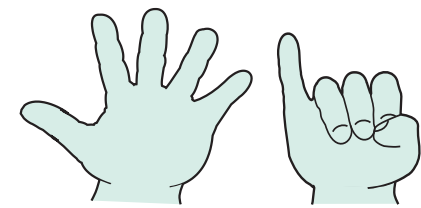
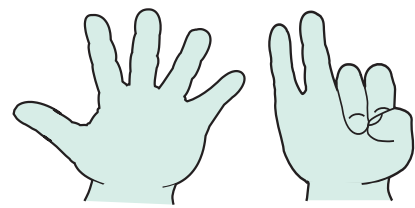


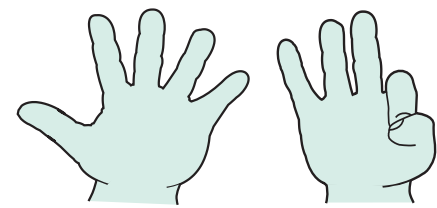
Models and images for partitioning and recombining



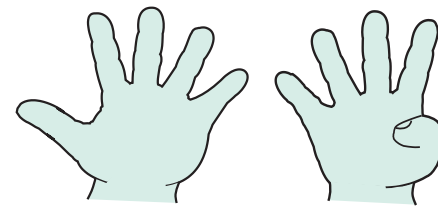
6 is 5 and 1 more
 $6 = 5 + 1$



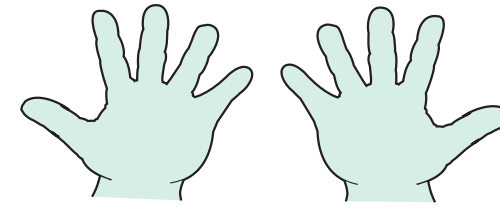
7 is 5 and 2 more
 $7 = 5 + 2$



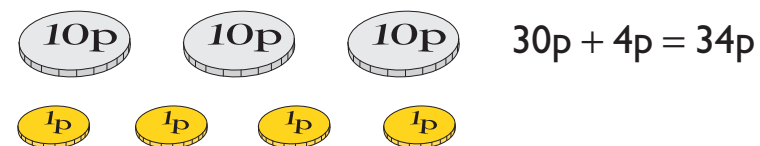
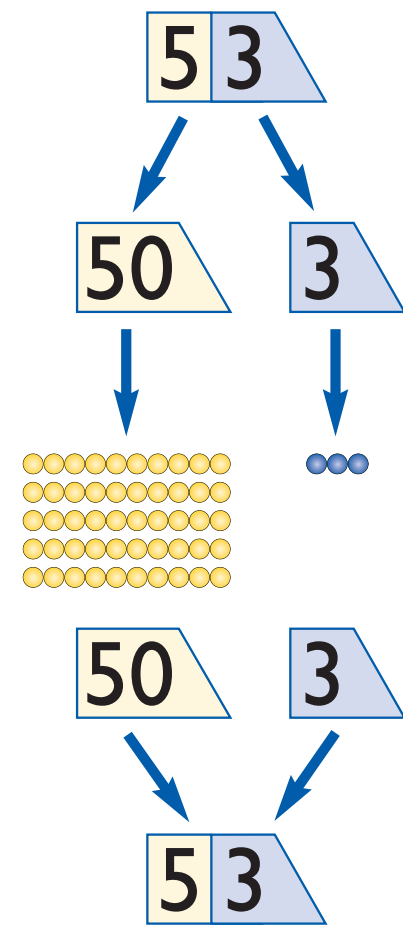
8 is 5 and 3 more
 $8 = 5 + 3$



