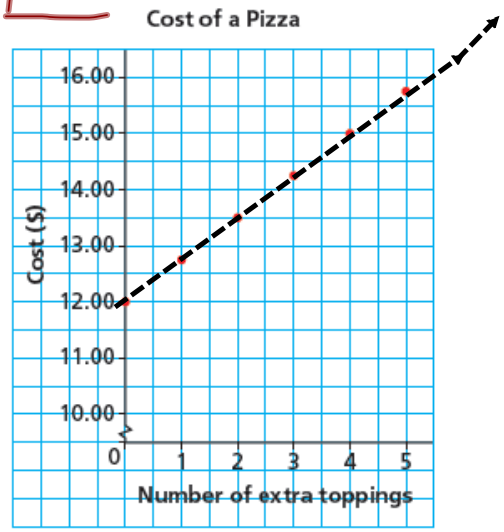
5.6 Properties of Linear Relations

LESSON FOCUS Identify and represent linear relations in different ways.

Make Connections

The table of values and graph show the cost of a pizza with up to 5 extra toppings.

Number of Extra Toppings	Cost ($)
0	12.00
1	12.75
2	13.50
3	14.25
4	15.00
5	15.75



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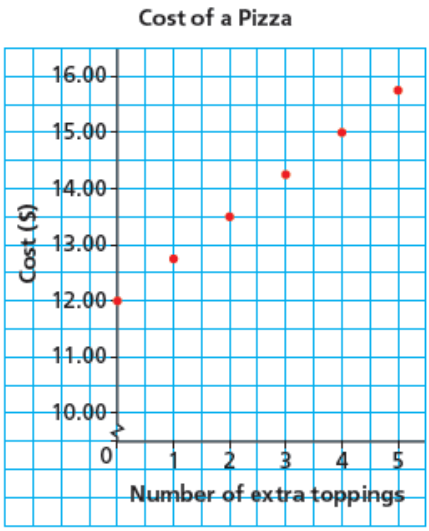


What patterns do you see in the table?

Write a rule for the pattern that relates the cost of a pizza to the number of its toppings.

How are the patterns in the table shown in the graph?

How can you tell from the table that the graph represents a linear relation?

$C = 12 + 0.75n$

Here is another example of a linear relation...

The cost for a car rental is \$60, plus \$20 for every 100 km driven.
The independent variable is the distance driven and the dependent variable is the cost.
We can identify that this is a linear relation in different ways.

- a table of values

Independent variable →

Distance (km)	Cost (\$)
0	60
100	80
200	100
300	120
400	140

← Dependent variable

+100, +100, +100, +100

+20, +20, +20, +20

For a linear relation, a constant change in the independent variable results in a constant change in the dependent variable.

How to identify a linear relation...

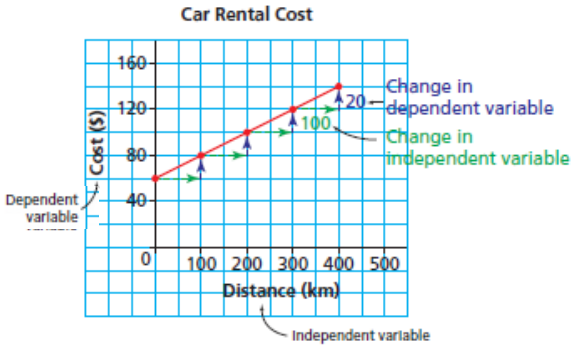
- a set of ordered pairs

$$\{(0, 60), (100, 80), (200, 100), (300, 120), (400, 140)\}$$

(+100, +100, +100, +100 above the pairs; +20, +20, +20, +20 below)

Why is it important that the ordered pairs are listed so their first elements are in numerical order?

- a graph



The graph of a linear relation is a straight line.

We can use each representation to calculate the **rate of change**.

The rate of change can be expressed as a fraction:

$$\frac{\text{change in dependent variable}}{\text{change in independent variable}} = \frac{\$20}{100 \text{ km}}$$

$$= \$0.20/\text{km}$$

$$\frac{\Delta y}{\Delta x} = \frac{\text{Rise}}{\text{Run}}$$

5.6 Properties of Linear Relations

Which table of values represents a linear relation? Justify your answer.

a) The relation between the number of bacteria in a culture, n, and time, t minutes.

t	n
0	1
20	2
40	4
60	8
80	16
100	32

+20 +20 +20 +1 +2

Not Linear

b) The relation between the amount of goods and services tax charged, T dollars, and the amount of the purchase, A dollars

A	T
60	3
120	6
180	9
240	12
300	15

Linear

The rate of change is \$0.20/km; that is, for each additional 1 km driven, the rental cost increases by 20¢. The rate of change is constant for a linear relation.

We can determine the rate of change from the equation that represents the linear function.

Let the cost be C dollars and the distance driven be d kilometres.

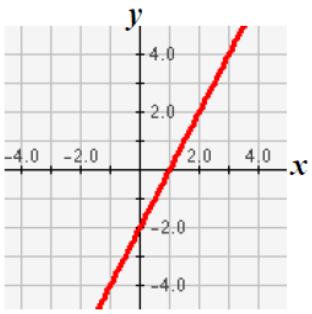
An equation for this linear function is:

$$C = 0.20d + 60$$

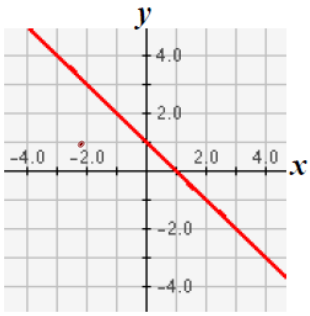
- C: dependent variable
- 0.20: rate of change
- d: independent variable
- 60: initial amount

1. State if each graph represents a linear or nonlinear relationship?

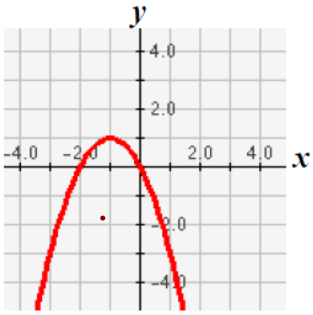
a.



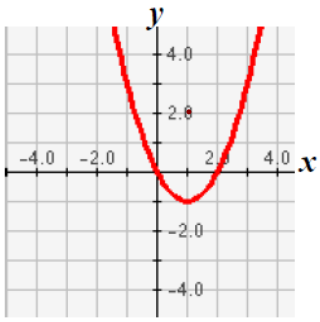
b.



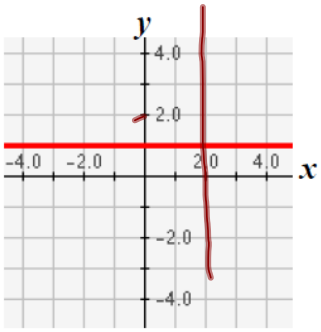
c.



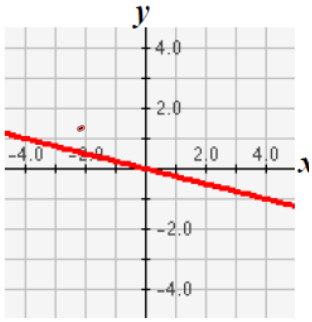
d.



e.



f.



Attachments

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