

3

NumberSense

COMPREHENSIVE WORKBOOK

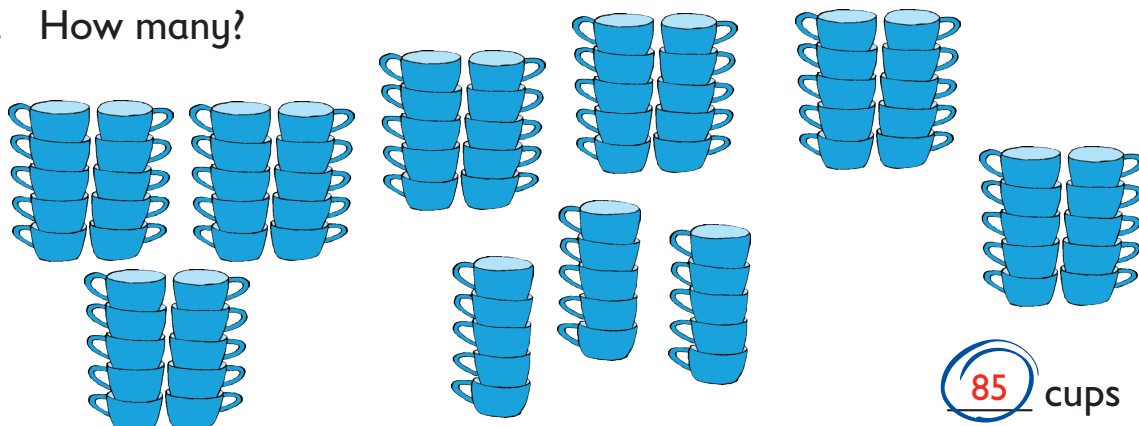
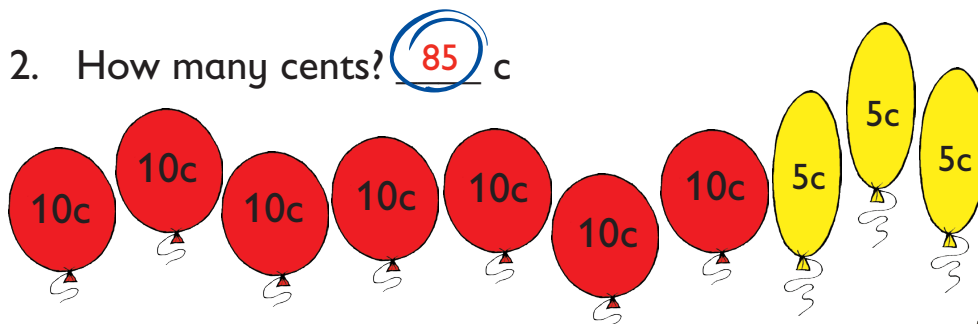
English

Teacher Guide

**MAKING
SENSE OF
NUMBERSense**
PROMPTS, STRATEGIES
& SOLUTIONS



1. How many?

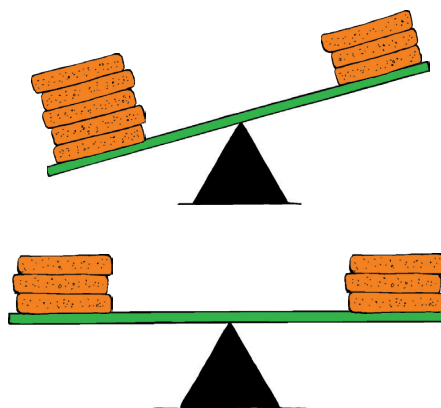
2. How many cents? 85 c

? What is the same and what is different between the cups and the balloons?

The two sides are not equal.

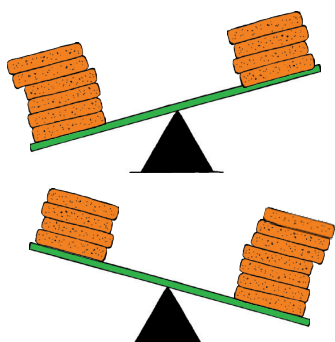
How can we make the sides equal?

We can take away 2 blocks from the side with 5 blocks.

We write: $5 - 2 = 3$ 

3. Make the sides equal.

? What do you notice?

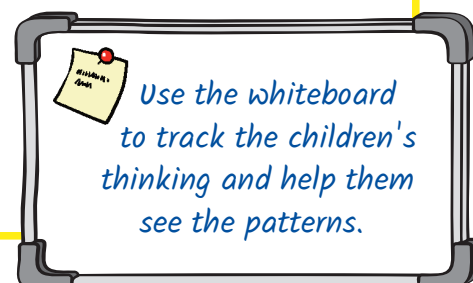


$$6 - 2 = \underline{4}$$

$$4 = \underline{6} - 2$$

$$4 = \underline{7} - 3$$

$$7 - 3 = \underline{4}$$





Things to think about



Activity 3: Make the sides equal



The **New Idea** icon alerts children to a new activity or concept. This icon should also alert you to allow for time to introduce and practise this new idea.

In these activities, children practise making the sides equal by subtracting. Number sentences will become what we call context-free calculations. The completion of these activities is much more about building numbers than it is about 'doing calculations'. You will notice that many of these 'make the sides equal' activities involve patterns and relationships that we encourage the children to notice and use.

