B2 *Number Classification and Bases* