4.1 Writing Equations to Describe Patterns

Example (1):   A landscape designer uses wooden boards as edging for the plots in a herb garden.

☐   ☐☐   ☐☐☐   ☐☐☐☐

1 plot   2 plots   3 plots   4 plots

The number of boards, *b*, is *related* to the number of plots, *p*.
This relationship can be represented in different way:

- using pictures
- using a table of values
- using an equation

Number of Plots, *p*	Number of Boards, *b*	
1	4	} 3
2	7	} 3
3	10	} 3
4	13	} 3

Determine the pattern in the number of boards.

The number of boards is three times the number of plots plus one.

Step 1: Numerical Coefficient

$3p$

no equals sign

Write an *expression* that represents the number of boards for any number of plots p: $3p+1$

An *equation* is: $b = 3p + 1$
equals sign

Step 2: Constant Term

$3p + 1$

Verify the equation by substituting values of *p* and *b* from the table.

numerical coefficient

$b = 3p + 1$ ← constant term

↑ dependent variable

↑ independent variable

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Example (2):   An airplane is cruising at a height of 10 000 m. It descends to land. This table shows the height of The plane every minute after it began its descent. The height of the plane changes at a constant rate.

Time (*t* minutes)	Height (*h* metres)	
0	10 000	} -300
1	9 700	} -300
2	9 400	} -300
3	9 100	} -300
4	8 800	

↑ numerical coefficient

a) Write an expression for the height in terms of the time since the plane began its descent.

$$-300t + 10000 \quad \underline{or} \quad 10\,000 - 300t$$

b) Write an equation that relates the height of the plane to the time since it began its descent.

$$10\,000 - 300t = h$$

c) What is the height of the plane after 15 minutes?

$t = 15$

$10000 - 300t = h$

$10000 - 300(15) = h$

$10000 - 4500 = h$

$\boxed{5\,500 = h}$

d) How long after beginning its descent does the plane land?

$h = 0$

$10\,000 - 300t = h$

$10\,000 - 300t = 0$
      -10000 -10000

$-300t = -10\,000$
$\overline{-300} \qquad \overline{-300}$

$t = 33.\overline{3} \text{min}$

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Example (3): The cost of a taxi ride is the sum of a fixed cost of $2.50, plus $1.75 for each kilometer.

a) Write an **EQUATION** that relates the cost of a taxi ride, F dollars, to the distance travelled, n.

$$F = 1.75n + 2.50$$

b) Determine the cost of a 28-km taxi ride.

$n = 28$

$F = 1.75n + 2.50$
$\quad = 1.75(28) + 2.50$
$\quad = 49 + 2.50$
$\quad = \$51.50$

c) If the cost of the taxi ride was $28.75, how many kilometers was the taxi ride?

$F = 28.75$

$F = 1.75n + 2.50$
$28.75 = 1.75n + 2.50$
$\quad -2.50 \qquad\qquad -2.50$
$\dfrac{26.25}{1.75} = \dfrac{1.75n}{1.75}$

$n = 15 \, km$

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