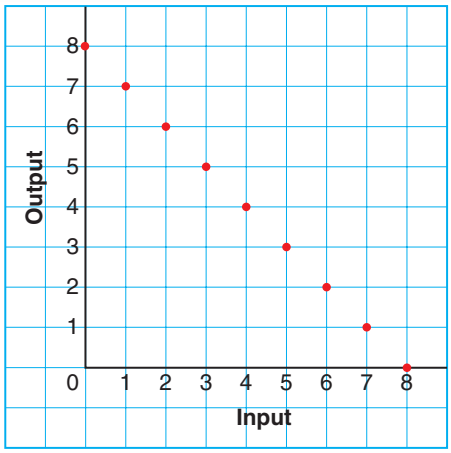
6.6 Creating a Table of Values

Focus Create a table of values from the equation of a linear relation.

How many different ways can you describe the relation shown in this graph?



Investigate

Work with a partner.

At the country fair, Mischa sells hot dogs for $3 each, and drinks for $2 each.
A meal consists of hot dogs and one drink.

The number of hot dogs in a meal, h, is related to the total cost of the meal in dollars.
The relation is: h is related to $3h + 2$.

➤ Copy and complete the a table of values for the relation.

Input h	Output $3h + 2$
1	
2	

➤ How can you use the table of values to find:
- the cost of a meal when a person orders 9 hot dogs?
- the number of hot dogs ordered when a meal costs $35?

Reflect & Share

Compare your answers with those of another pair of classmates.
When you know the total cost of a meal, how can you determine the number of hot dogs ordered?
What helped you solve this problem?
What else can you find out using the table or the relation?
Work together to write, then answer, 3 questions about this relation.

Connect

We can represent a relation in different ways.
For example, consider this relation: x is related to $20 - 3x$

➤ We can create a table of values.

When $x = 1$,
$20 - 3x = 20 - 3(1)$
$= 20 - 3$
$= 17$

When $x = 2$,
$20 - 3x = 20 - 3(2)$
$= 20 - 6$
$= 14$

A table of values is:

Input x	Output $20 - 3x$
1	17
2	14
3	11
4	8
5	5
6	2
7	–1

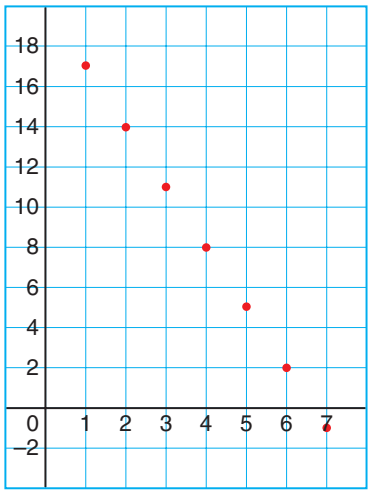
(+1 between each pair of input values; –3 between each pair of output values)

When the input increases by 1, the output decreases by 3.

When the change in the input is constant and the change in the output is constant, the relation is a **linear relation**.

➤ We can draw a graph.
Use the data in the table.
The input is plotted on the horizontal axis.
The output is plotted on the vertical axis.
On the horizontal axis, the scale is 1 square represents 1 unit.
On the vertical axis, the scale is 1 square represents 2 units.

Graph of $20 - 3x$ against x



➤ We can write an equation for the relation.
We introduce a second variable, y.
Then, an efficient way to write the relation x is related to $20 - 3x$ is:
$y = 20 - 3x$
We say the equation of the linear relation is $y = 20 - 3x$.

We write the table of values as:

x	1	2	3	4	5	6	7
y	17	14	11	8	5	2	–1

A related pair of x and y values is called an **ordered pair**.
Some ordered pairs for this relation are:
$(1, 17), (2, 14), (3, 11), (4, 8), (5, 5), (6, 2), (7, -1), (x, y)$

Example 1

Saskatoon Pizza charges \$11 for a medium cheese pizza, plus \$2 for each topping. An equation for this relation is $c = 11 + 2n$, where n represents the number of toppings and c represents the cost of the pizza in dollars.

a) Use the equation to create a table of values.
b) Use the equation to find the cost of a pizza with 5 toppings. Check the answer.
c) Use the equation to find how many toppings are on a pizza that costs \$27.

