

Math 10

Lesson 3-1 Representing Relations

I. Lesson Objectives:

- 1) To define a **relation**.
- 2) To learn how to represent and interpret relations.

II. Relations – defined

Go to D2L and click on the video by the Math Dude that I have labelled as **L3-1 Relations**.

In the video, the children counted how many cards have the number 2, how many have a 4, and so on. They came up with the following ordered pairs (6, 11), (10, 5), (4, 19), (8, 11), and (2, 25). In the video, the Dude defines a relation as a set of ordered pairs, but this is actually a weak definition. In general, a **relation** is an **association or relationship between two quantities or variables**. As we will see below, a relation can associate/relate numbers, words, symbols, or anything else you can think of.

III. Representing relations

A relation can be presented in words, as ordered pairs, as a mapping (i.e. an arrow diagram), as a table of values, as a graph, and as an equation. For the relation between the number on a card and the number of cards we can represent it in several ways.

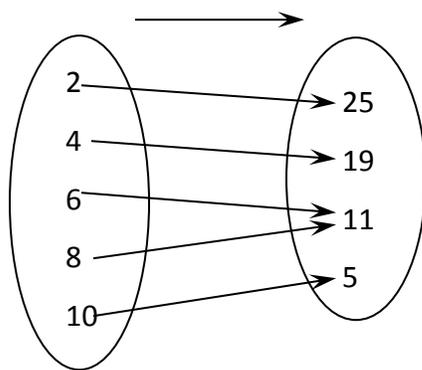
As ordered pairs

{ (2, 25), (4, 19), (6, 11), (8, 11), (10, 5) }

Note that I have arranged the ordered pairs from lowest to highest card number. Why? The presentation of a relation should be done in order to see if there is a pattern or trend between the numbers in the relation.

As an arrow diagram

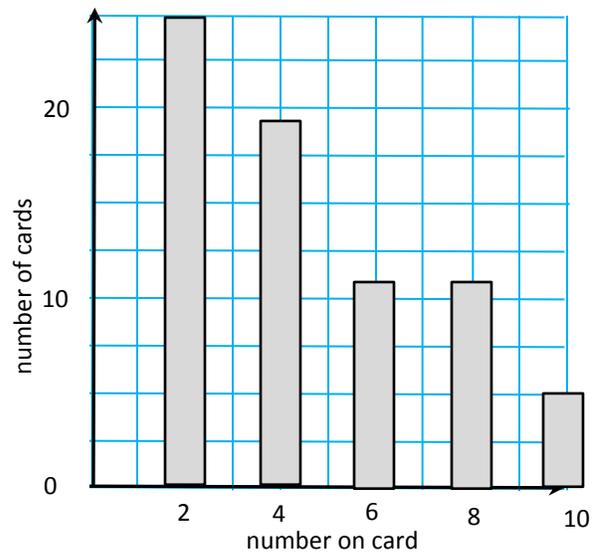
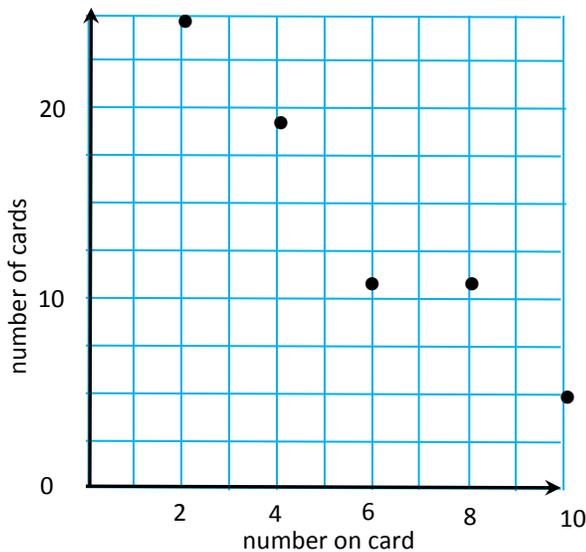
number on card related to number of cards



As a table of values

number on card	number of cards
x	y
2	25
4	19
6	11
8	11
10	5

As a graph

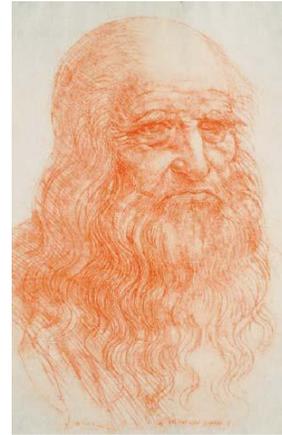


bar graph

It is very important to notice how different representations of the data communicate things to the reader. In the representations above, which ones make it easier for you to see trends or tendencies in the data? For me, the table of data and the graphs make it is easier to see the trend that as the number on the card increases the number of cards with that number decreases. For me, the trend is harder to notice in the ordered pairs and arrow diagram representations.

Example 1

The famous artist and inventor Leonardo da Vinci (1452–1519) studied the proportions of the human body. One of the relations he measured was the proportion of the length of the ear to the length of the face. (Why would Leonardo be interested in this?) The relation he discovered could be presented in a variety of ways:



In Words

He found that the length of your face, f , (from chin to hairline, except for Dr. Licht and Mr. Zado) is equal to three times the length of your ear, e .

