Big Idea: 'Matariki'

TE IWA O MATARIKI
THE NINE STARS OF MATARIKI

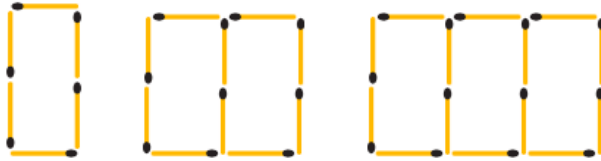**WALT:** Complete matchstick patterns and create a rule

Success Criteria: I know . . .
- how to count matchsticks for each pattern
- how to create a table and complete the progression

Matchstick pattern rules video

Checking your understanding

1 Jack used matchsticks to begin a pattern of rectangles.

shape 1   shape 2   shape 3

Write the missing words or numbers for each of these.
a Each shape shows some _____ made with matchsticks.
b Shape 1 has ___ rectangle, shape 2 has ___ rectangles and shape 3 has ___ rectangles.
c Shape 1 has ___ sticks, shape 2 has ___ sticks and shape 3 has ___ sticks.
d These shapes follow a sequence that is called a _____ pattern.

2 Jane used matchsticks to make a spatial pattern of houses.

How many extra matches are needed to change 1 house into 2 houses?

Copy and complete this table.

Number of houses	1	2	
Number of sticks			

Example 30 Finding a general rule for a spatial pattern

a Draw the next two shapes in this spatial pattern.

b Complete the table.

Number of triangles	1	2	3	4	5
Number of sticks required	3				

c Complete this pattern rule: number of sticks × ☐ = number of triangles

d How many sticks would you need for 20 triangles?

Solution

Explanation

a
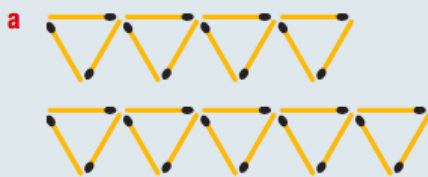
Follow the pattern by adding one triangle each time.

b

No. of triangles	1	2	3	4	5
No. of sticks	3	6	9	12	15

An extra 3 sticks are required to make each new triangle.

c number of sticks = 3 × number of triangles

3 sticks are required per triangle.

d number of sticks = 3 × 20 triangles = 60 sticks

20 triangles × 3 sticks each

[Further work on patterns video](#)

4 a Draw the next two shapes in this spatial pattern.

For part **c**, check that your pattern rule works for all values in the table.

b Copy and complete this table.

Number of crosses	1	2	3	4	5
Number of sticks					

c Copy and complete this pattern rule: number of sticks = ☐ × number of crosses

d How many sticks would you need for 10 crosses?

5 a Draw the next two shapes for this spatial pattern.

b Copy and complete this table.

Number of squares	1	2	3	4	5
Number of sticks					

c Copy and complete the pattern rule:
number of sticks = ☐ × number of squares

d How many sticks would you need for 12 squares?

[Watch the video on patterns explanation](#)

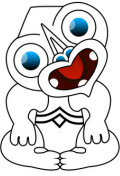**6 a** Draw the next two shapes for this spatial pattern.

b Copy and complete this table.

| Number of hexagons	1	2	3	4	5
Number of sticks					

How many extra matches would you need to add another hexagon?

c Copy and complete the pattern rule:
number of sticks = ☐ × number of hexagons

d How many sticks would you need for 20 hexagons?

7 List the shapes (**A** to **D**) in the correct order to make a spatial pattern. (Start with the smallest shape.) Then draw the next shape in the sequence.

A   B   C   D
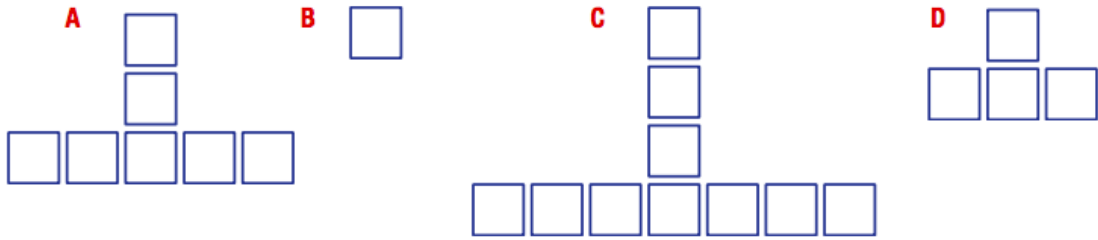
Challenge and extension

Example 31 Finding more challenging rules

a Draw the next two shapes for this spatial pattern.

b Copy and complete this table.