A Solution

a) Since it is possible to order a pizza with no toppings, start the table of values with $n = 0$.
When $n = 0$, the cost is:

$$\begin{aligned} c &= 11 + 2n \\ &= 11 + 2(0) \\ &= 11 + 0 \\ &= 11 \end{aligned}$$

A pizza with no toppings costs \$11.

When $n = 1$,

$$\begin{aligned} c &= 11 + 2n \\ &= 11 + 2(1) \\ &= 11 + 2 \\ &= 13 \end{aligned}$$

When $n = 2$,

$$\begin{aligned} c &= 11 + 2n \\ &= 11 + 2(2) \\ &= 11 + 4 \\ &= 15 \end{aligned}$$

When $n = 3$,

$$\begin{aligned} c &= 11 + 2n \\ &= 11 + 2(3) \\ &= 11 + 6 \\ &= 17 \end{aligned}$$

A table of values is:

n	*c*
0	11
1	13
2	15
3	17

b) To find the cost of a pizza with 5 toppings, substitute $n = 5$.

$$\begin{aligned} c &= 11 + 2n \\ &= 11 + 2(5) \\ &= 11 + 10 \\ &= 21 \end{aligned}$$

A five-topping pizza will cost \$21.

To check the answer, extend the table.

In the second column, the value of c increases by 2 each time.

So, when $n = 4$, $c = 19$; and when $n = 5$, $c = 21$.

c) To find out how many toppings are on a pizza that costs \$27, substitute $c = 27$.

$27 = 11 + 2n$

Solve for n.

$27 - 11 = 11 + 2n - 11$

$16 = 2n$

$\frac{16}{2} = \frac{2n}{2}$

$8 = n$

There are 8 toppings on a pizza that costs \$27.

To check the answer, calculate the cost of a pizza with 8 toppings.

For 8 toppings, the cost is \$11 plus $8 \times$ \$2, which is \$11 + \$16 = \$27.

Since this matches the given cost, the number of toppings is correct.

Example 2

The equation of a linear relation is: $y = -5x - 3$
Some ordered pairs in the relation are:
$(0, -3), (1, -8), (2, -13), (3, \ ), (4, -23), (\ , -28)$
Find the missing numbers in the ordered pairs.

A Solution

The first missing number is in the ordered pair $(3, \ )$.
The missing number is the value of y when $x = 3$.
Substitute $x = 3$ in the equation $y = -5x - 3$.

$$y = -5(3) - 3$$
$$= -15 - 3$$
$$= -18$$

The ordered pair is $(3, -18)$.
The second missing number is in the ordered pair $(\ , -28)$.
The missing number is the value of x when $y = -28$.
Substitute $y = -28$ in the equation $y = -5x - 3$.

$$-28 = -5x - 3$$

Solve for x.

$$-28 + 3 = -5x - 3 + 3$$
$$-25 = -5x$$
$$\frac{-25}{-5} = \frac{-5x}{-5}$$
$$5 = x$$

The ordered pair is $(5, -28)$.

Example 2
Another Solution

To find the missing number in $(3, \ )$:
There is a pattern in the x-values.
So, list the y-values in order, and
look for a pattern in the y-values.
$-3, -8, -13, ?, -23, -28$
The numbers decrease by 5 each time.
So, the first missing number is: $-13 - 5 = -18$

To find the missing number in $(\ , -28)$:
The first ordered pair is $(0, -3)$.
-28 is in the 6th ordered pair.
So the missing number is 5.

Discuss the ideas

1. Look at the tables of values in *Connect*.
   Give some examples of pairs of numbers that will never appear in these tables.
2. Why do you think the numbers (4, 8) are called an ordered pair, and not simply a pair?
3. To check that a solution to an equation is correct, you can either extend the table of values or substitute in the equation.
   a) When would it be easier to extend the table of values?
   b) When would it be easier to substitute?

