Numeric and Geometric Patterns

pg. 142-148

Recognize and extend number patterns

We can make patterns with numbers, for example, the numbers 1; 5; 9;13 …… form a pattern. Each number in the pattern is called a **term**. The first term in this pattern is 1 and the second term is 5. The dots after the number 13 tell you the pattern continues beyond what is shown.

To form a pattern, you may add or subtract the same number repeatedly. This is called a **constant difference**. In some patterns you divide or multiply to extend the pattern and this is called a **constant ratio**. In the example, the constant difference (number 5) is added to extend the **sequence.**

Use the given rule to calculate the missing values in each table

$$k = m + 3$$

m	1	2	3	7	
k					18

Describe the relationship between the numbers in the top row and the bottom row in the table using the given letters.

Then, write down the value of the

a) 10th number (term)

b) 30th number (term)

Rule: $y =$

x	1	2	3	4
y	4	8	12	16

10th term= 4 x 10 = 40

30th term = 30 x 4 = 120

- Write the required term in each of these patterns.

In the number pattern 1; 4; 9; ….. find the fifth term.

$$T_n = n^2$$

So T_n = number in sequence/ output value

n= the term in the sequence/ input value

Therefore, the value of the fifth term will be:

Rule: $T_n = n^2$

$T_5 = 5 \text{ x } 5$

$T_5 = 25$

T	1	2	3	4
n	1	4	9	

Numeric patterns

Ex. 11.1 pg. 143

1 a, e, f, i, h

2 a, b, g, h

3 b, c, e

1. a) 81; 243; 729
   b) 55; 44; 33
   c) 625; 3125; 15625
   d) 8; 4; 0
   e) 10,8; 11; 11; 2
   f) 2,5; 2; 1,5
   g) 0,625; 0,75; 0,875
   h) $7\frac{1}{4}$; $7\frac{1}{2}$; $7\frac{3}{4}$
   i) 36; 49; 64
   j) 16; 22; 29

2. a) 12
   b) 78
   c) 109
   d) 8
   e) 19
   f) 25
   g) 5.5 cm
   h) 5
   i) $12\frac{3}{4}$
   j) 2 m

n

3. a) 25
   b) 2
   c) 8
   d) 16
   e) 0,4

Constant difference

- Every time we add constant number such as 3 to the previous term for example 1; 4; 7; 10; _____; also every time we subtract a constant number such as 4 from the previous term for example 13; 9; 5; 1; _____

Constant ratio

- When we multiply by a constant number, such as 3, for example 3; 9; 27; 81; _______; also when we divide by a constant number, such as 5, for example 25; 5; 1; $\frac{1}{5}$; _______

Ex. 11. 2 pg. 143

1 a, d, f; g

2 a, f, g, i

ADD:

Give the next two terms in the sequence:

1. 40; 20; 10; 5; _____; ______
2. 14; 11; 9; 6; _____; ______

1. a) 2 b) -3
c) -5 d) 6
e) 0,5 f) $-0{,}2$
g) $\frac{1}{2}$ h) 0,05 mm
i) $-0{,}125\ \ell$

2. a) 2 b) $\frac{1}{5}$
c) 6 d) $\frac{1}{2}$
e) 2 f) $\frac{1}{2}$
g) 2 h) $\frac{1}{2}$
i) $\frac{1}{5}$

Finding the rule of the numeric pattern

- Consider the following numeric sequence:

5; 7; 9; 11; …..

$\mathrm{T_n} = 2n + 3$

Term 1:

$\mathrm{T_1} = 2(1) + 3$

=5

Term 2:

$\mathrm{T_2} = 2(2) + 3$

=7

Therefore, the 20th term is:

$\mathrm{T_n} = 2n + 3$

$\mathrm{T_{20}} = 2(20) + 3$

$\mathrm{T_{20}} = 43$

Finding the rule of the numeric pattern

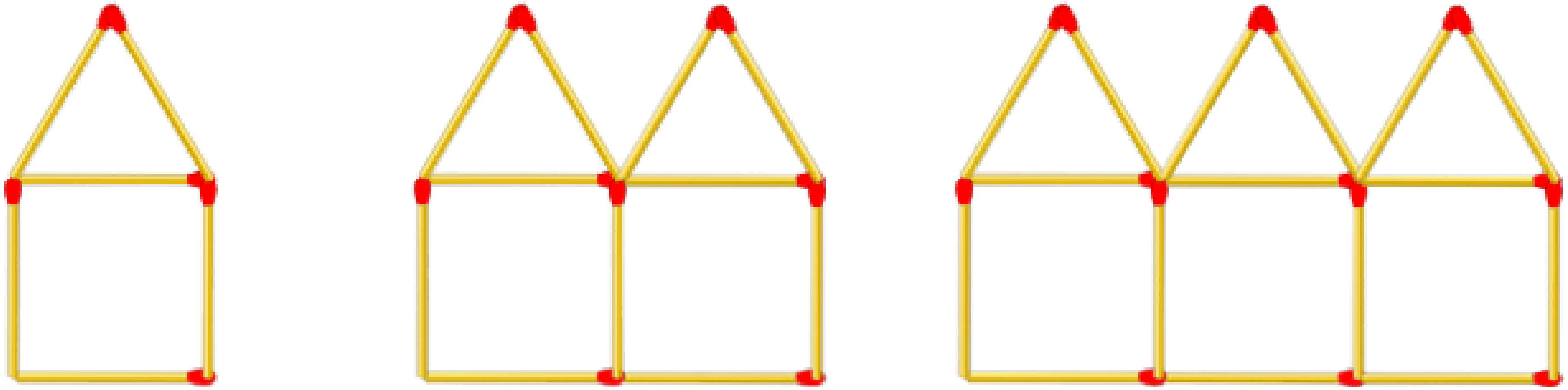
Ex. 11.4 pg. 146

1 - 5

1. $5 \times$ the position of the term $+ 4$ and the 20^{th} term is 104.
2. $4 \times$ the position of the term $+ 12$ and the 19^{th} term is 88.
3. $11 \times$ the position of the term $+ 2$ and the 11^{th} term is 123.
4. $4 \times$ the position of the term $- 1$ and the 15^{th} term is 59.
5. $4 \times$ the position of the term $- 2$ and the 18^{th} term is 70.

Geometric patterns

- Geometric patterns are number patterns represented by diagrams. This illustrates the formation of the number pattern. Representing the number patterns in tables makes it easier to describe the general rule for the pattern.



Term (Pattern)	1	2	3	4	10
No of matchsticks	6	11	16		

$$y = 5x + 1$$

Example

Study the pattern and count the number of dots in each stage.

Stage 1 Stage 2 Stage 3 Stage 4

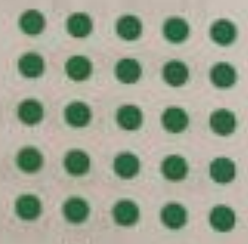
Stage number	1	2	3	4	5	6
Number of dots	1	4	9			

1. Describe what you notice.
2. Draw the fifth stage.
3. List all square numbers up to 100.

Answers

1. When you have counted the number of dots in each stage, display the information in a table. Each stage is a square made of dots. The number of dots equals the square of the stage number.

2.



Stage 5

3. You will have realised that the numbers of dots in each stage are squares. So if we continue this geometric pattern, we will find the square numbers up to 100: 1; 4; 9; 16; 25; 36; 49; 64; 81; 100.

