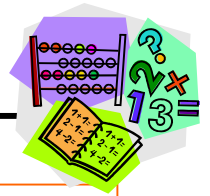


Using Equations to Describe Patterns



An equation shows a relationship between two or more unknowns (variables). Variables are letters used to represent known and unknown information. Variables help set up an equation.

Any letter can be used to represent numbers, such as a , b , n , x and y .

Some letters are not usually used because they can be mistaken for numbers or symbols:

- m may be mistaken for metres
- i may be mistaken for the number one
- o may be mistaken for a zero
- s may be mistaken for seconds.

Think of other letters that may be mistaken for numbers or symbols and discuss with a classmate or your teacher.

Example

A group of friends take a six-day bicycle trip. They decide to travel 80 km every day to allow time for meals, rest and sightseeing.

The table below shows the kilometres travelled on the trip.

$x = \text{Day}$	1	2	3	4	5	6
$y = \text{Total Distance Travelled}$	80 km	? km	? km	? km	? km	? km

If they travelled 80 km each day, how far will they have travelled by day 3? Day 6?

Variables

x = the day of the trip

y = the total distance travelled

Set up an equation, the relationship between x and y :

80 kilometres are travelled each day

$$y = x \text{ times } 80 \quad \text{or} \quad 80x$$

$$y = x \text{ times } 80 \quad \text{or} \quad y = 80x$$

When the relationship (or pattern) between numbers has been determined, predictions can be made.

Examples

- A)** In the table to the right, the pattern is y equals $2x + 1$.

Substituting numbers for x , y values can be determined.

x	$y = 2x + 1$
3	7
4	9
5	11
6	13
7	
8	
9	

If $x = 4$, solve for y

$$y = 2 \times 4 + 1$$

$$y = 9$$

If $x = 6$, solve for y

$$y = 2 \times 6 + 1$$

$$y = 13$$

- B)** Here is another example:

The missing values for y can be calculated:
Multiply the x value by 4 and subtract 1 from the product.

x	$y = 4x - 1$
2	7
4	15
6	23
8	21
10	39
12	47
14	
16	
18	

For example:

If $x = 9$, solve for y

$$y = 4(9) - 1$$

$$y = 36 - 1$$

$$y = 35$$

If $x = 20$, solve for y

$$y = 4(20) - 1$$

$$y = 80 - 1$$

$$y = 79$$

Extend the pattern by solving for y when x is 14, 16 and 18.

Write a pattern in words to help better understand a pattern and a problem.

Examples

x	$y = x + 3$
2	5
3	6
5	8
6	9
9	12
11	14

A) The pattern to the right can be described:

- take the number in the first column (x) and add 3 to get the number in the second column (y) OR $x + 3 = y$
- so, $y = x + 3$ This is called an equation and shows a relationship between the numbers in x and y .

B) Here is another example of a pattern that can be described using an equation.

x	y
3	12
5	20
6	24
9	36
10	40
12	48

To get from x to y :

- take the number in x and multiply by 4 to get the number in y (OR $x \times 4 = y$)
- so, $y = 4x$ (or $4 \times x$, four multiplied by x)

When writing out number patterns in tables, always show the relationship in equation form.

x	$y = 4x$
3	12
5	20
6	24
9	36
10	40
12	48



Practice: Using Equations to Describe Patterns

1. Make a table using pencil and paper or a computer.

Using the values 5, 7, 8, 9, 10, show the relationship $y = 2x$.



2. Monique purchased cards for her friends. The chart below shows how much she spent. x represents the number of cards she bought, y represents the amount of money the cards will cost. Write the equation to show the relationship and complete the chart.

x	$y =$
1	\$1.10
2	\$2.20
4	
6	
	\$7.70
9	
	\$11.00

3. Pedro accepted a position as an apprentice welder. Complete the table below to determine his wages. x represents the hours that Pedro worked. y represents the wages that he earned. Write the equation to solve for y .

x	$y =$
1	\$16.50
3	
	\$49.00
6	
7.5	
	\$140.25
	\$181.50

4. Stephen's parents are coordinating a family reunion and ask him to make his famous wonton soup. One batch of Stephen's soup will feed 3 people. Look at the table below and determine how many batches of soup Stephen will need to make for 45 people.

# of Batches	# of People
x	$y =$
1	3
2	6
4	
5	
	21
9	
	30
12	
	45

Extend this table to answer the following questions.

- a) Write the equation to solve for y .
- b) Use the equation and solve for y for 75 and 117 guests.
5. Use guess and check or another method to determine the patterns in the following T-tables. Indicate the relationship by completing the equation for y .

a)

x	$y =$
	3
2	6
4	12
6	
	21
9	
	33

b)

x	$y =$
3	10
5	12
10	17
15	
	25
21	
	38

c)

x	$y =$
9	6
10	7
12	9
14	12
16	16

d)

x	$y =$
2	8
4	16
5	20
7	36
10	48

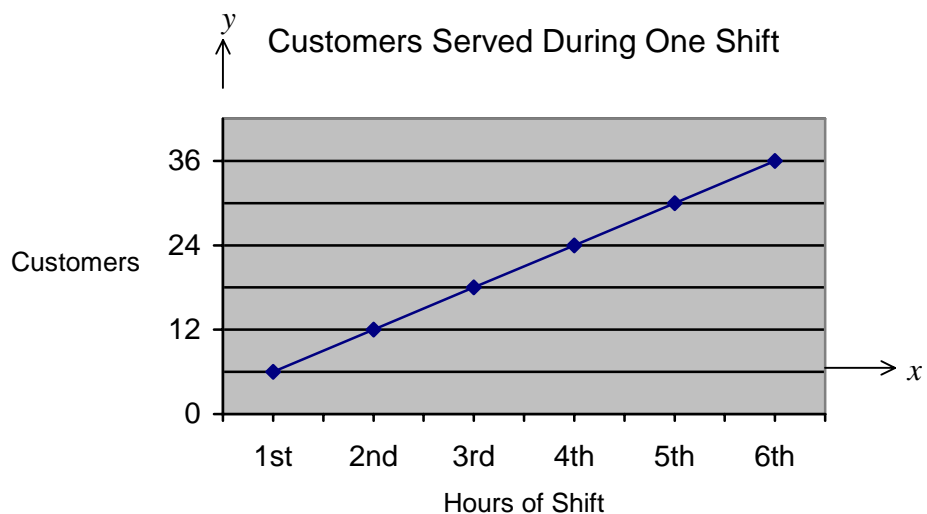
e)

x	$y =$
1	3
2	5
4	9
7	19
10	23
	27

f)

x	$y =$
1	1
3	5
4	7
6	15
9	19
	23

6. a) Write an equation solving for y to show the relationship between the hours of the shift and the number of customers served.

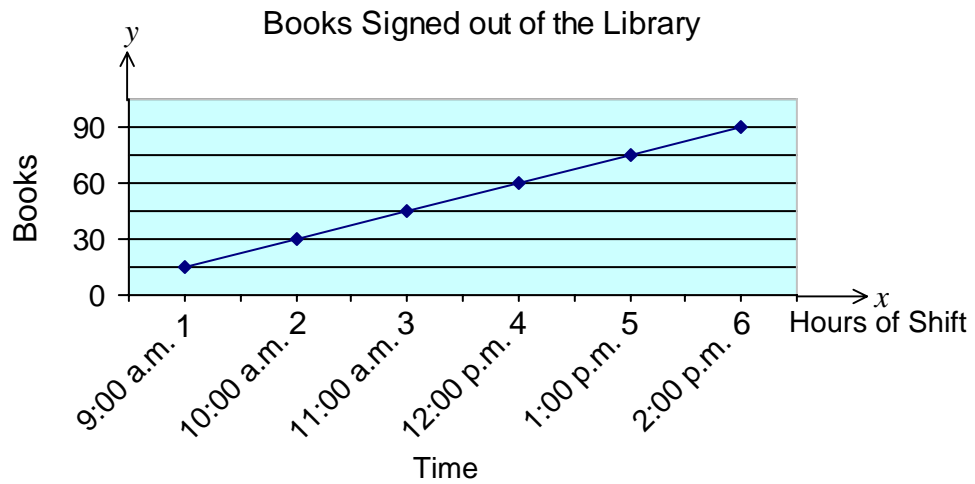


- b) Complete the table below.

x	$y =$
1	6
2	
3	
4	
5	
6	

- c) In word form, state the relationship between the variables x and y .

