Number Sets

A **set** is a collection of objects or things.

For example:

The set of all fingers: $F = \{\text{thumb, index, middle, ring, pinky}\}$

The set of odd numbers: $D = \{1, 3, 5, 7, 9, 11, 13, 15, 17, 19, \ldots\}$

↓

"continues on"

The number of elements in set S is represented by $n(S)$.

$n(F) = 5$

↓

FINITE SET

$n(D) =$ INFINITE

↓

INFINITE SET

$\{a, b, c, \ldots, x, y, z\}$ → FINITE SET, "..." USED TO SAVE US FROM WRITING A LONG LIST

$\in$ is the symbol that means 'is a member of' or 'is in'

THUMB $\in$ F

73 $\in$ D

$=$ EQUALS

$\neq$ NOT EQUAL TO

$\notin$ is the symbol that means 'is not a member of' or 'is not in'

THUMB $\notin$ D

60 $\notin$ D

1. List the members of set S which contains the:

(a) factors of 12 $n(S) = 6$

$S = \{1, 2, 3, 4, 6, 12\}$

(PUT NUMBERS IN ORDER)

(b) multiples of 7 $n(S) =$ INFINITE

$S = \{7, 14, 21, 28, 35, \ldots\}$

(c) composite numbers between 2 and 10.

COMPOSITE → NON-PRIME NUMBER

PRIME # → ONLY FACTORS ARE 1 AND ITSELF

$S = \{4, 6, 8, 9, 10\}$

$n(S) = 5$

2. Find $n(S)$ for each set in question 1.

Special Number Sets

Natural Numbers $\mathbb{N} = \{0, 1, 2, 3, 4, 5, 6...\}$

All Integers $\mathbb{Z} = \{0, \pm1, \pm2, \pm3, \pm4, \pm5, \pm6...\}$ → INCLUDES ZERO

All Positive Integers $\mathbb{Z}^+ = \{1, 2, 3, 4, 5, 6, ...\}$ → DOES NOT INCLUDE ZERO

ZAHLEN : GERMAN FOR "NUMBERS"

NOTE : INTEGERS ARE "Z" NOT "I" BECAUSE "I" IS USED FOR IMAGINARY NUMBERS

Rational Numbers $\mathbb{Q}$

("R" USED FOR REAL NUMBERS)

("Q" IS FOR QUOTIENT)

Rational numbers have the form $\frac{p}{q}$

where p and q are integers, and $q \neq 0$.

For example, the following are all rational numbers:

Q IS ALL FRACTIONS

$\frac{17}{5}$ $\quad 12 \quad$ $0.75 \quad$ $-\frac{1}{4}$

- WHOLE NUMBERS
- TERMINATING DECIMALS
- REPEATING DECIMALS (FOLLOW A PATTERN)

Irrational Numbers $\overline{\mathbb{Q}}$

Irrational numbers are numbers which cannot be written in rational form.

CAN NOT WRITE AS A FRACTION

For example: Radicals (surds) $\sqrt{2}$ $\sqrt{11}$

π (3.14159265….)

ONLY THOSE THAT DO NOT SIMPLIFY TO WHOLE NUMBERS

Non-recurring decimals (0.123456789….)

Real Numbers $\mathbb{R}$ → ANYTHING THAT IS RATIONAL OR IRRATIONAL (DECIMALS OR INTEGERS)

Real numbers include all numbers which can be placed on the number line.

Real numbers: $\frac{1}{3}$ $\sqrt{5}$ π

Not real numbers: $\frac{4}{0}$ $\sqrt{-5}$

(cannot write in decimal form)

IMPOSSIBLE (NOT REAL)

IMPOSSIBLE (IMAGINARY)

$i = \sqrt{-1}$

$\sqrt{-16} = \sqrt{16(-1)}$

$= 4\sqrt{-1}$

$= 4i$

3. Show that the following are rational numbers.

(a) $0.\overline{58}$ (b) $0.\overline{6}$ (c) $0.\overline{134}$

$0.585858\ldots$

Let $x = 0.585858\ldots$

$100x = 58.585858\ldots$

$100x = 58 + x$

$99x = 58$

$x = \frac{58}{99}$

$x = 0.\overline{6}$

$10x = 6.666\ldots$

$10x = 6 + x$

$9x = 6$

$x = \frac{6}{9}$

$x = \frac{2}{3}$

$x = 0.\overline{134}$

$1000x = 134.\overline{134}$

$1000x = 134 + x$

$999x = 134$

$x = \frac{134}{999}$

d) $-0.05 \rightarrow -0.05 \times \frac{100}{100} = \frac{-5}{100}$

$= -\frac{1}{20}$

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