Introduce the children to subtraction and the subtraction symbol ($-$) as a means of recording and reinforce addition and the addition symbol ($+$).

With this activity, you should take time to make sure the children understand what is meant by subtraction. You could use a problem as a context as is done on page 2. For example, Fundi has 5 apples. She gives 2 to Yusuf. How many apples are left? Start by modelling with counters or drawing a picture. Then demonstrate how it might look on a see-saw. Finally, write the calculation.

Take time to revisit the see-saw of **Workbook 2** page 8. Remind the children of how we balanced the see-saw by adding blocks to one side. Ask the children to think about another way of balancing the see-saw. More than a few will say that we could have done so by removing blocks from one side. Write both ways of expressing this: $3 + 2 = 5$; $5 - 2 = 3$.



Manipulating number

**Manipulating numbers activity 1: Single-digit arithmetic*

1. Complete.

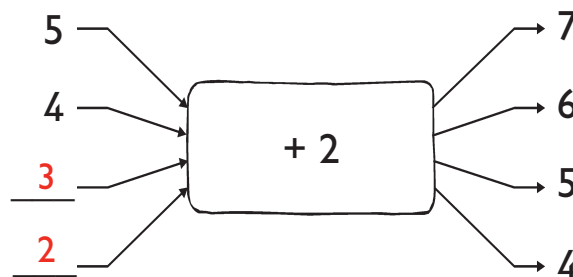


Give 'rules' for how to complete the number chart. For example, start at 70 and go backwards or 'fill in the numbers in the 3rd row'.

1	2					7	8	9	10
11	12								
21	22				26				30
		33	34						
	42			45					
51		53			56				
61	62								70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100



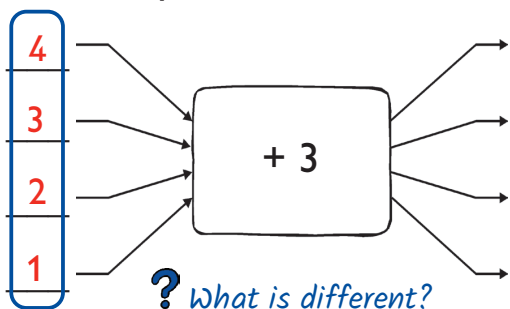
This is a flow diagram. Can you see how it works?



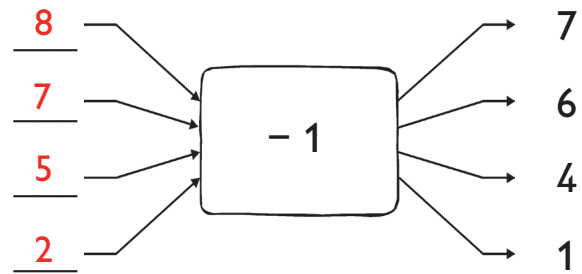
2. Complete.



How does this flow diagram work?



? What is different?



3. Fundi has 3 cookies.

Sara has 1 cookie more.

How many cookies does Sara have?

4 cookies



Differentiation



For more confident children:

- extend to higher number ranges:
1 more than 30?, than 60?, than 100?
10 more than 3?, than 30?, than 110?, etc.





Things to think about



Activity 2: Flow diagrams

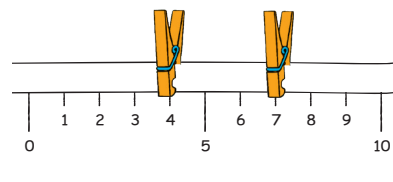
Flow diagrams were introduced in **Workbook 2** but were limited to addition and finding the output numbers. The flow diagrams in Workbook 3 now have unknown input values. Note, we do not expect Grade 1 children to use the vocabulary of 'input' and 'output'.

The purpose of these activities is to reinforce the mental arithmetic activities from the teacher-led activity. The mental arithmetic questions expose children to the patterns in the building of (arithmetic with) numbers. The flow diagrams ask the same questions in a written format.

When the output number is missing it can be thought of as, 'What do we get when we add 3 to 1?' When the input number is missing it can be thought of as, 'What number must 3 be added to, to get 4?' To support this, use a number line and ask,

'What must I add to 4 to get 7?' (See image.).

'Is it bigger or smaller than 7?'. Expect the children to guess and check initially.



Activity 3: Addition- and subtraction-type problem

In **Workbook 2**, the problems all had illustrations that depicted the problem exactly. That is still the case for a few problems in this workbook. However, problems are also introduced in this workbook where the illustration does not illustrate/explain the problem directly.

Remember to do a daily problem-solving routine that prepares children for the problem on the page.

Managing problems

- Pose the problem.
- Children make a plan and solve the problem.
- Teacher monitors the children and identifies:
 - Primitive solution that will help those who cannot get started.
 - Sophisticated solution that reflects understanding and 'where we want to be'.
 - Solutions that represent misunderstanding and/or mistakes.
- Teacher manages discussion and reflection.
- Pose a related problem.



Problem solving

* Compare problems used to support the development of addition and subtraction like responses.

Problem-solving strategies





When activities have groups of 3s, 4s, or 6s, children can count in 1s or 2s, use repeated addition, or break down the numbers to make them easier to count.

