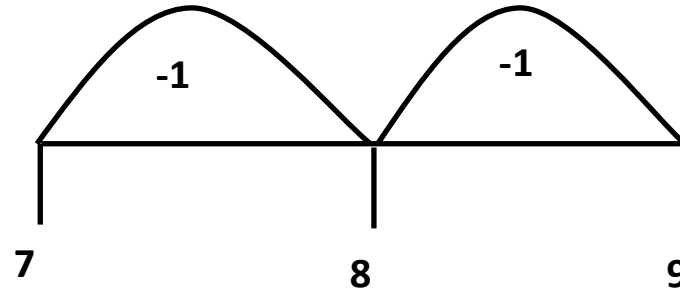
# Year 1 Mental Addition and Subtraction Strategies

## Counting on/back

$$8+3=11$$



$$9-2=7$$



## Reordering: Count on from larger number

$$3 + 8 = \text{rewrite as } 8 + 3 =$$

## Find pairs that total 10

$3+4+7$  is the same as  $3+7+4$  is the same as  $10+4$

NB: Children are not expected to draw number lines. They are used for demonstration only.



# Year 1 Mental Addition and Subtraction Strategies

## Partition into 5 and a bit

$5 + 8$  becomes  $5+5+3$  becomes  $10 + 3 = 13$

$7 + 8$  becomes  $5+2+5+3$  is the same as  $5+5+2+3$  becomes  $10+5$

## Use near doubles

$5+6$  becomes  $5+5+1$  becomes  $10+1= 11$

## Begin to bridge through 10

$$6+7 = ?$$

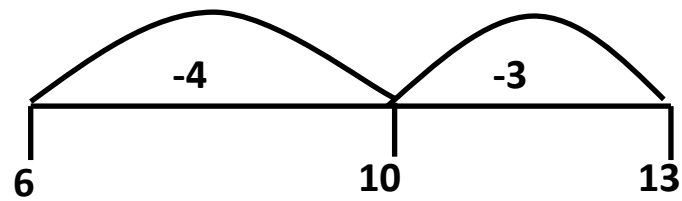
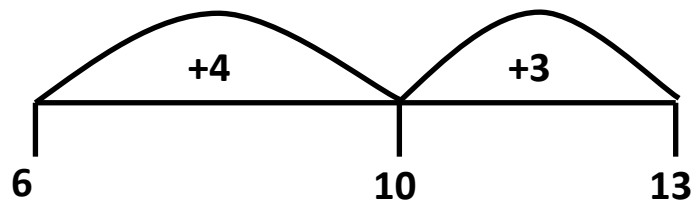
$$6+4 = 10$$

$$10+3 = 13$$

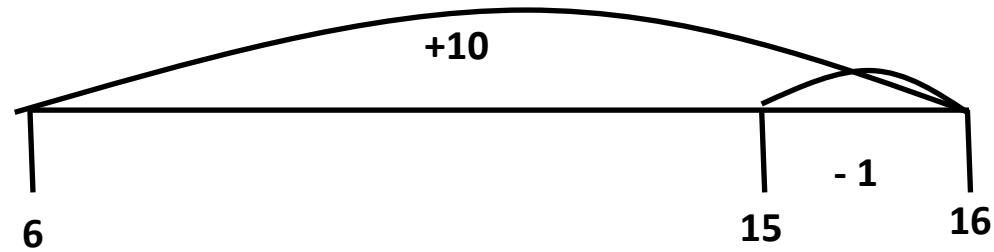
$$13-7 = ?$$

$$13-3 = 10$$

$$10-4 = 6$$



# Year 1 Mental Addition and Subtraction Strategies

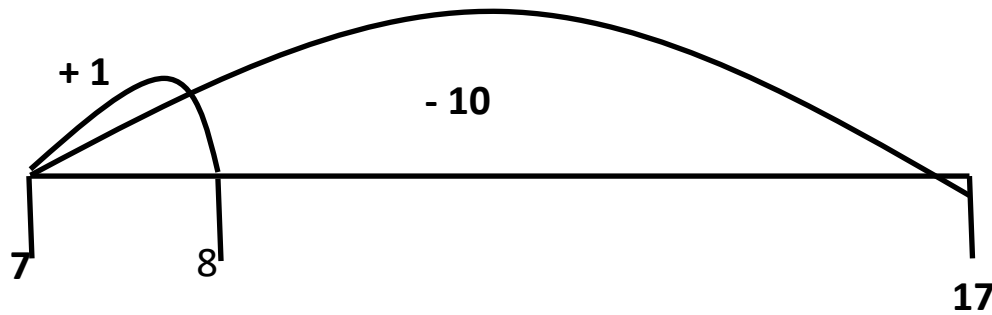


## Add or Subtract 9

$$6+9=$$

$$6+10=16$$

$$16-1=15$$



$$17-9=$$

$$17-10=7$$

$$7+1=8$$

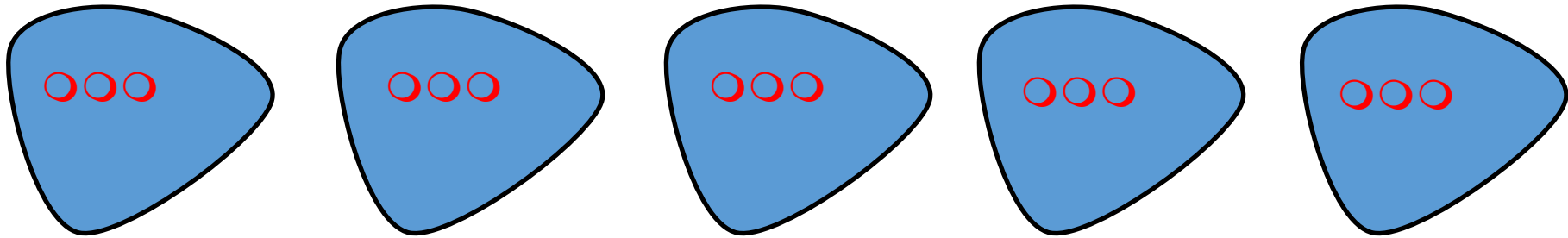




# Year 1 Multiplication and Division

## Multiplication

There are 3 sweets in one bag. How many sweets are there in 5 bags?

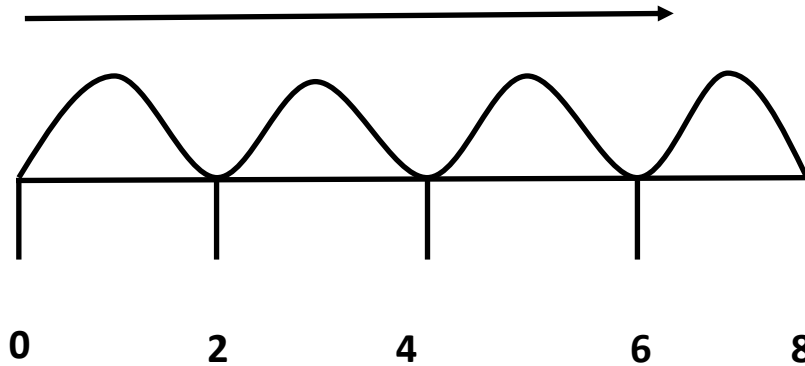


## Arrays

2 groups of 4 or 4 groups of 2



## Jump forward in 2s on a number line



# Year 1 Multiplication and Division

## Division

12 children get into teams of 4 to play a game. How many teams are there?

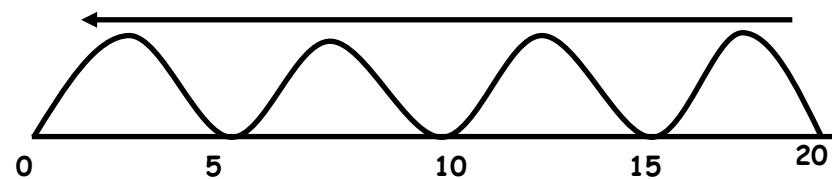


## Arrays

Put into groups of two



Jump backwards in 5s on a number line



Clover Hill  
Primary School  
Year 2



Mental & Written  
Calculation Policy

## Addition and Subtraction

### Children in Year 2 should:

- Recall and use addition and subtraction facts to 20 fluently, and derive and use related facts up to 100 e.g. use  $3 + 7 = 10$  to know that  $30 + 70 = 100$
- Use concrete objects and pictorial representations to support their solution of addition and subtraction problems and to add and subtract mentally including Tens & Ones +/- Ones, Tens & Ones +/- Tens, Tens & Ones +/- Tens & Ones, Ones + Ones + Ones.
- Show that addition of two numbers can be done in any order (commutative) and subtraction of one number from another cannot. Use the associative law of addition to show for example that  $5 + 2 + 1 = 1 + 5 + 2 = 1 + 2 + 5$ .
- Recognise and use the inverse relationship between addition and subtraction and use this to check calculations and solve missing number problems.
- Record mental additions and subtractions using horizontal number sentences and/or empty number lines to show and explain the steps in their calculations.
- Recording in columns supports place value and prepares for formal methods.

### • Multiplication and Division

### Children in Year 2 should:

- Use materials and contexts in which multiplication and division relate to grouping and sharing discrete and continuous quantities, to arrays and to repeated addition. Begin to relate ideas to fractions and measures.
- Recall and use the multiplication and division facts for the 2, 5 and 10 multiplication tables, including recognising odd and even numbers.



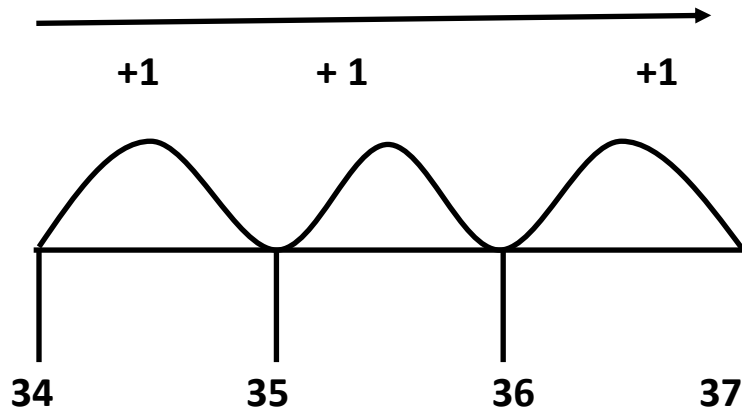
- Make connections between these tables and connect the 10 multiplication table to place value and the five table to divisions on a clock face
- Use number sentences to show multiplication as repeated addition.
- Record multiplications and divisions as jumps on number lines.
- Calculate mathematical statements for multiplication and division within the multiplication tables and use  $\times$ ,  $\div$  and  $=$  signs.
- Show that multiplication of two numbers can be done in any order (commutative) and division of one number by another cannot.
- Use commutativity and inverse relationships to develop multiplicative reasoning e.g.  $4 \times 5 = 20$  and  $20 \div 5 = 4$
- Solve problems, including problems in contexts, involving multiplication and division, using materials, arrays, repeated addition, mental methods and multiplication and division facts.



