

Numicon 4 Sample

Number Pattern Calculating



Numicon Overview chart

Format for the Numicon Approach- a teaching programme for Early childhood, Years 0 – 4 and students at a higher level working at these curriculum levels. A programme for those beyond Year 4 is Investigations with Numicon, suitable for a Gifted and Talented programme.

	Teaching Support		Apparatus	Assessment Resources	Activities for Home
	Number Pattern Calculating Teaching Resource Handbook & Implementation guide	Geometry Measures Statistics Teaching Resource Handbook & Implementation guide	Number Pattern Calculating Geometry Measures Statistics	Number Pattern Calculating Explorer Progress books , 3 per student Geometry Measures Statistics Explorer progress Book , 1 per student	Number Pattern Calculating Explore More Copymasters , 1 per class
Year 1 (age 5-6)			Apparatus Pack A 		
Year 2 (age 6-7)					
Year 3 (age 7-8)					
Year 4 (age 8-9)			Apparatus Pack B 		
Year 5 Year 6	Investigations with Numicon Resources currently in development for all elements of Numicon in Years 5-6,(ages 9-11)				

Key mathematical ideas Equivalence, Fractions, Multiplying, Place value, Rounding
Mathematical thinking

Numbers and the Number System

Key mathematical ideas provide a summary of the important concepts.

Introducing decimal fractions

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Typical values	100ml contains	250ml contains	%GDA*	typical adult
Energy	199kJ	500kJ	6%	2000kJ
Protein	47kcal	120kcal		
Carbohydrate	0.5g	1.3g		
of which sugars	10.5g	26.3g	29%	90g
Fat	10.5g	26.3g		70g
of which saturates	trace	trace		
Fibre	trace	trace		
Sodium	trace	trace		
Salt equivalent	trace	trace		

* Guideline daily amounts

Meaningful real-life contexts give children situations they can relate to.

Educational context

In this activity group, children's understanding of part-whole relationships is extended with the introduction of decimal fractions, initially in the context of intervals on measuring scales. The number line is used as the context in which children are encouraged to consider the numbers that lie between whole numbers, and to understand that tenths can be expressed as both common and decimal fractions. Place value within decimal fractions is linked with scaling up or down 10 times, and practical activities using Numicon 10-shapes on a Decimal Baseboard supports children's understanding and their ability to use decimal notation. In the concluding activities, children apply their knowledge of place value to comparing and ordering decimal fractions.

Learning opportunities

- To understand that fractions fall between two consecutive whole numbers on the number line.
- To understand that common fractions and decimal fractions can both be used to represent the same number.
- To know that the decimal point serves to separate the whole and the parts of a mixed number.
- Use knowledge of place value to connect the column value to the quantity value of decimal fractions.
- To use place value understanding to compare and order decimal fractions.
- To round decimal fractions.

Words and terms for use in conversation

intervals, measuring scales, tenth, decimetre, decimal fraction, common fraction, whole number, in between, decimal point, rounding, place value

Learning opportunities detail the range of mathematics introduced in the activity group.

Assessment opportunities

Look and listen for children who can:

- Use the words and terms for use in conversation effectively.
- Say a number that sits between two consecutive whole numbers on the number line.
- Express tenths of a whole as common fractions and decimal fractions.
- Explain that, moving one place from right to left, the value increases 10 times, and, moving one place left to right, the value decreases 10 times.
- Explain that the digit in the first decimal place represents the number of tenths.
- Show decimal fractions correctly using place value cards.
- Compare and order decimal fractions.
- Round decimal fractions to the nearest whole number.

Explorer Progress Book 4b, pages 16–17

After completing work on this activity group, give children the chance to work on their Explorer Progress Book.

Explorer Progress Books offer a great opportunity to assess and monitor progress.

Numbers and the Number System

Focus activities

Activity 1: Introducing decimals through measuring

Have ready: metre sticks, objects to measure

Step 1

Ask children to measure one or two objects around the room with metre sticks. Talk about how many of these objects are exactly, e.g. 1, 2 or 3 metres long. Wait for children to explain that most objects they measure are not exactly the same length as the metre stick; they are 1, 2 or 3 metres, and a bit more or a bit less. Ask what we could do to measure these objects more accurately. Allow children to make suggestions and agree that we need smaller units.

