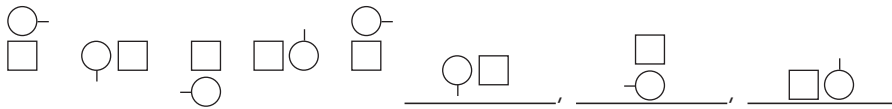


# Geometric patterns

**1** Look at each of the following patterns. Complete the next three elements in the pattern.

**a** 1, 2, 4, 8, 16, 32, 64, 128

**b** 

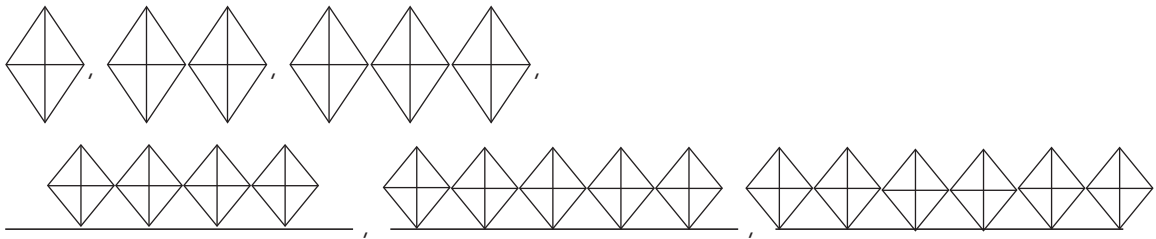
**c** 

**d** 

**e** 1, 1, 2, 3, 5, 8, 13, 21, 34

**Investigate:** What is the number pattern in Question 1e called? *The Fibonacci series*

**2 a** Draw the next 3 elements of this pattern.



**b** Use the pattern to complete the table.

<b>Number of diamonds</b>	1	2	3	4	5	6	7
<b>Number of triangles</b>	8	16	24	32	40	48	56

**c** Complete the sentence below that describes the relationship (the rule) between the number of diamonds and the number of triangles. This relationship is shown on the table with the purple arrows.

The number of triangles is 8 times the number of diamonds.

**d** Use this pattern to help you calculate how many triangles would be in 25 diamonds.

$25 \times 8 = 200$  triangles in 25 diamonds.

**e** How many diamonds are there if there are 296 triangles?

$\frac{296}{8} = 37$  diamonds

# Identifying patterns

- 1 Indicate with a tick (✓) which of the following pictures show repeating patterns.



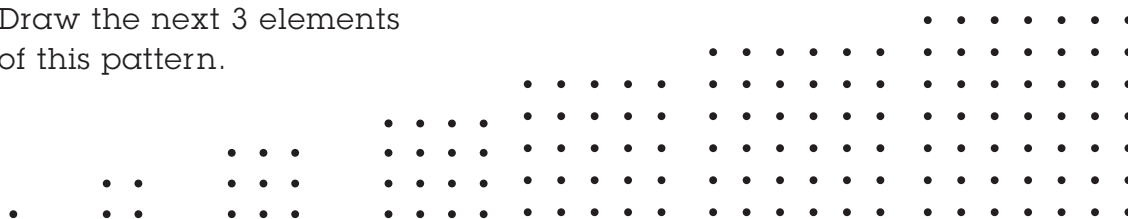
\_\_\_\_\_ ✓ \_\_\_\_\_ ✓ \_\_\_\_\_ \_\_\_\_\_ \_\_\_\_\_

- 2 Look at the table. Identify the column pattern/rule and complete the sentence that describes the rule.

1	2	3	4	5	6	7
2	4	6	8	10	12	14

The numbers in the bottom row of the table can be found by multiplying top row by 2.  
 The numbers in the top row of the table can be found by dividing bottom row by 2.

- 3 a Draw the next 3 elements of this pattern.



- b Use the pattern to complete the table.

<b>Position in pattern</b>	1	2	3	4	5	6	7
<b>Number of dots</b>	2	4	9	16	25	36	49

- c Write in a sentence the rule that connects the two sets of numbers in the table.

\_\_\_\_\_ *number of dots = position in pattern squared* \_\_\_\_\_

- d Use this rule to help you calculate how many dots would be in the twentieth position of the pattern.

