Applying Pattern Rules

▶ **GOAL**

Recognize patterns, and use rules to extend and create the patterns.

Learn about the Math

Anthony tells Rosa about a story called "Pigs Is Pigs," by Ellis Parker Butler. In this story, two pet guinea pigs (a male and a female) are in a pen at a railway station. They keep having babies! Soon the station is overrun with guinea pigs.

? **How many pairs of guinea pigs will there be after one year?**

Anthony and Rosa decided to model the way that the number of guinea pigs would grow. They wrote the following rules for their model:

• The guinea pigs must be two months old before they can have babies. Then they can have a new litter every month.
• There will be only two babies (a male and a female) in each litter.
• There is enough food and water, and the animals are healthy and keep living.

A. Copy Rosa's diagram to show how the number of pairs of guinea pigs would increase. Extend the diagram for one more month.
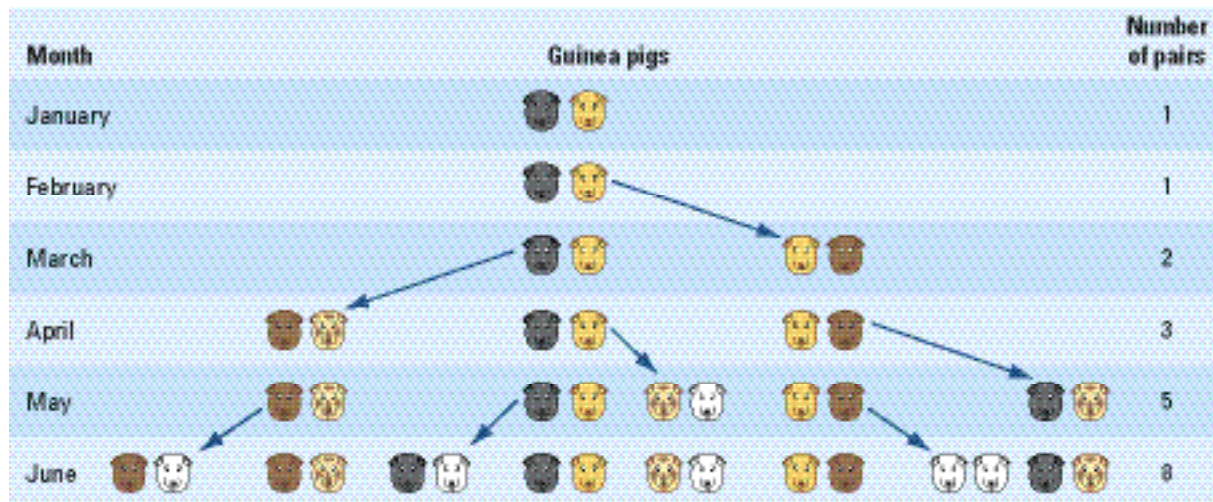
B. Copy this table that Anthony made.

C. What is the rule for the pattern in the table?

D. Write the missing numbers in the **sequence**.

E. How many pairs of guinea pigs will there be at the end of one year?

Month	Number of pairs of guinea pigs
January	1
February	1
March	2
April	3
May	5
June	8
July	13
August	
September	
October	
November	
December	

sequence

a list of things that are in a logical order or follow a pattern; for example, the sequence 1, 3, 5, 7, 9, … shows the odd numbers in order

Reflecting

1. Suppose that you only knew the first three **terms** of the sequence in step D. Explain why you would not have enough information to fill in the remaining terms.

term

each number or item in a sequence; for example, in the sequence 1, 3, 5, 7, …, the third term is 5

2. Suppose that you wanted to determine the number of pairs of guinea pigs at the end of two years. Why would you have to do many calculations using the pattern rule for this sequence?

3. Can you find the 12th term in this sequence without knowing the 11th term? Explain your answer.

Work with the Math

Example 1: Recognizing a multiplication pattern and describing the pattern rule

Describe a pattern rule for the sequence 2, 4, 8, 16, 32, … . Then write the next four terms.