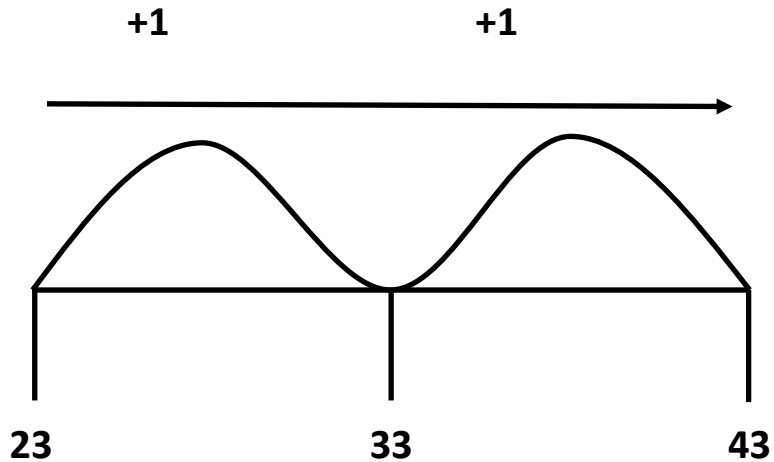
# Year 2 Mental Addition and Subtraction Strategies

## Counting on/back in ones and tens

$34 + 3 =$



$23 + 20 =$



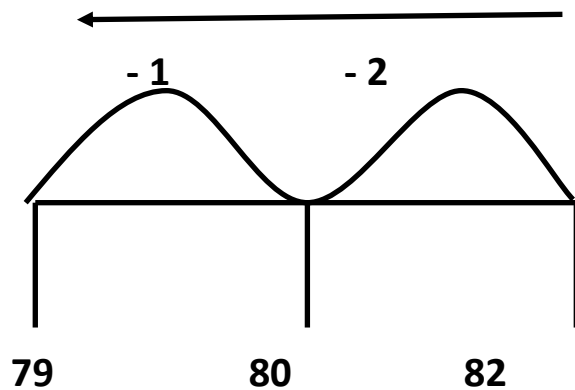
NB: Children are not expected to draw numbers lines. They are used for demonstration only.



## Year 2 Mental Addition and Subtraction Strategies

Count up to find a small difference

$$82 - 79 =$$



Reordering

$$5 + 7 + 5 = \text{becomes } 5 + 5 + 7$$

Using near doubles

$$6 + 7 = \text{becomes } 6 + 6 + 1 =$$

$$40 + 39 = \text{becomes } 40 + 40 - 1 =$$



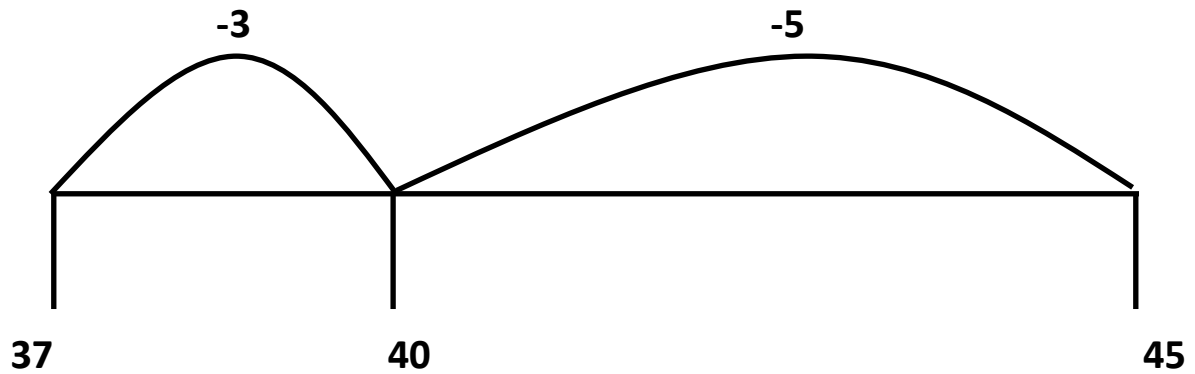
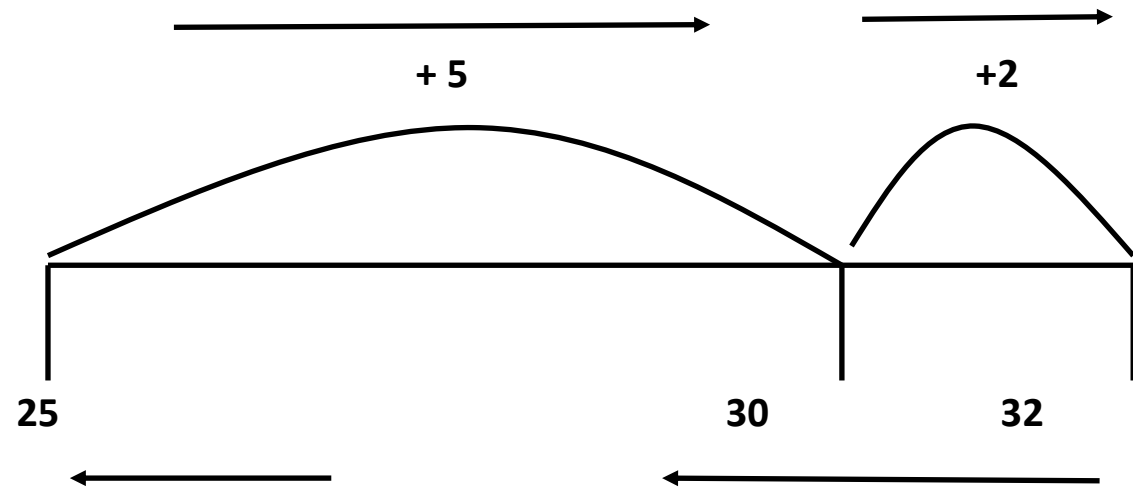
## Year 2 Mental Addition and Subtraction Strategies

### Bridge though multiples of 10

$25 + 7 =$  becomes  $25 + 5$

then

$30 + 2$



$45 - 8 =$  becomes  $45 - 5$

Then  $40 - 3$





## Year 2 Mental Addition and Subtraction Strategies

### Partitioning using multiples of 10

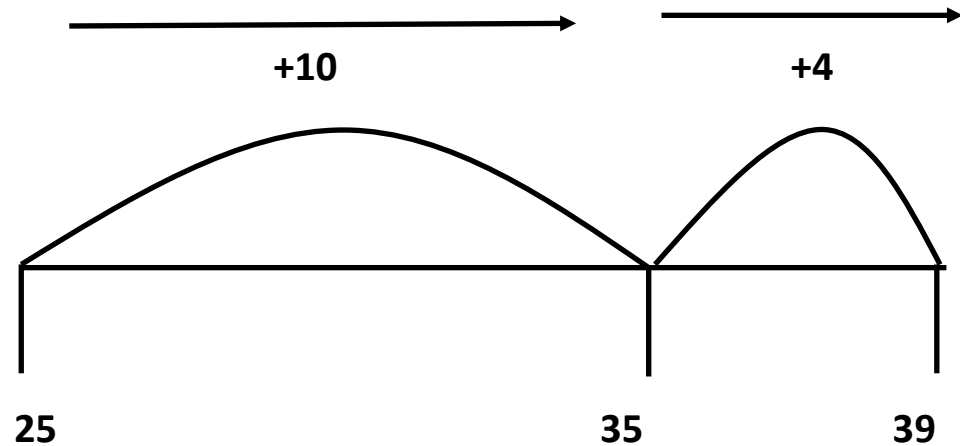
$25 + 14 =$

$20 + 10 = 30$     or     $25 + 10 = 35$

$5 + 4 = 9$

$35 + 4 = 39$

$30 + 9 = 39$

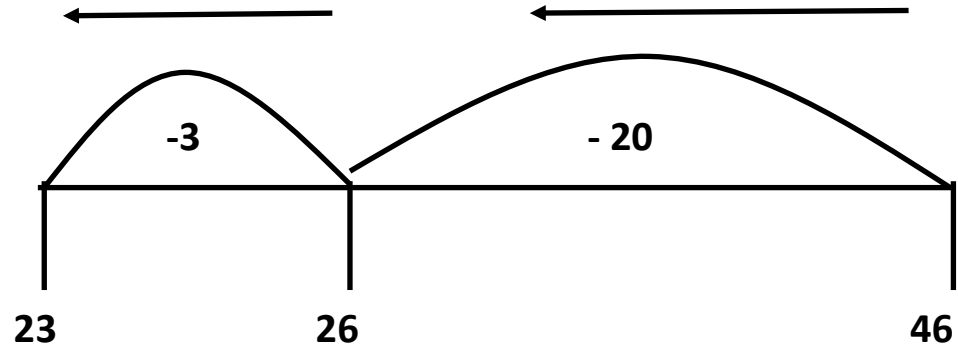


$46 - 23 =$

$40 - 20 = 20$     or     $46 - 20 = 26$

$6 - 3 = 3$

$26 - 3 = 23$



### Compensating to add/subtract numbers close to a multiple of 10

$24 + 19 = ?$

$70 - 11 = ?$

$24 + 20 = 44$

$70 - 10 = 60$

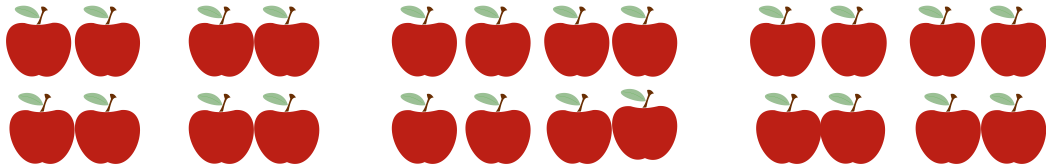
$44 - 1 = 43$

$60 - 1 = 59$



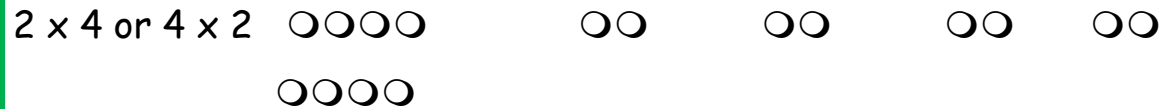
# Year 2 Multiplication and Division Strategies

## Multiplication



There are 4 apples in one box. How many apples in 6 boxes?

