

Unit 4: NUMERIC AND GEOMETRIC PATTERNS AND NUMBER SENTENCES

We are looking at two lessons in this unit:

LESSON 40: Geometric Patterns, Tables and Flow Diagrams (1)

LESSON 46: More number sentences (2)

Lesson 40: Geometric patterns, tables and flow diagrams (1)

Teacher's notes

This lesson is one of the fully planned lessons to be used to cover the Term 1 curriculum.

CAPS topics: 2.1 Numeric and geometric patterns and number sentences

Lesson Objective: Learners will be able to use tables and flow diagrams to record information from geometric patterns and to develop and use rules for some patterns.

Lesson Vocabulary: input, output, rule, flow diagram, record, data

Teacher Resources needed for this lesson: Blank flow diagram, blank table

Learner Resources needed for this lesson: Blank flow diagram, blank table

Date:

Week

Day

1. Mental maths (5 minutes)

	What is ...	Answer		What is ...	Answer
1	$7 \times 6 =$	42	6	$6 \times 3 =$	18
2	$9 \times 9 =$	81	7	$2 \times 10 =$	20
3	$10 \times 10 =$	100	8	$9 \times 5 =$	45
4	$4 \times 5 =$	20	9	$7 \times 3 =$	21
5	$8 \times 9 =$	72	10	$8 \times 8 =$	64

2. Link to previous lesson (5 minutes)

- Write the following table on the board

Input	2	3	4
Output	7	8	9

- Say: **Look carefully at the table.**
- Ask: **What is the rule?** (Add 5)

3. Correct homework (5 minutes)

The answers to the Homework Activity for Lesson 39 are provided in Lesson 39. Use this time to purposefully address gaps in learners' knowledge and to identify and address learner errors.

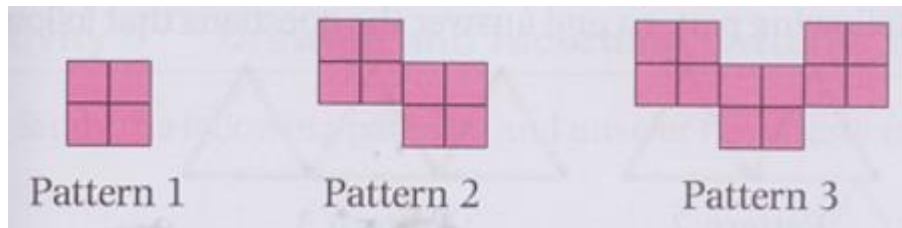
4. Lesson content – concept development (35 minutes)

This lesson builds on learners' knowledge of geometric patterns and tables. In this lesson, learners also see how flow diagrams can be used to record numeric information from geometric patterns and to help develop rules for the patterns.

Say: Today we are learning to use tables and flow charts to record data from geometric patterns and to develop the calculation plan or rule for the pattern.

Activity 1: Whole class activity

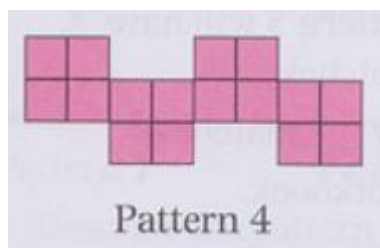
- Say: **Bheki is laying square tiles in this pattern**
- Draw Patterns 1, 2 and 3 on the board.



- Ask: **How many tiles in:**
 - **Pattern 1** (4 tiles)
 - **Pattern 2** (8 tiles)
 - **Pattern 3** (12 tiles)

Note: It is fine if, at this stage, learners count the tiles – they will see how to develop and use a rule as the lesson progresses.

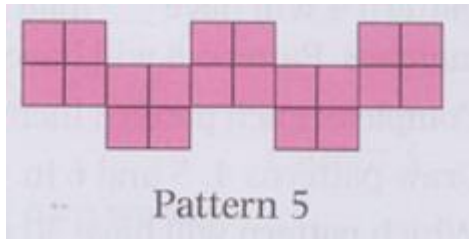
- Ask: **How many tiles are added with each new pattern?** (4 tiles)
- Say: **Describe the change from one pattern to the next.** (The pattern grows as a square block of 4 tiles is added each time).
- Say: **Predict how many tiles there will be in Pattern 4.** (16 tiles)
- Say: **Check your prediction by drawing Pattern 4 in your classwork book.**
- Give learners time draw Pattern 4. Remind them that it is a sketch. They must work quickly.
- Draw Pattern 4 on the board.