Kaitlyn's Solution

2, 4, 8, 16, 32, 64, 128, 256, 512

$\times 2 \times 2 \times 2$ …

Starting with 2, each number is doubled or is multiplied by 2.

You could also say that each number in the sequence is a power of 2. The pattern could be written as $2^1, 2^2, 2^3$, …, where the base is 2 and the exponent increases by 1 each time.

Patterns and Relationships **125**

The rule for a sequence is "Start with 0 and add 1 more each time: +1, +2, +3, and so on." Write the next eight numbers in the sequence.

Omar's Solution

0, 1, 3, 6, 10, 15, 21, 28, 36

+1 +2 +3 …

I just kept adding 1 more than I added the last time.

Ⓐ Checking

4. These sequences have the same kind of addition rule as the guinea pig sequence. Write the next three terms in each sequence.

a) 2, 2, 4, 6, 10, …

b) 3, 3, 6, 9, 15, …

5. Describe the pattern rule for each sequence. Write the next three numbers.

a) 4, 8, 16, 24, 32, …

b) 4, 8, 12, 16, 20, …

c) 5, 8, 11, 14, …

d) 10, 100, 1000, …

Ⓑ Practising

6. a) Describe the rule for this sequence. 100, 99, 97, 94, 90, …

b) Write the next three numbers.

7. Use the addition rule for the guinea pig sequence to determine the next three terms in each sequence.

a) 4, 4, 8, 12, 20, 32, ...

b) 5, 5, 10, 15, 25, ...

c) 10, 10, 20, 30, 50, ...

d) 13, 13, 26, 39, 65, ...

8. Describe the pattern rule for each sequence. Write the next three numbers.

a) 3, 6, 12, 24, …

b) 1, 3, 9, 27, …

c) $1, \dfrac{1}{2}, \dfrac{1}{4}, \dfrac{1}{8}, \ldots$

d) 576, 288, 144, 72, …

9. The pattern rule for a sequence is "Start at 10, double the number before this one, and subtract 1." Write the first five numbers in the sequence.

10. The pattern rule for a sequence is "Start at 2, triple each number, and add 1." Write the first five numbers in the sequence.
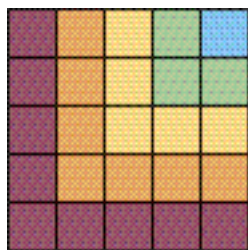
11. The rule for a pattern is "Add 2, subtract 1, add 3, subtract 1, add 4, subtract 1, and so on." For example, if you start at 10, the next six numbers are 12, 11, 14, 13, 17, and 16.

$+2 \quad -1 \quad +3 \quad -1$

10　12　11　14　13　17　16

a) Start at 50, and write the next five numbers in the sequence.

b) Start at 29, and write the next four numbers in the sequence.

12. Use this diagram to determine the sum of the first 10 odd numbers. Explain how you found your answer.

⊕ Extending

14. Using the same rule as in question 11, write the next three numbers in a sequence that starts with

  a) 65

  b) 309

15. a) Describe the rule for this pattern.
      0, 1, 2, 3, 6, 11, 20, 37, 68, …

  b) Write the next three numbers.

13. Create a rule that will result in an interesting number pattern. List the first seven numbers in your sequence.
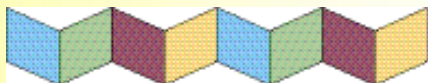

Mental Imagery | *FOLDING SQUARES*

- Colour eight squares on 2 cm grid paper as shown.
  Colour the back of each square the same colour as the front.

- Cut out the eight squares to form a long strip. Fold on the lines between the squares to form an accordion.
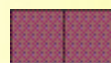
- Follow the steps below to fold the accordion to form a two-square red pattern.

  A. Fold the *left* blue and green behind the *middle* red and yellow.
  B. Fold the *right* red and yellow in front to cover the *middle* blue and green.
  C. Fold the reds under the yellows to show two yellows at the front.
  D. Complete the last folding to form the red–red pattern.

  1. Fold your accordion along the lines between the squares to form the following.

      a)   **c)**

      b)   **d)**