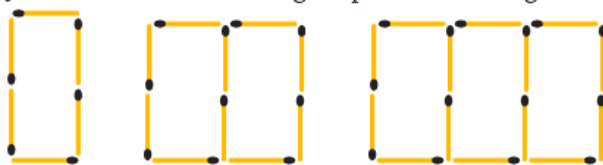


Big Idea

Mana tangata: Build on individual strengths, increase learners' self-confidence and self-esteem, and allow your learners to make a contribution. Mana tangata means developing self-esteem through contributing. Mana tangata helps describe a learner-centred teaching environment because the learner's contribution and resulting self-esteem is important. (PE tough guy & girl challenge at Barry Curtis Park, Radio station, band, wearable art, mural, students to identify their passion projects, etc...)

Checking your understanding from last time Do now

- 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			

WALT form rules from the given spatial patterns

Success Criteria I can see and count how the numbers increase in a pattern
 multiple additions can also be written as a multiple of a number

[Matchstick pattern rules video](#)

Example 30 Finding a general rule for a spatial pattern

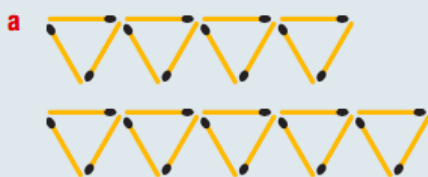
- a Draw the next two shapes in this spatial pattern.



- 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 \times = number of triangles
 d How many sticks would you need for 20 triangles?

Solution**Explanation**

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 = $3 \times$ number of triangles 3 sticks are required per triangle.
 d number of sticks = 3×20 triangles = 60 sticks 20 triangles \times 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 = $\square \times$ 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 = $\square \times$ 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.



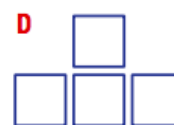
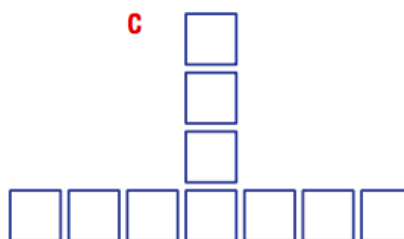
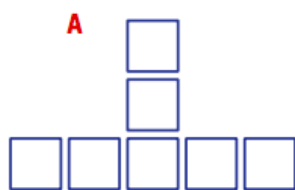
- b Copy and complete this table.

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 = $\square \times$ 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.



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


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.



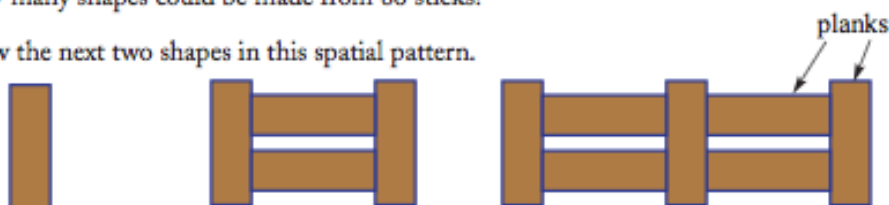
Copy the last shape and add more sticks to make the next shape.



- 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.



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 = $7 \times$ number of 'hats'
- B Number of sticks = $7 \times$ number of 'hats' + 1
- C Number of sticks = $6 \times$ number of 'hats' + 2
- D Number of sticks = $6 \times$ number of 'hats'

12 Which rule correctly describes this spatial pattern?

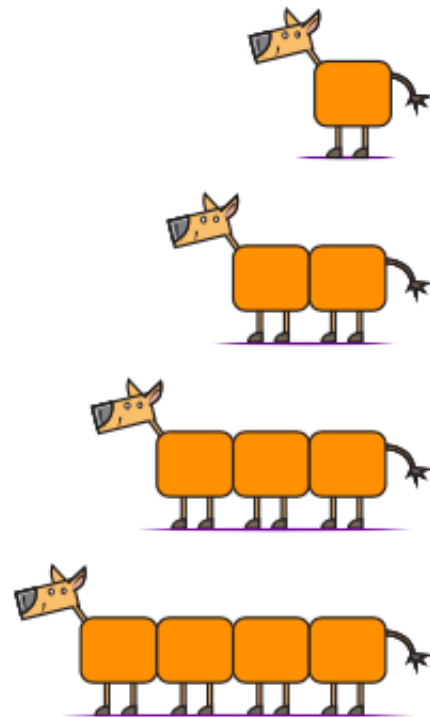


- A Number of sticks = $5 \times$ number of houses + 1
- B Number of sticks = $6 \times$ number of houses + 1
- C Number of sticks = $6 \times$ number of houses
- D Number of sticks = $5 \times$ number of houses

★ 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

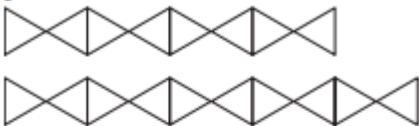
Exercise 3I

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

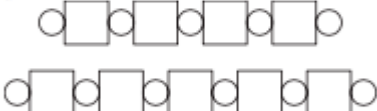
2

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

3 a



d



4 a



b

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

c number of sticks = $4 \times$ number of crosses

d 40 sticks

5 a



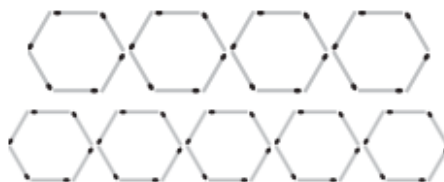
b

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

c number of sticks = $4 \times$ number of squares

d 48 sticks

6 a



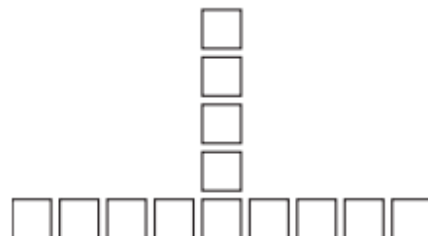
b

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

c number of sticks = $6 \times$ 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	$1+2=3$	$1+2 \times 2=5$	$1+2 \times 3=7$	$1+2 \times 4=9$

c number of sticks = $1 + 2 \times$ number of triangles

d 25 sticks

e 40 triangles

9 a



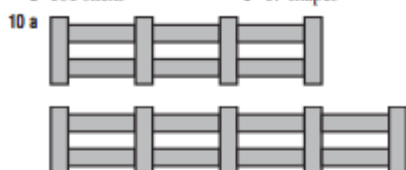
Answers

b

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

c number of sticks = $1 + 5 \times$ number of shapes

d 101 sticks **e** 17 shapes



b

Number of fence sections	0	1	2	3	4
Number of planks	1	$1 + 3 = 4$	$1 + 3 \times 2 = 7$	$1 + 3 \times 3 = 10$	$1 + 3 \times 4 = 13$

c number of planks = $1 + 3 \times$ number of fence sections

d 28 planks **e** 14 fence sections

11 A

12 A

13 Answers may vary.

