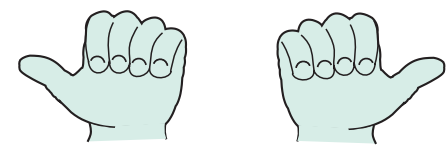
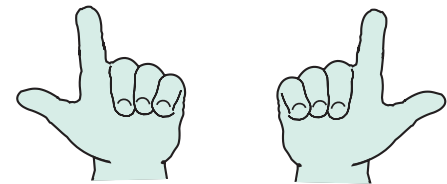


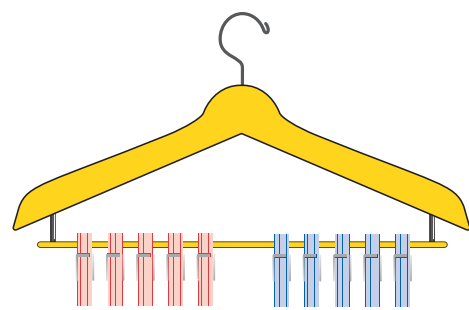
# Models and images for addition and subtraction facts to 20



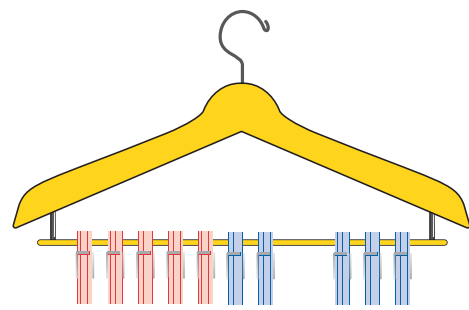
$1 + 1 = 2$        $2 - 1 = 1$   
double 1 is 2      half of 2 is 1



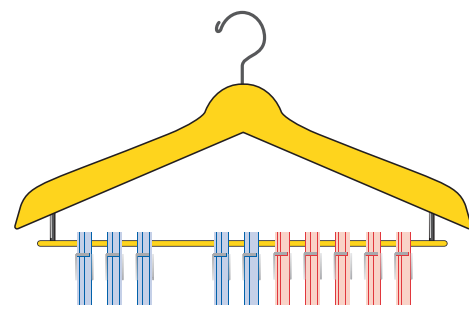
$2 + 2 = 4$        $4 - 2 = 2$   
double 2 is 4      half of 4 is 2  
...





$10 = 5 + 5$





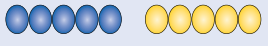
$10 = 7 + 3$




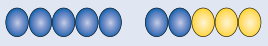
$10 = 3 + 7$


      double 6 = 12       $6 + 6 = 12$   
      half of 12 = 6       $12 - 6 = 6$


      double 7 = 14       $7 + 7 = 14$   
      half of 14 = 7       $14 - 7 = 7$       etc.

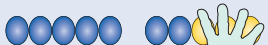
       $10 = 5 + 5$   
 $10 - 5 = 5$


       $10 = 6 + 4$        $4 + 6 = 10$   
 $10 - 4 = 6$        $10 - 6 = 4$


       $10 = 7 + 3$        $3 + 7 = 10$   
 $10 - 3 = 7$        $10 - 7 = 3$


       $10 = 8 + 2$        $2 + 8 = 10$   
 $10 - 2 = 8$        $10 - 8 = 2$

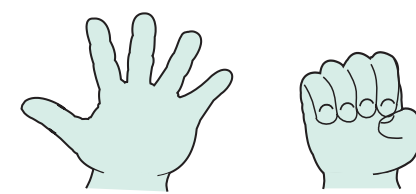
       $10 = 9 + 1$        $1 + 9 = 10$   
 $10 - 1 = 9$        $10 - 9 = 1$

       $7 + ? = 10$        $10 - ? = 7$

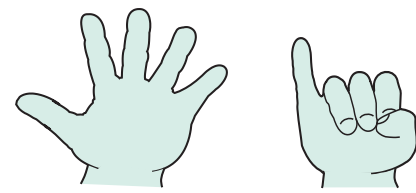
       $6 = 5 + 1$        $1 + 5 = 6$   
 $6 - 1 = 5$        $6 - 5 = 1$

       $7 = 5 + 2$        $2 + 5 = 7$   
 $7 - 2 = 5$        $7 - 5 = 2$

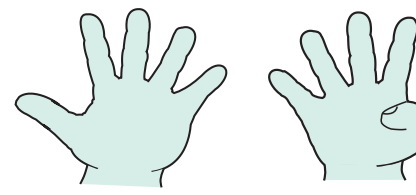
       $7 = 4 + 3$        $3 + 4 = 7$   
 $7 - 3 = 4$        $7 - 4 = 3$       etc.