6

1. How many?



Every face has two eyes, even when an eye is covered by hair.

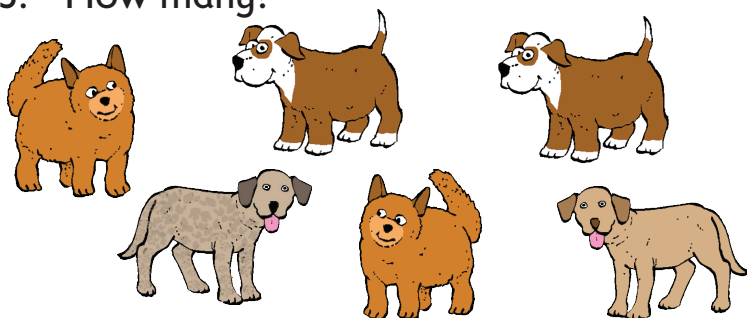
12 children
2 eyes per child
24 eyes

2. How many?



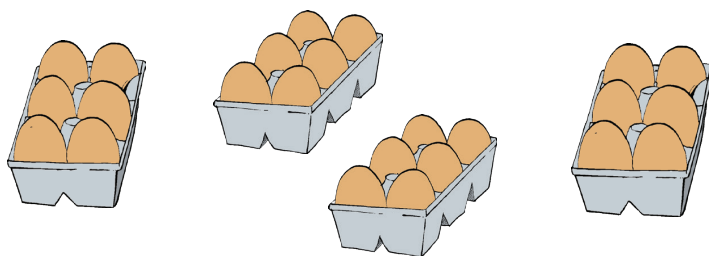
8 tricycles
3 wheels per tricycle
24 wheels

3. How many?



6 dogs
4 paws per dog
24 paws

4. How many?



4 boxes
6 eggs per box
24 eggs

5. Complete.

24 = 12 twos
 24 = 8 threes
 24 = 6 fours
 24 = 4 sixes

? What do you notice?

? What is the same?

? What is different?



The building of these numbers summarises the counting.



Planning a lesson

Understanding the page: key prompts

As part of your preparation, complete the workbook page and these key prompts.

Notice

What mathematics does the page intend for children to notice?

The same number can be counted in different ways.

Plan

Parallel activities: Which activities on the page require a similar activity to sufficiently prepare the children for the page by scaffolding, checking for understanding (consolidating) or extending?

Rote counting:

- 2s, 5s, 10s to 45

Rational counting:

Give the children large groups of counters. Get them to estimate and write down their estimate in their jotters. Then encourage them to find a strategy to count the items quickly and efficiently. Encourage counting in groups of 2s, 5s and 10s. Provide a structure to help the children organise their counting. Compare results and estimates. Discuss which approach to grouping the counters was most effective.

Give the children a number of counters. Differentiate by giving different numbers such as 12, 24, 36 which all work well. Ask the children to find all the ways they can group the number. For example, 12 can be arranged as 6 groups of 2 and 2 groups of 6; 4 groups of 3 and 3 groups of 4. Model this by writing on the whiteboard.

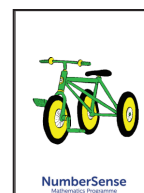
Reflect

Use the question bank to select specific questions to ask about this page during the reflection session (to reveal what we want the children to notice).

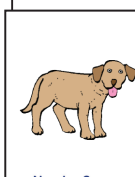
- ? How many sixes do you need to make 12?
- ? How many twos do you need to make 12?
- ? How many fours do you need to make 12?
- ? How many threes do you need to make 12?



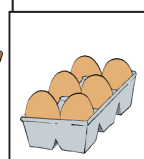
Counting icons



NumberSense
Mathematics Programme



NumberSense
Mathematics Programme



NumberSense
Mathematics Programme



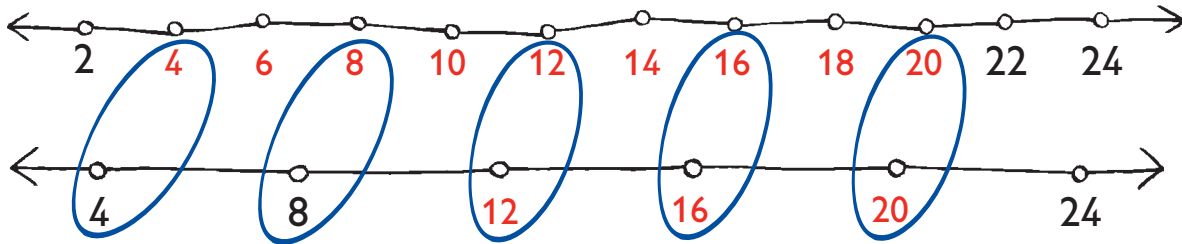
Use the whiteboard to track the children's thinking and help them see the patterns.

? What do you notice?



Every second number when counting in 2s is the same number when counting in 4s.

1. Complete.



If we combine two numbers that are the same, we say that the number is doubled. For example, double 3 = $3 + 3 = 6$



Doubling and halving was first introduced in Workbook 2.

