1.3   Exercises

Exercise 1.1

Give examples of numbers that are

> a) natural numbers
> b) integers
> c) integers but not natural numbers
> d) rational numbers
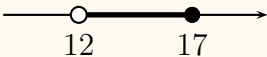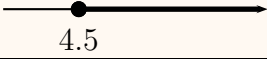> e) real numbers
> f) rational numbers but not integers

Exercise 1.2

Which of the following numbers are natural numbers, integers, rational numbers, or real numbers? Which of these numbers are irrational?

a) $\frac{7}{3}$ b) -5 c) 0 d) $17,000$ e) $\frac{12}{4}$ f) $\sqrt{7}$ g) $\sqrt{25}$

Exercise 1.3

Complete the table.

Inequality notation	Number line	Interval notation
$2 \le x < 5$		
$x \le 3$		
	12 ○——● 17	
	●——— ○ -2	
		$[-2, 6]$
		$(-\infty, 0)$
	●——— 4.5	
$5 < x \le \sqrt{30}$		
		$\left(\frac{13}{7}, \pi\right)$

Exercise 1.4

The tables below describe assignments between inputs x and outputs y. Determine which of the given tables describe a function. If they do, determine their domain and range. Describe which outputs are assigned to which inputs.

a)

x	-5	3	-1	6	0
y	5	2	8	3	7

b)

x	6	17	4	-2	4
y	8	-2	0	3	-1

c)

x	19	7	6	-2	3	-11
y	3	3	3	3	3	3

d)

x	1	2	3	3	4	5
y	5.33	9	13	13	17	$\sqrt{19}$

e)

x	0	1	2	2	3	4
y	0	1	2	3	3	4

Exercise 1.5

In a store, every item that is for sale has a price.

a) Does the assignment which assigns to an item its price constitute a function (in the sense of Definition 1.8 on page 6)?

b) Does the assignment which assigns to a given price all items with this price constitute a function?

c) In the case where the assignment is a function, what is the domain?

d) In the case where the assignment is a function, what is the range?

Exercise 1.6

A bank offers wealthy customers a certain amount of interest if they keep more than 1 million dollars in their account. The amount is described in the following table.

dollar amount x in the account	interest amount
$x \leq \$1,000,000$	$\$0$
$\$1,000,000 < x \leq \$10,000,000$	2% of x
$\$10,000,000 < x$	1% of x

a) Justify that the assignment cash amount to interest defines a function.

b) Find the interest for an amount of:

   i) $\$50,000$ ii) $\$5,000,000$ iii) $\$1,000,000$
   iv) $\$30,000,000$ v) $\$10,000,000$ vi) $\$2,000,000$

Exercise 1.7

Find a formula for a function describing the given inputs and outputs.

a) *input*: the radius of a circle
   output: the circumference of the circle

b) *input*: the side length in an equilateral triangle
   output: the perimeter of the triangle

c) *input*: one side length of a rectangle, with other side length being 3
   output: the perimeter of the rectangle

d) *input*: the side length of a cube
   output: the volume of the cube