

BACK ON **TRACK**

GRADE 7 LEARNER BOOK

Numeric and Geometric Patterns

Learner name:



Western Cape
Government

QUALITY EDUCATION

for every child in every classroom in every school in the province

Lesson 1: Learner activity 1 – Extending patterns.

Write the following 3 terms in each of the number sequences below. Also, in each case, describe the relationship between the consecutive terms.

1. 6; 18; 54; 162; ...

4. 1; 3; 6; 10; 15; ...

2. 20; 31; 42; 53; ...

5. 10; 9,7; 9,4; 9,1; ...

3. 18 000; 1 800; 180; 18; ...

Lesson 1: Learner activity 2: Relationship between dependent and independent variable

In the case of a number sequence, the position (number) of the term can be considered the independent variable, as shown for the sequence 15; 19; 23; 27; 31; ... in this table:

Term number	1	2	3	4	5	6	7	8	50
Term	15	19	23	27	31				

(a) Copy and complete the table above.

(b) How can we calculate term 50?

(c) Lungile reasoned like this: I added 4 each time to complete the table. I counted backwards to see what came before term 1. I got 11 and then I knew I was adding 4 to 11 to get the first term.

Complete the pattern below to indicate Lungile's thinking:

Term 1: $11 + 1 \times 4 = 11 + 4 = 15$ Term 2: $11 + 2 \times 4 = 11 + 8 = 19$

Term 3:

Term 4:

Term 5:

Term 6:

Term 10:

Term 50:

(d) Write down the rule to calculate the term for any term number in terms of n .

Lesson 2: Learner Activity 1 – Describing patterns.

1. When a son was born, his father was 28 years old. How old is the father, when the son is 10, 15 and 20 years old?

Son's Age	0	1	2	3	4	10	15	20
Father's Age								

2. How do you calculate the son's age if the father's age is 60 years old?

Show your calculations. Show the number sentence as well.

3. Find the son's age when the father is 58, 70 and 80 years old.

4. Write down the rule to calculate the term for any term number in terms of n .

Lesson 2: Learner Activity 2 – Describing patterns.

1. Complete the following table:

Term Number	1	2	3	4	5	6	7	8	9
Constant difference of 10						30			
Constant difference of -5						30			

2. Investigate each of the patterns below. Find the pattern and write the next four terms in the sequence.

(a) 1; 4; 9; 16; 25

(b) 3; 6; 11; 18; 27

(c) 20; 19; 17; 14; 10

(d) 20; 25; 29; 32; 34

Lesson 3: Learner Activity 1 – Your turn...

1. Calculate the next five numbers and the 100th number in each sequence. Describe your methods.

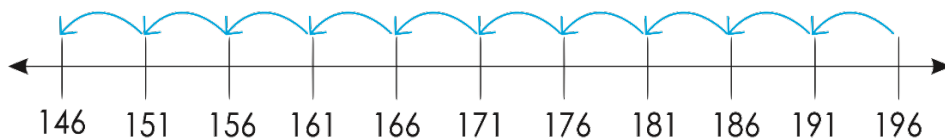
Sequence A: 5; 10; 15; 20; 25; 30; 35; ...

Sequence B: 7; 14; 21; 28; 35; 42; 49; ...

Sequence C: 9; 18; 27; 36; 45; 54; 63; ...

2. What is the same, and what is different, in each of these sequences above?

3. Describe the pattern below and extend it by 5 more numbers on both sides.



i.

ii.

4. Identify the rule in each case.

a. 65; 68; 71; 74;

b. 92; 89; 86; 83;

Lesson 4: Learner Activity1

A pattern with matches is shown:



Fig 1



Fig 2



Fig 3

Figure no.	1	2	3	4	5	6	7	8	n
No. of Matches	3	5	7						

1. Explain how the patterns is formed:

2. Complete the table

3. What rule did you use to complete the table?

4. How many matches are needed to form Figure number 9?

5. How many matches are needed to form Figure number 17? Explain.

6. If you used the recursive rule to complete the table, it would have taken a long time to answer question (5) because you had to add the same number many times. Try to find an easier way to answer question (5). Describe your method.

7. Copy and complete the pattern below. (Hint: It may help to think of Figure number 1 or term 1 like this:



There is one match at the beginning and two more are added every time.

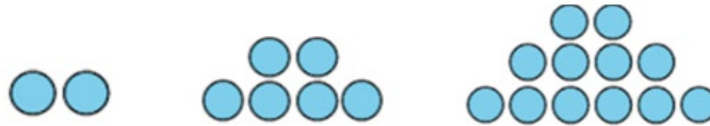
It helps to "see" the two matches that are added each time.

