

Assessing with Numicon

A proven approach



Help all your students achieve in Mathematics

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Numicon is a multi-sensory approach to understanding mathematics, built on a proven pedagogy that raises achievement across all ability levels

With clear opportunities to assess the understanding of each child, Numicon enables you to confidently inform others within the NZ Curriculum guidelines.

Your students' progress can be carefully tracked and evidenced, so you can ensure every child achieves end of year expectations and is ready for secondary school.



You can assess with Numicon by:

1. Implementing clearly defined formative Assessment Opportunities provided in each activity group every day, by **looking and listening** to students while being alongside their learning.
2. Using the **Explorer Progress Books** to capture each child's ability to apply their knowledge and understanding to problem-solving and connections with everyday life - maths.
3. Have discussions with students using the **Assessment Cards (2)** for each Activity Group to promote deeper thinking (Meta cognition) and self- reflection
4. **Keeping a track** of student's progress over time using the defined Milestones

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Key mathematical ideas Multiplying, Pattern, Mathematical thinking and reasoning

Calculating

Developing fluency with multiplying facts to 12×12

5



Educational context

This activity group is about revising all the multiplying structures that were introduced in Number, Pattern and Calculating 3, and continuing to develop children's fluency in calculating. The children will meet a range of multiplying problems in a variety of contexts, including correspondence problems where n objects are connected to m objects. A variety of imagery is used to support children's understanding, and to support them memorizing times tables facts. Key connections are made to everyday contexts (including measuring) in which multiplying is used. The activities in this group can be adapted with any of the times tables as a focus, according to children's abilities, in order to help them consolidate and learn multiples to 12×12 off by heart, both in sequence and at random.

Learning opportunities

- To interpret an array as a model of multiplying.

Assessment opportunities

Look and listen for children who can:

- Use the words and terms for use in conversation effectively.
- Write multiplying sentences for problems involving repeated amounts.
- Find products of two numbers on multiplying squares.
- Write two multiplying sentences for an array and notice that, e.g. 4×6 and 6×4 give the same product.
- Recall multiplying facts to 12×12 .
- Explain the effects of multiplying by 0 and by 1.
- Illustrate a scaling problem with apparatus and a multiplying sentence.

Explorer Progress Book 4a, pp. 20–23

After completing work on this activity group, give small focus groups of children their Explorer Progress Books and ask them to work through the challenges on the pages. As children complete the pages, assess what progress they are making with the central ideas from the activity group. Refer to the assessment opportunities for assistance. Children will also have the opportunity to complete their Learning Log (p22–23) where they can reflect on the mathematics they have done so far.

Explore More Copymaster 21: Multiplying Game

After completing work on Activity 5, give children Explore More Copymaster 21: Multiplying Game (enlarged to A3) to take home.

Within the Teaching Resource Handbook, assessment opportunities are displayed at the start of each Numicon Activity Group, so you know what to look and listen out for

The **assessment opportunities** outline what to **look and listen for** in whole class, group, and individual work

Activity Groups are matched to pages within **Explorer Progress Books** to help you assess each child individually

Children enjoy learning in a sequential manner with meaningful activities and clear assessment

Developing fluency with multiplying facts to 12×12

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Learning opportunities

- To interpret an array as a model of multiplying.
- To know that multiplying is what we do instead of adding repeated groups.
- To record sequences of multiples systematically in a table, and read products.
- To find products on multiplying squares.
- To know the effects of multiplying by 0 and by 1.
- To learn and improve fluency with the times tables up to 12×12 .
- To know that we multiply to find the area of rectangles.
- To recognize that we multiply by numbers greater than 1 to scale up an amount.

Words and terms for use in conversation

multiply, times, lots of, groups of, sets, array, product, multiplying sentences, multiplication tables, times tables, times tables square, commutative, multiplying facts, multiples, dimension, length, width, rectangle, square, area, multiplied by, scaling, scaled up by

Assessment opportunities

Look and listen for children who can:

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Explore More Copymaster 21: Multiply Game

After completing work on Activity 5, give children Explore More Copymaster 21: Multiplying Game (enlarged to A3) to take home.