If we split a number into two equal parts, we say that the number is halved. For example, half of 6 = 3 because $6 = 3 + 3$

2. Complete the tables. Note the skipping of numbers in the top row: 3, 5, 7.

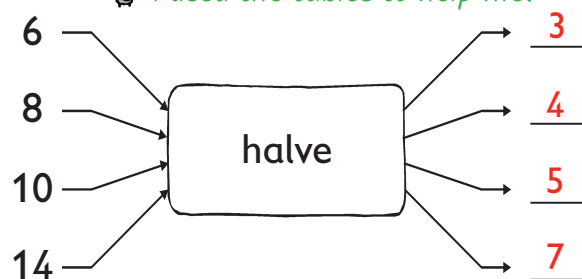
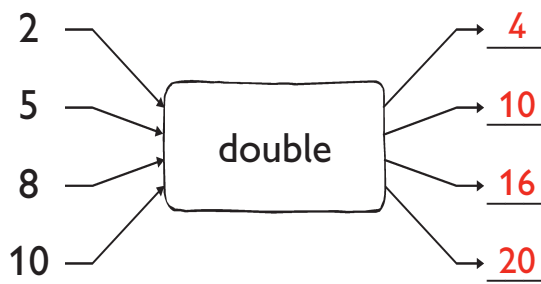
Dogs	1	2	3	5	7	8
Ears	2	4	6	10	14	16

Dogs	1	2	3	4	5	6
Ears	2	4	6	8	10	12

3. Complete. ? What can help you complete the flow diagram?



I used the tables to help me.





Ideas for teaching



Activity 2: Tables

Paired tables are often used to reveal patterns. Ask the children if they can use the top table to complete the bottom table.

? What do you notice about the numbers in the top row and the numbers in the bottom row?



The bottom number is double the top number.

Dogs	1	2	3	5	7	8
Ears	2	4	6	10	14	16



We can double the number of dogs to get the number of ears.

Dogs	1	2	3	4	5	6
Ears	2	4	6	8	10	12



We can halve the number of ears to get the number of dogs.

? How many ears do 3 dogs have?



6 ears.

? If there are 6 dogs, how many ears will there be?



12 ears

? What do you notice?



The number of ears is double the number of dogs.

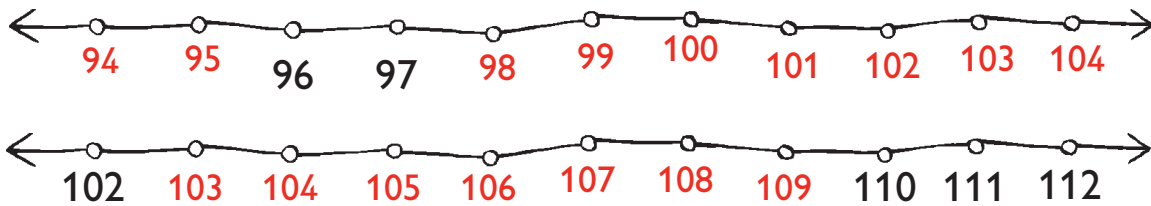
Do not tell the children about the skipped numbers in the table. Use this as an opportunity to assess who is just counting and who sees the relationship between the number of dogs and the number of ears. Encourage them not to simply count but compare the number of dogs and ears.



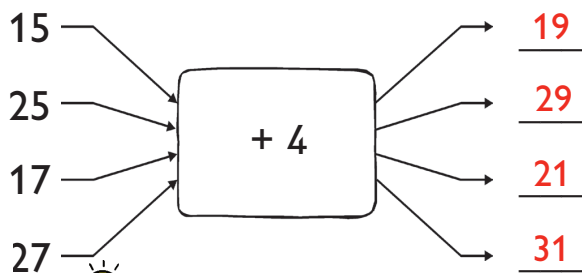
Manipulating number

* Manipulating number activity 5: Doubling and halving

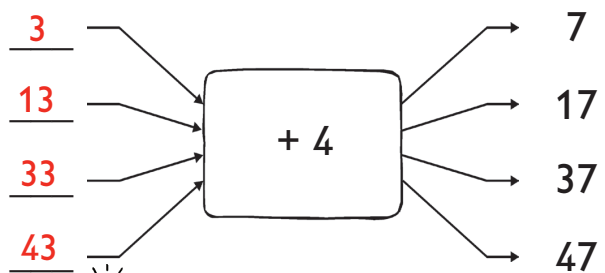
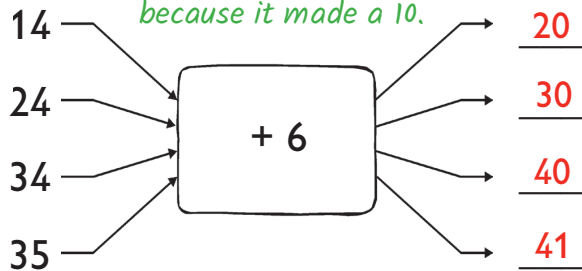
1. Complete.



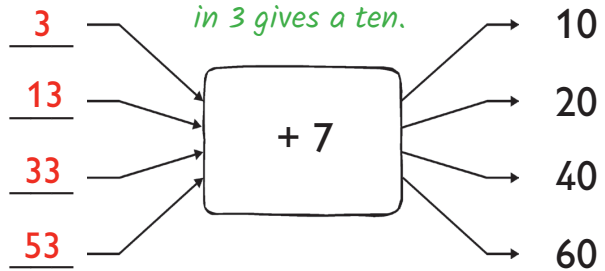
2. Complete. ? Can you use a number line to help you?