9 is 5 and 4 more
 $9 = 5 + 4$



10 is 5 and 5 more
 $10 = 5 + 5$



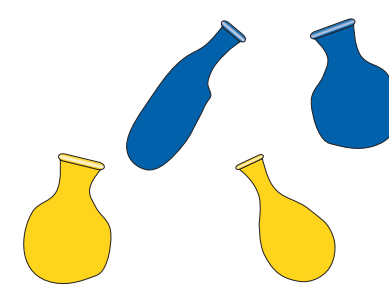
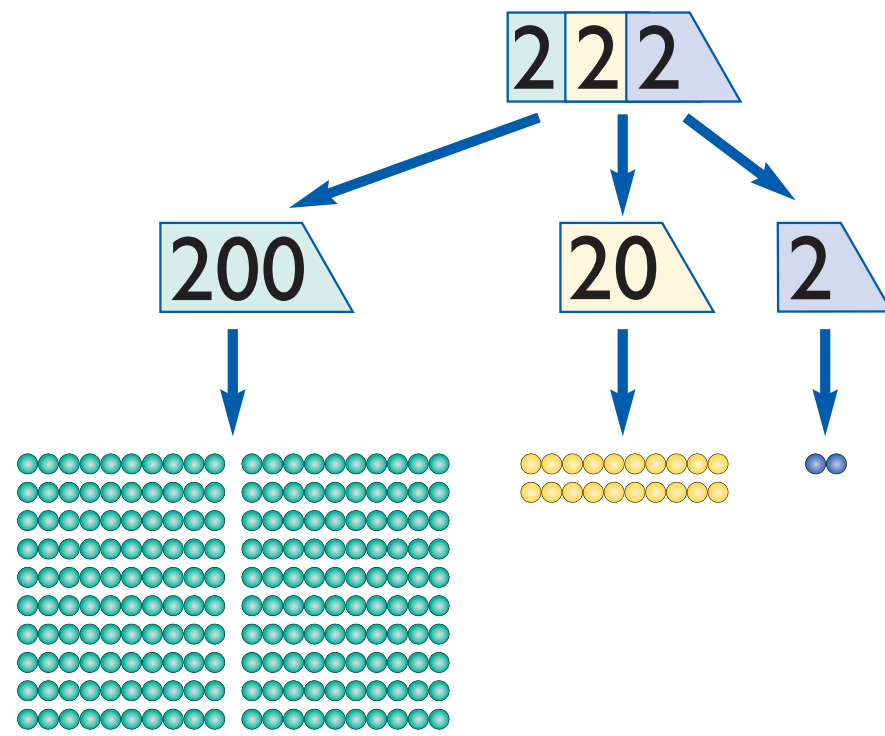
4 1p could be made from 10p + 10p + 10p + 10p + 1p



or 20p + 20p + 1p

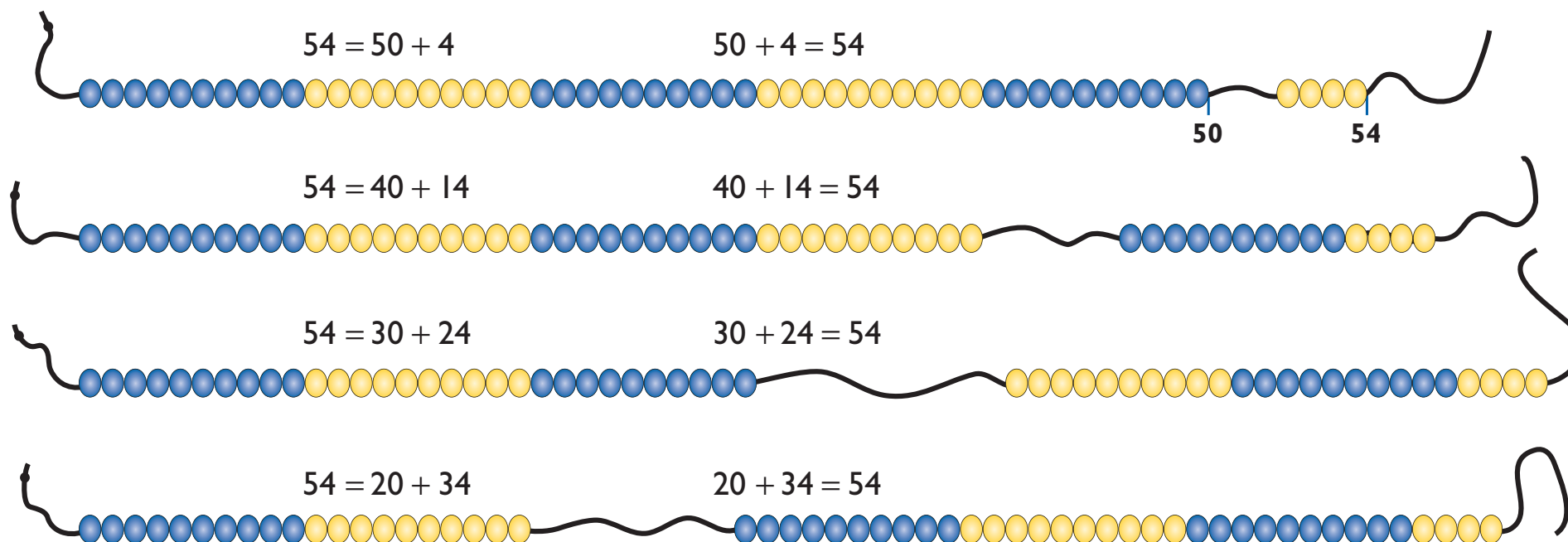
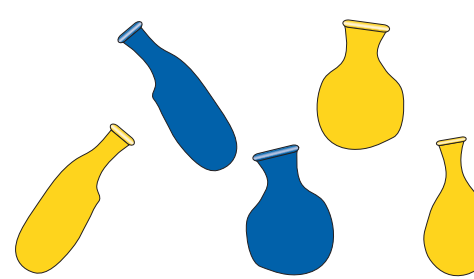