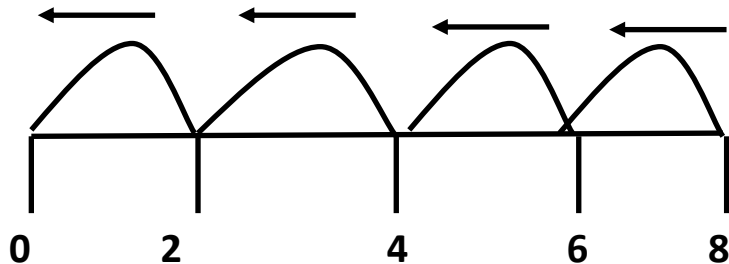
## Arrays



Repeated Addition  $2 \times 4 = 2 + 2 + 2 + 2$  or  $4 \times 2 = 4 + 4$

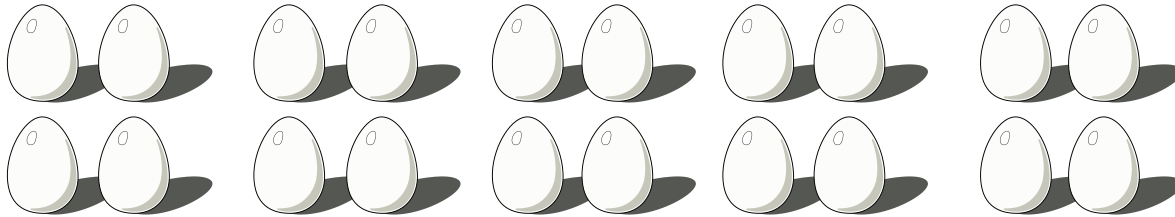
## Number lines

$2 \times 4 =$  Can also be used for division  $8 \div 2$



# Year 2 Multiplication and Division Strategies

## Division



4 eggs fit in a box.

How many boxes would you need to pack 20 eggs?

## Arrays

○○○○

$16 \div 2$

○○ ○○

○○○○

○○ ○○

Sharing  $10 \div 2$

Grouping  $10 \div 2$

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# Year 2 Multiplication and Division Strategies

## Multiplication & Division

### Signs and Symbols

$$\square \times 2 = 12$$

$$\square = 12 \div 6$$

$$12 = \square \times 6$$

$$12 \div 2 = \square$$

### Double by partitioning

$$16 \times 2 = ?$$

Partition 16 into 10 and 6

$$10 \times 2 = 20$$

$$6 \times 2 = 12$$

$$20 + 12 = 32$$

### Halving by partitioning

$16 \div 2 = ?$  Partition 16 into 10 and 6

$$10 \div 2 = 5 \text{ and } 6 \div 2 = 3$$

$$5 + 3 = 8$$



Clover Hill  
Primary School  
Year 3



Mental & Written  
Calculation Policy

## Addition and Subtraction

### Children in Year 3 should:

- Add and subtract numbers mentally including Hundreds, Tens & Ones +/- Ones, Hundreds, Tens & Ones +/- Tens, Hundreds, Tens & Units +/- Hundreds.
- Use horizontal number sentences and empty number lines sometimes to support explanation of their mental calculation methods.
- Solve varied addition and subtraction problems including missing number problems using number facts and place value.
- Develop their understanding of written methods; working from expanded to using (compact) formal written methods of columnar addition and subtraction with numbers of up to three digits. Particular attention should be paid to the language used when modelling these methods. The value of digits should be retained according to place value and use of practical materials /representations may aid understanding
- Estimate the answer to a calculation and check using inverse operations.

## Multiplication and Division

### Children in Year 3 should:

- Draw pictures and arrays to represent multiplications and divisions if necessary to support understanding, including for situations involving remainders.
- Use number sentences and / or number lines to explain multiplication / division as repeated addition / subtraction
- Partition arrays to find related number facts for single digit tables facts eg  $8 \times 4 = (4 + 4) \times 4$  or  $8 \times 4 = (5 + 3) \times 4$ .



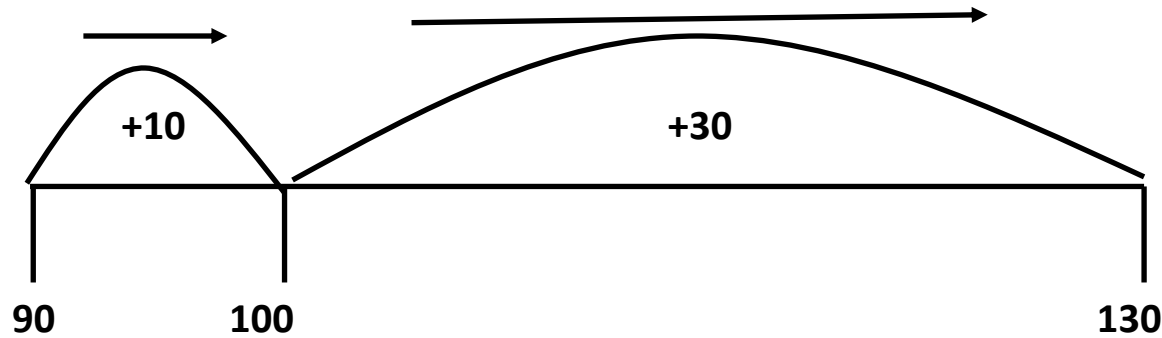
- Recall and use multiplication and division facts for the 3, 4 and 8 multiplication tables.
- Connect 2, 4 and 8 tables through doubling.
- Develop efficient mental methods e.g. using commutativity and associativity and using known facts to derive other related facts.
- Use partitioning and use of the distributive law to introduce multiplication and division of a two digit by one digit number. Support this work with images and materials such as arrays and place value counters.
- Write and calculate mathematical statements for multiplication and division using the multiplication statements that they know, including for two-digit numbers times one digit numbers, using mental and progressing to formal written methods of short multiplication and division.
- Use tables facts to solve problems including missing number, integer scaling and correspondence problems in which  $n$  objects are connected to  $m$  objects.



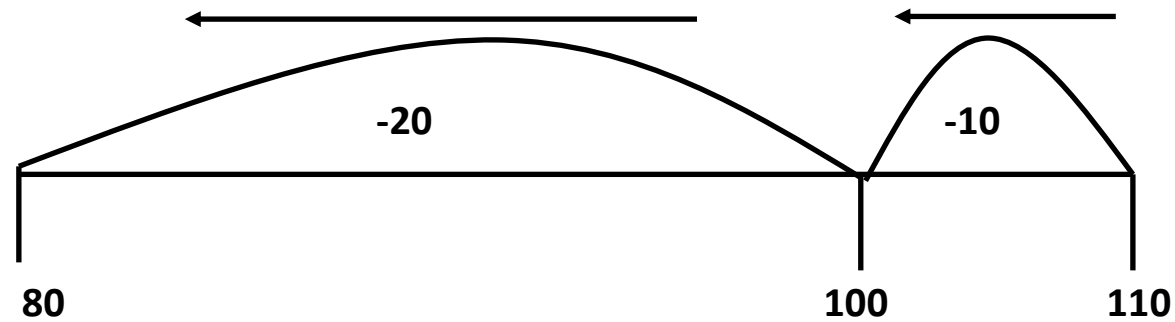
## Year 3 — Addition and Subtraction Mental Strategies

Add/subtract ones. Tens and hundreds using number bonds and place value to find efficient steps

$$90 + 40 =$$



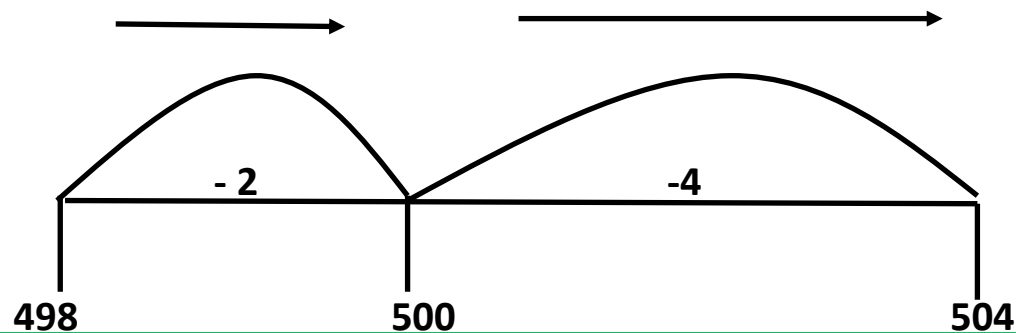
$$110 - 30 =$$



NB: Number lines are used to demonstration only.