Adding 6 to a 4 was easier because it made a 10.



Adding 7 to a number ending in 3 gives a ten.



3. Make the sides equal. ? What do you notice?

$$14 = \underline{12} + 2$$

$$14 = \underline{11} + 3$$

$$14 = \underline{10} + 4$$

$$14 = \underline{9} + 5$$

$$15 = \underline{12} + 3$$

$$15 = \underline{11} + 4$$

$$15 = \underline{10} + 5$$

$$15 = \underline{9} + 6$$

? What is different between making 14 and making 15?

15 is one bigger each time.

? How did you solve this? Where did you start?

$$\begin{aligned} 10 + 6 &= 12 + \underline{4} \\ 10 + 5 &= 12 + \underline{3} \\ 10 + 4 &= 12 + \underline{2} \\ 10 + 3 &= 12 + \underline{1} \end{aligned}$$

$$\begin{aligned} 12 + 6 &= 14 + \underline{4} \\ 12 + 5 &= 14 + \underline{3} \\ 12 + 4 &= 14 + \underline{2} \\ 12 + 3 &= 14 + \underline{1} \end{aligned}$$

? What number are you making on each side of the = ?

p.5

p.4

p.1



Additional prompts and strategies

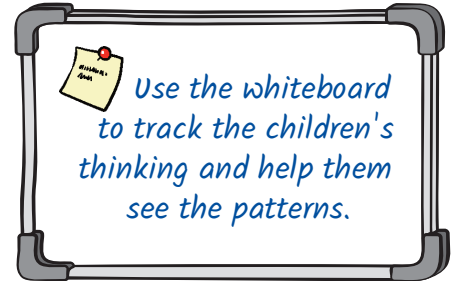


Activity 3: Make the sides equal

Model the equivalence transformation based on the children's explanations:

$$\begin{array}{ccc} 10 + 6 = & 12 + ? \\ \wedge & \wedge \\ 10 + 2 + 4 = & 10 + 2 + 4 \end{array}$$

$$\begin{array}{ccc} 10 + 5 = & 12 + ? \\ \wedge & \wedge \\ 10 + 2 + 3 = & 10 + 2 + 3 \end{array}$$



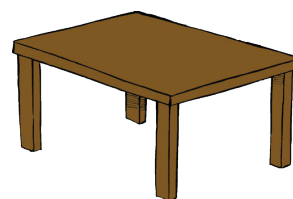
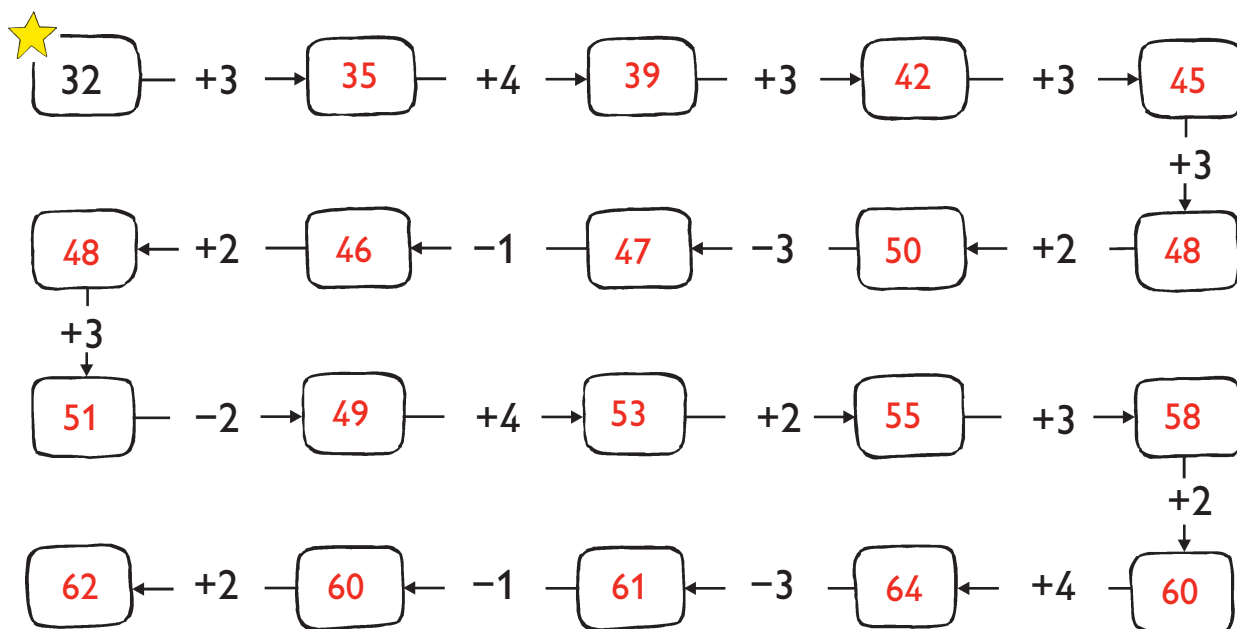
Manipulating number