\_\_\_\_\_  $20^2 = 400 \text{ dots}$  \_\_\_\_\_

- e Which position of the pattern would have 225 dots?

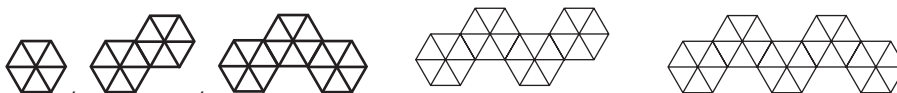
\_\_\_\_\_  $\sqrt{225} = 15$ . The 15th position would have 225 dots. \_\_\_\_\_



Is there another way to write the rule? Can you write the rule as a number sentence?

# Identifying and using patterns

- 1 a Draw in the next 2 elements of this pattern.



- b Use the pattern to complete the table.

Number of hexagons	1	2	3	4	5	6	7
Number of triangles	6	12	18	24	30	36	42

- c Write in a sentence the rule that connects the number of hexagons to the number of triangles.

*Number of hexagons multiplied by six is equal to the number of triangles.*

- d Use this pattern to help you calculate how many triangles there would be if there were 15 hexagons.

$$6 \times 15 = 90 \text{ triangles}$$

- e How many hexagons would there be for 300 triangles?

$$300 \div 6 = 50 \text{ hexagons}$$

- 2 The rule for each table has been written for you. Use this rule to complete the tables below.

- a The numbers in the bottom row of the table can be found by adding 5 to the numbers in the top row of the table.

1	2	3	4	5	6	7
6	7	8	9	10	11	12

- b The numbers in the top row of the table can be found by subtracting 8 from the numbers in the bottom row of the table.

1	2	3	4	5	6	7
9	10	11	12	13	14	15

- 3 Look at the table below.

- a Identify the rule that connects the two sets of numbers and complete the statements.

10	11	12	13	14	15	16
7	8	9	10	11	12	13

The numbers in the bottom row of the table can be found by

*Subtracting 3 from the numbers in the top row*

- b Write this rule using the reverse operation.

*Add 3 to the numbers in the bottom row to get the numbers in the top row.*

# The rule

- 1 Use equipment such as matchsticks and counters to create two patterns of your own. Draw the first 4 elements of each pattern in the spaces provided. Ask a classmate to look at your patterns and complete the next 3 elements.

<b>a</b>	Answers will vary
<b>b</b>	

- 2 Identify the rule that connects the rows in the table and complete the statements.

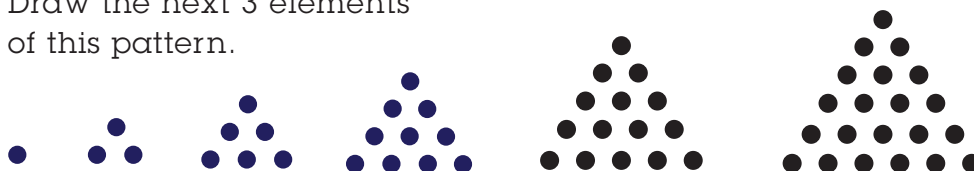
1	2	3	4	5	6	7
3	6	9	12	15	18	21

The numbers in the bottom row of the table can be found by

Multiplying the numbers in the top row by 3

The numbers in the top row of the table can be found by dividing the bottom row by 3.

- 3 **a** Draw the next 3 elements of this pattern.



- b** Use the pattern to complete the table.

<b>Position in pattern</b>	1	2	3	4	5	6	7
<b>Number of dots</b>	1	3	6	10	15	21	28

- c** Write in a sentence the rule that connects the two sets of numbers in the table.

To find number of dots, add position in pattern to previous number of dots.



How would you calculate the number of dots in the sixteenth position of the pattern?

# Using rules

**1** Write the rule that connects the top row of numbers to the bottom row of numbers for each table. Then use it to calculate the missing numbers in the table.

**a**

8	9	10	11	12	13	14	25	65
64	72	80	88	96	104	112	200	520

Rule: Bottom row is equal to top row multiplied by 8.

**b**

1	2	3	4	5	6	7	22	33
6	9	12	15	18	21	24	69	102

Rule: Bottom is equal to top row multiplied by 3 plus 3.