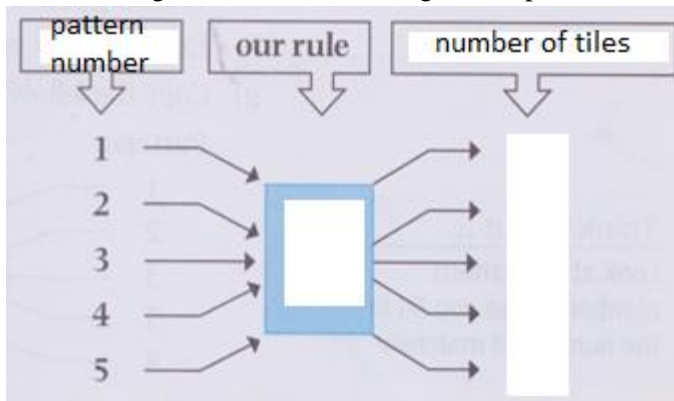
- Say: **Check that you have drawn Pattern 4 correctly. Correct your work if necessary.**
- Say: **Predict how many tiles there will be in Pattern 5.** (20 tiles)
- Say: **Check your prediction by drawing Pattern 5 in your classwork book.**
- Give learners time draw Pattern 5.

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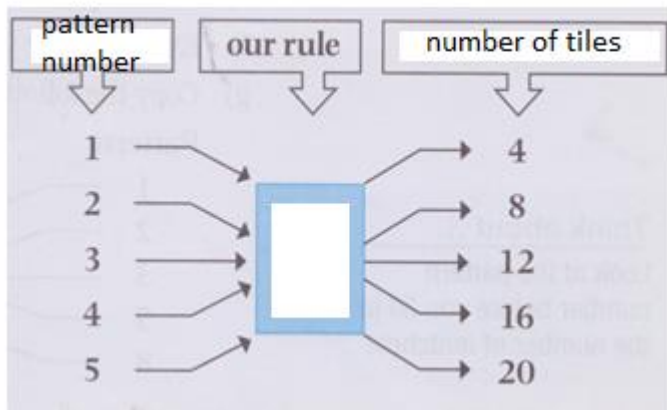
- Draw Pattern 5 on the board.



- Use the blank flow diagram.
- Say: Use a blank flow diagram. **Let's use the information from our pattern diagrams and a flow diagram to work out a rule for working out how many tiles are needed for any pattern number.**
- On the flow diagram, fill in the headings and input numbers:



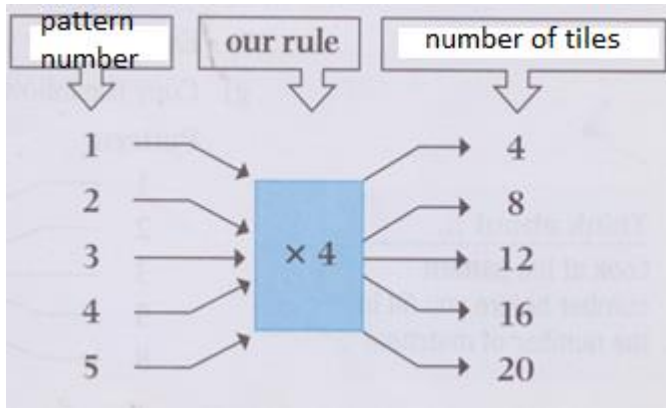
- Say: **Use your blank flow diagram. Write the headings and pattern numbers.**
- Say: **Use your flow diagram. Fill in the output numbers.**
- Give learners time to fill in output numbers, then write them on your flowchart:



- Say: **Let's develop a rule for this pattern that will help us work out the number of tiles without needing to draw and then count the tiles.**
- Ask, pointing at the input-output numbers as you speak: **What do we do to the 1 to change it into a 4?** (Multiply 1 by 4. Learners might say: $1 + 3$. This is also correct, but learners will soon see that it won't give a rule that works for all input-output numbers pairs).
- Ask, pointing at the input-output numbers as you speak: **What do we do to the 1 to change it into an 8?** (Multiply 2 by 4. Note: $2 + 3$ won't work here).
- Say: **It looks like our rule, or calculation plan, could be multiply by 4. Let's test it on one more input number.**
- Ask: **What is 3 multiplied by 4?** (12)
- Ask: **Look at the Pattern 3 diagram. How many tiles in Pattern 3?** (12 tiles)

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- Say: **Our rule for this pattern: Multiply by 4 is correct.**
- Fill in the rule on the flow diagram:



- Write the following table on the board.
- Say: **Use the information from the pattern diagrams and the flow diagram to complete this table.**

Input: _____	1	2	6	10	20	100
Output: _____						

- Give learners time to complete the table and then check their answers:

Input: (Pattern number)	1	2	6	10	20	100
Output: (Number of tiles)	(4)	(8)	(24)	(40)	(80)	(400)


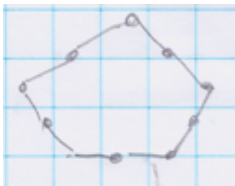
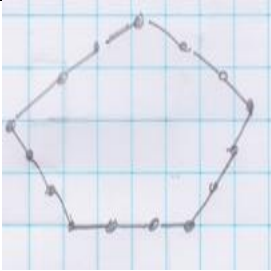
- **Ask: If Bheki has 400 tiles, what pattern number can he build?** (100). Show learners how to read this from the table.

Activity 2: Learners work in pairs


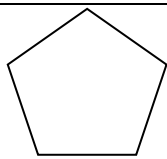
Say: **Do Activity 2 in your LAB.**

- Walk around the classroom to support learners as needed.
- Correct Activity 2 with learners so that they can receive immediate feedback. The answers are given in brackets and sometimes in italics below.

1. This pattern is made with matchsticks.

				
1	2	3	4	5

- Name the geometric shape in this pattern: (*pentagon*)
- How many sides in this geometric shape? (*5*).
- Explain how to get from Pattern 4 to Pattern 5.
(*'Grow' the pattern by adding one matchstick to each side of the pentagon (5 matchsticks in total).*)
- Draw patterns 4 and 5 in the spaces in the table.

ANSWERS	
	
1 <i>(Pattern 4 should have 4 matchsticks per side)</i>	2 <i>(Pattern 5 should have 5 matchsticks per side)</i>

e. Complete the table.

Diagram number	1	2	3	4	5	6	7	10	100
Number of matchsticks	(5)	(10)	(15)	(20)	(25)	(30)	(35)	(50)	(500)
RULE: (<i>Multiply the patterns number by 5</i>)									

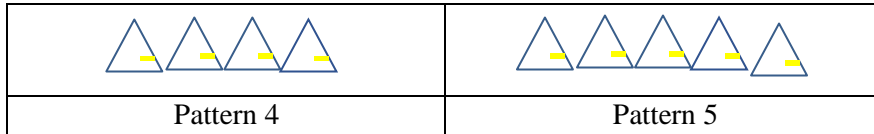
2. Look carefully at the pattern and then answer the questions.

The pattern has been made with matchsticks.



- Explain how to get from Pattern 2 to Pattern 3.
(*'Grow' the pattern by adding another triangle standing on its base.*)
- Complete the sentences:
 Pattern 1 has (3) matchsticks.
 Pattern 2 has (6) matchsticks.
 Pattern 3 has (9) matchsticks.

c. Draw patterns 4 and 5.