Talk about different measuring situations, e.g. how long, how heavy, how much. Explain that these situations are very different from having a set of discrete, separate objects to count. Discuss with children how scales are marked with smaller and smaller divisions so that they can be used to describe continuous measures more accurately than, e.g. '2 and a bit'.

Step 2

Look at the decimetre markings on a metre stick. Talk about the fraction of the metre stick that they represent. Agree that there are 10 sections on the stick so each section is $\frac{1}{10}$ of the whole stick.

Step 3

Measure the length of a table or height of a bookshelf with the metre stick. Record the length in whole metres and tenths of a metre, e.g. 1 m and $\frac{4}{10}$ m. Say this as 'one whole metre stick and four tenths of a metre'. Draw a number line on the board so children make connections between the measuring activity and the number line. Model locating the whole numbers on the number line and then counting along in tenths, e.g. '1 metre, 1 metre and 1 tenth, 1 metre and 2 tenths, ...' to identify the measurement (e.g. Fig. 1).

Step 4

Give children plenty of opportunities to measure objects and locate numbers on the number line, as in Step 3.



Activity 2: Reading scales

Have ready: weighing scales, capacity vessels, Reading Scales (photocopy master 62)

Step 1

Talk with children about weighing scales and capacity vessels which have scales marked with 10 intervals between the labelled amounts. Show them the scales on Reading Scales (photocopy master 62). Ask them to explain what the instruments with these scales measure and to make comparisons between the scales. Listen for children talking about 10 intervals between each label on the scales and calling these tenths.

Step 2

Repeat Activity 1, Step 3, but this time measure the mass and capacity of objects and record these measurements in whole units and tenths of a unit on a number line. Measurements can also be read from markers placed on the scales shown on Reading Scales (photocopy master 62).

Activity 3: Making connections with fractions on a number line

Step 1

Draw a 0–10 number line and mark and label the whole numbers. Ask children if they know any more numbers that could be labelled on this line. If they struggle, encourage them to think of in-between points by relating the line to familiar contexts such as a 10-hour journey or a 10-kilogram weighing scale. Look and listen for children who suggest mixed numbers like $3\frac{1}{2}$ or $5\frac{1}{10}$ and for those who can explain where these could be positioned. Some children may have the idea that whole numbers are the only numbers. For these children, talk about in-between points until they agree that there are lots of numbers we could label between the whole numbers.

Step 2

Ask children to say a number that sits between any two consecutive whole numbers on the number line. Draw a number line from 2 to 3 and talk to children about where on the line they would label $2\frac{1}{2}$. **Look and listen** for children suggesting dividing the space on the line into two equal sections. Talk with them about where $2\frac{1}{2}$ needs to be positioned.

Step 3

Ask children to label a number between 2 and $2\frac{1}{2}$. Look and listen for children suggesting tenths, e.g. $2\frac{1}{10}$ and for those who can explain that they need to divide each half into a further five sections, making ten equal sections between 2 and 3. Agree that halfway along is $\frac{5}{10}$ and so the halfway point is 2 and $\frac{5}{10}$. Then find 2 and $\frac{3}{10}$ and similar points. Some children may suggest 2 and $\frac{1}{4}$ and explain that they know that $\frac{1}{4}$ is half of a half. Agree that this would be positioned halfway between 2 and $2\frac{1}{2}$, which is also halfway between 2 and $\frac{2}{10}$ and 2 and $\frac{3}{10}$.

New learning is introduced through real-life scenarios. In this activity group, children start to learn about decimals through measuring.

A clear list of the concrete objects used to support learning is provided at the start of every focus activity.

'Look and listen for...' points help you to assess how children are responding to activities.

Activities for children to complete at home give children further opportunities to talk about mathematics.