Count up to find a difference

$$504 - 498 = 6$$





# Year 3 — Addition and Subtraction Mental Strategies

## Bridge through multiples of 10

$$357 + 7 = ?$$

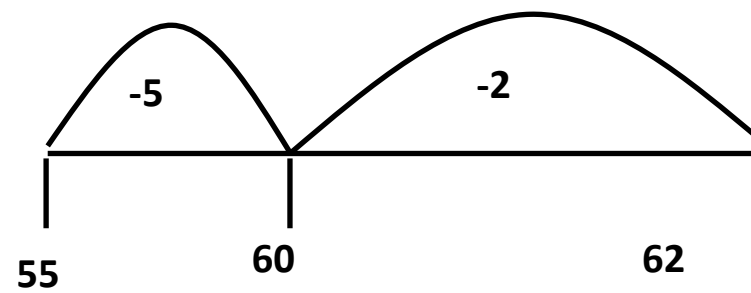
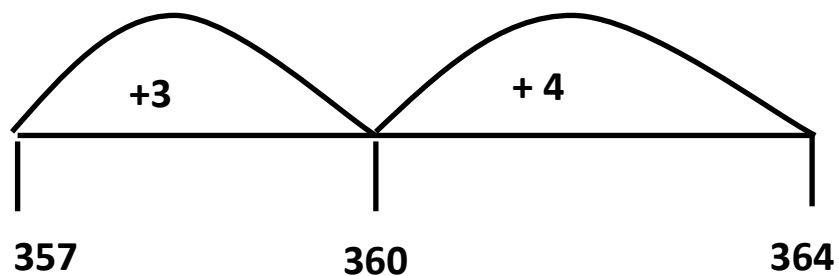
$$357 + 3 = 360$$

$$360 + 4 = 364$$

$$62 - 7 = ?$$

$$62 - 2 = 60$$

$$60 - 5 = 55$$



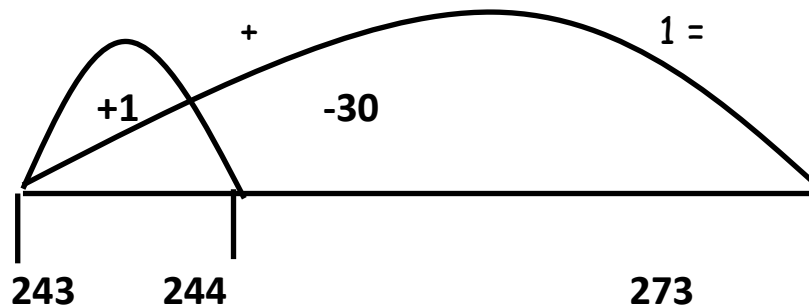
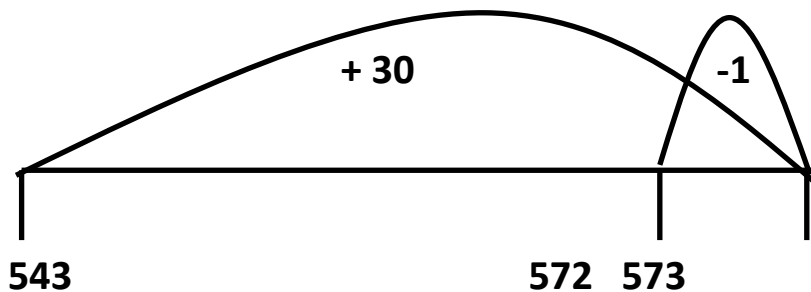
## Compensating to add/subtract numbers close to a multiple of 10

$$543 + 29 = ?$$

$$543 + 30 = 573 \text{ then } 573 - 1 = 572$$

$$273 - 29 = ?$$

$$273 - 30 = 243 \text{ then } 243 + 1 = 244$$



## Year 3 — Addition and Subtraction Mental Strategies

### Partitioning using multiples of 10

$$86 + 57 = ?$$

$$80 + 50 = 130 \quad \text{or} \quad 86 + 50 = 136$$

$$6 + 7 = 13 \quad \quad \quad 136 + 7 = 143$$

$$96 - 24 = ?$$

$$90 - 20 = 70 \quad \text{or} \quad 96 - 20 = 76$$

$$6 - 4 = 2 \quad \quad \quad 76 - 4 = 72$$



## Year 3 Written Methods

### Formal addition method

$$\begin{array}{r} \phantom{+} \phantom{2} \phantom{3} \phantom{4} \\ + \phantom{2} \phantom{3} \phantom{4} \\ \hline \phantom{+} 2 \phantom{3} \phantom{4} \\ \phantom{+} 1 \phantom{3} \phantom{4} \\ \hline \phantom{+} 3 \phantom{3} \phantom{4} \\ \phantom{+} 4 \phantom{4} \\ \hline \phantom{+} 7 \phantom{4} \\ \phantom{+} 5 \\ \hline \phantom{+} 9 \phantom{4} \end{array}$$

$$\begin{array}{r} \phantom{+} \phantom{2} \phantom{3} \phantom{4} \\ + \phantom{2} \phantom{3} \phantom{4} \\ \hline \phantom{+} 2 \phantom{3} \phantom{4} \\ \phantom{+} 1 \phantom{3} \phantom{4} \\ \phantom{+} 1 \phantom{3} \phantom{4} \\ \hline \phantom{+} 4 \phantom{3} \phantom{4} \\ \phantom{+} 7 \phantom{4} \\ \phantom{+} 1 \phantom{4} \\ \hline \phantom{+} 11 \phantom{4} \\ \phantom{+} 8 \\ \hline \phantom{+} 19 \phantom{4} \end{array}$$



## Year 3 Written Methods

### Expanded subtraction method

			70	13
$87 = 80 + 7$	or	$83 = $	<del><math>80 + 3</math></del>	
$- 53$		$- 57$	<u><math>50 + 3</math></u>	
$30 + 4 = 34$			$20 + 6$	

### Introduce formal method

$$\begin{array}{r} \phantom{-} \phantom{2} \phantom{8} \phantom{5} \\ - \phantom{2} \phantom{8} \phantom{5} \\ \hline \phantom{2} \phantom{8} \phantom{5} \\ \phantom{2} \phantom{8} \phantom{5} \end{array}$$

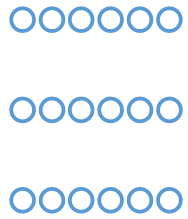
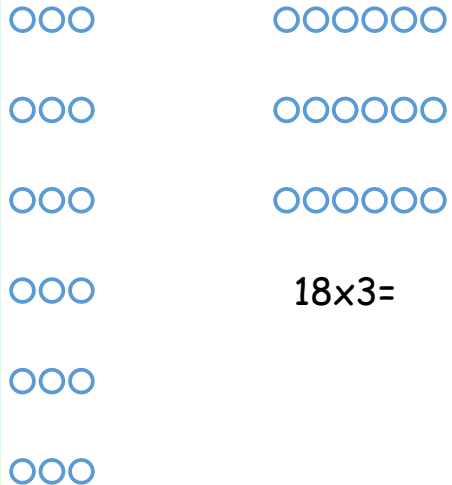
$$\begin{array}{r} \phantom{-} \phantom{2} \phantom{8} \phantom{5} \\ \phantom{-} \phantom{2} \phantom{8} \phantom{5} \\ \phantom{-} \phantom{2} \phantom{8} \phantom{5} \\ \phantom{-} \phantom{2} \phantom{8} \phantom{5} \\ \hline \phantom{-} \phantom{2} \phantom{8} \phantom{5} \\ \phantom{-} \phantom{2} \phantom{8} \phantom{5} \end{array}$$



# Year 3 Multiplication & Division Mental Strategies

## Arrays

$3 \times 6$  or  $6 \times 3$



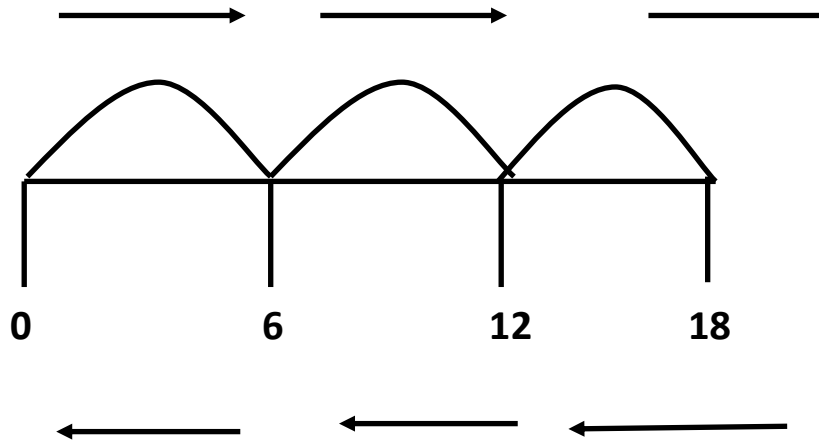
$18 \times 3 =$

$18 \div 6 =$

## Repeated addition

$3 \times 6 = 3 + 3 + 3 + 3 + 3 + 3$

## Number lines



Used for multiplication and division

$$6 \times 3 = 18$$

$$18 \div 3 = 6$$



## Year 3 Multiplication & Division Mental Strategies

Write and calculate mathematical statements for multiplication and division

$6 \times 8 = \square$

$30 \div 5 = \square$

$\square \times 4 = 28$

$8 = 40 \div \square$

Leading to Formal Method

$$\begin{array}{r} \phantom{1} \phantom{2} \phantom{9} \\ \phantom{1} \phantom{2} \phantom{9} \\ \hline 1 \phantom{2} \phantom{9} \\ \phantom{1} 4 \phantom{3} \\ \phantom{1} \phantom{2} 3 \end{array}$$



# Year 3 Multiplication & Division Strategies

## Division

$$56 \div 4 = ?$$

Partition 56 into 40 and 16

$$\begin{aligned} 40 \div 4 &= 10 \text{ and } 16 \div 4 = 4 \\ &= 10 + 4 \\ &= 14 \end{aligned}$$

## Formal method

$$\begin{array}{r} 14 \\ 4 \overline{) 56} \\ \underline{40} \phantom{0} \\ 16 \\ \underline{16} \\ 0 \end{array}$$



Clover Hill  
Primary School  
Year 4



Mental & Written  
Calculation Policy



## Addition and Subtraction

### Children in Year 4 should:

- Continue to add and subtract numbers with up to four digits mentally where the nature of the numbers makes this appropriate. They may use horizontal number sentences or empty number lines to support an explanation of the steps in their calculation. They should be given opportunities to identify calculations which are appropriate for a mental method and explain why.
- Add and subtract numbers with up to four digits using the formal written methods of columnar addition and subtraction where appropriate. Their understanding of the procedures involved may be supported by the use of expanded written methods and practical materials if required.
- Estimate and use inverse operations to check answers to a calculation.

## Multiplication and Division

### Children in Year 4 should:

- Recall multiplication and division facts for multiplication tables up to  $12 \times 12$
- Explore division situations that give rise to remainders
- Use place value, known and derived facts to multiply and divide mentally (e.g.  $600 \div 3 = 200$  can be derived from  $2 \times 3 = 6$ , including multiplying by 0 and 1; dividing by 1; multiplying together three numbers.
- Use knowledge of number facts and laws of arithmetic: commutative, associative and distributive to solve mental and written calculations.



- \* Recognise and use factor pairs
- \* Use arrays and models such as the grid method or place value counters to develop understanding of the formal methods of short multiplication and division
- \* Multiply two digit and three digit numbers by a one digit number using formal written layout of short multiplication
- \* Use the formal written method of short division with exact answers.
- \* Solve one and two step problems in contexts involving multiplying and adding, including using the distributive law to multiply two digit numbers by one digit, integer scaling problems and correspondence problems such as when  $n$  objects are connected to  $m$  objects.