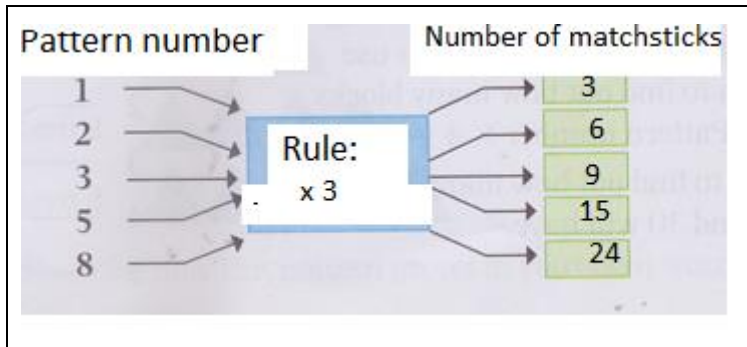


d. Complete the sentences:

Pattern 4 has (20) matchsticks.

Pattern 5 has (25) matchsticks.

e. Complete the flow diagram (*the learners have to write in the number of matchsticks each time.*)



f. Complete the table.

HINT: Decide whether the input is the pattern number or the number of matchsticks.

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Look at the flow diagram f or help with the rule.

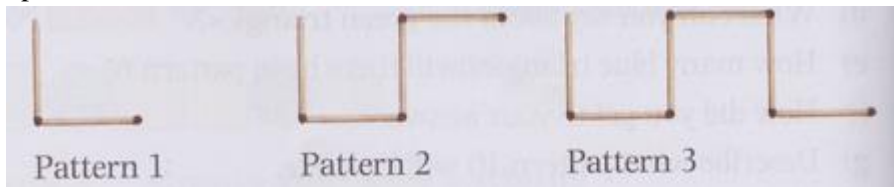
Input: (Pattern number)	1	2	3	4	5	8	10	100
Output: (Number of matchsticks)	(3)	(6)	(9)	(12)	(15)	(24)	(30)	(300)
Rule: <i>Multiply the patterns number by 3 OR pattern number $\times 3$</i>								

Activity 3: Learners work in pairs

Say: **Do Activity 3 in your LAB.**

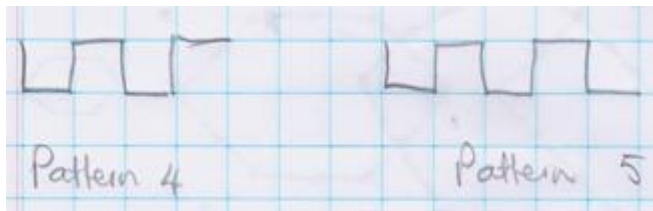
- Walk around the classroom to support learners as needed.
- Correct Activity 3 with learners so that they can receive immediate feedback. The answers are given in italics or brackets below.

1. Look carefully at the pattern and then answer the questions.
The pattern has been made with matchsticks.

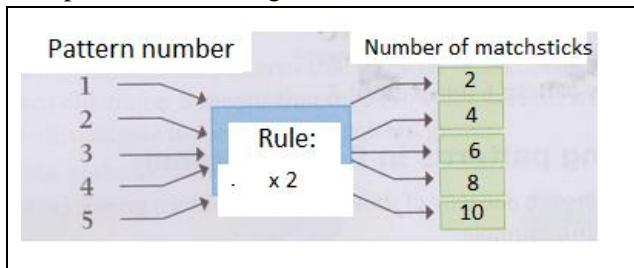


- a. Complete the sentences:
 Pattern 1 has 2 matchsticks. We could say Pattern 1 has $1 \times (2)$ matchsticks.
 Pattern 2 has (4) matchsticks. We could say Pattern 2 has $2 \times (2)$ matchsticks.
 Pattern 3 has (6) matchsticks. We could say Pattern 3 has $3 \times (2)$ matchsticks.
- b. Draw Patterns 4 and 4

ANSWERS:



- c. Complete the sentences:
 Pattern 4 has (8) matchsticks. We could say Pattern 4 has $4 \times (2)$ matchsticks.
 Pattern 5 has (10) matchsticks. We could say Pattern 5 has $5 \times (2)$ matchsticks.
- d. Complete the flow diagram (*the learners have to write in the number of matchsticks each time.*)



- e. Complete the table.
 HINT: Decide whether the input is the Pattern number or the number of matchsticks
 Decide whether the output is the Pattern number or the number of matchsticks
 Look at the flow diagram for help with the rule.