Numbers and the Number System

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Activity 4: Introducing decimal notation

Have ready: Place Value Frame – HTU (photocopy master 60), number rods, base-ten apparatus or interlocking cubes, Explore More Copymaster 14: Milk Round

Step 1

Remind children about the work they did with the number line in Activity 3. Give any two points on the number line for children to say a number in between, including, e.g. 3 and 4, 3 and $\frac{4}{10}$ and 3 and $\frac{7}{10}$. Also include much larger numbers, e.g. 51 and 52, 251 and 252.

Explain that there is another way to write in-between numbers: using a decimal point. Refer to these as 'decimal fractions'. Show children how to write decimal fractions using a point in between the whole number and the tenths. Encourage them to notice that the decimal point separates the whole and the parts. Discuss how we read and say decimal fractions, e.g. 2 and 5 tenths is written as 2.5 and said as '2 point 5'.

Introduce the term 'common fraction'. Explain that we use this term to describe all the fractions children have learnt – proper and improper fractions and mixed numbers – whereas 'decimal fractions' describes fractions where the parts and wholes are separated by a decimal point.

Encourage children to understand that they can write the same number using decimal or fraction notation, e.g. $2\frac{1}{2}$ is the same as 2.5, just written differently.

Step 2

Work with children to write a few of the measurements made during Activities 1 and 2 as decimal fractions, e.g. 2 m and $\frac{5}{10}$ m is written as 2.5 m and 1 kg and $\frac{7}{10}$ kg is written as 1.7 kg. Encourage them to identify the whole unit and the parts of a unit each time.

Step 3

Show children the Place Value Frame – HTU (photocopy master 60; see Fig. 2). Make connections with previous place value work to help them understand that digits written in a particular place signify a particular value. Listen for children who can talk about the whole numbers as units or ones and encourage them to make links between the quantity values for each place so that they begin to explain that places to the left get '10 times bigger' and places to the right get '10 times smaller' each time. Encourage plenty of discussion about this, moving digits between places to explore the quantity values.

Hundreds	Tens	Units	tenths
		4	2

2

Step 4

It is important for children to make the link that the tenths are 10 times smaller than the units. Make reference to this with apparatus and in everyday examples, e.g. compare 1 to 10 using base-ten apparatus, number rods or interlocking cubes, and talk about 1 biscuit out of a packet of 10, £1 and £10, 1 and 10 minutes. Move on to examples such as 40 and 4, 60 and 6. Remind children of their work on multiplying and dividing by 10, and its effect on place value, in Calculating 7 (pages 180–186).

After completing work on this focus activity, give children the chance to take home and complete Explore More Copymaster 14: Milk Round

Activity 5: Using Numicon Shapes to support decimal notation

Have ready: Numicon Baseboard Laminates, Numicon 1-shapes, Numicon 10-shapes (grey if available), Decimal Grids (photocopy master 18)

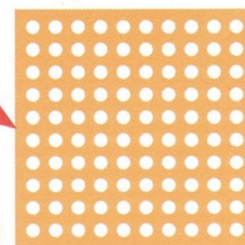
Step 1

Show children the Decimal Baseboard and compare it to a Numicon 1-shape (see Fig. 3). Wait until children talk about the relative sizes. Agree that the Decimal Baseboard is 100 times bigger than the 1-shape.

Ask children to imagine that the 1-shape has been put under a microscope or magnifying glass and magnified 100 times, making it 100 times bigger and allowing us to see that it is made up of 100 smaller parts. Talk with children about what we can see when we magnify other objects under a microscope and how this is useful in, e.g. medicine, science and technology.

Step 2

Place ten 10-shapes on the Decimal Baseboard. Ask children to imagine that here the Shapes are, like the Decimal Baseboard, under the microscope, and have been magnified. Agree that ten of these 'small' 10-shapes fill the Decimal Baseboard. Encourage children to name each Shape as a fraction of the whole. It may help children to use the 10-shapes to represent packets of pencils or biscuits and talk about how many packets are in the whole box, allowing them to name each packet or Shape as a tenth.