$5 + ? = 10$        $10 - 5 = ?$



$6 + ? = 10$        $? + 6 = 10$   
 $10 - 6 = ?$        $10 - 4 = 6$






$9 + ? = 10$        $? + 9 = 10$   
 $10 - 9 = ?$        $10 - ? = 9$   
...

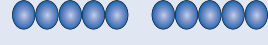
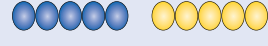
       $8 + ? = 10$



       $7 + ? = 10$



       $7 + 3 = 10$



       $15 + 5 = 20$



       $20 = 10 + 10$   
       $20 - 10 = 10$



       $20 = 15 + 5$        $5 + 15 = 20$   
       $20 - 5 = 15$        $20 - 15 = 5$   
 $(10 + 5 + 5 = 10 + 10 = 20)$



       $20 = 11 + 9$        $9 + 11 = 20$   
       $20 - 9 = 11$        $20 - 11 = 9$   
 $(10 + 1 + 9 = 10 + 10 = 20)$


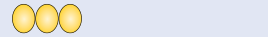
       $20 = 12 + 8$        $8 + 12 = 20$   
       $20 - 8 = 12$        $20 - 12 = 8$   
 $(10 + 2 + 8 = 10 + 10 = 20)$


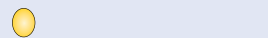
       $20 = 13 + 7$        $7 + 13 = 20$   
       $20 - 7 = 13$        $20 - 13 = 7$   
etc.       $(10 + 3 + 7 = 10 + 10 = 20)$

       $15 = 11 + 4$        $4 + 11 = 15$   
       $15 - 4 = 11$        $15 - 11 = 4$

       $15 = 12 + 3$        $3 + 12 = 15$   
       $15 - 3 = 12$        $15 - 12 = 3$   
etc.

       $17 = 13 + 4$        $4 + 13 = 17$   
       $17 - 4 = 13$        $17 - 13 = 4$

       $13 = 9 + 4$        $4 + 9 = 13$   
       $13 - 4 = 9$        $13 - 9 = 4$

       $11 = 8 + 3$        $3 + 8 = 11$   
       $11 - 3 = 8$        $11 - 8 = 3$

## Progression

### Reception

- What is one more, one less than 6, 4, 8 etc?
- There are 5 toys in a box. If I put one more in (take one out) how many are in the box now?
- How many toes on 2 feet?
- How many pairs of shoes for a horse? How many shoes altogether? And for two horses?

### Year 1

#### Autumn

- What is one more, 2 more than 8?
- What is one less, 2 less than 8?
- Find pairs of cards that total 10.
- If  $7 + 3 = 10$  what else do you know?
- I put 4 pennies in my purse. I add another 3. How many pennies are in the purse now? If I take out 2 pennies, how many pennies are in the purse?

#### Spring

- We have 10 pegs on the coathangers, how can we split them into 2 groups? Is there another way? How can you be sure you have got them all?
- I'm thinking of a number and I add 2. The total is 7. What was my number?
- Put eight bears in a box. Take out 4. How many are there in the box now?
- How many corners do 2 triangles have?
- 10 green bottles ... 3 accidentally fall. How many bottles are left?

#### Summer

- What is 10 more than 16? What is 10 less than 22?
- What is 5 add 10? What is 5 add 9? How did you do that?
- Using digit cards show me two numbers that have a difference of 2.
- How many days are in 2 weeks?
- What is  $4 + 2 + 1$ ?

### Year 2

#### Autumn

- If  $9 - 2 = 7$ , what else do you know?
- What is half of 18, 14?
- What is double 8, 6?
- Which three numbers could add up to 12? Are there any others?
- What is  $4 + 6$ ? What is  $40 + 60$ ?

#### Spring

- What addition facts can you use to help you calculate  $12 - 5$ ,  $19 - 8$  etc?
- Look at this number sentence  $\square + \triangle = 7$ . What could the two missing numbers be? What else?
- Can you show me pairs of numbers that total 17?
- What numbers go in the boxes  $23 - 19 = \square$ ,  $73 - 68 = \square$ ,  $58 + \square = 61$ ,  $85 + \square = 91$ ?
- What is  $6 + 7$ ,  $21 + 20$ ,  $42 + 41$ ?

#### Summer

- I thought of a number and subtracted 9. The answer was 6. What was my number? How do you know?
- Find pairs of cards that total 18.
- Show me on the number line how many steps you must take to get from 13 to 20, or 17 back to 13 etc.
- Make as many number sentences as you can using 6, 5 and 11.
- What is  $43 + 9$ ,  $42 - 9$ ,  $50 - 11$ ,  $25 + 19$ ?