Number of squares	0	1	2	3	4
Number of sticks	1	$1 + \square \times 1 = \square$	$1 + \square \times 2 = \square$	$1 + \square \times 3 = \square$	$1 + \square \times 4 = \square$

c Copy and complete the rule for the pattern:
number of sticks $= 1 + \square \times$ number of squares

d How many sticks are needed to make 30 squares this way?

e How many squares could be made from 25 sticks?

Solution

a

b

Number of squares	0	1	2	3	4
Number of sticks	1	$1 + 3 \times 1 = 4$	$1 + 3 \times 2 = 7$	$1 + 3 \times 3 = 10$	$1 + 3 \times 4 = 13$

c number of sticks $= 1 + 3 \times$ number of squares

d 91 sticks

e 8 squares

Explanation
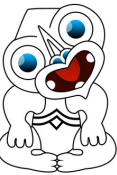
Add 3 sticks at a time to complete each new square.

Count the squares. Complete the calculations, then count sticks in the diagrams to check.

The number of sticks is 1 more than 3 times the number of squares.

$1 + 3 \times 30 = 91$

$25 - 1 = 24$,
$24 \div 3 = 8$

Read the information given above

8 a Draw the next two shapes for this spatial pattern.

> How many extra matches are needed to make 1 matchstick into a triangle?

b Copy and complete this table.

Number of triangles	0	1	2	3	4
Number of sticks	1	$1 + \square = \square$	$1 + \square \times 2 = \square$	$1 + \square \times 3 = \square$	$1 + \square \times 4 = \square$

c Copy and complete the rule for this pattern:
number of sticks = $1 + \square \times$ number of triangles

d How many sticks are needed to make 12 triangles this way?

e How many triangles could be made from 81 sticks?

9 a Draw the next two shapes in this spatial pattern.

> Copy the last shape and add more sticks to make the next shape.
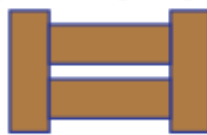
b Copy and complete this table.

Number of shapes	0	1	2	3	4
Number of sticks	1	$1 + \square = \square$	$1 + \square \times 2 = \square$	$1 + \square \times 3 = \square$	$1 + \square \times 4 = \square$

c Copy and complete the rule for this pattern:
number of sticks = $1 + \square \times$ number of shapes

d How many sticks are needed to make 20 shapes this way?
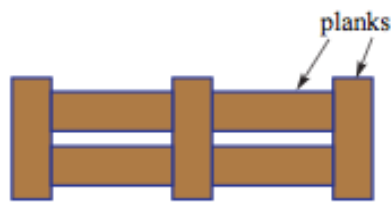
e How many shapes could be made from 86 sticks?

10 a Draw the next two shapes in this spatial pattern.

planks

0 fence section   1 fence section   2 fence section

b Copy and complete this table.

Number of fence sections	0	1	2	3	4
Number of planks	1	$1 + \square = \square$	$1 + \square \times 2 = \square$	$1 + \square \times 3 = \square$	$1 + \square \times 4 = \square$

c Copy and complete the pattern rule: number of planks = $1 + \square \times$ number of fence sections

d How many planks would you need to make 9 fence sections?

e How many fence sections can be made from 43 planks?

11 Which rule correctly describes this spatial pattern?

   A Number of sticks = 7 × number of 'hats'
   B Number of sticks = 7 × number of 'hats' + 1
   C Number of sticks = 6 × number of 'hats' + 2
   D Number of sticks = 6 × number of 'hats'

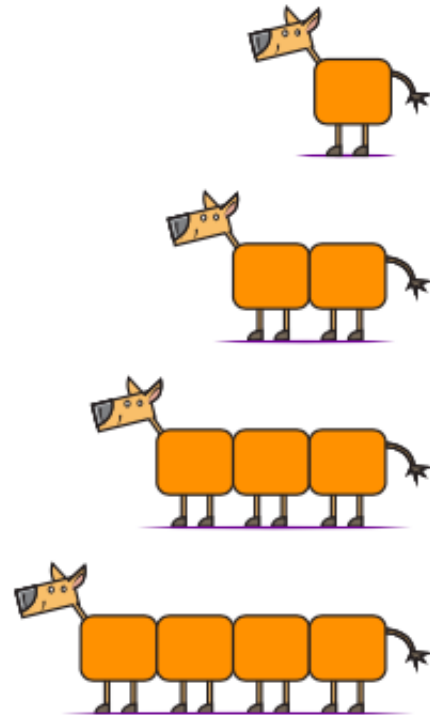**12** Which rule correctly describes this spatial pattern?