**Manipulating number activity 3: Completing 10s, 100s and 1000s*

1. Complete.

95 ; 96 ; 97 ; 98 ; 99 ; 100 ; 101 ; 102 ; 103 ; 104 ; 105 ;
106 ; 107 ; 108 ; 109 ; 110 ; 111 ; 112 ; 113 ; 114 ; 115 ; 116 ;
117 ; 118 ; 119 ; 120 ; 121 ; 122 ; 123 ; 124 ; 125 ; 126 ; 127 ;
128 ; 129 ; 130 ; 131 ; 132 ; 133 ; 134 ; 135 ; 136 ; 137 ; 138

2. Complete. Start at the ★



3. Complete the tables.

Tables	1	2	3	4	5	10
Legs	4	8	12	16	20	40

Tables	1	2	4	8	16	17
Legs	4	8	16	32	64	68



Ideas for teaching



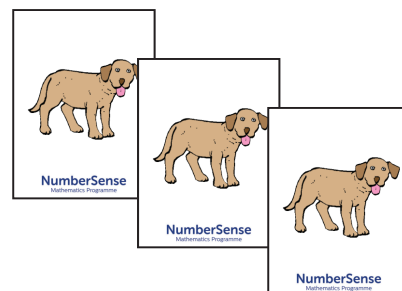
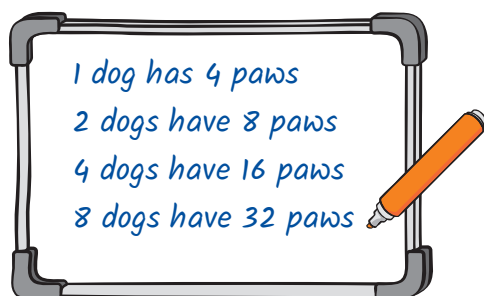
Counting icons



Device posters



Building on what was done on page 44, use icon cards of dogs to allow the children to count the number of paws. Write the following up on the whiteboard as they count/calculate:



Using a table device poster, fill in the answers for 1, 2, 4, 8 dogs. Ask what the children notice and see who notices the doubling happening in the top and bottom row of the table.

Tables	1	2	3	4	5	10
Legs	4	8	12	16	20	40

Tables	1	2	4	8	16	17
Legs	4	8	16	32	64	68

double double
double double

? What do you notice about the answers to 2 and 4?

? How did you know how many legs 17 tables have?



The answer to 2 is double the answer to 1.
The answer to 4 is double the answer to 2.
That means the answer to 8 will be double the answer to 4. I can do this for 16 too!



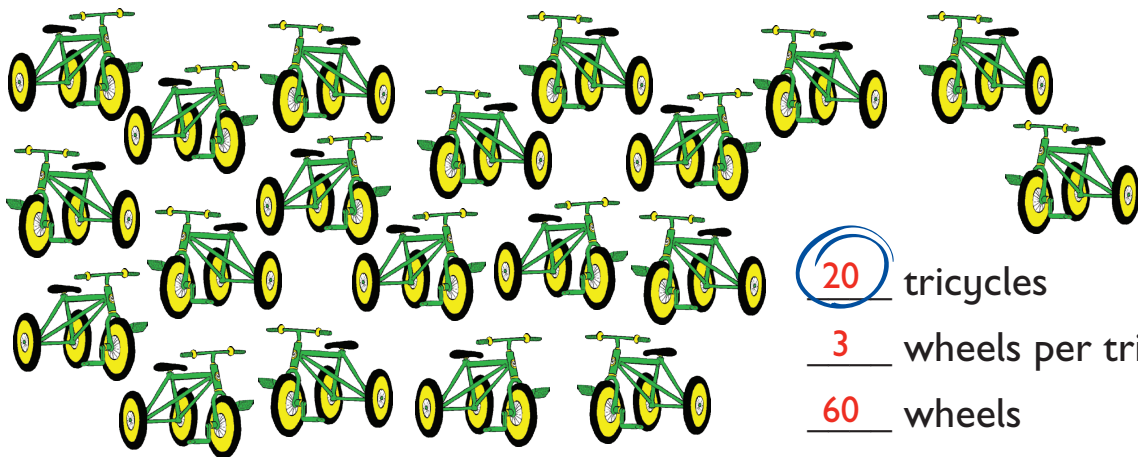
If 16 tables is 64 legs - which I got by doubling the answer to 8 - then 17 legs will be four more legs because it is one more table, 68.

? How many legs would 20 tables have? (double 10 tables) 32 tables?
(double 16 tables) 24 tables? (10 tables + 10 tables + 4 tables).