As an Equation

$$f = 3e$$

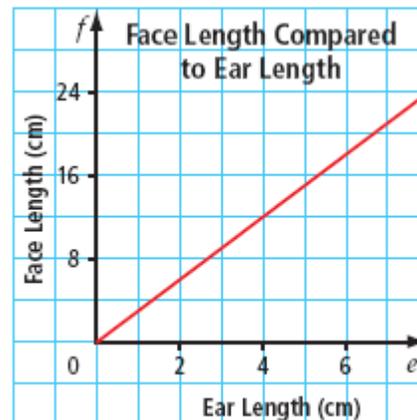
As Ordered Pairs

(4, 12), (4.5, 13.5), (5, 15), (5.5, 16.5), (6, 18), (6.5, 19.5)

As a Table of Values

Ear Length, e (cm)	Face Length, f (cm)
4	12
4.5	13.5
5	15
5.5	16.5
6	18
6.5	19.5

As a Graph



Question 1

Animals can be associated with the classes they are in.

- Describe this relation in words.
- Represent this relation:
 - as a set of ordered pairs
 - as an arrow diagram

Animal	Class
ant	Insecta
eagle	Aves
snake	Reptilia
turtle	Reptilia
whale	Mammalia

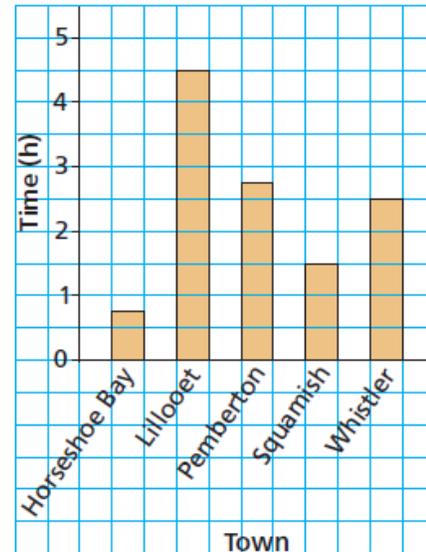
Question 2

Different towns in British Columbia can be associated with the average time, in hours, that it takes to drive to Vancouver. Consider the relation represented by this graph.

Represent the relation:

- as a table
- as an arrow diagram

Average Travel Time to Vancouver



IV. Assignment

1. What are the advantages and disadvantages of the different ways you can represent a relation?

2. For each table:

- Describe the relation in words.
- Represent the relation:
 - as a set of ordered pairs
 - as an arrow diagram

a)

Coin	Value (\$)
penny	0.01
nickel	0.05
dime	0.10
quarter	0.25
loonie	1.00
toonie	2.00

b)

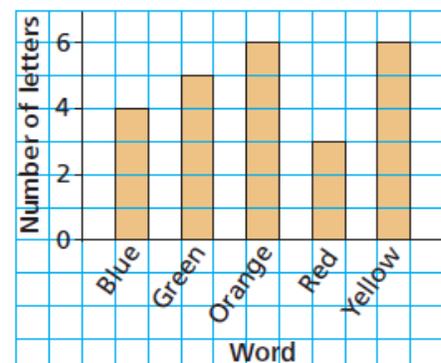
Sport	Equipment
badminton	shuttlecock
badminton	racquet
hockey	puck
hockey	stick
tennis	ball
tennis	racquet
soccer	ball

3. Consider the relation represented by this graph.

Represent the relation:

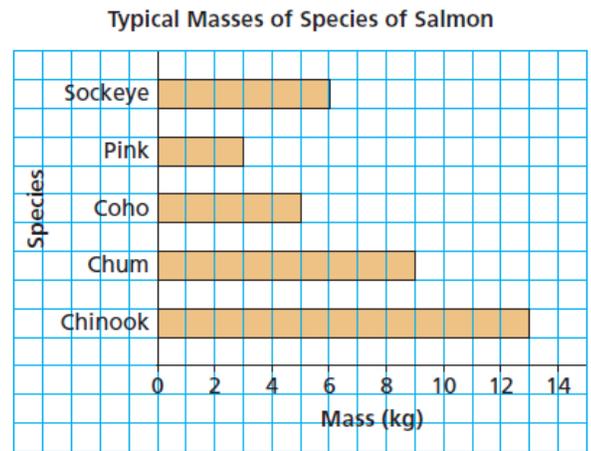
- as a table
- as an arrow diagram

Number of Letters in a Word



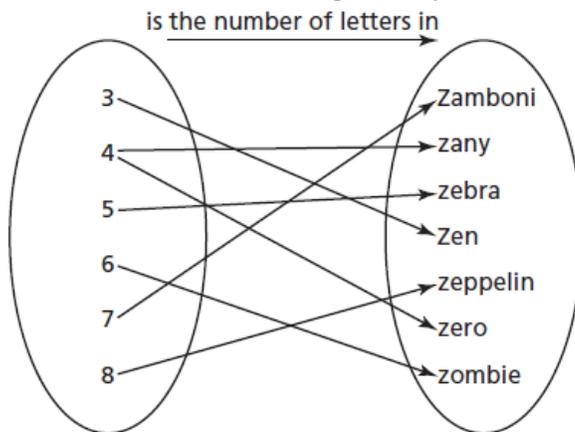
4.

- Describe the relation represented by this bar graph.
- Represent the relation as a set of ordered pairs.
- Represent the relation in a different way.



5. For a word game, words that begin with the letter Z can be difficult to find.

- What does this arrow diagram represent?



- Represent this relation in two different ways.
- Create an arrow diagram for words beginning with the letter X, then represent the relation in two different ways.

6. A digital clock displays digits from 0 to 9 by lighting up different segments in two squares. For example, the digit 2 needs 5 segments to light up, as shown.

- List the set of ordered pairs of the form: (digit, number of segments lit up)
- Represent this relation in two different ways.