   A Number of sticks = 5 × number of houses + 1
   B Number of sticks = 6 × number of houses + 1
   C Number of sticks = 6 × number of houses
   D Number of sticks = 5 × number of houses

⭐ **Design your own spatial pattern**

13 Design a spatial pattern to fit the following
    number patterns.
   a 4, 7, 10, 13, …
   b 4, 8, 12, 16, …
   c 3, 5, 7, 9, …
   d 3, 6, 9, 12, …
   e 5, 8, 11, 14, …
   f 6, 11, 16, 21, …

Answers

Exercise 3I

1 a rectangles   **b** 1, 2, 3   **c** 6, 10, 14   **d** spatial

2

Number of houses	1	2	3
Number of matchsticks	6	11	16

3 a

b

c
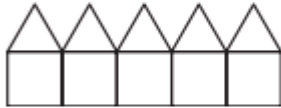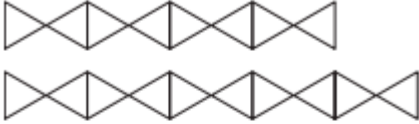
d
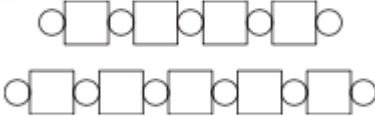
4 a

b

Number of crosses	1	2	3	4	5
Number of sticks	4	8	12	16	20

c number of sticks = 4 × number of crosses

d 40 sticks

5 a

b
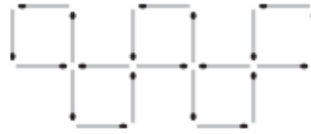
Number of squares	1	2	3	4	5
Number of sticks	4	8	12	16	20

c number of sticks = 4 × number of squares

d 48 sticks

6 a
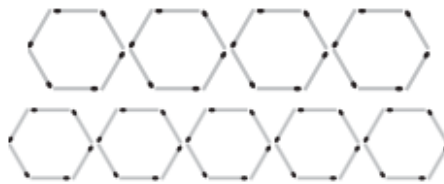
b

Number of hexagons	1	2	3	4	5
Number of sticks	6	12	18	24	30

c number of sticks = 6 × number of hexagons

d 120 sticks

7 B, D, A, C
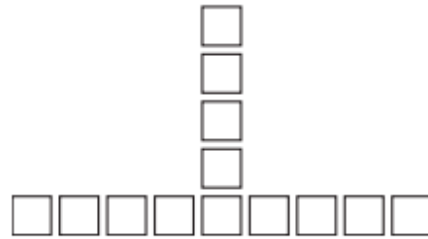
8 a

b

Number of triangles	0	1	2	3	4
Number of sticks	1	1 + 2 = 3	1 + 2 × 2 = 5	1 + 2 × 3 = 7	1 + 2 × 4 = 9

c number of sticks = 1 + 2 × number of triangles
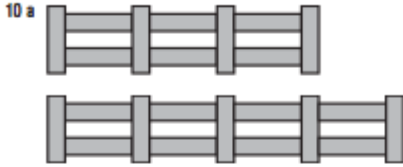
d 25 sticks   **e** 40 triangles

9 a
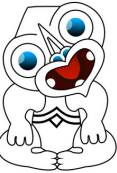
Answers

b

Number of shapes	0	1	2	3	4
Number of sticks	1	1 + 5 = 6	1 + 5 × 2 = 11	1 + 5 × 3 = 16	1 + 5 × 4 = 21

c number of sticks = 1 + 5 × number of shapes

d 101 sticks   **e** 17 shapes

10 a

b

Number of fence sections	0	1	2	3	4
Number of planks	1	1 + 3 = 4	1 + 3 × 2 = 7	1 + 3 × 3 = 10	1 + 3 × 4 = 13

c number of planks = 1 + 3 × number of fence sections

d 28 planks   **e** 14 fence sections

11 A

12 A

13 Answers may vary.