Input: (Pattern number)	1	2	3	4	5	8	10	100
Output: (Number of matchsticks)	(2)	(4)	(6)	(8)	(10)	(16)	(20)	(200)
Rule: <i>Multiply the patterns number by 2 OR Pattern number $\times 2$</i>								

6. Homework activity (5 minutes)

Explain to learners what they need to do for homework.

1. Look carefully at the pattern and then answer the questions.

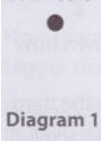


Diagram 1

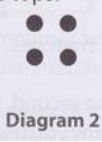


Diagram 2

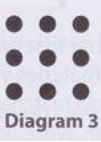


Diagram 3

Diagram 4

Diagram 5

a. Describe the pattern in your own words:
(Dots are added to increase each row by 1 dot and each column by 1 dot.)

b. Add Diagrams 4 and 5 to the pattern:

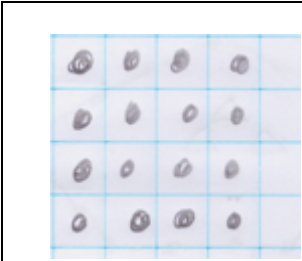


Diagram 4

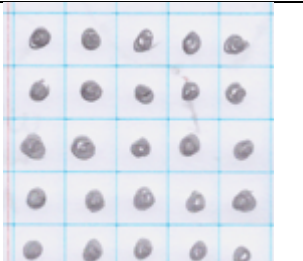


Diagram 5

c. Complete the sentences:
 Diagram 1 has $1 \times (1)$ dots = 1 dot
 Diagram 2 has $2 \times (2)$ dots = (4) dots
 Diagram 3 has $3 \times (3)$ dots = (9) dots
 Diagram 4 has $4 \times (4)$ dots = (16) dots
 Diagram 5 has $5 \times (5)$ dots = (25) dots

d. Use the answers to question c. to complete the table.

Input: <i>(Pattern number)</i>	1	2	3	4	5	7	10	100
Output: <i>(Number of dots)</i>	(1)	(4)	(9)	(16)	(25)	(49)	(100)	(1 000)
Rule: <i>Pattern number \times Pattern number = Output</i>								

7. Reflection and summary of lesson (5 minutes)

Call the whole class to attention and summarise the key concepts of the lesson.

Say: **Today we have learned to use flow diagrams and tables to record information from geometric patterns.**

Lesson 46: More number sentences (2)

Teacher's notes

This lesson is one of the fully planned lessons to be used to cover the Term 1 curriculum.

CAPS topics: 2.1 Numeric and geometric patterns and number sentences

Lesson Objective: Learners will be know how and when to use the associative property to make calculations easier. Learners will understand the meaning of equivalence and the equal sign.

Lesson Vocabulary: brackets, operator

Teacher Resources needed for this lesson: A3 sheet with word problem: Amy's savings – see below
Learner Resources needed for this lesson: None

Date:

Week

Day

A3 sheet with word problem:

Amy had R432 in her savings account. She saved another R46 and then another R54. How much money does she have now?

[At bottom of A3 sheet] $432 + 46 + 54 = \square$)

1. Mental maths (5 minutes)

	What is ...	Answer		What is ...	Answer
1	$3 \times 4 =$	12	6	$3 \times 9 =$	27
2	$6 \times 4 =$	24	7	$4 \times 10 =$	40
3	$6 \times 6 =$	36	8	$9 \times 5 =$	45
4	$7 \times 6 =$	42	9	$8 \times 8 =$	64
5	$4 \times 0 =$	0	10	$5 \times 4 =$	20

2. Link to previous lesson (5 minutes)

Link to concepts learned in previous lessons by asking questions:

- Ask: **Are the following true or false?**
 - $9 + 3 = 3 + 9$ (True)
 - $9 - 3 = 3 - 9$ (False)
 - Subtraction can be used to check multiplication. (False)
 - Addition can be used to check subtraction. (True)

3. Correct homework (5 minutes)

- The answers to the Homework Activity for Lesson 45 are provided in Lesson 45. Use this time to purposefully address gaps in learners' knowledge and to identify and address learner errors.