Practice

Check

4. Copy and complete each table of values.

a) $y = x + 1$

x	y
1	
2	
3	
4	
5	

b) $y = x + 3$

x	y
1	
2	
3	
4	
5	

c) $y = 2x$

x	y
1	
2	
3	
4	
5	

5. Make a table of values for each relation.
   a) $y = 2x + 1$
   b) $y = 2x - 1$
   c) $y = -2x + 1$

6. The equation of a linear relation is:
   $y = 9x - 7$
   Some ordered pairs in the relation are:
   $(0, -7)$, $(1, 2)$, $(2, \quad)$, $(3, 20)$,
   $(4, \quad)$, $(\quad, 38)$
   Find the missing numbers in the ordered pairs.

7. Melanie earns $7 per hour when she baby-sits. An equation for this relation is $w = 7h$, where h represents the number of hours and w represents Melanie's wage in dollars.
   a) Use the equation to create a table of values.
   b) In one week, Melanie earned $105. How many hours did she baby-sit?
   c) In one month, Melanie baby-sat for 24 h. How much did she earn from baby-sitting in that month?

Apply

8. Copy and complete each table of values.

a) $y = x + 2$

x	y
–3	
–2	
–1	
0	
1	
2	
3	

b) $y = x - 3$

x	y
–3	
–2	
–1	
0	
1	
2	
3	

c) $y = x + 4$

x	y
–3	
–2	
–1	
0	
1	
2	
3	

9. Make a table of values for each relation.

a) $y = -2x + 3$

b) $y = -5x - 4$

c) $y = 8x - 3$

10. The equation of a linear relation is:
$y = -3x + 5$
Some ordered pairs in the relation are:
(–3, 14), (–1, 8), (1,), (3, –4),
(5,), (, –16)
Find the missing numbers in the ordered pairs.

11. The equation of a linear relation is:
$y = -2x + 7$
Find the missing number in each ordered pair.

a) (–8,) **b)** (12,)

c) (, 31) **d)** (, –23)

12. **Assessment Focus** Herbie has a mass of 100 kg.
His personal trainer sets a goal for him to lose 2 kg per month until he reaches his goal mass. An equation for this relation is $m = 100 - 2n$, where n represents the number of months and m represents Herbie's mass in kilograms.

a) Use the equation to create a table of values.

b) At some time, Herbie should have a mass of 60 kg. How many months will he have trained?

c) By his birthday, Herbie had trained for 7 months.
What was his mass then?

13. Candice is experimenting with divisibility rules. She can't remember the rule for "divisibility by 9", so she makes a table of values to study the multiples of 9.
She uses the equation $m = 9t$ to find multiples of 9.

a) In the equation $m = 9t$, what does m represent?
What does t represent?

b) Make a table of values for this equation.

c) What patterns do you see in the table?
Use these patterns to write a rule for divisibility by 9.

d) Is 126 divisible by 9?
How do you know?

e) What is the 17th multiple of 9?
How do you know?

14. Take It Further
These ordered pairs are in the same linear relation:
(–2, –6), (0, 2), (2, 10), (4, 18)
The ordered pairs below are also in this relation. Find the missing number in each ordered pair.
Describe the strategy you used.

a) (–4,) **b)** (, –26)
c) (3,) **d)** (, –2)

15. Take It Further
These ordered pairs are in the same linear relation: (0, –8), (–4, –28), (4, 12)
The ordered pairs below are also in this relation. Find the missing number in each ordered pair.
Describe the strategy you used.

a) (–2,) **b)** (, –48)
c) (6,) **d)** (, –3)

Math Link

Science

Pressure is force per unit area.
Pressure is measured in pascals (Pa).
A formula for pressure is:

$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

When we know the pressure in pascals and the area in square metres, we can use this formula to find the force newtons (N).

Reflect

You have learned 2 ways to find the missing number in an ordered pair.
Which strategy do you prefer?
When might you use one strategy rather than the other?