

**Lesson Topic:** Addition and Subtraction - Inverse operations (Number Board)**Concept/s in Focus:**

- Addition is joining quantities (parts) together to make a total (part + part = total)
- Subtraction is separating a total into parts or taking a part away from the total leaving a part
- Addition and subtraction are inverse operations. The action of one will undo the other.
- An addition situation on a number board will have a start number, an action (joining) and an end number.
- A subtraction situation on a number board will have a start number, an action (separating/taking away) and an end number.

**Introduction / Teacher Background Information:**

This lesson builds on two previous lessons where students investigated using strategies to solve addition and subtraction computations and modelling them on a Number Board i.e. *Addition on a Number Board (Adding tens and ones)* and *Subtraction on a Number Board (Subtracting tens and ones)*. The strategies investigated in these lessons were Break Up 1 Number and Change 1 Number and Fix (for addition and for subtraction of 2-digit numbers). In this lesson students will be helped to see that a trail left on a Number board from an addition situation can also represent a subtraction situation if the Start and End numbers are swapped. Students will also be able to see the connection between addition and subtractions as inverse operations where the start number in an addition computation becomes the end number in the inverse subtraction computation e.g.  $24+12=36$  and  $36-12=24$ .

A potential difficulty that might be encountered in this lesson is the students not counting on the right number of tens or ones when completing strategies. As the marker circles being used are all the same colour so the computation represented can be interpreted as addition or subtraction, a computation like  $54+32$  that covers the numbers 54, 64, 74, 84, 85, 86 could be considered as  $54+42$  because there seem to be 4 rows down counting the start number. The same error could be conceived in the ones when either adding or subtracting. The focus needs to be on counting ON from the number given i.e. 54 add 3 tens is 64, 74, 84.

**Australian Curriculum links:** ACMNA029**Resources:**Whole Class Activity:

- The Mat (rows of 10 spaces)
- Numbers 1-60/100 depending on size of the Mat [1-100 Number cards A5](#)
- Objects to mark the trail on the mat – suggest small circles of coloured paper – [Small marker circles for The Mat](#). Copy a page of circles on the same colour paper and cut them out. In this lesson the same colour will be used as the START and END numbers will be interchanged.
- Access to a whiteboard that the students can see along with The Mat

Hands-On Activity:

- 1-100 Number Board File: [Number Board 1-100](#)
- At least 8 transparent counter per student (preferably the same colour for each student but this doesn't really matter – (it will match the independent activity more closely if they do)
- A copy of the 1-100 number board for the teacher (to keep track of moves made)
- PowerPoint [1-100 number board](#) to project and show trails around the board.


Independent Activity:

- 1 copy of the worksheet per student [Addition and Subtraction as inverse operations Number Board worksheet](#)


### Whole Class Activity:

- Have the students sit around The Mat on the floor in the classroom or outside.
- Either prepare the mat before the lesson and place the numbers in order on the grid, or hand some students a few number cards each and have them place them on the grid in order. If the numbers given to students are random then the students will need to think more about where to place them and need to work together to fill the grid. This could be good revision for those needing to be reminded which of the of the structure of the Number Board.
- Explain that the same coloured marker circles will be showing the START, the TRAIL and the END of each computation in this activity
- Revise modelling of Break Up 1 Number strategy for addition on the Number board by giving a student an example like  $23+22$  to model /work out on The Mat.
- Choose a student to start on The Mat.

[Student name] *Please stand on number 23.*

-  *Please place one of these marker circles on the number 23.  
If you were going to **add 22** how would you move around the Number Board to show this?*


- If the student needs prompting ask:

-  *Could you Break Up the 22 you need to add into parts that could be easier to add using the Number Board?  
What do you know about the number 22 (It has 2 ten and 2 ones).  
How can we add 2 tens on the Number Board? (Move down 2 rows)  
How could we add the 2 ones? (Move across 2 spaces to the right)*

- Show the trail between the START and the END numbers by placing a marker circle on each number the student moved through.
- Leave this trail on The Mat and then model a different subtraction computation on The Mat as well.

- Revise subtracting 2-digit numbers on the Number board by giving a student an example like  $58-12$  to model /work out on The Mat. (That will not overlap the addition trail already done)
- Choose a student to place a START marker circle on number 58.
- If they need help use these questions:


*How did we subtract / take-away 12 from this START number on the Number Board?*

-  *Think about what we have been doing before on the mat.  
What do you know about the number 12 (It has 1 ten and 2 ones).  
How did we subtract/take-away 1 ten before? (Move 1 row up)  
How could we subtract the 2 ones? (Move 2 spaces across toward the smaller numbers)*

- If needed model subtracting the 12 by subtracting 10 (by moving up 1 row) and subtracting the 2 ones (by moving back 2 spaces).
- Show the trail between the START and END numbers using the marker circles.

-  *What do you notice about all these START and END circles? (They are one row and 2 spaces apart)*

- Compare the two trails on the Mat.

-  *What do you notice about all these two trails? What is the same and what is different? (Accept all observations e.g. They both go two directions down/up and across, they start and finish on different numbers,*

one is longer than the other)

- Clear the Mat of marker circles.
- Place one marker circles on the Mat on each of these numbers 24, 34, 35, 36, 37, 38 and 39.