4. Lesson content – concept development (25 minutes)

The main objective for all work done in the topic of number sentences is to improve learners' calculation and problem-solving skills. Although number sentences are specifically dealt with in this topic, remember that number sentences should be included in all content areas. In this lesson, learners see how the associative property* (i.e. $1 + 2 + 3 = (1 + 2) + 3 = 1 + (2 + 3)$) can be used to make calculations easier. Before explaining the associative property, you need to explain the function of brackets in a number sentence. In this lesson, we also look more carefully at the meaning of the equal sign in a number sentence.

(* Learners do not need to know this term, but must know how and when to use it to make calculations easier.)

Many learners have the limited view that an equal sign (=) means 'here comes the answer'. It is important that learners understand that the equal sign indicates equivalence, that is, that what is on either of the equal sign the same value, as in this number sentence $3 + 2 = 6 - 1$.

For this reason, we include number sentences with expressions on both sides of the equal sign in this lesson.

Say: Today we learn to combine numbers in ways which make calculations easier and we also learn more about the equal sign in a number sentence.

Activity 1: Whole class activity

NOTE: Have the A3 sheet with the word problem about Amy's savings ready for use during the second part of this activity. (*Amy had R432 in her savings account. She saved another R46 and then another R54. How much money does she have now?*)

– Write this number sentence on the board:

$$37 + 76 + 24 = \square$$

- **Ask: What is the operation in this number sentence?**
- Say, pointing to the three numbers: **In this calculation the operation is add or plus. We need to add three numbers. However, we can only add two numbers at a time. Let's look at the calculation and try to be clever about which two numbers to add first.**
- Say: **It is not always best to start by adding the first two numbers.**
- Say: **Write this number sentence in your classwork book. Solve the number sentence as quickly as you can.**
- Ask: **What is $37 + 76 + 24$? (137)**
- Ask: **Who managed to do this sum quickly in their head? (Learners respond)**
- Say: **Come to the board and show us how you grouped the numbers to make the calculation quicker and easier.** (Answers might vary but eventually the answer you want is: I added 76 and 24 to get 100, then I added 37 to get 137)
- Say: **It is always easier to add or subtract numbers involving multiples of 10, 100, 1 000. In this example we did not add the first two numbers. We added the second two numbers to get 100, then it was easy to add 37.**
- Say: **We can show the order in which we did the calculation on the board by using brackets.**

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- Write the number sentence, with brackets, on the board:

$$37 + (76 + 24) = \square$$

- Say, pointing to the brackets: **These symbols are brackets. Brackets tell us how to group the numbers and what we should do first.**
- Say: **If you did not find the answer by adding 76 and 24 first, re-write the numbers sentence, with brackets in your classwork book and then solve the number sentence following the instruction the brackets are giving you.**

$$37 + (76 + 24) =$$

$$37 + 100 = 137$$

- Place the word problem about Amy’s savings on the board and read it with learners. Fold the A3 sheet so that the number sentence is not visible at first.
 - Say: Write a number sentence describing the problem. $(432 + 46 + 54 = \square)$
 - Say: **Solve the word problem as quickly as you can. Use brackets to show which numbers you worked with first.** $432 + (46 + 54) =$
 $432 + 100 = 532$
 Amy has R532

Activity 2: Learners work in pairs

Say: **Do Activity 2 in your LAB.**

- Move around the classroom to support learners as needed.
- Correct Activity 2 with learners so that they can receive immediate feedback.