**c**

30	40	50	60	70	80	90	250	500
8	9	10	11	12	13	14	30	55

Rule: Bottom is equal to (top + 50) divided by ten.

**2** Bill is a builder on a construction site and he mixes the cement mortar for the bricks. For every shovelful of cement, he adds 6 shovelfuls of sand.



**a** Use this information to complete the table below.

<b>Shovelfuls of cement</b>	1	2	3	4	5	6	7
<b>Shovelfuls of sand</b>	6	12	18	24	30	36	42

**b** How can Bill calculate how many shovelfuls of sand he needs to add?

Multiply the shovelfuls of cement by 6.

**c** If Bill used 156 shovelfuls of sand on Tuesday, how much cement did he use?

26 shovelfuls.

**d** On Wednesday, Bill used 32 shovelfuls of cement. How much sand did he use?

196 shovelfuls.

**e** If Bill used his shovel a total of 336 times on Thursday, how many shovelfuls of cement did he use?

$336 \div 7 = 48$  shovelfuls of cement.

How did you solve part e? Share your answer with a classmate. Did they use the same method?

# Using patterns and rules

1 A rule has been given for each of these tables. Use it to complete the missing numbers in the tables.

a The bottom number can be found by multiplying the top number by 10.

5	6	7	8	9	10	11
50	60	70	80	90	100	110

b The bottom number when divided by 6 gives the top number.

11	12	13	14	15	16	17
66	72	78	84	90	96	102

2 One litre of paint can paint an area of 16 square metres ( $16 \text{ m}^2$ ).

a Use this information to complete the table below.

Litres of paint	1	2	3	4	5	6	7
Area covered ( $\text{m}^2$ )	16	32	48	64	80	96	112



b Write the rule that describes how many litres of paint it takes to cover an area.

*Litres required is equal to area divided by 16.*

c Use this rule to determine how many litres of paint would be needed to cover an area of 240 square metres.



*15L*

d If the wall to be painted measured  $425 \text{ m}^2$  in area, how many litres of paint would be needed? If necessary, round your answer up to the nearest litre.



*27 litres*

Why must you round your answer to Question 2d up, instead of down?

e If paint can only be bought in 5 L cans, how many cans would be bought?

*6 cans*

f After the wall is painted, what volume of paint remains in the last can?

*$3\frac{7}{16}$  L*

MiB 3  
Cards  
84 & 85

# Biscuits, patterns and rules

The ingredients for making chocolate meringue biscuits are:

4 egg whites, 1 cup sugar, 2 cups chocolate chips,  $\frac{1}{2}$  teaspoon salt and  $\frac{1}{2}$  teaspoon cream of tartar.

This mixture makes 60 mini biscuits.



1 Use the information to complete the table.

<b>Number of egg whites</b>	1	2	3	4	5	6	7
<b>Cups of chocolate chips</b>	0.5	1	1.5	2	2.5	3	3.5
<b>Number of biscuits</b>	15	30	45	60	75	90	105

2 Write the rule that links how many biscuits are made to how many egg whites are used.

*Biscuits is equal to 15 times egg whites*

3 Write the rule that links how many cups of chocolate chips are used to how many egg whites are used.

*Cups of chocolate chips is equal to half egg whites.*

4 Use the rules you have written above to calculate how many biscuits would be made and how many cups of chocolate chips would be required if 20 egg whites were used.

$$20 \times 15 = 300 \text{ biscuits}$$

$$20 \div 2 = 10 \text{ cups of chocolate chips}$$

5 If you were asked to make 480 of these biscuits for a cake stall at school, how many egg whites and how many cups of chocolate chips would you need?

$$480 \div 15 = 32 \text{ egg whites}$$

$$32 \div 2 = 16 \text{ cups chocolate chips}$$

6 In the cupboard there are 10 cups of chocolate chips. How many egg whites are needed to use all the chocolate chips? How many biscuits will this make?

*20 egg whites.*

*300 biscuits.*

MiB 3  
Card 86

Complete a table, as in Question 1, which shows egg whites, cups of sugar and teaspoons of salt. Write the rules that link egg whites to cups of sugar and egg whites to teaspoons of salt. If you had only one egg white, how much of all the other ingredients would you need? How many biscuits would you make?