Fractions: part–whole relationships

13

Educational context

The activities in this group build on children's own experiences of part–whole relationships within familiar everyday situations, e.g. sharing marbles, a fruit bar, or pizza equally with someone else. Because some of the key ideas children meet in relation to fractions are challenging, this group of activities are visual, practical and use everyday familiar items to enable children to develop their understanding of the relationship between wholes and parts. Children are then given opportunities **to develop understanding of 'one half' as being a special share of a whole – one of two equal parts**.

Children will need to have prior understanding of 'greater than', 'less than' and 'equivalence'. The practical work in this activity group lays the foundation for fraction notation, but it is not introduced at this stage.

Aims

- To recognize wholes and parts of wholes in everyday contexts
- To be able to separate parts from wholes in a collection of real items presented as parts and wholes
- To identify wholes and corresponding parts of a whole
- To create shares and equal shares of a whole or an amount
- To identify and create two equal parts, realizing that a whole can be halved in different ways
- To understand that one half means one of two equal parts of a whole thing or amount
- To be able to share using halves
- To be able to represent half an even Numicon Shape
- To recognize the pattern that is visible when halving even Numicon Shapes in size order

Communicating

Imagery
Numicon Display Number Line

Equipment
See the individual 'have ready' for each activity, various items for the activities in the 'Extending the activities' section.

Words and terms for instruction (supported with signs and symbols)
share, cut, look, separate

Mathematical words and terms (supported with signs and symbols)
whole, wholes, share, shares, sharing, half, halves, parts, piece, equal, equal parts, equally, how many?

Assessment

Individual Record of Progress: Fractions 1–12

Putting the activities into context

Talk with children about common situations involving whole things, e.g. ask children when they last did something with their family. Have some real-life scenarios set up, e.g. 'Part of my puzzle is missing. Can you help me find the missing piece to make it whole?', 'Would you like a part of this chocolate bar?' Make the part–whole relationship explicit and concrete in discussion about the scenario.

Talk with children about situations where they might need to share things with someone else. Be sure to include in the conversation situations involving whole sets of discrete objects, e.g. wrapped sweets, beads, marbles, cherries: 'I have a pack of cards. Can you help me share them all equally between the group so that we can play a game?'; and continuous wholes, e.g. cakes, chocolate bars, pizzas: 'How could we share this whole cake fairly between the four of us?'

Link to Number, Pattern and Calculating 1

Calculating 5

Link to Number, Pattern and Calculating 2

Calculating 16; Numbers and the Number System 6

The activities

Activity 1: Wholes and part–whole relationships

Have ready: a selection of wholes and parts, e.g. a whole jigsaw and a jigsaw piece, a full orange and a segment, a full chocolate bar and a piece of chocolate, an unsliced loaf or wrapped loaf and a slice of bread, a flower and a petal, two sorting rings or card circles

Step 1

Tell children they are going to be looking at whole things and parts that make up a whole. Place the items randomly on the table and ask children to identify the wholes from the selection of parts and wholes. Continue until each child has had a turn.

Step 2

Mix up the items again. Label one sorting ring or paper disc 'wholes' and the other 'parts'. Demonstrate sorting into wholes and parts by placing the petal in the parts ring or circle and saying, 'This petal is part of the flower, so I am putting it here in the circle labelled "parts".' Children sort the rest of the items into parts and wholes.

Step 3

Ask questions about why particular items have been placed in each group. Check understanding by asking children to explain, label (or sign) to justify their categorization.

Step 4

Mix up the items for a third time. Children identify the wholes and their parts and put the pairs together, e.g. put the slice of bread with the loaf. Again, ask children to explain their grouping to check their understanding.

Smaller steps

- Begin by modelling each step, e.g. pick up the orange and say, 'This is a whole orange. Can you find me another whole thing?'

Further practice

- Practise the activity often, varying the selection of items used for parts and wholes.

Activity 2: Halving continuous wholes

Have ready: Numicon Shapes, discs of modelling clay to represent pizzas, plastic knives, two large pizzas (or pizzas made from modelling clay) and a knife

Step 1

Tell children that a friend is coming over for tea but there is only one pizza. Ask them what they think they should do. Agree that the best thing would be to cut the pizza into two equal parts. Give out the modelling dough discs and the plastic knives and ask children to cut their pizza into two equal pieces. Discuss 'fair shares' and ask children if they think they have cut two equal parts. Listen for children who use the word 'half', or ask children if they know how much of the pizza they will get and explain that one of two equal parts is a called a half.

Step 2

Discuss what 'half' means and then cut one of the large pizzas in two so that one piece is noticeably bigger than the other. Ask children if what you have done is fair and to explain their answers. Listen for and reinforce the use of 'half'. Agree that this is not a fair share because the pizza is not cut in half.

