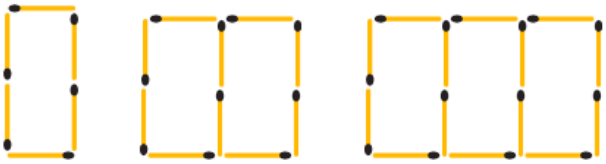
Big Idea

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.

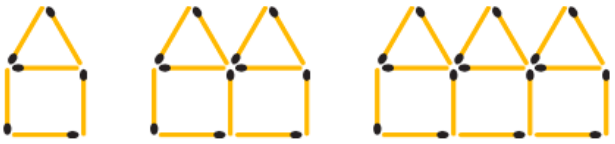
a Each shape shows some _____ made with matchsticks.

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

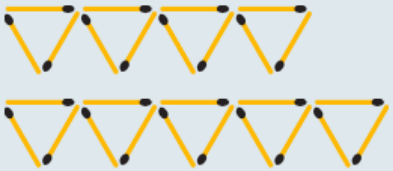
a Draw the next two shapes in this spatial pattern.

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

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

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					

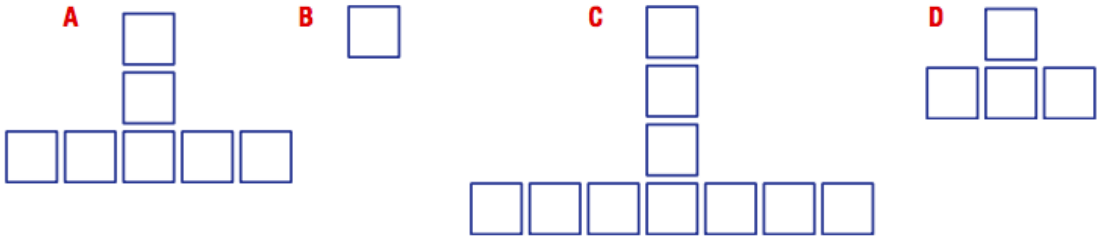
How many extra matches would you need to add another hexagon?

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

d How many sticks would you need for 20 hexagons?

Problem-solving and Reasoning

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 + □ × 1 = □	1 + □ × 2 = □	1 + □ × 3 = □	1 + □ × 4 = □

c Copy and complete the rule for the pattern:
number of sticks = 1 + □ × 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 × 1 = 4	1 + 3 × 2 = 7	1 + 3 × 3 = 10	1 + 3 × 4 = 13

c number of sticks = 1 + 3 × 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 + ☐ = ☐	1 + ☐ × 2 = ☐	1 + ☐ × 3 = ☐	1 + ☐ × 4 = ☐

c Copy and complete the rule for this pattern:
number of sticks = 1 + ☐ × 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.

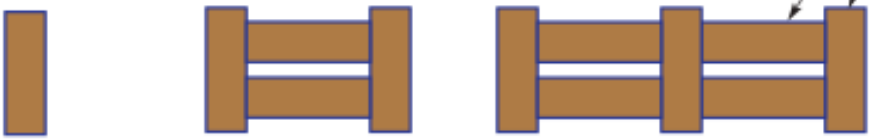
Number of shapes	0	1	2	3	4
Number of sticks	1	1 + ☐ = ☐	1 + ☐ × 2 = ☐	1 + ☐ × 3 = ☐	1 + ☐ × 4 = ☐

c Copy and complete the rule for this pattern:
number of sticks = 1 + ☐ × 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 + ☐ = ☐	1 + ☐ × 2 = ☐	1 + ☐ × 3 = ☐	1 + ☐ × 4 = ☐

c Copy and complete the pattern rule: number of planks = 1 + ☐ × 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'

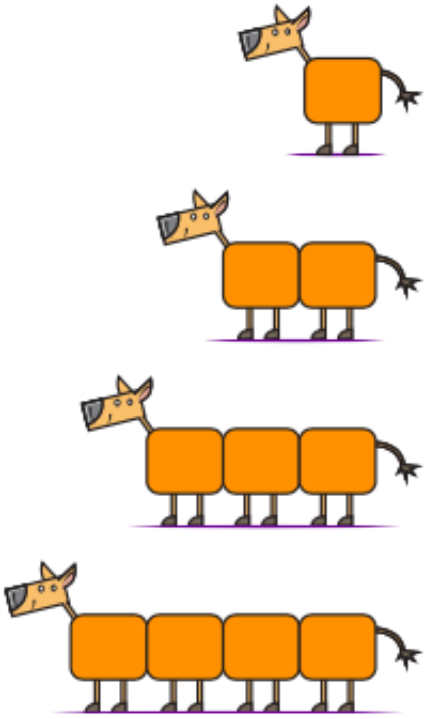
12 Which rule correctly describes this spatial pattern?

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

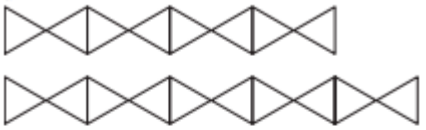
Exercise 3I

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

2

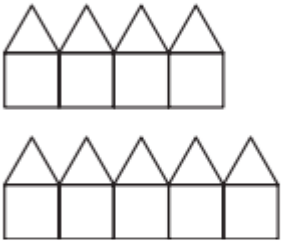
Number of houses	1	2	3
Number of matchsticks	6	11	16

3 **a**

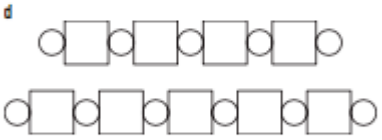


b

c



d



4 **a**

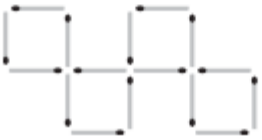
b

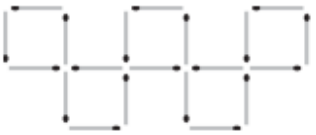
Number of crosses	1	2	3	4	5
Number of sticks	4	8	12	16	20

c number of sticks = 4 × number of crosses

d 40 sticks

5 **a**





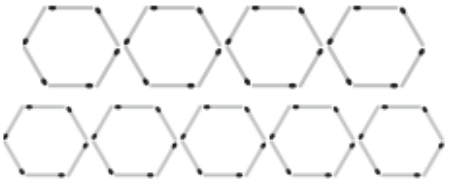
b

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**



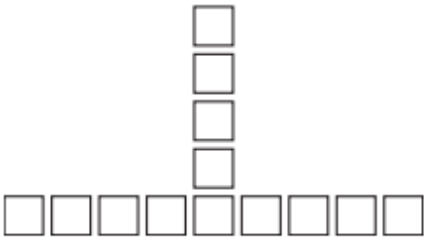
b

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**

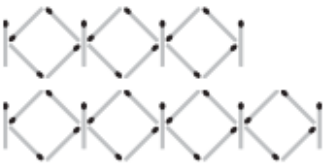
b

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

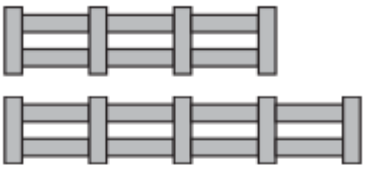
b

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.

a

b

c

d

e

f