Calculating

Focus activities

Activity 1: Exploring a multiplying context

Have ready: Numicon Coloured Counters, Numicon 10s Number Line, Numicon Shapes

Step 1

Talk to children about games where players need a certain number of, e.g. cards or counters. Say that, e.g. each player of a board game needs 4 counters. Ask children to show how many counters are needed if they play with two others. Look and listen for children organizing their Counters into groups or arrays, and for those limited to counting in ones.

Step 2

Compare children's arrangements. Agree an array (see Fig. 1) allows us to see without counting that we have 3 sets of 4 Counters. Look and listen for children counting in groups or using number facts to find three 'times' or 'lots of' 4. Encourage children to discuss how the array shows there are three sets of 4 Counters, rather than four sets of 3 Counters.

Step 3

Work with children to write a number sentence for the number of Counters. Listen for children using the language 'times', 'sets', 'groups' or 'lots of', and linking to 3 people with 4 objects each. Wait for children to suggest repeated adding or multiplying. Agree these are written, e.g. $4 + 4 + 4 = 12$ and $3 \times 4 = 12$, recalling the action and symbol for multiplying (see Fig. 2). Encourage children to see that the multiplying sentence is more succinct.

Step 4

Encourage children to use Shapes on the 10s Number Line to illustrate the problem. Look and listen for children placing a 4-shape (for 4 counters) three 'times' (see Fig. 3). Agree that this shows '3 times 4' is equal to 12. Remind children that when multiplying the total is called the 'product'.

Step 5

Repeat Steps 1–4 for a different number of players.

Step 6

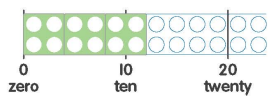
Introduce a different game and number of objects per player, e.g. a hoopla game where each player needs 3 hoops. Ask how many hoops would be needed for 2, 3, 4, ... turns. Each time, ask children to illustrate with Counters or Shapes, and to write a multiplying sentence before finding the product.



1



2



3

Step 7

Show children a list of objects per player for other games, e.g. 4 cards, 3 marbles, 5 dominoes, 6 counters, 2 dice. Ask about the number of items needed for different numbers of players. Look and listen for children working confidently to write multiplying sentences and find products.

Step 8

For one of the contexts, ask children how many objects are needed for zero players. Encourage them to agree no items. Then ask about zero items and 5 players. Agree that, again, zero items are needed. Use Shapes to help children understand the effect of multiplying by zero: ask them to pick up zero Shapes 'five times' or to pick up the 5-shape 'zero times'. Write the multiplying sentences for this: $0 \times 5 = 0$ and $5 \times 0 = 0$.

Activity 2: Writing multiplying sentences

Have ready: Numicon 10–100 cm Number Rod Track, number rods

Step 1

Work with children to create words, pictures or patterns using several same-size rods, e.g. Fig. 4.

Step 2

Ask children to write multiplying sentences for each creation, e.g. (for Fig. 4) $10 \times 4 = 40$. Support children who need help to find the product by placing the rods used in the Number Rod Track.

Step 3

Repeat for other suggestions, e.g. Fig. 5.

Next, allow children to use a mix of rods, e.g. Fig. 6 gives $5 \times 10 = 50$, $3 \times 6 = 18$ and $1 \times 2 = 2$.



4



5



$$\begin{aligned} 5 \times 10 &= 50 \\ 3 \times 6 &= 18 \\ 1 \times 2 &= 2 \end{aligned}$$

6

Step 1

Talk to children about games where players need a certain number of, e.g. cards or counters. Say that, e.g. each player of a board game needs 4 counters. Ask children to show how many counters are needed if they play with two others. Look and listen for children organizing their Counters into groups or arrays, and for those limited to counting in ones.

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Compare children's arrangements. Agree an array (see Fig. 1) allows us to see without counting that we have 3 sets of 4 Counters. Look and listen for children counting in groups or using number facts to find three 'times' or 'lots of' 4. Encourage children to discuss how the array shows there are three sets of 4 Counters, rather than four sets of 3 Counters.

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Work with children to write a number sentence for the number of Counters. Listen for children using the language 'times', 'sets', 'groups' or 'lots of', and linking to 3 people with 4 objects each. Wait for children to suggest repeated adding or multiplying. Agree these are written, e.g. $4 + 4 + 4 = 12$ and $3 \times 4 = 12$, recalling the action and symbol for multiplying (see Fig. 2). Encourage children to see that the multiplying sentence is more succinct.