or lots of other ways with 20p, 10p and 1p coins.



$10 + 10 + 4$
 $= 20 + 4$
 $= 24$ balloons

We need 35 balloons
 $35 = 30 + 5$. We need 3 packs of 10 and 5 single balloons



Progression

Reception

- Show some different ways of planting these 5 bulbs in these 2 bowls; putting 5 biscuits on 2 plates.
- I have 4 red buttons and 2 yellow buttons so that's 6 buttons altogether. Can you draw that for me?

Year 1

Autumn

- Show 12 beads. What number is this? Use place value cards to show me the same number. Now show me 17, 19, 11 etc.
- How can I count these shells most easily?



- $8 = \square + 7$ $1 + 7 = \square$
- $8 = \square + 6$ $2 + 6 = \square$
- $8 = \square + 5$ etc. $3 + 5 = \square$ etc.
- How many hands do you need to show me 12? Can you draw it?

Spring

- What number needs to go in the box? $14 = \square + 4$
 $12 = \square + 2$ etc.
- Tell me how you would add $7 + 8$ (5 and a bit $5 + 2 + 5 + 3$).
- What number is the same as one ten and four units?
- What number goes in the box:
 $5 + \square = 6$
What number if we want the answer to be 7, 15?

Summer

- I'm thinking of the number 34. Hold up $\overline{30}$. Can you show me with your cards what is missing?
- I'm thinking of the number 48. Hold up $\overline{8}$. Can you show me with your cards what is missing?
- What numbers go in each box?
 $54 = \square + 4$, $3 + 20 = \square$
 $42 = 40 + \square$, $60 + 7 = \square$
 $42 - 2 = \square$, $63 - \square = 60$
 $19 - 10 = \square$, $\square - 10 = 3$
- Say which number is the same as: one ten and seven ones two tens (and no ones).

Year 2

Autumn

- Make 47p in 10p and 1p coins.
- What numbers go in the boxes?
 $64 = \square + 4$ $50 + 2 = \square$
 $64 = \square + 14$ $40 + 12 = \square$
 $64 = \square + 24$ etc. $30 + 22 = \square$
- How many ways can you make 75? e.g. $70 + 5$.
- What is the value of the 5 in 53?
- What number is 10 more/less than 53?

Spring

- How many different ways can you make 45?
- I have 6 10p coins and 5 1p coins. How much money do I have?
- Show me a calculation where you would use 5 and a bit as a strategy for adding 2 numbers.
- Show me 10, 50, 90. Why is there only one card if it is a two-digit number?
- Show me 69 on the bead string. How many tens, how many ones? How many tens and ones if we add on one?

