NUMBER PATTERNS

EXAMPLES AND EXERCISES

GRADE 8

EXERCISE 1

Write down the next three numbers in each of the sequences below. Also explain in your own words, in each case, how you figured out what the numbers should be**.**

1. Sequence A 2; 5; 8; 11; _____ : _____ ; _____
2. Sequence B 4; 5; 8; 13; _____ : _____ ; _____
3. Sequence C 1; 2; 4; 8; _____ : _____ ; _____
4. Sequence D 3; 5; 7; 9; _____ : _____ ; _____
5. Sequence E 4;5; 7; 10; _____ : _____ ; _____
6. Sequence F 2; 6; 18; 54; _____ : _____ ; _____
7. Sequence G 1; 5; 9; 13; _____ : _____ ; _____
8. Sequence H 2; 4; 8; 16; _____ : _____ ; _____

GOING FROM ONE TERM TO THE NEXT

Write down the next three numbers in each of the sequences below:

EXAMPLE 1 A

1. Sequence A: 4; 7; 10; 13; 16; _____ ; _____ ; _____

EXAMPLE 1 B

Write down the value of d and the next three numbers in each of the sequences below:

1. Sequence B: 10; 18; 26; 34; 42; _____ ; _____ ; _____

EXAMPLE 1 C

Write down the value of d and the next three numbers in each of the sequences below:

1. Sequence C: 10; 5; 0; -5; -10; _____ ; _____ ; _____

EXAMPLE 1 D

Write down the value of d and the next three numbers in each of the sequences below:

1. Sequence D: -7; -3; 1; 5; _____ ; _____ ; _____

EXAMPLE 2 A

2. Sequence E: 4; 7; 12; 19; _____ ; _____ ; _____

EXAMPLE 2 B

2. Sequence F: 3; 9; 18; 30; _____ ; _____ ; _____

EXAMPLE 3 A

3. Sequence G: 4; 8; 16; 32; _____ ; _____ ; _____

EXAMPLE 3 B

Write down the constant ratio and the next three numbers in each of the sequences below:

3. Sequence H: 3; 12; 48; 192; _____ ; _____ ; _____

EXERCISE 2

Write down the next two numbers in each of the sequences below. Also explain, in each case, whether there is a constant first difference, constant second difference or a constant ratio.

1. $7;\ 9;\ 11;\ 13;\ ___\ ;\ ___$

2. $-5;\ -2;\ 1;\ 4;\ ___\ ;\ ___$

3. $2;\ 6;\ 12;\ 20;\ ___\ ;\ ___$

4. $1;\ 3;\ 9;\ 27;\ ___\ ;\ ___$

5. $10;\ 7;\ 4;\ 1;\ ___\ ;\ ___$

6. $\frac{1}{8};\ \frac{2}{8};\ \frac{4}{8};\ 1;\ ___\ ;\ ___$

7. $\frac{1}{8};\ \frac{2}{8};\ \frac{3}{8};\ \frac{4}{8};\ ___\ ;\ ___$

8. $9;\ 3;\ 1;\ \frac{1}{3};\ ___\ ;\ ___$

EXTENDING MORE SEQUENCES

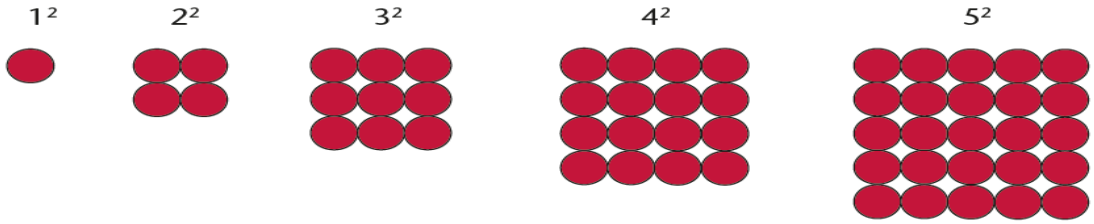
EXAMPLE 4

Write down the next three numbers in each of the sequences below:

4. Sequence I: 1; 4; 9; 16; _____ ; _____ ; _____

Example 4 (Can you find a second way to do this example?)