1	Draw a loop around the grouping of numbers that makes the number sentences quick and easy to solve. Then find the answer.	ANSWERS
	a. $37 + 63 + 49 = \square$ $37 + (63 + 49) = \square$ $(37 + 63) + 49 = \square$	$37 + 63 + 49 = \square$ $37 + (63 + 49) = \square$ $(37 + 63) + 49 = \square$ $(100 + 49 = 149)$
	b. $59 + 1\,275 + 325 = \square$ $(59 + 1\,275) + 325 = \square$ $59 + (1\,275 + 325) = \square$	$59 + 1\,275 + 325 = \square$ $(59 + 1\,275) + 325 = \square$ $59 + (1\,275 + 325) = \square$ $(59 + 1\,600 = 1\,659)$
2.	Solve each number sentence as quickly as you can. Remember that when adding, you can group the numbers however you want and still get the correct answer. Use brackets to show the order in which you worked.	
	a. $849 + 151 + 56 = \square$	$(849 + 151) + 56$ $= 1\,000 + 56$ $= 1\,056$
	b. $36 + (987 + 13) = \square$	$36 + (987 + 13)$ $= 36 + 1\,000$ $= 1\,036$

Activity 3: Whole class activity as well as learners working in pairs

- Write '=' on board and ask: **How do we say this?** (equals/ is equal to)
 - Ask: **What does the equal sign mean?** (What is on each of the equal side has the same value)
- Write this number sentence on the board: $6 \times 3 = 9 \times 2$
 - Say: **Write the number sentence in your classwork book and then solve the number sentence.** ($6 \times 3 = 18$ and $9 \times 2 = 18$)
 - Ask: **Is the number sentence true?** (Yes)
 - Ask: **How do you know?** ($18 = 18$ OR the left side and the right side have the same value)

Say: **Do Activity 3 in your LAB.**

- Move around the classroom to support learners as needed.
- Correct Activity 3 with learners so that they can receive immediate feedback. The answers are given in brackets or in italics in the following Activity.

1.	Solve each number sentence. Remember that the brackets show how the numbers are grouped and what you should do first.	
	a. $(17 - 7) - 2 = \square$	$(17 - 7) - 2$ $= 10 - 2$ $= 8$
	b. $17 - (7 - 2) = \square$	$17 - (7 - 2)$ $= 17 - 5$ $= 12$
	c. Compare the number sentences and answers in a. and b. What do you notice?	<i>The answers are different. With subtraction it makes a difference which order you subtract in.</i>
	d. True or false? When adding, you can group the numbers however you want to and still get the correct answer. ____ When subtracting, you can group the numbers however you want to and still get the correct answer. ____	<i>TRUE</i> <i>FALSE</i>
2.	Check whether the left side and the right side of the number sentence have the same value.	
	a. $149 + 51 = 2 + 98$ True or false? In this number sentence, the left side does not equal the right side. ____	$149 + 51 = 200$ $2 + 98 = 100$ <i>TRUE</i>
	b. $12 \times 100 = 6 \times 200$ True or false? In this number sentence, the left side equals the right side. ____	$12 \times 100 = 1\ 200$ $6 \times 200 = 1\ 200$ <i>TRUE</i>

5. Homework activity (5 minutes)

Explain to learners what they need to do for homework.

1.	Solve each number sentence as quickly as you can. Remember that when adding, you can group the numbers however you want to and still get the correct answer. Use brackets to show the order in which you worked.	ANSWERS
	a. $98 + 69 + 102 = \square$	$(98 + 102) + 69$ $= 200 + 69$ $= 269$
	b. $631 + 892 + 108 = \square$	$631 + (892 + 108)$ $= 631 + 1\ 000$ $= 1\ 631$
2.	Write the number that should replace the placeholder so that the left side and the right side have the same value.	
	a. $13 + 7 = 1 + \square$	$13 + 7 = 20$ So, $1 + \underline{19} = 20$
	b. $\square + 16 = 30 + 6$	$30 + 6 = 36$ So, $\underline{20} + 16 = 36$

6. Reflection and summary of lesson (5 minutes)

Call the whole class to attention and summarise the key concepts of the lesson.

Say: **Today we have learnt that when we are adding, we can group numbers however we want to to make the calculation quicker and easier.**

We have also learnt that the equal sign in a number sentence tells us the value of the numbers on the left is the same as the value of the numbers on the right.