Summer

- What would you add to 3 to make 53?
to 40 to make 53?
- What numbers go in the boxes?
 $53 = 30 + \square$, $67 - 30 = \square$.
- Use your cards to show me 202. Why are there only two cards if it is a three-digit number?
- I have 68p, how much will I have if I am given two 10p coins, and three 1p coins? What if I spend four 10p coins?

Year 3

Autumn

- What number is on this card $\overline{428}$?
- Write in figures these words: one hundred and sixty seven; four hundred and nine; three hundred and fifty.
- Make me a three-digit number and tell me how you made it.
- What is the value of 3 in 23, 36, 310?
- Which number is bigger 401 or 410? Why?

Spring

- Give 364p in £1, 10p and 1p coins.
- What number has four hundreds, five tens and six ones?
- Partition 502 and 430. What does the zero do?
- Explain your strategy for calculating $55 + 16$, $35 - 24$.
- Change one digit to make 476 into 976. Which digit did you change? What was the 4 worth? What is the 9 worth? By how much have we increased 476?

Summer

- Make the biggest/smallest number you can with these digits: 2, 5, 3. Now read the number(s). What is the value of the 2 in each number?
- In one step make 478 into 978, 263 to 203 etc.
- What numbers go in the boxes?
 $60 + 18 = \square$, $20 + 37 = \square$,
 $10 + 19 = \square$.
- What numbers go in the boxes?
 $43 - 20 = \square$, $54 - \square = 14$,
 $\square - 30 = 66$.

Year 4

- Work out mentally $24 + 58$ and explain how you did it.
($20 + 50 = 70$, $4 + 8 = 12$, $70 + 12 = 82$ OR $24 + 50 + 8 = 74 + 8 = 82$)
- Work out mentally $57 - 19$ and explain how you did it.
($57 - 17 - 2 = 40 - 2 = 38$ OR $57 - 20 + 1 = 37 + 1 = 38$)

Partitioning and recombining

Potential difficulties

Children may:

- record incorrectly numbers they hear, for example hearing thirty-one but reversing the digits and recording 13;
- interpret the two digits in a two-digit number as separate single-digit numbers, for example associate 47 with 4 and 7 not with 40 and 7, as they do not have a secure understanding of place value;
- be able to partition 47 into 40 and 7 but not into 30 and 17 or 20 and 27 etc, for later use when subtracting numbers that involve crossing boundaries or when using 'chunking' as a method of division;
- partition numbers into tens and units, but are less confident when partitioning in other ways, for example 17 into 5s and a bit to get 15 and 2 to help when doubling, or 16 into 15 + 1 and 8 into 5 + 3 when adding 16 and 8;
- recombine tens numbers with units, for example 30 and 2 to get 32, but are less assured recombining tens numbers with two-digit numbers, for example 40 and 38 and recording 438;
- associate combining with joining together rather than with addition, for example writing 40 combined with 2 as 402 rather than $40 + 2 = 42$;
- recognise from saying a number how it can be partitioned, for example that seventy-three can be partitioned as 70 and 3, but are confused by the 'teens' as how they are said does not help with partitioning;
- rely on their interpretation of the value of the digits in a two-digit number and have no images to draw upon to help them 'see' the different ways numbers can be partitioned and recombined;
- misunderstand zero as a placeholder and say that 103 has no tens rather than 10 tens;
- be over-reliant on the language of number to help them recombine and record three-digit numbers, for example saying one hundred and six and recording 1006;
- not associate the components of a number with their magnitudes when they partition and recombine and make errors of scale, for example partition 35 and 47 into 30 and 5 and 40 and 7 when adding, but sum the wrong components $30 + 7 = 37$ and $40 + 5 = 45$ and recombine as $37 + 45 = 712$;
- be over-reliant on partitioning when other calculation strategies are more efficient, for example working through $32 - 3$ as $20 + 12 - 3$ etc rather than counting back 3.