EXAMPLE 5



Pic 1 Pic 2 Pic 3 Pic 4 Pic 5

Complete the table below:

Picture number	**1**	**2**	**3**	**4**	**5**
Amount of circles					

1. How many circles will there be in picture 6?
2. How many circles will there be in picture 8?
3. How many circles will there be in picture 12?
4. How many circles will there be in picture *n*? Explain

EXAMPLE 6

Write down the next three numbers in each of the sequences below:

5. Sequence J: 1; 1; 2; 3; 5; _____;_____;_____

EXERCISE 3

Write down the next two numbers in each of the sequences below. Also in each case, explain how you determined the next two term.

1. 2; 5; 8; 11; 14; 17; ____ ; ____
2. 1; 4; 9; 16; 25; ____ ; ____
3. 1; 8; 27; 64; ____ ; ____
4. 2; 3; 5; 8; 13; ____ ; ____
5. 1; 5; 1; 10; 1; 15; ____ ; ____
6. $\frac{1}{5}; \frac{2}{5}; \frac{3}{5}$; ____ ; ____
7. 2; 2; 4; 6; 10; ____ ; ____
8. $2; 1; \frac{1}{2}; \frac{1}{4}$; ____ ; ____

A RULE TO DESCRIBE A PATTERN

EXAMPLE 7

Patterns with a constant difference

1. Sequence: 4; 7; 10; 13; …..

Complete the table below:

Position	**1**	**2**	**3**	**4**	**10**	**?**
Value	4	7	10	13	?	64
Rule						

EXAMPLE 8

Complete the table below and fill in the missing values

Position	**1**	**2**	**3**	**4**	**8**	**?**
Value	6	4	2	0	?	-22
Rule						

A SHORTCUT TO DETERMINE THE GENERAL RULE

EXAMPLE 9

Can you find a shortcut to determine the general rule?

Position	**1**	**2**	**3**	**4**	**10**	**?**
Value	4	7	10	13	?	64
Rule	4	4+3	4+3+3	4+3+3+3	4+3(9)	

EXAMPLE 10

Using the constant difference to help us determine a general rule

Input number	**1**	**2**	**3**	**4**	**10**
Output number	4	7	10	13	

EXAMPLE 11

Use the constant difference to help determine a general rule and T_{10}

Input number	**1**	**2**	**3**	**4**	**10**
Output number	4	9	14	19	

EXAMPLE 12

Determine a general rule for the sequence 10;7;4;1……

Input number				
Output number				

EXERCISE 4

Determine a general rule and T_{15} for each of the following sequences

1. $7;\ 9;\ 11;\ 13;\ \ldots;\ldots$
2. $-5;\ -2;\ 1;\ 4;\ \ldots;\ldots$
3. $11;\ 7;3;-1;\ \ldots;\ldots$
4. $\frac{1}{8};\ \frac{2}{8};\ \frac{3}{8};\frac{4}{8};\ \ldots;\ldots$

INVESTIGATING SEQUENCES

EXAMPLE 13

Given the following number pattern: 5; 12; 19; 26; ……

1. Determine the constant difference.
2. Determine the next TWO terms.
3. Describe the general rule for the pattern
4. Determine the 10^{th} term.
5. Which term will be equal to 82?