Step 3

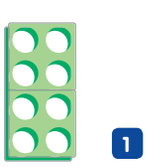
Carefully cut the second large pizza in half. Children look at the two pieces and compare them. Agree that the pizza is cut in two equal parts and that they would be able to share this fairly with their friend.

Step 4

Show children an 8-shape and ask if they know what a half of this would be. Ask if they can think of a way to check. Agree that to find half of the 8-shape we need to find two Shapes the same that fit on top of the 8-shape. Children find two Shapes that are the same to fit on top of the 8-shape (see Fig. 1).

Step 5

Give children Shapes separated into even and odd numbers. They find a half of each even Shape 2–10 and lay out their findings in order, from smallest to largest (see Fig. 2).



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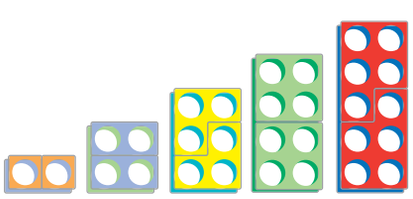

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Step 6

Discuss children's findings about half of each even Shape. Look and listen for those who see a pattern in the relationship of the Shapes and their halves. Discuss the patterns and draw children's attention to them (see Fig. 3).

Step 7

Give children a template for 12 using a 10-shape and a 2-shape. Ask them to find a half of 12. Look and listen for children who refer to the pattern they saw in Steps 4–6 and know that two 6-shapes will fit over the 12 template and that this continues the pattern they saw before.

Step 8

Children continue the pattern with a template for 14. Look for those who see immediately that 7 is half of 14.

Smaller steps

- Give children modelling dough discs cut in two, some with equal parts and some obviously not. Discuss and ask children to identify the fair shares. Explain that these equal pieces are called 'half'.

Further practice

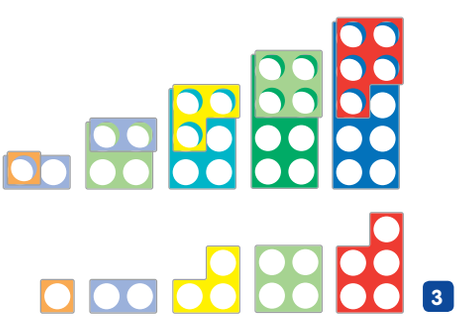
- Provide lots of practical, real-life opportunities for halving a whole, e.g. sharing a small carton of milk equally between two glasses, pouring batter into cake tins, cutting a cake in half.
- Model and reinforce the term 'half' in each scenario.
- Practise Steps 4–6 often and remind children about the patterns seen in this activity.
- Provide paper disks for children to fold in half.

Activity 3: Equal parts of discrete wholes

Have ready: Numicon Feely Bags containing 12 Numicon Coloured Pegs (1 Feely Bag per child), a pack of game cards (used for snap, pre-selected so that they can be shared equally with the group, e.g. 12 cards for a group of 3 or 4 children)

Step 1

Explain to children that they are going to look for 'fair shares': special situations where all of the parts need to be equal when sharing. Show children the pack of cards and ask how they think the cards can be shared between them, so a game can be played fairly. Discuss ideas and check by sharing out. Agree what a 'fair share' is.



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Step 2

Deal the cards and ask children how many cards they each have. When they agree that they all have a 'fair share', play a game of snap. (The distribution of cards at the end of the game should be kept by children for Step 3.)

Step 3

Ask children to look at the cards they each have after the first game of snap. Discuss if these are now fair shares and who might win or who might be 'out' first if another game was played. Ask if this would be a fair game. Children explain their answers and discuss. Agree that, for a fair game, the shares need to be equal.

Step 4

Allow children time to practise dealing the cards and ask them to check that they all get fair shares each time, reinforcing the term 'fair share'.

Step 5

Tell children that you have a Feely Bag with Pegs in to represent apples. Say, 'I have a bag of twelve apples and I need to share them fairly between six children. How many apples will each child get?' Give children a Feely Bag each with 12 Pegs in and ask them to work out how many apples each child will get. Give them time to model their thinking and talk about their ideas.

Step 6

Children agree how many apples each child will get and model the sharing out process with the Pegs to illustrate, saying, 'Yes, there were twelve apples in the Bag and six children. If we share the apples out fairly, they get two each.'

Smaller steps

- Keep the group size small (1-1 or 1-2) for children who are struggling and use fewer cards in the game of snap.
- Make a cake batter and ask children to share the mix between bun cases or cake tins.
- Provide opportunities to share small amounts of familiar items into two or three groups using real-life scenarios.