Step 4

Encourage children to use Shapes on the 10s Number Line to illustrate the problem. Look and listen for children placing a 4-shape (for 4 counters) three 'times' (see Fig. 3). Agree that this shows '3 times 4' is equal to 12. Remind children that when multiplying the total is called the 'product'.

Step 5

Repeat Steps 1–4 for a different number of players.

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Introduce a different game and number of objects per player, e.g. a hoopla game where each player needs 3 hoops. Ask how many hoops would be needed for 2, 3, 4, ... turns. Each time, ask children to illustrate with Counters or Shapes, and to write a multiplying sentence before finding the product.

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Milestones are a robust, reliable resource for ensuring every child meets end of year expectations, giving you evidence of a child's understanding *along the way*.

Milestones:

- Mark key concepts and skills to be grasped by each child at regular points throughout the year
- Give you confidence in tracking a child's progress over time
- Are integrated into the medium-term planning materials

Milestone **2**

- To give a rounded estimate of amounts to 1000
- To round any number to the nearest 10, 100 or 1000
- To connect estimation and rounding numbers to the use of measuring instruments
- To use the strategy of rounding numbers and adjusting to make calculations easier
- To use the strategy of partitioning in different ways to simplify adding and subtracting calculations
- To use the strategy of adding or subtracting multiples of 10 in mental calculating
- To use compensating as a non-computational strategy for adding and subtracting
- To know that it is important to look carefully at the numbers involved in a calculation before deciding which strategy to use
- To recall multiplying and dividing facts for multiplication tables up to 12×12
- To generalize and explain the effects of multiplying by 0 and by 1
- To use the commutative property of multiplying and the inverse relationship between dividing and multiplying to speed up fluent recall of multiplying and dividing facts

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Explorer Progress Books make evidence-gathering simple and effective. They show a pupil's depth of comprehension and give insight into their thought process, making it easy for you to assess their development over time

Have ready: timer
Date ____/____/____

Times Tables Squares

Record how long it takes you to fill in the answers to this times tables square.


x	3	4	6	7
2				
5				
8				
9				

My time :

Now time how long it takes you to fill in this square.
Try to be quicker than you were last time!

x	5	3	9	6
8				
4				
2				
7				

My time :


 Teacher notes

Date ____/____/____


A Multiplying Game

Kristina's game involved throwing two 0-9 dice and multiplying the two numbers together each time.

How many different ways can she get a score of at least 30, but not more than 40?
(Throwing a '7' and an '8' would not work because $7 \times 8 = 56$, and that is more than 40.)



Can you explain how you know that you've found all the different ways?

 Teacher notes

Explorer Progress Books:

- Allow a child to demonstrate their ability to apply their understanding in a new context
- Provide an independent record of success for every pupil
- Are ideal for gathering evidence of progress

Children enjoy seeing their progress with these activities

Have ready: timer

Date ____/____/____

Times Tables Squares

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9				

My time

__	__	:	__	__
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×	5	3	9	6
8				
4				
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My time

__	__	:	__	__
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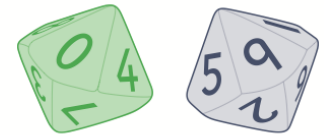


Teacher notes

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(Throwing a '7' and an '8' would **not** work because $7 \times 8 = 56$, and that is more than 40.)

Can you explain how you know that you've found all the different ways?



Numicon Books	NZC Level	Year & Number Framework	Refreshed Curriculum
Firm Foundations Breaking Barriers	Level 1	Year 1 Stages 0 - 3	Phase 1
Numicon 1 Breaking Barriers Numicon Intervention Programme (NIP)	Level 1	Year 2 Stage 4	
Numicon 2 Breaking Barriers NIP	Level 2	Year 3 Stage 5	
Numicon 3 Breaking Barriers NIP	Level 2	Year 4 Stage 5	Phase 2
Numicon 4 Big Ideas Investigations	Level 3	Year 5 Stage 6	
Numicon 5 Big Ideas Investigations	Levels 3/4	Year 6 Stage 7	
Numicon 6 Big Ideas Investigations	Level 4	Year 7 - 8 Stage 8	Phase 3

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Your next steps...

- Contact info@numicon.co.nz
- Visit www.numicon.co.nz for more information about Numicon and the latest developments in assessment
- Download editable Milestone files for individual and groups on [Numicon Online](#)

How to get in touch:

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