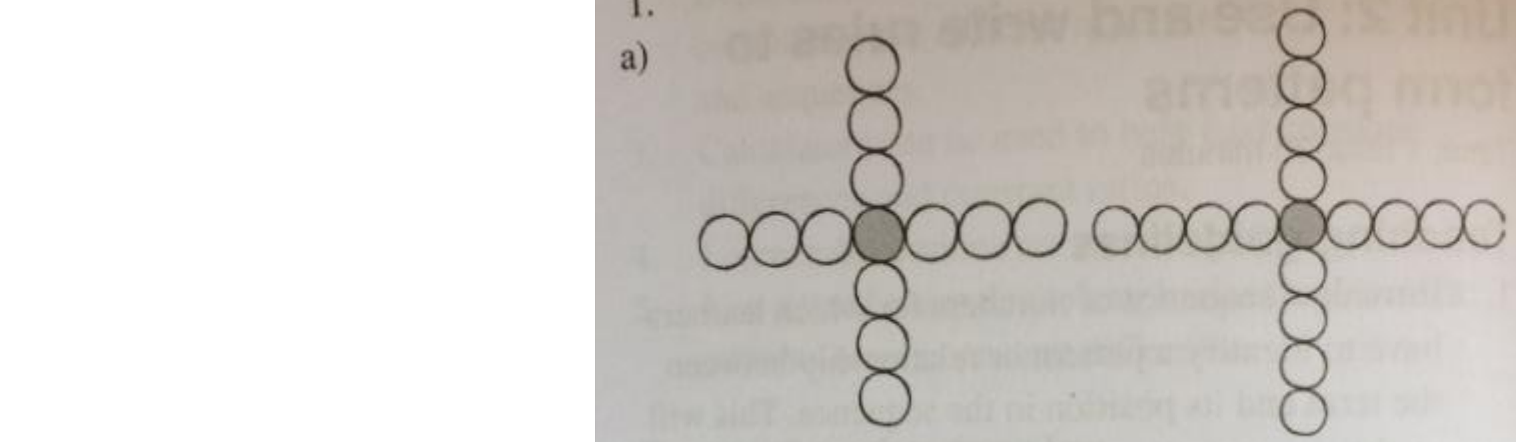
Geometric patterns

Ex 11.5 pg. 148

1-3

1.

a)



b) 13 and 17

c)

Design number	1	2	3	4	5	6
Number of circles	1	5	9	13	17	21

d) Add four circles to the previous pattern

e.) $T_n = 4n - 3$

f.) $T_{12} = 4 \times 12 - 3$
$= 45$

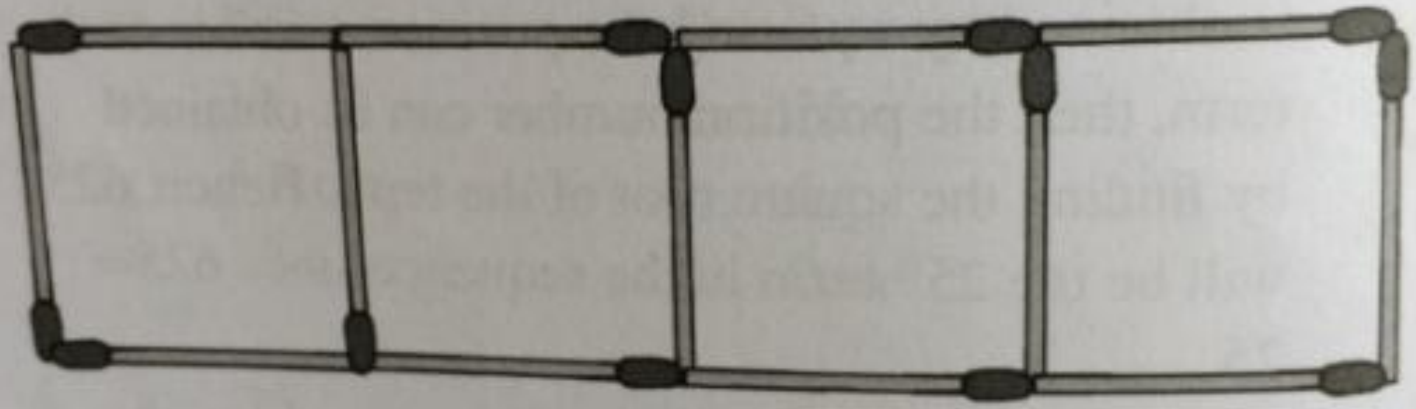
2. a) 12 units

b)

Side length of cube	3	4	5	6	7	8	9
Volume of cube	9	16	25	36	49	64	81

c) Square 7

3.a)



b) 4

c) 7

d) 10

e) $T_{n=3n+1}$

f) $T_{10=3\times 10+1=31}$

Pattern number	1	2	3	4	5	10
Number of matches	4	7	10	13	16	31