8. Term 1: $1 + 1 \times 2 = 3$ Term 2: $1 + 2 \times 2 = 5$
 Term 3: $1 + 3 \times 2 = 7$ Term 4:
 Term 5: Term 10: Term 17:
9. What stays the same in the pattern and what varies?
 10. How many matches will be at figure number " n "?

Lesson 4: Learner Activity 2

GROWING PATTERNS

Copy and complete the table below.



Pattern	1	2	3	4	5	6
Circles						
Circles: Clever counting	2	$2 + 4$				

Lesson 4: Learner Activity 3

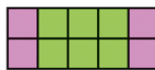
Copy and complete the table below.



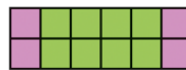
Picture 1



Picture 2



Picture 3



Picture 4

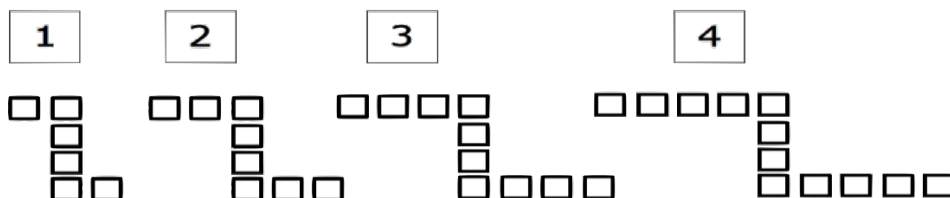


Picture 5

Picture Number	In Words	Drawing	Number of Squares/tiles
6			
60			

Lesson 5: Learner Activity 1

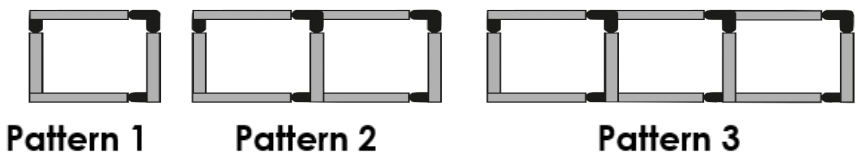
Extend and represent patterns using relationships and rules.



1. Draw the 6th figure in this pattern.
2. Explain in your own words how the pattern develops or how the pattern grows from one figure to the next.
3. Develop a calculation plan (RULE).

Lesson 5: Learner Activity 2

Extend and represent patterns using relationships and rules.



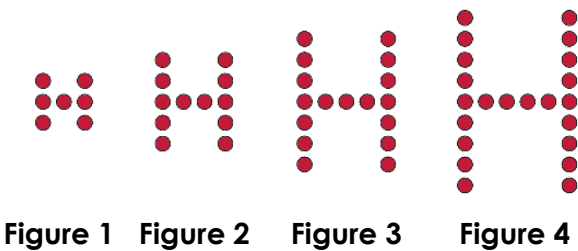
- 1. Explain how the pattern is formed.
- 2. Copy and complete the table below:
- 3. What rule did you use to complete the table?

Pattern Number (Term Number)	1	2	3	4	5	6	7	8	<i>n</i>
Number of Matches	4								

- 4. How many matches are needed for Figure 9 (or term 9)?
- 5. How many matches are needed for figure 20 (or term 20)?
- 6. What rule did you use to calculate the number of matches in question 5?
- 7. Complete the pattern:
Term 1: $1 + 1 \times 3 = 4$ Term 2: $1 + 2 \times 3 = 7$
Term 3: $1 + 3 \times 3 =$ Term 4:
Term 5: Term 10: Term 17:
- 8. What remains the same in the pattern and what differs?

Lesson 5: Learner activity 3

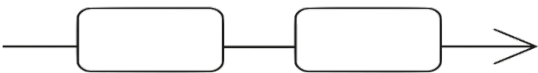
Note the figure below with the red dots.



- 1. How many dots are used to form Figure 5 (what is the constant difference)?
- 2. Draw figure 5.
- 3. Complete the table:

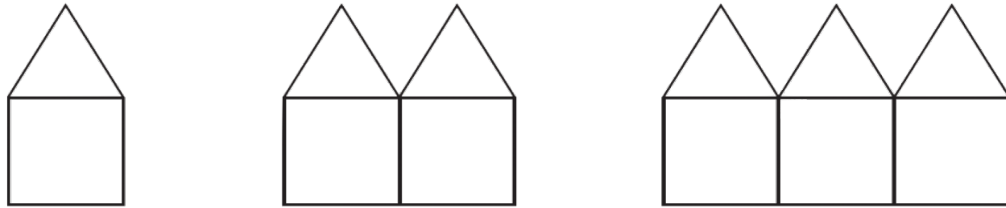
Figure number	1	2	3	4	5	6	7	8
Number of dots	7	12	17					

- 4. Complete the flow diagram.