Other useful models and images

Examples of progression and application in Years 4 to 6

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

Year 4

- Read and write whole numbers to at least 10 000 in figures and words, and know what each digit represents.

What is the value of the digit 4 in the number 7451? And the 7?

Write the number that is equivalent to: Seven thousands, four hundreds, five tens and six ones.

- Understand decimal notation and place value for tenths and hundredths, and use it in context.

Convert £13.25 to pence or 125 cm to m.

- Partition into tens and units, adding the tens first.

Work out mentally that $24 + 58 = 82$, because it is $20 + 50 = 70$ and $4 + 8 = 12$, making $70 + 12 = 82$.

- Develop and refine written methods for column addition and subtraction of two whole numbers less than 1000, and addition of more than two such numbers.

$$\begin{array}{r} 625 \\ + 48 \\ \hline 600 \\ 60 \\ 13 \\ \hline 673 \end{array}$$

- Develop and refine pencil methods for $TU \times U, TU \div U$.

$$23 \times 8 \quad \begin{array}{r} \times \quad 20 \quad 3 \\ 8 \quad | \quad 160 \quad 24 \quad | \quad 184 \end{array}$$

$$72 \div 5 = (50 + 22) \div 5 \\ = 10 + 4 \text{ remainder } 2 \\ = 14 \text{ remainder } 2$$

Year 5

- Read and write whole numbers in figures and words, and know what each digit represents.

What is the value of the digit 7 in the number 79 451? And the 9?

What needs to be added to 47 823 to make 57 823?

- Use decimal notation for tenths and hundreds. Know what each digit represents in a number with up to two decimal places.

What is the 4 worth in 7.45? And the 5?

Use a calculator, in one step, change 7.82 to 7.86.

- Use known number facts and place value for mental addition and subtraction.

Work mentally to calculate $5.7 + 2.5$ and $0.57 + 0.25$.

- Extend written methods to: column addition/subtraction of two integers less than 10 000; addition or subtraction of a pair of decimal fractions both with one or both with two decimal places.

$$\begin{array}{r} 7587 \\ + 675 \\ \hline 7000 \\ 1100 \\ 150 \\ 12 \\ \hline 8262 \end{array} \quad \begin{array}{r} \pounds 6.72 \\ + \pounds 8.56 \\ \hline \pounds 14 \\ \pounds 1.20 \\ \pounds 0.08 \\ \hline \pounds 15.28 \end{array}$$

- Use informal pencil and paper methods to support, record and explain multiplications or divisions.

$$346 \times 8 \quad 196 \div 6 = (180 + 16) \div 6$$

$$\begin{array}{r} 2400 \\ 320 \\ 48 \\ \hline 2768 \end{array} \quad \begin{array}{r} 6 \overline{)196} \\ -180 \quad (6 \times 30) \\ \hline 16 \\ 12 \quad (6 \times 2) \\ \hline 4 \end{array}$$

Answer 32 r 4

Year 6

- Use decimal notation for tenths and hundredths in calculations, and tenths, hundredths and thousandths when recording measurements. Know what each digit represents in a number with up to three decimal places.

Convert 1.25 litres to millilitres

Using a calculator, in one step, change 7 to 0.07.

- Extend written methods to column addition and subtraction of numbers involving decimals.

$$124.9 + 7.25 \\ 14.5 \text{ kg} + 750 \text{ g} \\ 401.2 + 26.85 + 0.71$$

- Extend written methods to multiplication of decimals, and division of HTU by TU.

$$4.92 \times 3 \quad 4.00 \times 3 = 12.00 \\ 0.90 \times 3 = 2.70 \\ 0.02 \times 3 = 0.06 \\ \hline 14.76$$

$$972 \div 36 = (720 + 252) \div 36$$

$$\begin{array}{r} 36 \overline{)972} \\ -720 \quad (36 \times 20) \\ \hline 252 \\ 252 \quad (36 \times 7) \\ \hline 0 \end{array}$$

Answer 27

PARTITIONING AND RECOMBINING