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Concrete materials help illustrate children's thinking and reasoning.

Numbers and the Number System

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Step 3

Ask children to agree on the amount of the Decimal Baseboard covered by one of the 10-Shapes (e.g. Fig. 4) and to say and write this as a fraction and a decimal: one tenth, $\frac{1}{10}$, zero point one and 0.1. Agree that these are all equivalent and that they are different ways of saying or writing the same number.

Step 4

Repeat until children are confident saying and writing the fraction and decimal equivalents for two, three (see Fig. 5), four or more Shapes on the Decimal Baseboard, and are able to represent a given decimal fraction on the Decimal Baseboard. Talk again about how many of the Shapes fill the whole board. Agree that $\frac{10}{10}$ make a whole.

Step 5

Children can shade Decimal Grids (photocopy master 18) with 10-patterns to represent 10-shapes on the Decimal Baseboard, labelling them with fraction and decimal equivalents (e.g. Fig. 6).

Step 6

Work with children to represent the decimal parts of various numbers, e.g. 5.3, 4.5, 13.6, 23.2, on the Decimal Baseboard. Look and listen for children who can explain that 5.3 is 5 whole units and 3 tenths and for those who can show this on a decimal grid or Decimal Baseboard.

Careful progression is built into every activity group, and across the whole teaching programme, helping children become fluent through understanding.

Activity 6: Using decimal place value cards

Have ready: base-ten apparatus, Place Value Cards

Step 1

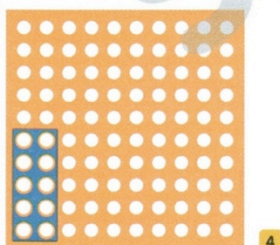
Show children base-ten 100-flats and 10-sticks. Ask how we could use these to represent decimal numbers. Look and listen for children who compare the sizes and identify that ten 10-sticks make a 100-flat, so the 10-sticks could represent tenths.

Step 2

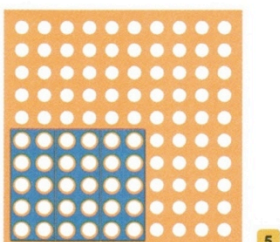
Give children a set of Place Value Cards. Ask them to make a decimal number with the cards, read it, and then make it with the apparatus. Listen for children who can read the decimal numbers and explain the column and quantity value of each part, e.g. '2 point 3' is 2 and 0.3. Look and listen for children who can make each number with base-ten apparatus (e.g. Fig. 7).

Step 3

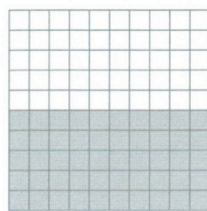
Ask children to repeat for other examples, before swapping the order to select the apparatus first and then make the number it represents with Place Value Cards.



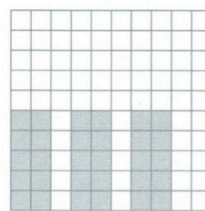
4



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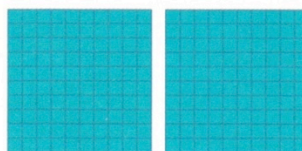
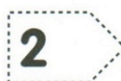
0.5, $\frac{5}{10}$



0.3, $\frac{3}{10}$

6

2.3



7

'Using and applying' is supported through use of real-life contexts.

6

Activity 7: Comparing decimal quantities

Have ready: Numicon Baseboard Laminates, Numicon 10-shapes (grey if available), Place Value Cards, base-ten apparatus or counting stick, photos of decimal points appearing in everyday contexts, a variety of food nutrition labels

Step 1

Ask children to think about the contexts and places in which they have seen decimal numbers used. Display photos of decimals used in different everyday contexts and notice that some, e.g. money, have more than one digit after the decimal point. In each case, look and listen for children making the connection that the digit in the first decimal place represents tenths of the whole unit, e.g. the first decimal place when looking at a price such as £2.15 is worth 1 tenth of a pound: 10 pence.