Lesson 5: Learner Activity 4

Ralph built houses with match sticks. It looks like the figures below.



(a) Explain how the pattern is formed.

(b) Complete the table.

Figure No. (Term No.)	1	2	3	4	5	6	7	8	9	n
# Matches	6	11	16							

(c) What rule did you use to complete the table?

(d) How many matches are needed for figure 9 (or term 9)?

(e) How many matches are needed for figure 20 (or term 20)?

(f) What rule did you use to calculate the number of matches in question (e)?

(g) Complete the pattern:

Term 1: $1 \times 5 + 1$

Term 2: $2 \times 5 + 1$

Term 3: $3 \times 5 + 1$

Term 4: _____

Term 5: _____

Term 10: _____

Term 17: _____

(h) What stays the same in the pattern in (g) and what varies?

(i) Use the flow diagram below to write down the rule that you can use to calculate the number of matches needed for any figure in the pattern.



(j) Write down the rule to calculate the term for any term number in terms of n .

Lesson 6: Learner Activity 1

Squares are arranged to form figures as shown below, according to a rule.

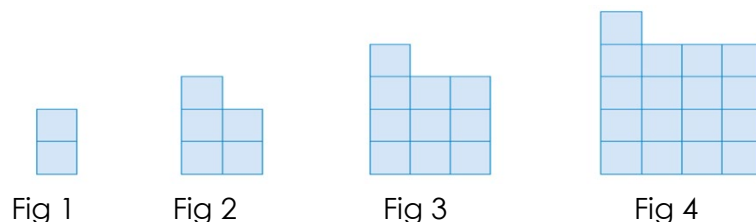


Fig 1

Fig 2

Fig 3

Fig 4

1. Copy and complete the table. Then determine the differences between consecutive terms.

Figure number	1	2	3	4	5	6	7	8
Number of squares	2	5						

2. Describe the recursive rule that you can use to extend the pattern in words.

3. Nombuso played around with the differences between consecutive terms. She noticed that the pattern (+ 3; + 5; + 7; ...) was similar to the one that you get when you calculate the differences between square numbers. This made her think that she should investigate square numbers to help her find a rule that could link the figure number and the number of squares.

Complete the following pattern along the lines of Nombuso's thinking:

Figure 1: $1 \times 1 + 1 = 1 + 1 = 2$

Figure 2: $2 \times 2 + 1 = 4 + 1 = 5$

Figure 3:

Figure 4:

Figure 5:

Figure 6:

Figure 7:

Figure 8:

Figure 50:

4. Write a rule to calculate the number of squares for any figure number/term.
5. Write your rule, in Question 2, in terms of ***n***, where ***n*** is the symbol for any figure number.

Lesson 6: Learner activity 2

The numbers in each row of the table form a pattern, but not all of the numbers are given.

A						4	6	8	10					
B						10	8	6	4					
C						5	8	11	14					
D						20	17	13	8					

1. Copy the table and fill in the missing numbers.
2. What is the constant difference in row A?
3. What is the constant difference in row C?
4. Investigate each of the patterns below. Find the pattern and write the following four terms in the sequence.
 - (a) 1; 4; 9; 16; 25
 - (b) 3; 6; 11; 18; 27
 - (c) 20; 19; 17; 14; 10
 - (d) 20; 25; 29; 32; 34

Lesson 7: Learner activity 1

Study the sequences below:

Pattern A: 6; 11; 16; 21; 26

Pattern B: 13; 17; 21; 25; 29

Pattern C: 20; 23; 26; 29; 32

Pattern D: 1; -3; -7; -11; -15

Pattern E: 31; 33; 35; 37; 39

Pattern F: -20; -25; -30; -35; -40

Pattern G: 25; 31; 37; 43; 49

Pattern H: 26; 33; 40; 47; 54

Pattern I: -11; -17; -23; -29; -35

Sequence I in question 5 is a **decreasing** sequence; the numbers become smaller as the sequence progresses: -11; -17; -23; -29; -35

Sequence H is an **increasing** sequence; each term is bigger than the previous term: 26; 33; 40; 47; 54.

1. (a) Which sequences are increasing sequences?
(b) Which sequences are decreasing sequences?
2. (a) By how much does sequence A increase from one term to the next?
(b) By how much does sequence B increase from one term to the next?
(c) Which of the sequences increases by the biggest amount from one term to the next, and by how much does it increase?

Sequence G increases by 6 from term to term, and sequence E increases only by 2. We may say that sequence G increases faster than sequence E.

3. (a) Which of the sequences above, decreases the fastest?
 (b) Which of the sequences above decreases the slowest?

X	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100