Further practice

- Show children three bowls of dried snacks with differing numbers of snacks in and ask if they look like 'fair shares'. Ask children to explain their thinking and ask if they know a way to check. Discuss ideas and agree a way to make sure the three bowls have equal shares. Children share the snacks between the bowls equally.

13

Activity 4: Equal parts of continuous wholes

Have ready: Numicon 8-, 1- and 2-shapes, Numicon Coloured Pegs, a chocolate bar with 8 pieces

Step 1

Explain to children that they are going to think about 'fair shares' again. Show them the bar of chocolate and say that a boy wants to share it fairly with his 3 friends. Children think about how the chocolate bar could be shared equally between the 4 children. Listen to and discuss their ideas. Agree that the chocolate bar will need to be broken up to be shared.

Step 2

Ask children if they know how many pieces of chocolate the 4 friends will get each. Ask them how they could share out the pieces. Discuss their ideas.

Step 3

Give children the 8-, 1- and 2-shapes and Pegs. They use the 8-shape to represent the chocolate bar and select from the Pegs, 1- and 2-shapes to try out their ideas.

Step 4

Discuss the ways children illustrated their ideas and ask them again how many pieces of chocolate each of the 4 children would get. Ask them to explain (or sign) and model their answers or, if necessary, model their correct ideas and provide a commentary as you do this, e.g. 'Yes, there are eight pieces of chocolate. If we share these out between four children, they will each get two pieces.' (See Figs 4 & 5).

Step 5

Agree that each child will get 2 pieces and check by placing 2-shapes over each group of 2 Pegs (see Fig. 6). Check by putting four 2-shapes over an 8-shape (see Fig. 7).

Smaller steps

- Provide more real-life scenarios for simple sharing, e.g. a packet of 4 hot cross buns shared between 4 people. Ensure that children have the opportunity physically to break apart the continuous wholes, in this case the pack of buns, and share them out.
- When ready, move on to representing this action using Shapes. For example, use a 4-shape and four 1-shapes or Pegs to represent the packet of 4 hot cross buns and share out the Pegs between 4 children.

Further practice

- Practise the activity often, using a variety of real-life problems and different even Shapes.

Activity 5: Halving discrete wholes sets

Have ready: Numicon 10-shapes, Numicon Coloured Pegs (at least 20), Numicon 1-shapes, a bag of 12 wrapped sweets, two card circles or sorting rings

Step 1

Show children the bag of 12 sweets and say, 'A girl has a bag of twelve sweets and wants to share them with her friend.' Remind them of their previous work on fair shares and halves and ask them if they know how many sweets each child will get. Look and listen for children who say they will get half each or those who know that each child will get 6.

Step 2

Children check their answer by separating the sweets into two equal shares of 6, using the two card circles or sorting rings if necessary. For those who do not know it will be half, or 6, ask them to share out the sweets between the circles or rings and discuss their answers.

Step 3

Lay out 20 Pegs on the table. Children order the set of Pegs and tell you how many there are. Remind them to make groups of 10, if necessary. They check by placing 10-shapes on top of the groups of Pegs (see Fig. 8).

Step 4

Ask children what half of 20 of anything is. Look and listen for children who see that the 20 is already shared out into two groups of 10 and that half of 20 is 10. For those who are not sure, allow time for them to separate the group of 20 pegs into two groups of 10.

Step 5

Discuss their findings and agree that half of 20 is 10.

Smaller steps

- Use a smaller number of items to halve.
- Continue to use two card circles or sorting rings for halving activities.

Further practice

- Repeat the activity often, varying the number of items to be halved.


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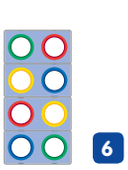
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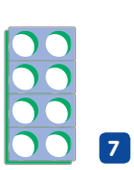
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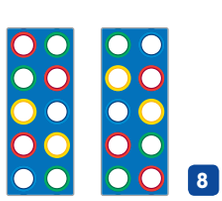
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Extending the activities

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Connecting activities

- Find wholes and parts in the environment; take children around the school building and outside space looking for wholes and parts.
- Collect pictures of parts and wholes (e.g. a cake and a slice, a pack of cards and a playing card) and play memory games where children take turns to find matching parts, wholes and pairs.
- Children make up, answer and illustrate their own real-life problems where sharing and halving are a focus.
- Make a scrapbook of real-life situations involving sharing parts of a whole. Each child designs a problem and presents it to the rest of the group for them to solve. Include the problems and solutions in the scrapbook.
- Provide lots of practical, real-life opportunities to share continuous and discrete wholes to enable children to experience the equal sharing of wholes in a variety of contexts.
- Provide a selection of regular paper shapes for children to fold in half.

For children moving on quickly

- Take further the work in Activities 2 and 5 by working on halves of even numbers.