Step 2

Collect some food nutrition labels (e.g. Fig. 8) from packaging for, e.g. sandwiches, cereals, biscuits or drinks. Talk about what these labels show and why they are useful.

Step 3

Read with children the mass of protein, sugar, fat, carbohydrate or fibre in a serving. Encourage them to talk about the quantities in comparison with each other, e.g. 'There is more protein than sugar in this food.' Ask them what they need to know about decimal numbers to be able to say this. Look and listen for children who realize that they have to be able to order the amounts to say which is larger or smaller.

Step 4

Compare 2.3 and 3.2. Ask children to make these numbers with Place Value Cards and to make the decimal parts with 10-shapes on the Decimal Baseboard, explaining how they know which number is larger and which is smaller. Look and listen for children generalizing that if the whole number is larger then the number is bigger, regardless of the decimal digit.

Explore partitioning both numbers by separating the place value cards and naming the parts: 2 and 0.3, 3 and 0.2. Use the < and > signs to show the larger and smaller number: $2.3 < 3.2$, $3.2 > 2.3$. Make comparisons with whole numbers by asking children how they know that 32 is greater than 23.

Step 5

Repeat Step 4 with the numbers 2.3 and 2.6. Look and listen for children who can identify that this time the whole number is the same, but 2.6 is the larger number or greater amount because 0.6 is more than 0.3.

Show children a number line or a counting stick with 2 labelled as the starting point and 3 as the end point. Ask children to find the positions of 2.3 and 2.6 to confirm which is the greater and which is the lesser amount. Alternatively, use base-ten apparatus or 10-shapes and Decimal Baseboards to make the decimal part of each number and compare (e.g. Fig. 9).

Step 6

Look back at the nutrition labels. Ask children to come up with their own statements or questions about the nutrition information and use the 'is greater than' and 'is less than' symbols in their responses.

Step 7

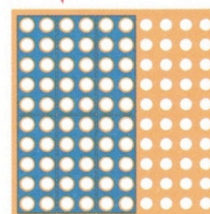
Encourage children to come up with generalizations about ordering decimal numbers, e.g. always look at the whole number part of the number first and then compare the tenths.

Activities are supported by clear illustrations.

NUTRITION INFORMATION		
Typical values	per 40g serving*	per 100g
Energy	237kcal	255kcal
Protein	11.4g	11.0g
Carbohydrate	33.4g	60.0g
sugars	9.8g	1.0g
Fat	6.7g	8.0g
saturated fat	2.8g	1.5g
Dietary fibre	1.6g	9.0g
Sodium	0.1g	trace

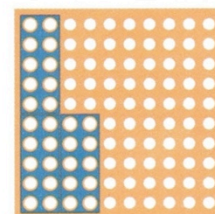
*with semi-skimmed milk

8



0.6

>



0.3

9

Numbers and the Number System

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Activity 8: Ordering decimals in a list

Have ready: a variety of cereal boxes or food nutrition labels for breakfast cereals, blank cards, number line in 0–20 and 20–40 sections, adhesive tack or washing line and pegs

Step 1

Provide children with a variety of cereal boxes or food nutrition labels for breakfast cereals. Ask them to look at the nutrition information and talk about what they notice, and whether anything surprises them. Look and listen for children making sense of the numbers and using comparative language to say that, e.g. a serving of one cereal contains more sugar than a serving of another.

Step 2

Ask children to write the name of each cereal and the amount of sugar in a serving on separate cards. Ask them to talk together to put these amounts in order. Look and listen for children quick to spot the smallest and largest numbers in the list and for those who work systematically through the list looking at the whole numbers and then the first decimal place.

Step 3

Display the cards in order, e.g. on a washing line or stuck on a board, to show the least to the greatest sugar content in a serving. Talk about what children have found out and why this information is useful.

Step 4

Give children a 0–40 number line (e.g. Fig. 10). Ask them to draw arrows to show the amount of sugar in a serving of each cereal.

Step 5

Once children understand how to estimate the position of decimal numbers on the number line, ask them to say which pair of whole numbers each amount of sugar is between, e.g. for Cereal A the amount of sugar is 14.8 g, which is between 14 and 15.