EXERCISE 5

QUESTION 1

Given the following number sequence:

$$2; 7; 12; 17; \ldots$$

1.1 Determine the constant difference.

1.2 Determine the next TWO terms.

1.3 Determine a general rule for the sequence.

1.4 Determine the 10^{th} term.

1.5 Which term in the sequence will be equal to 82?

QUESTION 2

Given the following number sequence:

$$7; 4; 1; -2; \ldots$$

2.1 Determine the constant difference.

2.2 Determine the next TWO terms.

2.3 Determine a general rule for the sequence.

2.4 Determine the 12^{th} term.

2.5 Which term in the sequence will be equal to -17?

QUESTION 3

Given the following number sequence:

$$\frac{1}{2}; \frac{3}{4}; 1; 1\frac{1}{4}; \ldots$$

3.1 Determine the constant difference.

3.2 Determine the next TWO terms.

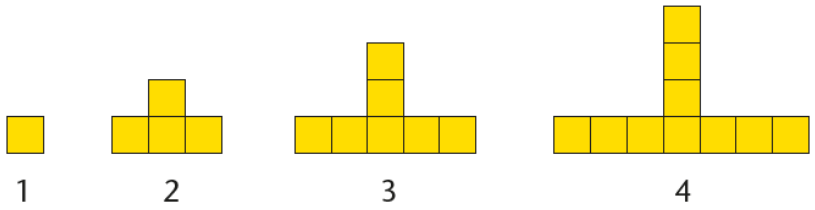
3.3 Determine a general rule for the sequence.

3.4 Determine the 6^{th} term.

3.5 Which term in the sequence will be equal to $\frac{7}{4}$?

PATTERNS FROM PICTURES

EXAMPLE 14



Pattern number	**1**	**2**	**3**	**4**
Number of squares	1	4	7	10

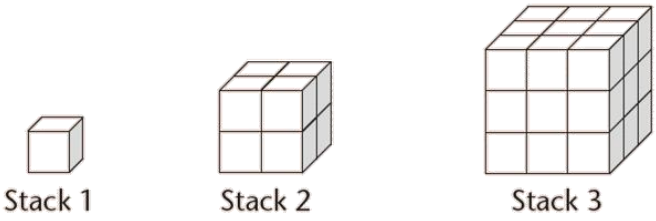
1. (a) How many squares will there be in pattern 5?

   (b) Determine the general rule for this pattern.

   (c) How many squares will there be in pattern 20?

   (d) What is the number of the pattern with 34 squares?

EXAMPLE 15



(a) How many cubes will there be in stack 5?

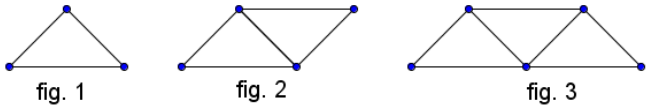
(b) Complete the table.

Stack number	**1**	**2**	**3**	**4**	**5**	**6**	**10**
Number of cues	1	8	27				

(c) Write down a rule to calculate the number of cubes for any stack number.

EXERCISE 6

QUESTION 1



Complete the table:

	fig. 1	fig. 2	fig. 3	fig. 4	fig. 5
Number of dots					
Number of lines					

1.1 Determine a rule for the dots.

1.2 Determine a rule for the lines.

1.3 How many dots will there be in figure 20.

1.4 Which figure will have 31 lines?

QUESTION 2

Complete the table:

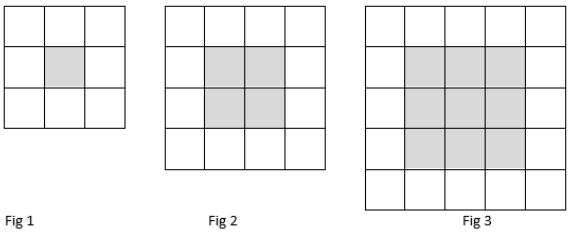


	fig. 1	fig. 2	fig. 3	fig. 4	fig. 5
Number of shaded blocks	1				
Number of white blocks	8				

2.1 Determine a rule for the shaded blocks.

2.2 How many shaded blocks will there be in figure 12?

2.3 How many white blocks will there be in figure 12?

2.4 How many blocks will there be in total in figure 10?