Models and images for understanding addition and subtraction

Reception
- There are three people on the bus. One more gets on. How many are there now?
- Which line has 2 fewer? Which line has 3?
- How many more can you plant five bulbs in two bowls?

Year 1
- Autumn
  - This domino has 3 spots on one side and 2 on the other. Making 3 altogether. If I turn it around will there still be 5? 5
  - Start at 2, then count on 3: 3 start at 5 count on 5
  - There are 9 grapes. I eat one, how many left? How many are left? And if I eat another?
  - There are 10 people on a bus. 3 get off, how many are left?
  - This tower has 6 cubes and this one has 4 cubes. What is the difference in height?

- Spring
  - What is 3 add 1? 4 plus 2? What is the sum of 6 and 6? What is the total of 5 and 7? What is 2 more than 19?
  - Two numbers could be added to make 9.
  - There are 10 people on the top deck of a bus, and 9 below. How many people altogether?
  - What is 3 cubes on an 8? If it is made away 2 then subtract 1. Subtract 2 from 11. What is 8 less than 9? What is the difference between 14 and 12?

Year 2
- Autumn
  - This domino has 7 spots, 3 on one side and 4 on the other. What number sentences could you write about it?
  - Start at 7 in your number line and count in 3 if you start at 3 and count in 7, will you get to the same number?
  - There are 10 grapes, you eat 4, how many are left?
  - There are 20 people on a bus, 3 get off, how many are left? If two towers have a difference of 3 cubes, what is the height?

- Spring
  - What is 18 plus 4? What is the sum of 14 and 16? What is 15 more than 7?
  - Rod three numbers with a total of 15.
  - What must I add to 14 to make 16? There are 14 people on the top deck of a bus and 9 below. How many are there?
  - What is 14 subtract 21 Subtract 30?
  - What must I add from 20 to make 37?
  - Find pairs of numbers with a difference of 10.

Year 3
- Autumn
  - If 12 dominoes have 20 spots altogether, how many spots might be on each side of each domino?
  - To work out 5 + 2, would you start at 5 and count on 2, or would you start at 2 and count on 5? Which number sentence could you write?
  - You have 29p in your pocket and spend 6p, how much do you have left?
  - There were 24 people on a bus. There are now only 18. How many are left?
  - Which line has most money? How much more?

- Spring
  - What is 17 plus 50? Add 65 to 14. What is the total of sum of 36.
  - Rod three numbers with a total of 10.
  - What must I add to 14 to make 37? There are 24 people on next deck of a bus and 14 below. How many are there altogether?
  - What is 25 take away 8? Take 7 from 42. Subtract 40 from 95.
  - What must I take from 14 to leave 4?
  - What is the difference between 22 and 61?
  - How many more than 4 is 49?

Year 4
- Autumn
  - Increase 46 by 23.
  - Which of these numbers could have a total of 107? Are there any others?
  - What number goes in the box? 9 + □ = 10; □ + 5 = 100.

- Spring
  - The 3 pies are on a cake hanger. Are the 2 more than 3. Are the 2 more than 1?
  - The 3 pies are on a cake hanger. Are the 2 more than 3. Are the 2 more than 1?

- Year 1
  - What is the difference between 14 and 12?
  - What is the difference between 7 and 16?
  - What must I take from 14 to leave 10?
  - What is the difference between 12 and 22?
  - What must I take from 14 to leave 10?
  - What is the difference between 14 and 12?

- Year 2
  - What numbers go in the boxes? 61 + □ = 66; □ + 71; □ + 50.

- Year 3
  - You have 70p and spend 30p, what do you have left?

- Year 4
  - What number sentence would you write?
Potential difficulties

Children may:
- count forwards from one, as they are used to doing so when counting objects but cannot count from any starting number;
- count forwards confidently but lose their place and lack fluency when counting backwards, particularly when crossing the tens boundaries;
- know the answer to one more or one less, but when adding or subtracting larger numbers may make mistakes as they include the first number when counting on/back, e.g. say 16, 15, 14 when subtracting 3 from 16;
- continue to rely on a combining model when adding two or more groups, having to count every object in the combined group rather than counting on from the larger group;
- not identify the number of items in a small group (subitise) and so have to count them out, consequently losing track when subtracting a small number mentally;
- use the take-away model when subtracting, e.g. 22 – 3, counting back to 19, but continue to apply the model to calculations such as 24 – 17 rather than use the difference model and count up from 17;
- count on or back without reference to the tens landmarks or knowledge of number facts and place value, e.g. counting on in ones from 15 when working out 26 – 15 rather than bridging through 20;
- add and subtract by counting on or back but not recognise the inverse relationship between the operations and so not be able to derive the associated subtraction facts from addition facts or vice versa;
- count on or back in tens and ones but not combine these processes, for example when subtracting nine, subtract ten and then add by one;
- associate + with addition and – with subtraction and do calculations such as 4 + 3 and 6 – 4, but not be able to find missing numbers in statements such as □ + □ = 9 and □ – □ = 5;
- recognise what calculation to do when word problems include the words add or take away, but are less confident when other language is used such as fewer, sum, total or difference;
- when shown, use resources or models such as number lines to help with simple calculations but not be able to apply these to unfamiliar contexts or to solving simple word problems.

These examples are drawn from section 6 of the Framework for teaching mathematics from Reception to Year 6.

Examples of progression and application in Years 4 to 6

- Understand and use when appropriate the principles (but not the names) of the commutative and associative laws as they apply to addition:
  - 86 + 95 = 95 + 86
  - 25 + 17 = 17 + 25 = (17 + 10) + 15 = 25 + 35 = 60
- Understand that subtraction is non-commutative, i.e. 5 – 7 is not the same as 7 – 5
- Understand that the sum of two positive numbers is greater that either number and that subtracting a positive number makes a number less
- Understand addition as the inverse of subtraction (addition reverses and vice versa) and use this to check results:
  - 625 – 598 with 538 + 877 = 625
- Respond rapidly to oral or written question, explaining the strategy used:
  - 646 add 50 and 43 subtract 46
  - Add 15, 6, 4, 35 and 1
  - What is the sum of 24 and 39? What is the difference between 28 and 65?

Year 4

- Use known number facts to rapidly answer:
  - □ + □ = □ (□ + □)
  - □ – □ = □ (□ – □)
  - □ + □ = □ (□ + □)
- Use a calculator to:
  - Find all the different totals you can make by using three of these five numbers:
    - □ + □ + □ = □
  - Find all the different totals you can make by using two of the numbers:

Year 5

- Use informal pencil and paper jottings to answer:
  - □ + □ = □ (□ + □)
  - □ – □ = □ (□ – □)
- Use a calculator to:
  - Find all the different totals you can make by using three of these five numbers:
    - □ + □ + □ = □
  - Find all the different totals you can make by using two of the numbers:

Year 6

- Use informal pencil and paper jottings to answer:
  - □ + □ = □ (□ + □)
  - □ – □ = □ (□ – □)
- Use a calculator to:
  - Find all the different totals you can make by using three of these five numbers:
    - □ + □ + □ = □
  - Find all the different totals you can make by using two of the numbers: