5.2 - Properties of Functions

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Some terminology:

- **Domain**: Refers to the set of first elements in a relation.
  - ↳ sometimes called the "independent variable"
  - ↳ usually "x"
- **Range**: Refers to the set of second elements in a relation.
  - ↳ sometimes called the "dependent variable"
  - ↳ usually "y"

★ A **function** is a special kind of relation where each element of the domain (first set) is associated with one AND ONLY ONE element of the range.

Ex: Determine the domain and range of each relation below, and whether or not it's a function.

① Relation of shapes to # of right angles (90°) it has:

{(right triangle, 1), (acute triangle, 0), (square, 4), (rectangle, 4), (regular hexagon, 0)}

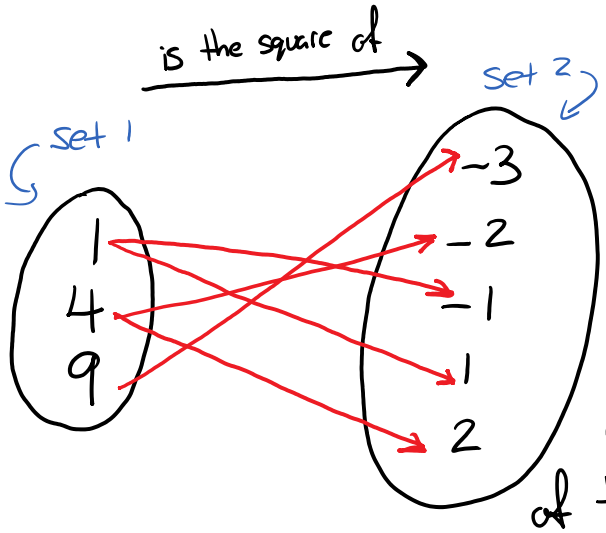
Domain: {right triangle, acute triangle, square, rec., r.h.}

Range: {0, 1, 4}

Since each element from the domain appears only once, it is not associated with more than one element of the range.

∴ It is a function.

② Squares



Domain: {1, 4, 9}

Range: {-3, ±2, ±1}

Since there is more than one arrow leaving at least one element of the domain, it is <u>not</u> a function.

<u>Ex:</u> What is the domain and range of the following relation? Is it a function?

number of marbles (n)	mass of marbles in kg (m)
1	1.27
2	2.54
3	3.81
4	5.08
5	6.35
6	7.62

Domain: {1, 2, 3, 4, 5, 6}

Range: {1.27, 2.54, 3.81, 5.08, 6.35, 7.62}

Function?

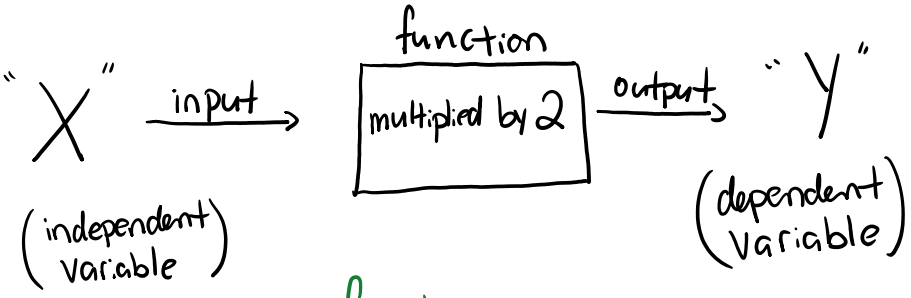
Yes, because the elements from the domain appear only once.

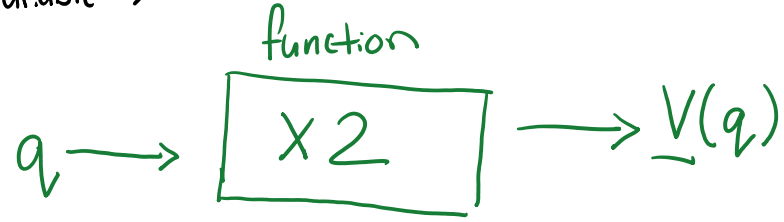
5	7.62	Yes, because the elements in
6		the domain appear only once.

HW: Pg. 270 # 4, 5, 8, 9, 10

Part 2:

We can use mathematical expressions to represent relations and functions:





V(q) is read "V of q" and is called "function notation".

V represents the function, (in this case, multiply q by 2).

How do we represent a number being multiplied by 2?

$\Rightarrow 2q$

So, $V(q) = 2q$

ie. $V(1) = 2(1) = 2$, $V(-10) = 2(-10) = -20$

Ex: $V = -0.08d + 50$ describes the volume (V, in litres) of gas left in your tank after travelling "d" kilometers.

① Describe the function using function notation.

$V = -0.08d + 50$ (V depends on d) $\rightsquigarrow V(d) = -0.08d + 50$

- "V of d"
  - V is a function of d.
  - V depends on d.
- How V depends on d.

② Determine the value of $V(600)$. What does this mean?

$V(d) \rightsquigarrow V(600)$

$d = 600$ → d. → the input.

$V(d) = -0.08d + 50$

$V(600) = -0.08(600) + 50$

$V(600) = -48 + 50$

$V(600) = 2$

If $d = 600$, that means we travelled 600 km

If $V(600) = 2$, that means after we drove 600km, we have 2L of gas left.

③ Determine d when $V(d) = 26$. what does this mean?

$V(d) = 26$

$V(d) = -0.08d + 50$

$(26) = -0.08d + 50$

- solve for d -

$26 = -0.08d + 50$

$-50 \quad -50$

$-24 = -0.08d$

$-0.08 \quad -0.08$

$d = \frac{-24}{-0.08} = 300$

If $V(d)=26$, that means we have 26 L of gas left.

If $d=300$, that means we drove 300 Km.

∴ When there is 26 L left in the tank, we've travelled 300 Km.

HW: Pg. 270 # 6-8, 14-16, 21/22