

Representing Patterns



Focus On ...

In this lesson, I will learn to

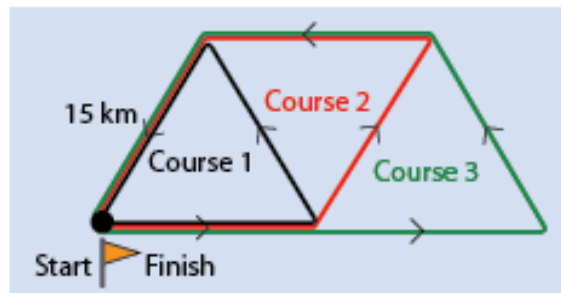
- distinguish between an expression and an equation
- represent pictorial and written patterns with linear equations
- describe situations that represent given linear equations
- solve problems that involve pictorial and written patterns using a linear equation
- verify linear equations by substituting values



Explore and Analyze

A skiff is a two-person sailing boat that can be used for racing. The carbon foam hull and multiple sails allow the boat to travel at speeds of 5 to 35 knots.

1 knot \approx 1.852 km/h

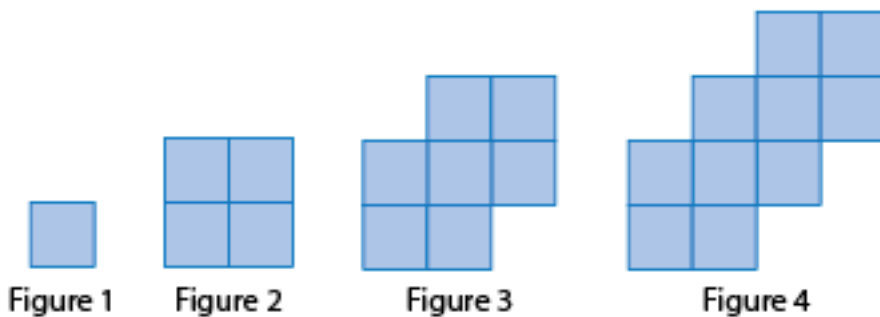


The diagram shows the first three racing courses for a class of skiffs. Each leg of the course is 15 km.

What do you think the next two courses might look like?

1. How could you determine the total distance of each racing course?
2. Assuming the pattern continues, what is the length of Course 9? Compare your strategy with a classmate's. Which strategy do you prefer? Explain why.
3.
 - a) Determine which course is 135 km long.
 - b) Determine the length of Course 23.
 - c) How did you determine the answers to parts a) and b)?

Example 1: Describe a Pictorial Pattern Using an Expression



- a) Describe how the pattern grows.
- b) Create a table of values to represent the relationship between the number of squares and the figure number for the first four figures.
- c) Write an expression and an equation to represent this pattern.
- d) How many squares are in the 12th figure?
- e) Which figure number has 106 squares? Verify your answer.

Can you verify your answer in more than one way?

Practise

For help with #1 to #4, refer to Example 1.

1. Evaluate each expression.

- $3x + 5$, when $x = 4$
- $6y - 15$, when $y = 2$
- $2w + 8$, when $w = -5$
- $-3z - 7$, when $z = -6$

2. a) Describe how the pattern grows.



Figure 1



Figure 2



Figure 3



Figure 4

- Make a table of values showing the number of sides for each figure in relation to the number of octagons.
- Write an expression and an equation to model the number of sides of each shape. Explain what each part of the equation represents.
- How many sides will a shape made up of 17 octagons have?
- How many octagons will make a figure with 722 sides?

3. Laurie uses yellow and white tiles to create a pattern.

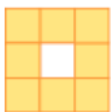


Figure 1

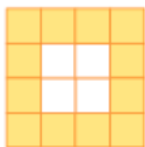


Figure 2

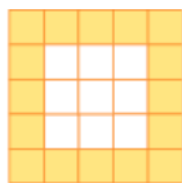
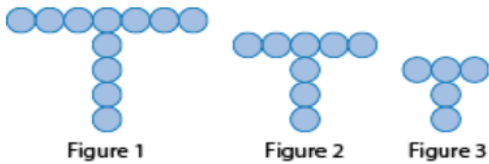


Figure 3

- Make a table of values to show the number of yellow tiles in relation to the figure number.
- Describe the relationship between the number of yellow tiles and the figure number.
- Develop an expression and an equation to model the number of yellow tiles. Explain what each part of the equation represents.
- How many yellow tiles are in Figure 24?
- Which figure number has 176 yellow tiles? Verify your answer.
- Is it possible to have a figure with 54 yellow tiles? Show how you know.

4. a) Make a table of values to show the number of circles in relation to the figure number.



- b) Describe the relationship between the number of circles and the figure number.
 c) Develop an expression and an equation to determine the number of circles in each figure. Explain what each part of the equation represents.
 d) How many circles are in Figure 17?
 e) Which figure number has 110 circles?
 f) Think about how you used the equation. What limitations does the pictorial model have that the equation does not?

5. Eric creates the following number pattern:

-14, -8, -2, 4,

- a) Make a table of values for the first 5 terms.
 b) Develop an equation to determine the value of each term in the number pattern.
 c) What is the value of the 123rd term?
 d) Which term has a value of 250?
6. Figure 2 of a pattern shows two heptagons connected along one side. Each additional figure has one additional heptagon. Each side length is 1 cm.



Figure 2

How many sides does a heptagon have?

- a) Draw the first 6 figures. Then, describe the pattern.
 b) Make a table of values showing the perimeter for the first 6 figures.
 c) What equation determines the perimeter of each figure? Identify each variable.
 d) What is the perimeter of Figure 12?
 e) How many heptagons are needed to create a figure with a perimeter of 117 cm?
 f) Can a figure have a perimeter of 74 cm? How do you know?

7. Emma creates a number pattern that starts with the number -5 . Each number that follows is 3 less than the previous number.
- a) Make a table of values for the first 5 numbers in the pattern.
 - b) What equation determines each number in the sequence?
 - c) What is the value of the 49th term?
 - d) Which term in the sequence has a value of -119 ?
8. Write an equation that models the relationship between the two columns of numbers in each table.
- a)

x	y
0	13
1	16
2	19
3	22