*What do you notice about the marker circles I have put on the Number Board? (Accept any answers including any that suggest they are showing a computation)*

*Which computation do you think these marker circles are showing? Is it an addition computation or a subtraction? (Allow students to discuss the possibility of it being both).*



*What is the START number then? (Help them realise it could be the number marked at either end of the trail of paper circles).*

- Help the students to work out what the computation could be.

*If we make the start number 24 would the computation be an addition or a subtraction? (an addition).*



*What is the end number for this addition computation? (39).*

*If the start number was the 39 would the computation for this trail be an addition or subtraction? (subtraction).*

*What is the end number for this subtraction computation? (24).*

- Record on a whiteboard where the students can see that the computation could be  $24 + \square = 39$  or  $39 - \square = 24$



*How can we work out which number was added or subtracted from these start numbers to get these end numbers? (Allow some discussion of the number of tens and ones that must have been added or subtracted)*

- Help the students see that the number of tens added was 1 (from 24 to 34) and the number of ones added was 5 (from 34 to 39). Remember not to include the start number in the count.
- Complete the computations on the whiteboard to show that this trail could represent  $24+15=39$  or  $39-15=24$

- Clear the marker circles from The Mat
- Place another trail of marker circles that could represent another simple Break Up 1 Number addition or subtraction computation e.g.  $26+43=69$  /  $69-43=26$  (cover 26, 36, 37, 38, 39) or  $35+32=67$  /  $67-32=35$  (cover 67, 57, 47, 37, 36, 35)
- Help the students see the trail can represent both an addition and a subtraction computation and that the number being added or subtracted is represented by the circles in the trail and the number of tens and ones added or subtracted needs to be identified.
- Clear the marker circles from The Mat.
- Place another trail of marker circles on The Mat but this time they represent a Change 1 number and Fix strategy e.g. cover 35, 45 and 44.

*Which computation do you think these marker circles are showing? Is it an addition computation or a subtraction? (Allow students to discuss the possibility of it being both but perhaps be confused by the trail seeming to add and subtract in itself).*

*What is the START number? (Remind them that it could be the number marked at either end of the trail of paper circles).*



*If we choose the start number as this one (point to the 35), What has happened to the 35? (Ten was added to make it 45 but then one was taken away)*

*So if 10 was added then one was taken away, how much was actually added? (only 9).*

*Does 9 make sense as the trail between 35 and 44? Does  $35+9=44$ ? (Allow time for them to check even if by counting in ones)*


- Work the computation from the 35 one step at a time and help the students see that the trail goes from the 35 to the 45 (add 10) and then to the 44 (subtract 1). So the computation is  $35+10-1$  which is the same as  $35+9$  which does equal 44.

 *What will the other computation be when 44 is the start number?*


- Work the computation from the 44 one step at a time and help the students see that the trail goes from the 44 to the 45 (add 1) and then back to the 35 (subtract 10). So the computation is  $44+1-10$  which is the same as  $44-9$  which does equal 35.
- Record the two equations on the whiteboard :  $35+9=44$  and  $44-9=35$ .
- These are quite complex to understand and many students might not see these but it is possible that some students will and they hopefully are a bit fascinated with how such a seemingly simple activity on the mat can reveal interesting mathematics.

#### **Hands On Activity:**

- Provide each student with a copy of the Number Board – 1 -100 file and number of transparent counters (preferably but not necessarily all the same colour)
- **Note:** A PowerPoint is included in the lesson resources for this lesson that can be projected on a whiteboard. In preparation mode (not in presentation mode), the counters on the side can be moved onto the Number Board to demonstrate movement around the grid to solve addition problems. (There may be other apps/online resources that could be used for this display)
- Record an expression on a whiteboard where the class can see it and have the students model this on their Number board using a number of transparent counters e.g.  $45+24$
- Ensure all the students have represented the expression on their Number Boards.

 *What is the START number for this computation?  
What is the END number for this computation?*

- Record the end number (result) on the whiteboard to complete the equation  $45+24=69$ .

 *What would the subtraction equation be that is represented by the counters on your Number Board?  
( $69-24=35$ )*

- Provide some other expressions that suit the Break Up 1 Number strategy and that don't extend beyond the edge of the Number board (do not bridge to make another ten) e.g.  $31+45$ ;  $76-43$  etc
- Have the students model these expressions and identify the END number.
- Students could record the completed equations on small whiteboards or in their Maths books. Ensure that they record both the addition and subtraction equations for each situation provided.
- Move to providing expressions that suit the Change 1 Number and Fix strategy. These computations will add or subtract a number that is close to a multiple of ten e.g.  $45+29$ ;  $76-39$
- Have the students model these on their Number Board with counters and record both equations that relate
- Use the PowerPoint 1-100 Number Board Addition and Subtraction computation trails to present prepared computation trails to the students. The first four slides show trails with yellow counters. These slides represent Break Up 1 Number computation trails. The other four slides with green counters represent Change 1 Number and Fix computation trails (and are more difficult)
- Have the students attempt to record an addition and a subtraction computation for each computation trail on the Number Board.

**Independent Activity:**

- Provide each student with a copy of the Addition and subtraction as inverse operations Number Board worksheet.
- This worksheet replicates the last part of the Hands On activity and presents 6 computation trails on 1-100 boards for the students to write an addition and a subtraction equation for.

**Understandings to look for:**

- Students who can see that the same situation (computation trail) can represent an addition or a subtraction situation
- Students who identify that the start number for an addition computation will be the end number for the inverse subtraction computation
- Students who can record addition and subtraction equations.