### Year 3

#### Autumn

- $\square - \triangle = 19$ . What could the two missing numbers be? What else?
- What is  $30 + 70$ ? What is  $300 + 700$ ?
- What number would we add to 25 to get 100?
- What is the nearest double to 13, 19, 71?
- Start with 14 on the number line. Count back in threes. Tell me the numbers you get.

#### Spring

- $\square + \triangle - \diamond = 20$ . What could the three missing numbers be?
- How many ways can you use 4, 7, and 11 in a number sentence?
- What is  $127 + 11$ ,  $136 - 9$ ,  $57 - 39$ ,  $103 + 69$ ?
- Continue the pattern  $16 + 3 = 19$ ,  $16 + 13 = 29$  etc. What is  $16 + 83$ ?

#### Summer

- Work out  $3 + 8 + 17$ . What number facts did you use?
- Can you do  $15 - 8$  in your head? How does this help you to find  $150 - 80$ ,  $65 - 58$ ?
- What numbers go in the box  $7 + 7 = \square$ ,  $17 + 17 = \square$ ,  $27 + 27 = \square$ ? What is double 77?
- What is half of 20, half of 16? Can you tell me half of 36?

### Year 4

- Give me four number facts using 19 and 5.
- Find the total of 18, 16, 12, 5. What number facts did you use?
- What is  $5016 - 5009$ ? What simple calculation is this equivalent to?
- What is double 14? What is  $140 + 147$ ?

## Addition and subtraction facts to 20

### Potential difficulties

Children may:

- learn the pairs of numbers that total 20, but not know the pairs that total each of the numbers up to 20;
- be able to add and subtract correctly when told the operation, but cannot decide which operation to use as they do not understand the meaning of, or the relationships between, addition and subtraction;
- be insecure with facts to 20 as they have not progressed from facts to 5, to 10 and to 20, and cannot make links between the different facts;
- think they have to learn that  $3 + 7 = 10$  and  $7 + 3 = 10$  as they do not understand the commutativity of addition;
- interpret the equals sign as 'makes' or 'gives an answer of' rather than 'equals' or think of it as a balance, and cannot interpret  $9 = 2 + 7$  correctly or use this fact to establish  $19 = 12 + 7$  etc;
- not be able to complete number sentences with the empty box in each of the three positions as they only see the empty box as the answer on the right-hand side;
- not record facts correctly as they have few strategies for remembering facts that involve visual images, rhymes or mnemonics etc;
- be unable to identify patterns which they can use to extend their knowledge of number facts, e.g.  $19 - 1 = 18$ ,  $19 - 2 = 17$ ,  $19 - 3 = 16$ ,  $19 - 4 = 15$ ;
- not use visual images enough to help them, for example when doubling 4 not 'see' how the fingers on each hand show  $4 + 4$ , or imagine a balance of 6 red and 6 blue beads when halving 12;
- not associate number facts such as  $13 + 5 = 18$  with  $18 - 5 = 13$  etc as they do not understand that addition and subtraction are inverse operations;
- think that they must always take the smaller number from the larger number, and later have to correct this misunderstanding when introduced to subtraction that involves crossing boundaries as in  $62 - 37$ , or when introduced to negative numbers;
- confuse the vocabulary of addition and subtraction when applying their knowledge of facts to solving problems, for example, associating 'how many?' with adding to find a total, when the question asks for 'how many more?'

## 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

- Derive quickly all number pairs that total 100.

$62 + \square = 100$ ;  $100 = 75 + \square$ ; what needs to be added to 37 to make 100?

- Add 3 to 4 small numbers, find pairs totalling 10, or 9 or 11.

$$4 + 1 + 7 + 9 = 10 + 11 = 21$$

- Use known number facts and place value to add or subtract mentally, including a pair of two-digit numbers.

$$45 + 22 = \square; 76 - \square = 51; 486 + \square = 500; 8400 + \square = 9000; 6000 - 5985 = \square$$

Add several multiples of 10, looking for pairs which total 100.

$$30 + 40 + 70 = \square$$

### Year 5

- Derive quickly decimals that total 1 or 10.

$$\square + 0.8 = 1; 6.2 + \square = 10$$

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

What needs to be added to 3.7 to make 4?

$$0.9 + 0.7 = \square; 470 + 380 = \square; 810 - 380 = \square; 7.4 + 9.8 = \square; 9.2 - 8.6 = \square$$

Work mentally to complete questions such as  $27 + 36 + 13 = \square$  looking for pairs that make multiples of 10 and doing these first.

### Year 6

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

What needs to be added to 6.47 to make 7?

$$5 - 4.81 = \square; 5700 + 2500 = \square; 6200 - 3800 = \square; 0.67 + 0.2 = \square; 0.5 + 0.31 = \square$$

Children will also need their knowledge of addition and subtraction facts to 20 when carrying out pencil and paper calculations. See section 6, pages 48–51 of the *Framework*.