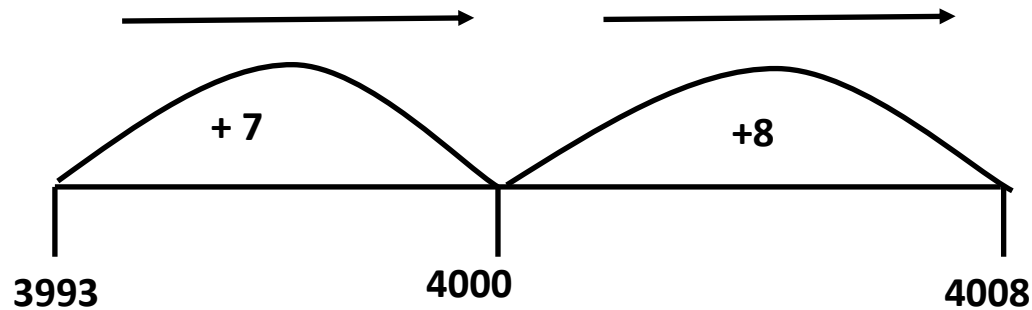


# Year 4 — Addition and Subtraction Mental Strategies

## Count up to find a small difference

$$4008 - 3993 =$$

$$7 + 8 = 15$$

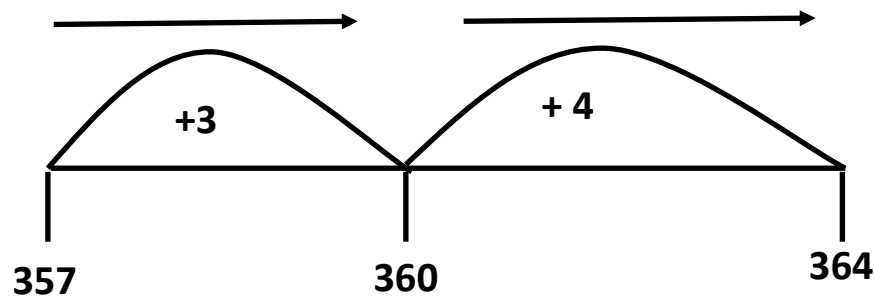


## Bridge through multiples of 10

$$357 + 7 = ?$$

$$357 + 3 = 360$$

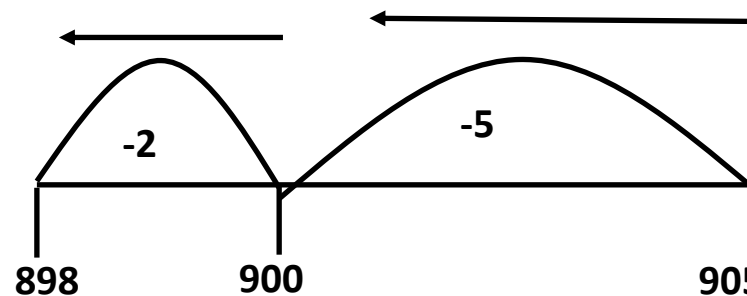
$$360 + 4 = 364$$



$$905 - 7 = ?$$

$$905 - 5 = 900$$

$$900 - 2 = 898$$



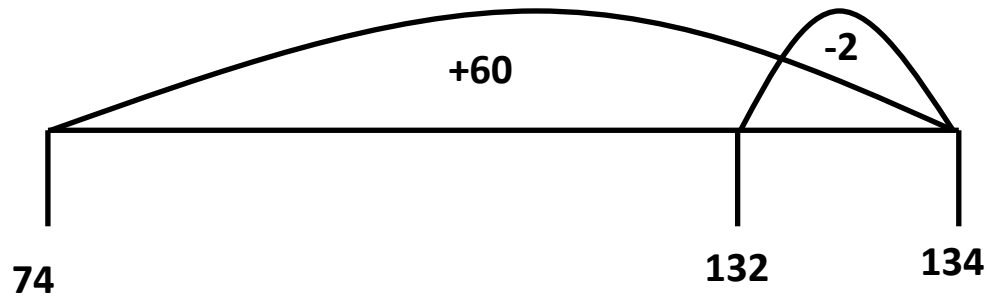
## Year 4 — Addition and Subtraction Mental Strategies

### Compensating to add/subtract numbers close to a multiple of 10

$$74 + 58 = ?$$

$$74 + 60 = 134$$

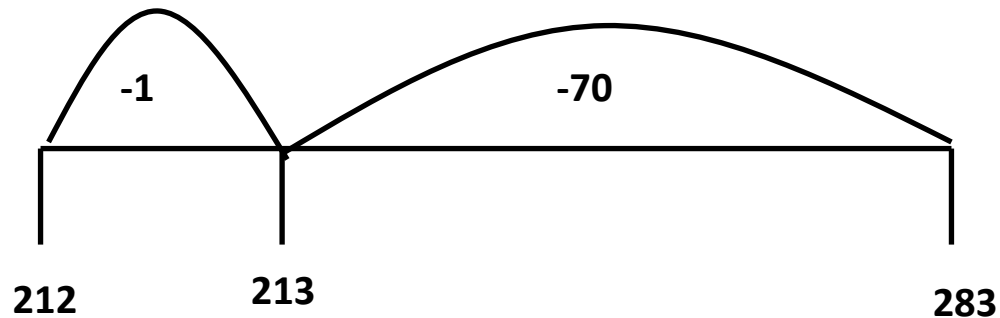
$$134 - 2 = 132$$



$$283 - 71 = ?$$

$$283 - 70 = 213$$

$$213 - 1 = 212$$



# Year 4 — Addition and Subtraction Mental Strategies

## Partitioning using multiples of 10

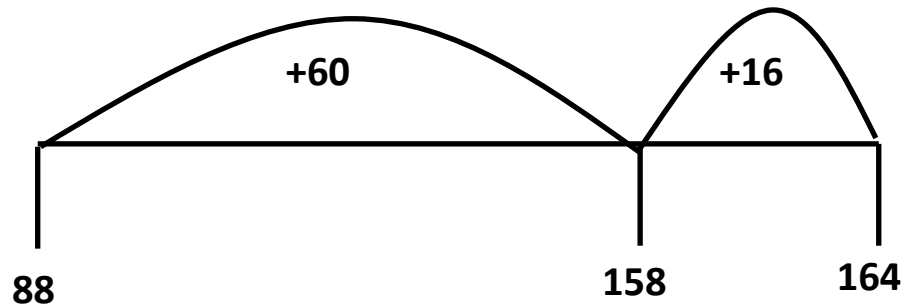
$$88 + 76 =$$

$$88 + 70 = 158$$

$$80 + 70 = 150$$

$$\text{or } 158 + 6 = 164$$

$$8 + 6 = 14$$



$$98 - 43 = ?$$

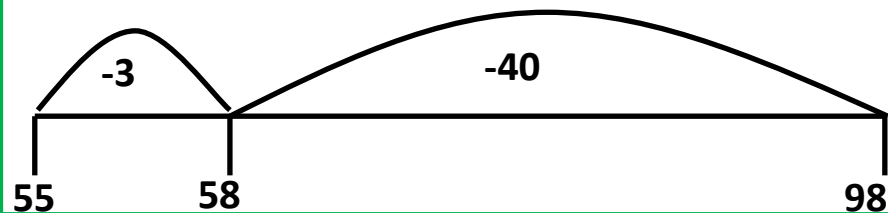
$$90 - 40 = 50$$

$$\text{or } 98 - 40 = 58$$

$$8 - 3 = 5$$

$$58 - 3 = 55$$

$$50 + 5 = 55$$



# Year 4 Written Methods

## Moving on to formal additional methods

$$\begin{array}{r} 3 \quad 5 \quad 8 \\ + \quad 7 \quad 3 \\ \hline 1 \quad 1 \\ 4 \quad 3 \quad 1 \end{array}$$

## Formal subtraction methods

$$\begin{array}{r} \quad \quad \quad 4 \quad 1 \\ \quad \quad 7 \quad \quad \quad 5 \quad 4 \\ - \quad \quad \quad 3 \quad 6 \\ \hline \quad \quad 7 \quad 1 \quad 8 \end{array}$$



# Year 4 Multiplication & Division Mental Strategies

Develop the use of arrays to aid understanding of commutative laws

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$$8 \times 4 = 32$$

○○○○○○○○

or

○○○○○○○○

$$4 \times 8 = 32$$

Develop the use of arrays to aid understanding of distributive law

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○○○○○○○○

$$8 \times 4 = 3 \times 4 +$$

$$5 \times 4$$

○○○○○○○○

○○○○○○○○



# Year 4 Multiplication & Division Mental Strategies

Use arrays to develop ideas of remainders

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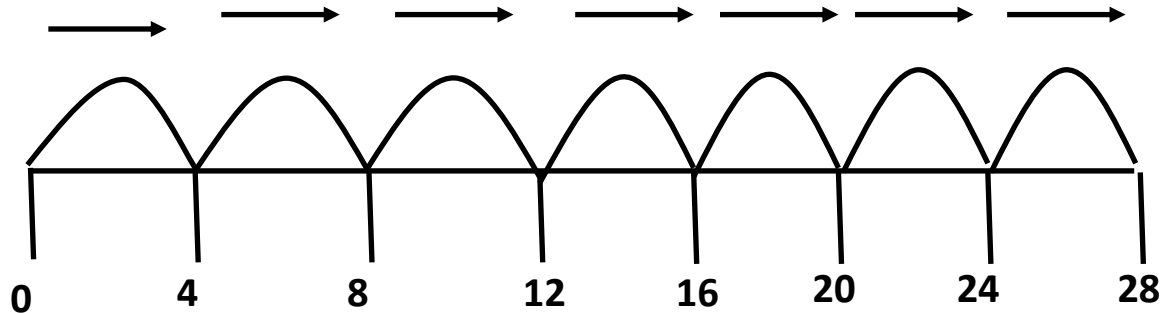
$$34 \div 8 = 4 \text{ remainder } 2$$