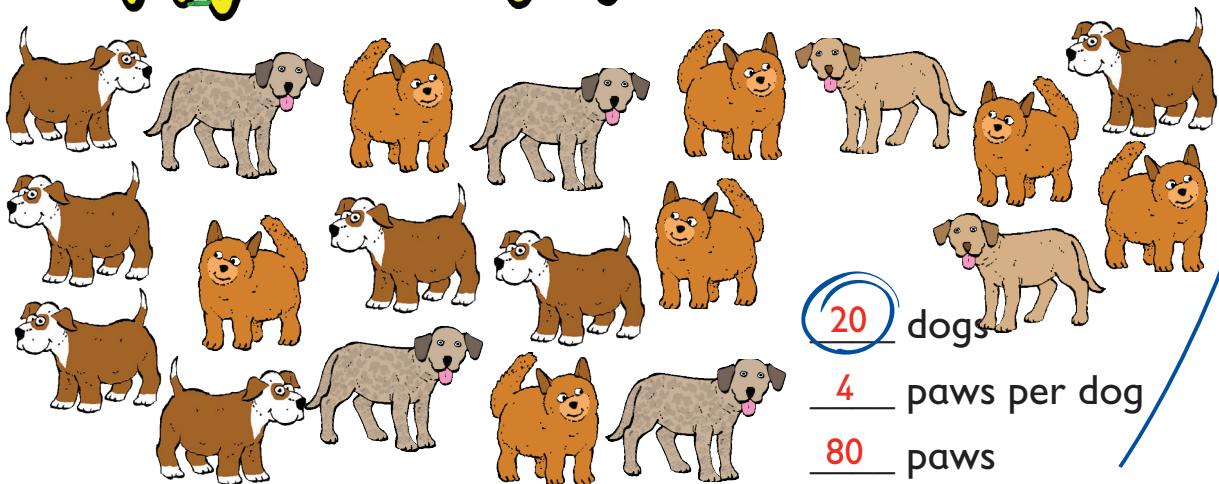
1. How many?



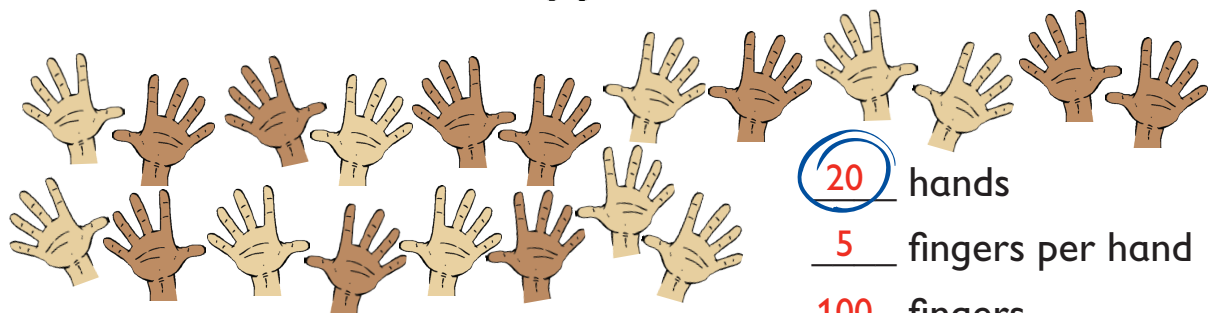
20 children
2 eyes per child
40 eyes



20 tricycles
3 wheels per tricycle
60 wheels



20 dogs
4 paws per dog
80 paws



20 hands
5 fingers per hand
100 fingers

$$20 \text{ twos} = 40$$

$$20 \text{ fours} = 80$$

$$20 \text{ threes} = 60$$

$$20 \text{ fives} = 100$$

? Why are the answers different if they all start with 20?



Planning a lesson

Understanding the page: key prompts

As part of your preparation, complete the workbook page and these key prompts.

Notice

What mathematics does the page intend for children to notice?

Counting in 1s or groups

Counting in some groups (2s, 5s, 10s) is easier than others (3s, 4s).

Plan

Parallel activities: Which activities on the page require a similar activity to sufficiently prepare the children for the page by scaffolding, checking for understanding (consolidating) or extending?

Rote counting: 2s: 42 to 84; 5s: 25 to 105

Rational counting:

- Give all the children a group of counters between 20 and 150. The number of counters given should be a multiple of ten, unless you'd like to extend the group.
- Tell them to group their counters in either 2s, 3s, 4s, 5s, 6s or 10s. Be curious as to how they do so.
- Ask each child how many groups they have. Then ask them how many are in each group. Finally, ask them to count all their counters in a way that makes sense to them without regrouping the counters.
- Model the writing of 'building the number' sentences on the whiteboard once you know their numbers. For example, if they grouped their counters into 30 twos that equals 60 counters in total. If they had 10 fours, that made it 40, etc.

Reflect

Use the question bank to select specific questions to ask about this page during the reflection session (to reveal what we want the children to notice).

? What on the page is the same?



The number of the children, tricycles, dogs and hands was 20.

? What is different?



The groups (eyes, wheels, paws, fingers)

? What do you notice about the answers for the eyes and the paws?



The number of paws was double the number of eyes.

? Which way of counting was quickest? Why?



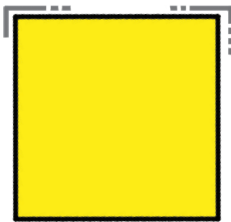
Counting in 5s was quickest and we got to the highest number.

TANGRAM PUZZLE



1. Place the Tangram Puzzle pieces that complete the drawings into the corners and trace around the pieces. The first one has been done for you.

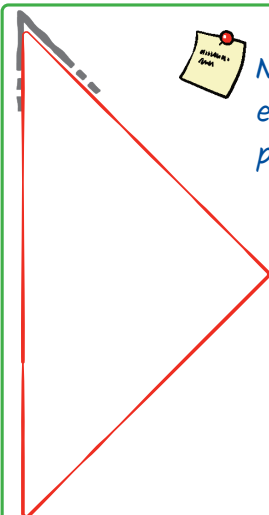
? How many sides does your shape have?