7. a) Write an equation solving for y to show the relationship between the hours of the shift and the number of books signed out.



- b) Complete the table below.

x	$y =$
hour 1	15
hour 2	
hour 3	
hour 4	
hour 5	
hour 6	

- c) In word form, state the relationship between the variables x and y .

8. The T-table shows the relationship between the cups of shredded carrots and the cups of shredded cabbage a caterer uses when making coleslaw.

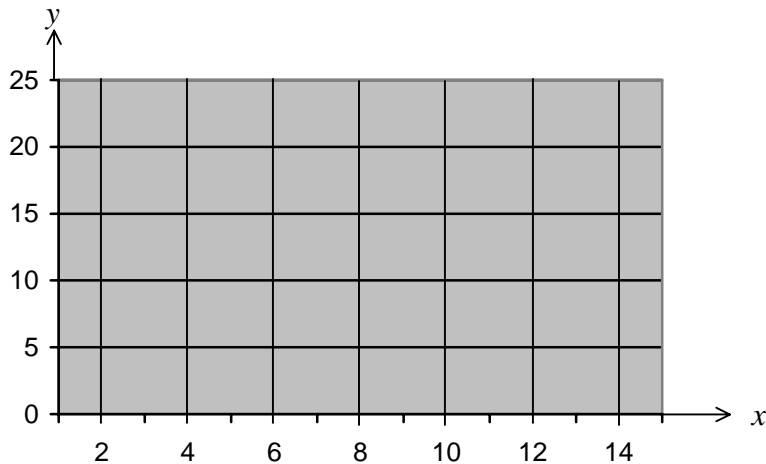
x	$y =$
2	6
5	9
6	
8	
9	
11	15
12	

x = cups of carrots
 y = cups of cabbage

- a) Determine the pattern, write the equation and complete the T-table.
 b) List the ordered pairs from the table above:

(2, 6) **(5, 9)** (____, ____) (____, ____) (____, ____)
 (____, ____) (____, ____)

- c) Place the ordered pairs on the graph below:



- d) Extend the pattern:

Predict the y value if x is 15.

Write the above as an ordered pair. _____

In word form, explain the pattern/relationship between the x and y variables.

9. The T-table shows the relationship between the amount of time Wendy takes to weld and the centimetres of pipe welded.

a) Complete the T-table and write the equation to solve for y .

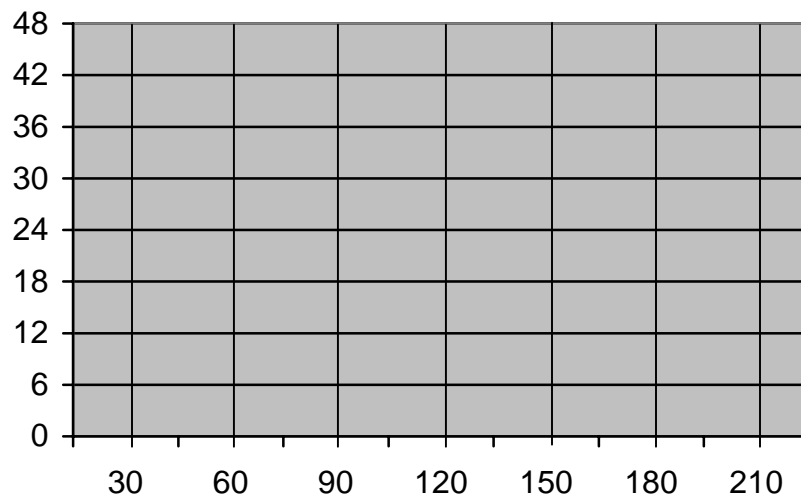
x (in seconds)	y (in cm)
30	2
60	4
90	
120	
150	
180	
210	14

x = Time (in seconds)
 y = Centimetres of pipe welded

b) List the ordered pairs from the table above:

(30, 2) (60, 4) (____, ____) (____, ____) (____, ____) (____, ____) (210, 14)

c) Place the ordered pairs and headings on the graph below:



d) Extend the pattern:

Predict how much pipe can be welded in 4 minutes. _____

Write the above as an ordered pair. _____

Use word form to explain the pattern/relationship between the x and y variables. _____