



## Connect and Reflect

### Key Ideas

- An expression is a combination of operations involving one or more numbers and variables. An equation is a mathematical statement that equates two expressions.
- You can use a table of values, an expression, or an equation to represent many pictorial or written patterns.
- The table of values, the expression, and the equation are related.
- To verify equations, substitute values.

### Practise

For help with #1 to #4, refer to Example 1 on pages 179–180.

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.

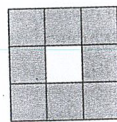


Figure 1

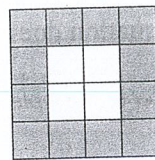


Figure 2

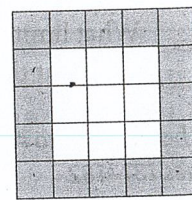
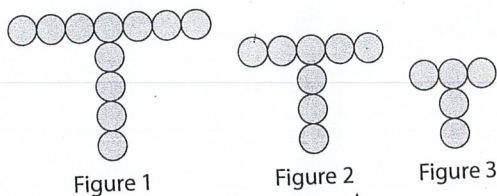


Figure 3

- 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?

For help with #5 to #8, refer to Example 2 on pages 181–182.

5. Eric creates the following number pattern:

$-14, -8, -2, 4, \dots$

- 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.

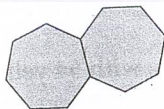


Figure 2

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

b)

$r$	$p$
0	17
1	24
2	31
3	38

c)

$k$	$t$
1	$-2$
2	1
3	4
4	7

d)

$f$	$w$
1	$-1$
2	$-3$
3	$-5$
4	$-5$

**Apply**

**9. ✓ Competency Check**

- a) Explain how to develop an equation to represent the perimeter in this pattern.

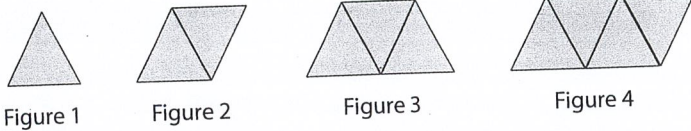
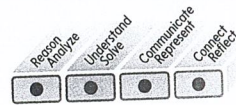


Figure 1

Figure 2

Figure 3

Figure 4



- b) What is the equation? Explain what each term represents.  
 c) Compare your equation with a classmate's.

10. Christina and Liam work in a shoe store and earn a flat rate of \$35/day plus \$6 for every pair of shoes they sell. Each got a different value for how much they would earn after selling 8 pairs of shoes.



Christina

I substituted  $p = 8$  into the expression  $6p + 35$ . When I calculated the result, I got \$83.

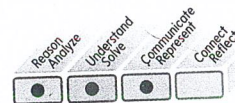


Liam

I substituted  $p = 8$  into the equation  $w = 6p$ . When I calculated the result, I got \$48.

Who is correct? How do you know? What mistake did the other person make?

11. Describe to a partner how you could determine the 59th value in the number sequence 4, 1, -2, -5, -8, ...



12. Rob is in charge of arranging hexagonal tables for a parent-night presentation. The tables each seat six people. They can be connected to form longer tables.



Figure 1

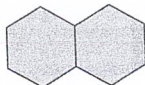


Figure 2



Figure 3

- a) Develop an equation to model the pattern. Identify each term.  
 b) How many parents can sit at a row of 5 tables?  
 c) Use another representation to verify your answer for part b).  
 d) A group of 30 people want to sit together. How many tables must Rob join together to seat them?

13. A school pays \$125 to design a T-shirt. It costs an additional \$15 to make each T-shirt.

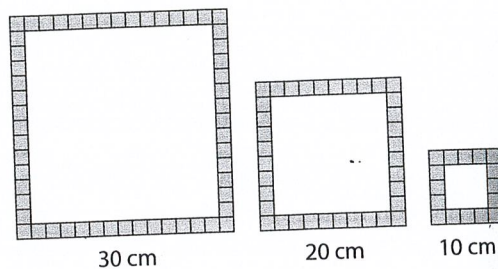
a) Copy and complete the table using this information.

Number of T-Shirts	Cost (\$)
0	125
5	200
10	
15	
35	
	950

- b) Develop an equation to determine the cost of the T-shirts. Explain the meaning of the numerical coefficient.
- c) What would it cost to make 378 T-shirts?
- d) If the school spent \$2345 for T-shirts, how many T-shirts were ordered?
- e) The school council has \$1800 available to spend. How many T-shirts can they order? Will they have any money left over? Explain.

14. An art store sells square picture frames with a border of tiles that each measure 2 cm by 2 cm. The smallest frame is 10 cm by 10 cm and has 16 tiles.

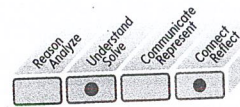
- a) Develop an equation to determine the number of tiles needed for each side length of frame.
- b) How many tiles are needed to make a frame that is 50 cm by 50 cm?
- c) What are the dimensions of a square frame made with 196 tiles?



15. Halley's Comet was named after Edmund Halley. He predicted that the comet would appear in 1758. The comet appears approximately every 76 years.



- a) Use a table to show the years of the next six sightings after 1758.
- b) When will Halley's Comet appear in your lifetime? How old will you be?
- c) Write an equation to predict the years when Halley's Comet will appear.
- d) Will Halley's Comet appear in the year 2370? How did you arrive at your answer?



**Extend**

16. a) Find the pattern that expresses all the numbers that are 1 more than a multiple of 3.  
b) What is the 42nd number?  
c) How can your pattern test to see whether 45 678 is 1 more than a multiple of 3?
17. a) Lodgepole pine trees need to be spaced 2.2 m apart. How long is a row of  $n$  trees? Write the equation.  
b) A pathway is 100 m long. You want to plant a line of lodgepole pine trees along both sides of the pathway. How many trees will you need? Will the trees be evenly spaced along the entire pathway?



18. a) Make a table of values for the first 5 terms of the number pattern  $-27, -18, -7, 6, \dots$   
b) Is the pattern linear? Explain how you know.  
c) Develop an equation to determine the value of each term in the number pattern.  
d) What is the value of the 103rd term?  
e) Which term has a value of 398?
19. A ball is dropped from a height of 2 m. The ball bounces to a height  $\frac{2}{3}$  of the height it was dropped from. Each subsequent bounce is  $\frac{2}{3}$  of the height of the previous bounce.



- a) Make a table of values for the first 5 bounce heights in the pattern.  
b) Is the pattern linear? Explain how you know.  
c) What equation can you use to determine the bounce height in relation to the number of bounces?  
d) What is the height of the 4th bounce?  
e) Which bounce has a height of approximately 0.117 m?