? How many corners does this shape have?



Note that all the shapes except the parallelogram are possible here.



Note that all the shapes except the square are possible here.

? What is the same about these shapes?



Their corners fit the drawing.



? What is different about these shapes?



Some have four corners and some have three.



? How did you get the shapes to fit?



I turned/flipped/moved them.



Discuss this with your friends. Did you use the same pieces?



Ideas for teaching



Activity 1: Tangram puzzles

Play games where you give the properties of the shape and the children must hold up the correct shape from their puzzle. It is not necessary that they use the correct vocabulary at this stage.

? I think of a shape. Its sides are all the same length.



A square.

? I think of a shape. Only two of its sides are equal.



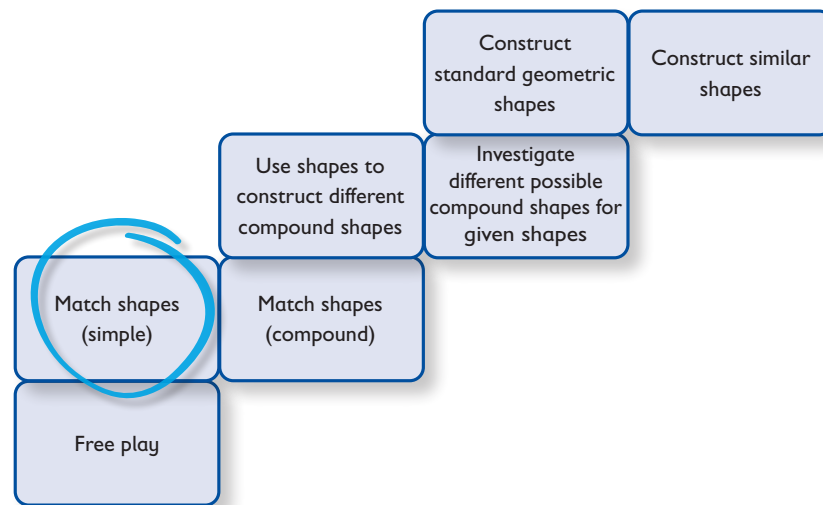
Any of the triangles and the 'squashed rectangle' (parallelogram).

? What should I have said if I wanted only the 'squashed rectangle'?



You should have said that it must have two equal sides and four corners.

Progression in the nature of the 2D shapes tasks.





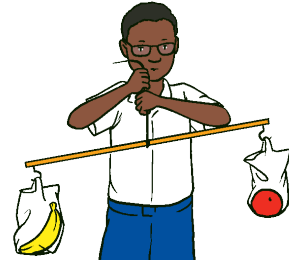
Remember to have your resources ready.

1. Make a simple balance scale.
2. For the pairs of objects provided by your teacher, use the balance scale to determine which object is heavier.



3. Which is heavier, the banana or the apple?

the banana



4. Which is heavier, the brick or the rock?

the rock



5. Which is heavier, the book or the box of pencils?

the book



6. Which is heavier, the butternut or the orange?

the butternut





Things to think about

Weight: Direct comparison: heavier or lighter

In these activities, we expect children to develop confidence in estimating, measuring, comparing and ordering objects in terms of mass using non-standard measures.

It is vital that the children actively participate in the weighing experiences with a range of objects. They should not just complete the page but simulate similar activities as a class. The children should have many opportunities to do this throughout the year.

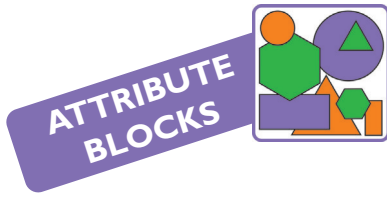
Children should complete each measurement to the nearest whole number of the measuring unit. At this stage we don't want children worrying about parts of the measuring unit.

Lead a reflective discussion with the children after they have completed the activity.

Ask questions such as:

- ? Which container weighs the most? Which container is the biggest?
- ? Which weighs the least? Which container is the smallest?
- ? Did you know these answers before you completed the activity? How could you have known?
- ? Did you all get the same results? If not, why not?

The first analysis of weights should be independent of sight. Put the objects in identical containers (shoe boxes) and let the children pick up and judge the relative weights. Compare the weights of at least three objects using the balance scale.



1. Working in pairs or a small group, put all the small Attribute Blocks in a box. Shake the box. Without looking into the box, take out 10 pieces.
2. Sort the pieces that you took out the box into two groups.
3. Trace the pieces into the boxes below to record how you sorted the pieces.

4. Compare your collection of pieces and explain how you sorted them with another group.





Additional prompts and strategies



Activity 1: Sorting

Remember, the page is only consolidation of the practical activity you should have done during the teacher-led time. For this page, the children should be given all the Attribute Blocks and asked to sort them in a way that makes sense to them.

Take note:

- *Who sorts according to only one attribute? (Colour/shape/size/thickness)*
- *Who sorts according to more than one attribute? (Colour and size or shape and thickness)*

The blocks can be sorted according to:

- *colour*
- *shape*
- *thickness (as on the page)*
- *size*

Doing this introduces opportunities for language like 'and' versus 'or' and 'but not ... because ...'.