Step 6

Repeat this type of ordering activity for different contexts involving, e.g. distance or capacity measurements.

Activity 9: Rounding decimals

Have ready: Numicon 10s Number Line and Numicon 10-shapes, or Numicon 1–100 cm Number Rod Track and 10-rods, weighing scales, objects to weigh (a range of masses up to, e.g. 5 kg)

Step 1

Ask children to talk about rounding and when it is useful. Look and listen for children who suggest estimating or when a rough answer is sufficient.

Ask a few children to estimate the mass of some objects around the room to the nearest kilogram. Record some of the suggestions.

Step 2

Using some scales marked with kilograms, weigh the objects. Talk to children about how to read the measurements accurately, to the nearest kilogram. Decide whose estimates were the closest.

Step 3

Show children the following list of mass measurements: 3.4 kg, 3.5 kg, 3.2 kg, 3.9 kg, 3.1 kg. Talk about which of these would round to 3 kg, to the nearest kilogram.

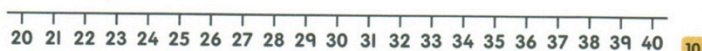
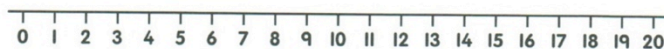
Step 4

Use the 10s Number Line or the Number Rod Track. Tell children that each 10-mark represents a tenth of a kilogram. Ask children to put 10-shapes on the 10s Number Line or 10-rods in the Number Track to represent the decimal part of each number, as they talk about the measurements in the list. Listen for children talking about the quantities that are over the halfway point and therefore round to 4 kg instead of 3 kg.

Step 5

Repeat until children can confidently explain how to round decimals to the nearest whole number. Look for opportunities in the day to record and round decimal numbers, e.g. in data handling or science investigations where children are asked to use stopwatches, electronic scales or data loggers. Discuss whether the results need to be recorded with one decimal place or to the nearest whole unit, depending on the context.

'Low threshold, high ceiling' activities give the opportunity for the whole class to be engaged in the same mathematics, even if they are working at different levels.



Numicon Year Four Number, Pattern & Calculating

Success!







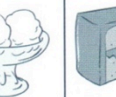

Numbers and the Number System 6: Introducing decimal fractions

Have ready: Numicon 10-Shapes, Decimal Place Value Frame (photocopy master 10), Decimal Baseboard Laminates (photocopy master 11), Decimal Number Line (photocopy master 12)

Date ____/____/____

How Much Sugar?

Arrange these amounts of sugar along the number line.

							
14.8 g	13.6 g	12.8 g	6.2 g	4 g	3.2 g	10 g	5.4 g

What is the difference between the highest and lowest amounts?
Can you explain how you worked this out?

Explorer Progress Books offer you opportunities to assess individual children and monitor progress.

Teacher notes

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Children have the freedom to record their answers in their own way, allowing you to see their thinking.

Have ready: Numicon 0-9 Numeral Cards, Numicon 10-Shapes, Decimal Place Value Frame (photocopy master 10), Decimal Baseboard Laminates (photocopy master 11), Decimal Number Line (photocopy master 12)

Date ____/____/____

Making Decimal Fractions



Can you choose 3 of these numeral cards to make a number between 15 and 20?
How many different numbers can you find?



Can you put your numbers in order? Can you explain how you worked this out?

Tasks presented to children in unfamiliar ways invite 'non-routine' problem solving.

Teacher notes

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Numbers and the Number System 6: Introducing decimal fractions

Open activities give you the opportunity to see how well children can use and apply.

Success!

Next steps to find out more about Numicon



www.numicon.co.nz has a wealth of information about Numicon, including video introductions to resources, free teaching support and details of professional development.

Visit the website to:

- Find out more about the Numicon Approach
- Book your place on a course
- Discover how Numicon raises achievement in mathematics with example case studies. The flow-on effect is seen in other subjects too.
- Join the mailing list to learn about events, tips and courses in your area. Emails are generally sent one per school term.