○○○○○○○○

○○

Use numbers lines

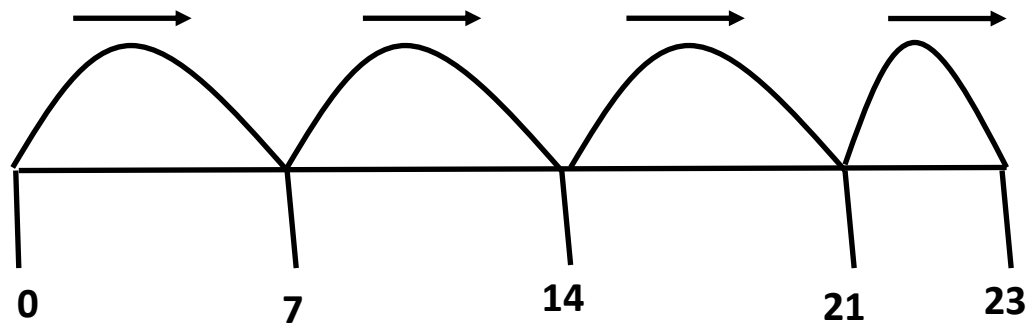
$4 \times 7$





# Year 4 Multiplication & Division Mental Strategies

## Number lines (including remainders)



## Record multiplication and division facts

$3 \times 7 = \square$

$21 \div 7 = \square$

$\square \times 7 = 21$

$7 = \square \div 3$



# Year 4 Multiplication & Division Mental Strategies

Use place value, known and derived facts to multiply and divide mentally

$$30 \times 6 = 3 \times 6 \times 10 = 18 \times 10 = 180$$

## Year 4 Formal Written Strategies

### Multiplication

$$\begin{array}{r} \phantom{X} \phantom{00} 2 \phantom{00} 3 \\ X \phantom{00} \phantom{00} 7 \\ \hline 1 \phantom{00} 6 \phantom{00} 1 \end{array}$$

### Division

$$\begin{aligned} 72 \div 5 &= 50 \div 5 = 10 \text{ then } 20 \div 5 = 4 \\ &= 10 + 4 \text{ with } 2 \text{ left over} \\ &= 14 \text{ remainder } 2 \end{aligned}$$

### Short Division

$$\begin{array}{r} 1 \phantom{00} 4 \\ 7 \overline{) 9 \phantom{00} 28} \end{array}$$



Clover Hill  
Primary School  
Year 5



Mental & Written  
Calculation Policy

## Addition and Subtraction

### Children in Year 5 should:

- \* Add and subtract numbers mentally with increasingly large numbers e.g.  $12,462 - 2300 = 10,162$ . Use horizontal number sentences and empty number lines sometimes to support explanation of their methods. They should be given opportunities to identify calculations which are appropriate for a mental method and explain why.
- \* Add and subtract whole numbers with more than four digits, including using formal written methods (columnar addition and subtraction). Particular attention should be paid to the language used when modelling these methods. The value of digits should be retained according to their place value.
- \* Understanding of the procedures involved may be supported by the use of expanded written methods and practical materials if required.
- \* Use rounding to check answers to calculations and determine, in the context of a problem, levels of accuracy
- \* Solve addition and subtraction multi-step problems in context, deciding which operations to use and why.
- \* Learn how to record the method they used when working with a calculator.

## Multiplication and Division

### Children in Year 5 should:

- Apply all multiplication tables and related division facts frequently, commit them to memory and use them confidently to multiply and divide numbers mentally to make larger calculations.
- Develop understanding and use of factors, multiples, factor pairs, common factors and multiples, primes, prime factors, non primes (composite numbers), squares and cubes (including notation for these).
- Establish if a number up 100 is prime and recall primes to 19.



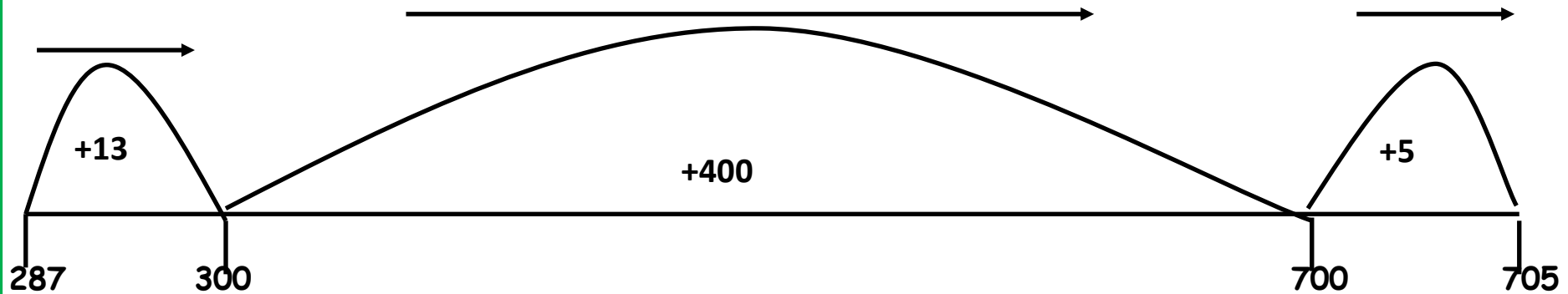
- \* Multiply numbers up to 4 digits by a one or two digit number using a formal written method, including long multiplication for two-digit numbers
- \* Divide numbers up to 4 digits by a one digit number using the formal written method of short division and interpret remainders appropriately for the context, including as fractions, decimals or by rounding.
- \* Multiply and divide whole numbers and those involving decimals by 10, 100 and 1000
- \* Use an expanded / informal method if they are not ready for the formal methods and be supported towards an understanding of the compact method using e.g. the grid method or place value counters
- \* Use multiplication and division facts to solve problems involving scaling by simple fractions and problems involving simple rates



# Year 5— Addition and Subtraction Mental Strategies

## Counting up to find a small difference

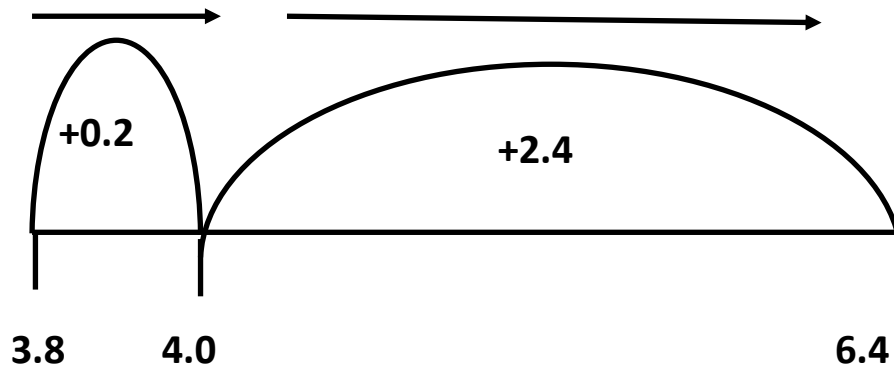
$$705 - 287 =$$



## Bridge through whole numbers for decimal numbers

### Addition:

$3.8 + 2.6$  is changed to  $3.8 + 0.2$  then add 2.4

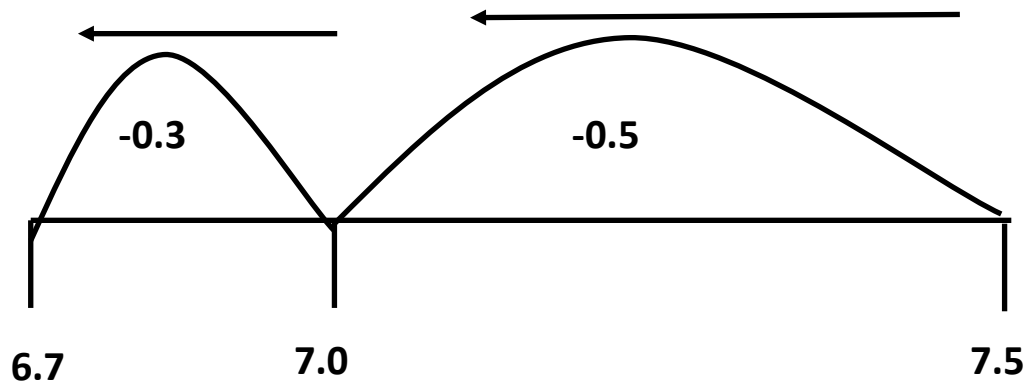


# Year 5— Addition and Subtraction Mental Strategies

## Bridge through whole numbers for decimals

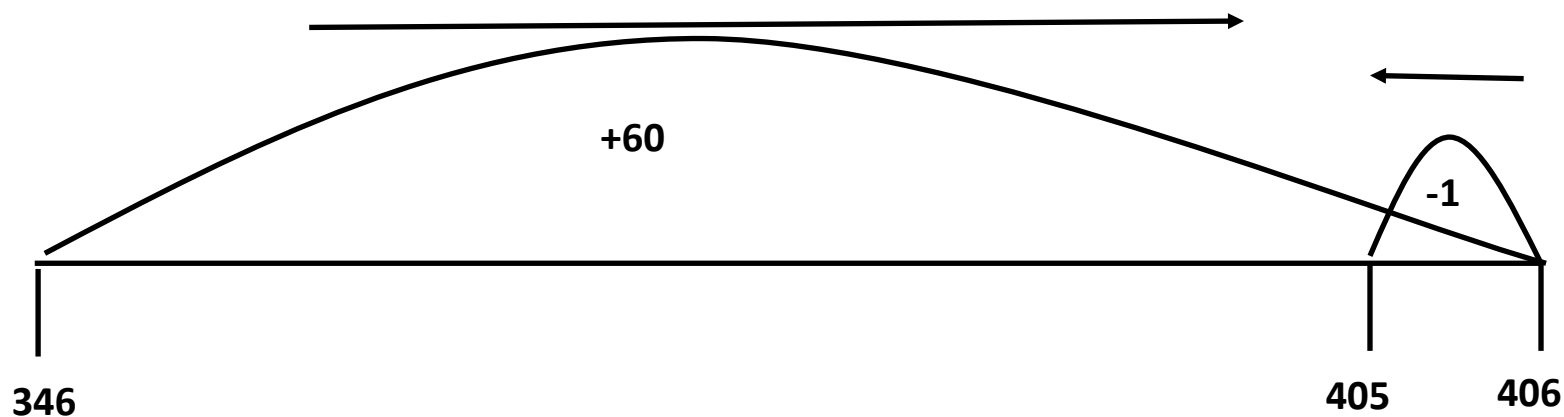
### Subtraction:

$7.5 - 0.8$  is changed to  $7.5 - 0.5 - 0.3$



## Compensating to add/subtract numbers close to a multiple of 10

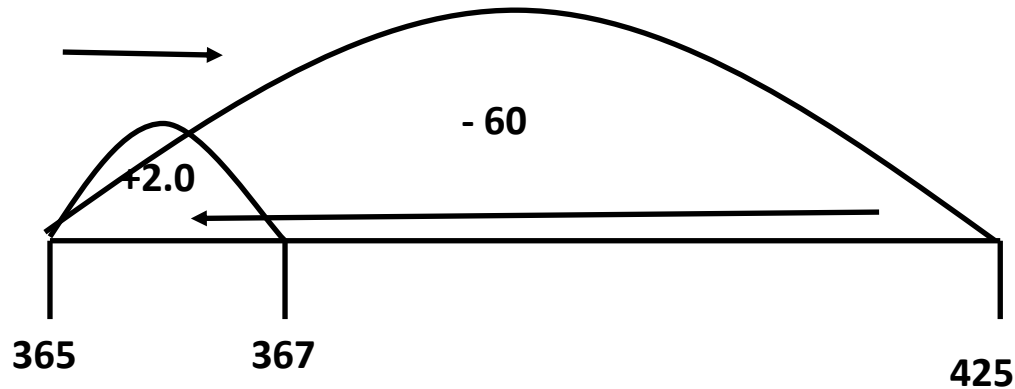
$346 + 59$  is the same as  $346 + 60 - 1$  or the same as  $406 - 1$



## Year 5— Addition and Subtraction Mental Strategies

### Compensating to add/subtract numbers close to a multiple of 10

$425 - 58$  is the same as  $425 - 60 + 2$  is the same as  $365 + 2$



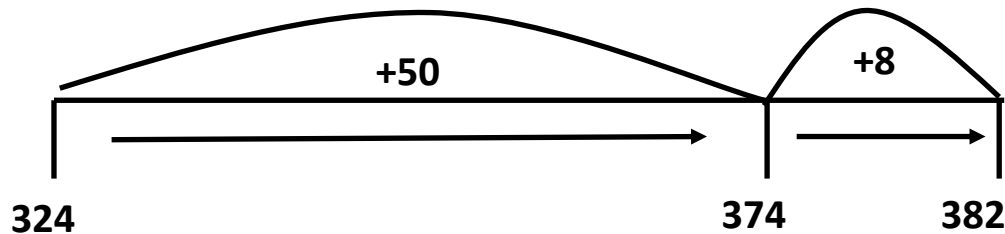
### Partition using multiples of 10

#### Addition:

$$324 + 58 = ?$$

$$324 + 50 = 374.$$

Then add the remaining 8.



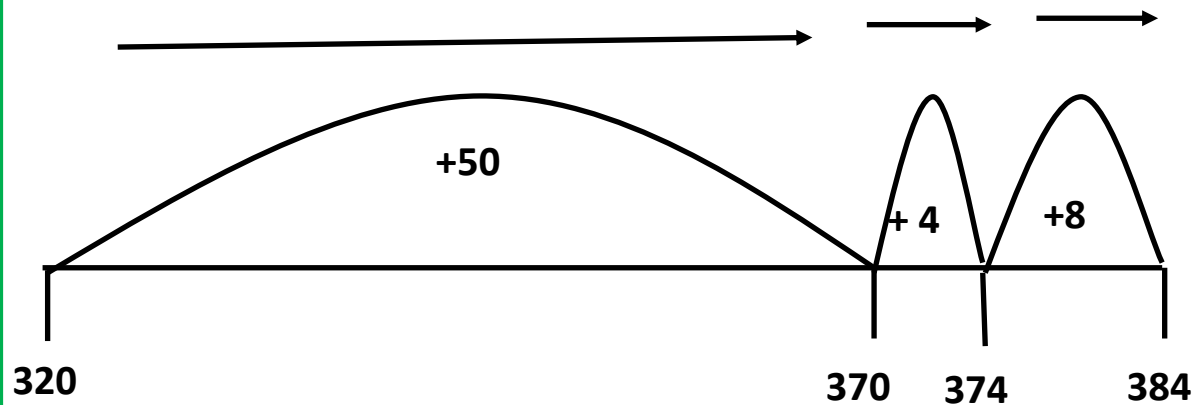


# Year 5— Addition and Subtraction Mental Strategies

## Partition using multiples of 10

### Addition:

$324 + 58$  is the same as  $320 + 50$  &  $4 + 8$

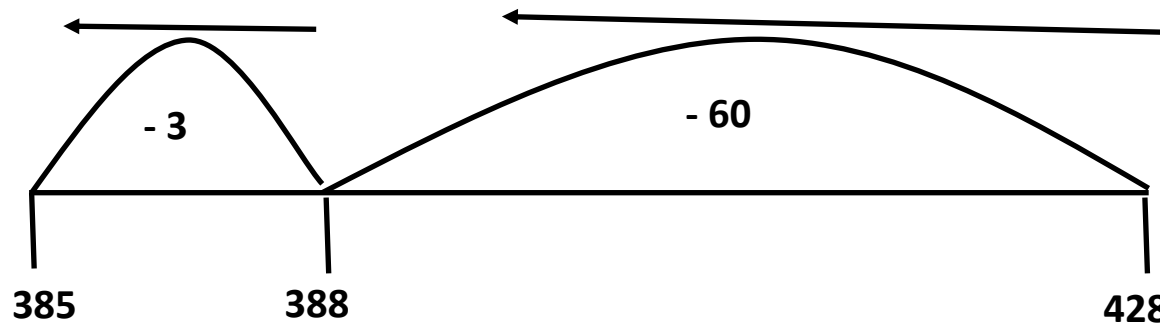


### Subtraction:

$428 - 43$  is the same as

$428 - 40 = 388$

$388 - 3 = 385$



# Year 5 Written Methods

## Formal addition methods

$$\begin{array}{r} \phantom{+} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ + \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ \hline \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \end{array}$$

	5	9	8	7
+	3	2	3	2
	1	1		
<hr/>				
	9	2	1	9

## Formal subtraction methods

$$\begin{array}{r} \phantom{-} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ - \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \\ \hline \phantom{0} \phantom{0} \phantom{0} \phantom{0} \phantom{0} \end{array}$$

	<del>6</del> 7	<del>14</del> 5	<del>1</del> 4	3
-	2	8	6	2
<hr/>				
	4	6	8	1



## Year 5 Multiplication & Division Mental Strategies

Use signs or symbols to complete questions using known facts.

$$9 \times 7 = \square$$

$$\square = 60 \times 2$$

$$\square \times 7 = 63$$

$$120 = \square \times 2$$

$$56 \div 7 = \square$$

$$1600 \div 2 = \square$$

Use number sentences to show mental strategy used.

$$36 \times 50 =$$

$$36 \times 100 = 3600$$

$$3600 \div 2 = 1800$$



# Year 5 Written Methods

## Short Multiplication

$342 \times 7$

	3	4	2	
x				7
	2	1		
<hr/>				
2	3	9	4	

## Short Division

$432 \div 5$

	8	6	r2	
5				
	4	<sup>4</sup> 3	<sup>3</sup> 2	

## Long multiplication for two digit numbers

$24 \times 16$

	2	4	
x	1 <sub>2</sub>	6	
<hr/>			
1	4	4	
2	4	0	
<hr/>			
3	8	4	



Clover Hill  
Primary School  
Year 6



Mental & Written  
Calculation Policy

### **Children in Year 6 should:**

- \* Perform mental calculations including with mixed operations and large numbers (and decimals). Use horizontal number sentences and empty number lines sometimes to support explanation of their methods. They should be given opportunities to identify the most appropriate tool for calculations ie mental method, mental with recording or formal written method and explain why.
- \* Practise addition and subtraction for larger numbers and decimals using the formal written methods of columnar addition and subtraction. The value of digits should be retained according to their place value. Materials / representations may support understanding.
- \* Use estimation to check answers to calculations and determine, in the context of the problem, an appropriate degree of accuracy.
- \* Round answers to a specified degree of accuracy.
- \* Use knowledge of the order of operations, and use of brackets, to carry out calculations involving the four operations.
- \* Solve addition and subtraction multi-step problems in contexts, deciding which operations to use and why.

### **Multiplication and Division**

- \* Perform mental calculation, including with mixed operations and large numbers. Identify common factors, common multiples and prime numbers.
- \* Multiply numbers up to four digits by a two digit whole number using the formal written method of long multiplication.



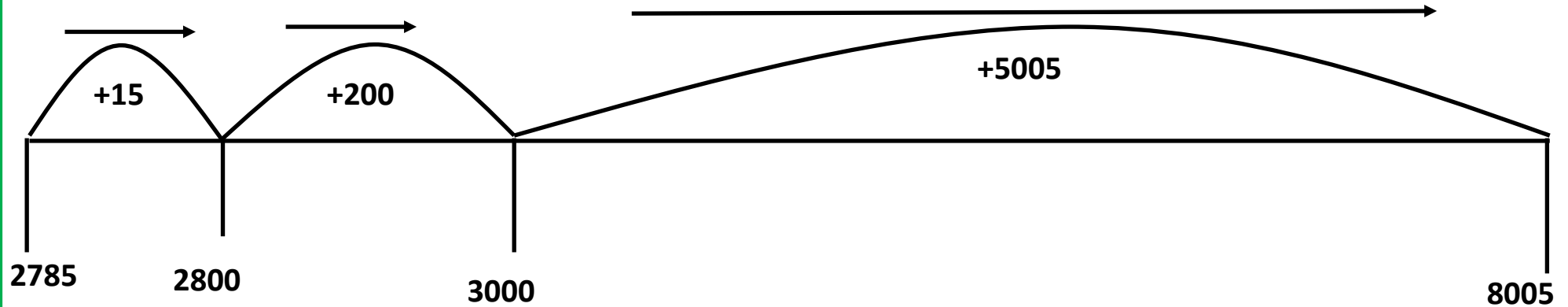
- \* Divide numbers up to four digits by a two digit whole number using the formal written method of long division and interpret remainders as whole number remainders, fractions, decimals or rounding.
- \* Divide numbers up to four digits by a two digit whole number using the formal written method of short division where appropriate, and interpret remainders according to the context.
- \* Use knowledge of the order of operations to carry out calculations involving the four operations.
- \* Solve problems in context using all four number operations and determine, in the context of the problem, an appropriate degree of accuracy □ They should be given opportunities to identify the most appropriate tool for calculations ie mental method, mental with recording, standard method or calculator and explain why.
- \* Use compact formal methods if they can do so efficiently and with understanding.



## Year 6— Addition and Subtraction Mental Strategies

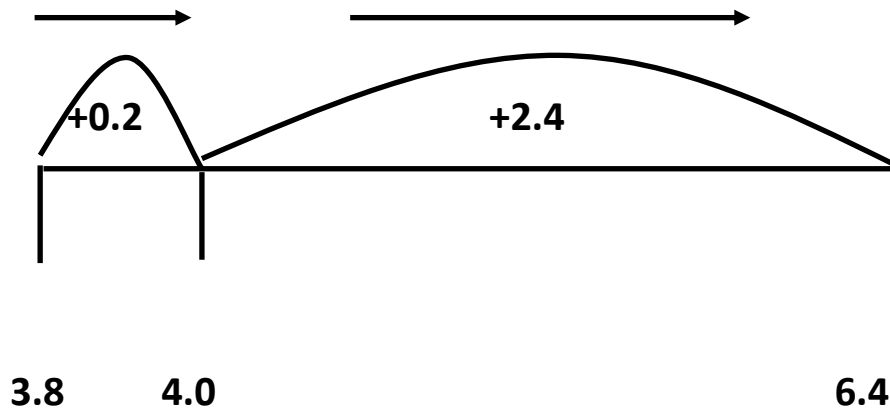
### Counting up to find a small difference

$$8004 - 2785 =$$



### Bridge through whole numbers for decimal numbers

Addition:  $3.8 + 2.6$  is the same as  $3.8 + 0.2 + 2.4$



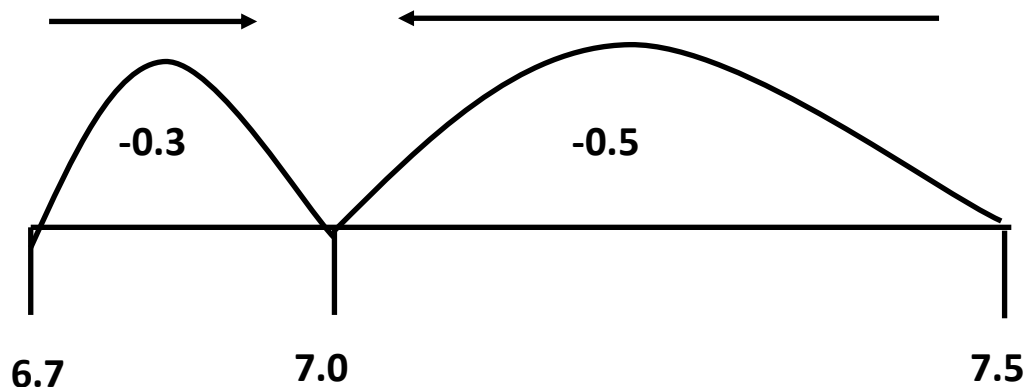


## Year 6— Addition and Subtraction Mental Strategies

### Bridge through whole numbers for decimals

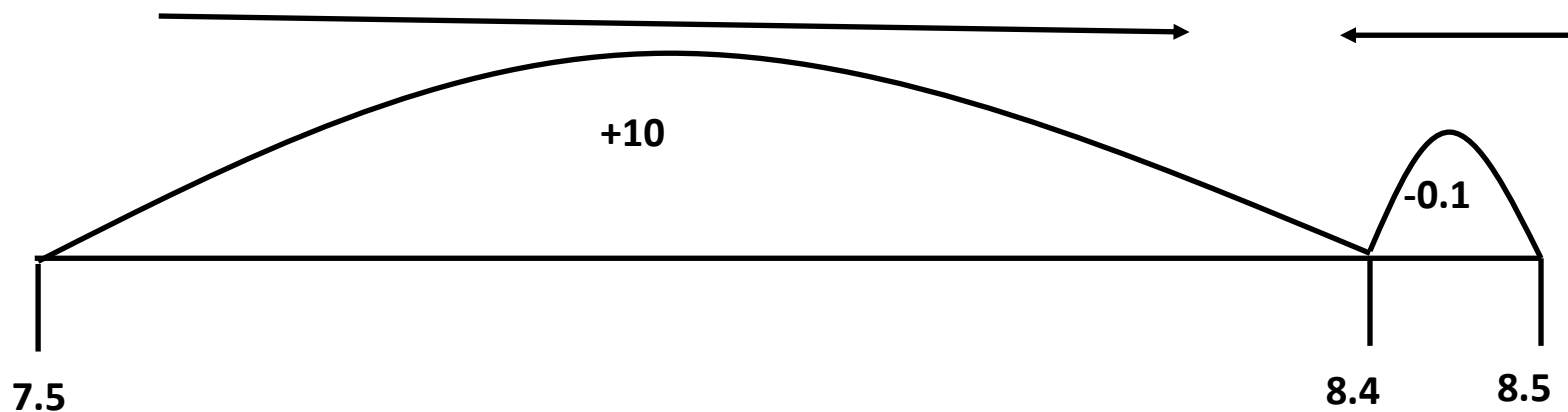
#### Subtraction:

$7.5 - 0.8$  is changed to  $7.5 - 0.5 - 0.3$



### Compensating to add/subtract numbers close to a multiple of 10

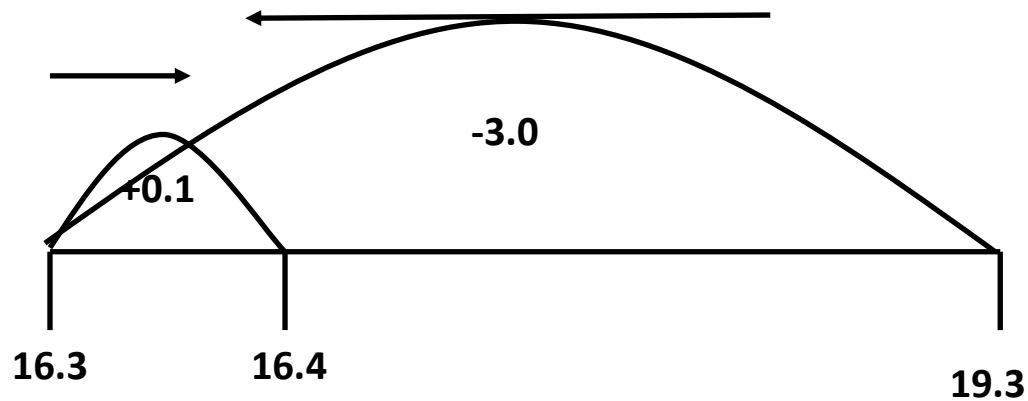
$7.5 + 0.9$  becomes  $7.5 + 1.0 - 0.1 =$



## Year 6— Addition and Subtraction Mental Strategies

### Compensating to add/subtract numbers close to a multiple of 10

19.3-2.9 is changed to 19.3- 3.0 + 0.1



### Partition using multiples of 10

#### Addition:

$$540 + 280 =$$

$$540 + 200 + 80 =$$

Or

$$500 + 200 + 40 + 80 =$$

#### Subtraction:

$$276 - 153 =$$

$$276 - 100 - 50 - 3 =$$



# Year 6 Formal Written Methods

## Formal addition methods

$$\begin{array}{r}
 \phantom{+} \phantom{7} \phantom{6} \phantom{4} \phantom{8} \\
 + \phantom{7} \phantom{6} \phantom{4} \phantom{8} \phantom{6} \\
 \phantom{+} 1 \phantom{6} \phantom{4} \phantom{8} \phantom{6} \\
 \hline
 \phantom{+} 9 \phantom{6} \phantom{4} \phantom{8} \phantom{6} \\
 \hline
 \end{array}$$

## Formal subtraction methods

$$\begin{array}{r}
 \phantom{-} \phantom{5} \cancel{6} \phantom{13} \cancel{4} \phantom{16} \phantom{7} \\
 - \phantom{5} \phantom{13} \phantom{16} \phantom{7} \phantom{4} \\
 \hline
 \phantom{-} 3 \phantom{13} \phantom{16} \phantom{7} \phantom{4} \\
 \hline
 \end{array}$$



## Year 6 Multiplication & Division Mental Strategies

Use signs or symbols to complete questions using known facts.

$$8 \times 9 = \square$$

$$\square \times 90 = 720$$

$$\square \times 9 = 72$$

$$80 \times 90 = \square$$

$$72 \div 9 = \square$$

$$72000 \div 9 \square$$

Use number sentences to show mental strategy used.

$$38 \times 25 =$$

$$38 \times 100 = 3800$$

$$3800 \div 4 = 950$$



# Year 6 Formal Written Methods

## Short Multiplication

$2741 \times 6$

		2	7	4	1	
x					6	
		4	2			
<hr/>						
1	6	4	4	6		

## Short Division

$432 \div 5$

			8	6	r2
		<hr/>			
5		4	<sup>4</sup> 3	<sup>3</sup> 2	

## Long multiplication for two digit numbers

$124 \times 26$

		1	2	4	
X			2	6	
		1	2		
<hr/>					
		7	4	4	
2		4	8	0	
<hr/>					
3		2	2	4	



# Year 6 Formal Written Methods

## Long Division

$432 \div 15$  becomes 28 remainder  $12/15 = 28 \text{ \& } 4/5$  or  $432 \div 15$  become 28.8

$$\begin{array}{r}
 \phantom{0} \phantom{2} \phantom{8} \\
 15 \overline{) 432} \\
 \underline{- 300} \phantom{0} \\
 132 \\
 \underline{- 120} \\
 r \phantom{1} \phantom{2}
 \end{array}$$

$15 \times 20$   
 $15 \times 8$

Or

$$\begin{array}{r}
 \phantom{2} \phantom{8} \phantom{.8} \\
 15 \overline{) 432.0} \\
 \underline{- 300} \phantom{0} \\
 132.0 \\
 \underline{- 120.0} \\
 \phantom{1} \phantom{2} \phantom{0} \\
 \phantom{1} \phantom{2} \phantom{0} \\
 \phantom{1} \phantom{2} \phantom{0}
 \end{array}$$

Always write down your times tables down the side to help you calculate.

$1 \times 15 = 15$

$2 \times 15 = 30$

$3 \times 15 = 45$

$4 \times 15 = 60$

$5 \times 15 = 75$

$6 \times 15 = 90$

$7 \times 15 = 105$

$8 \times 15 = 120$

$9 \times 15 = 135$

$10 \times 15 = 150$

$11 \times 15 = 165$

$12 \times 15 = 180$

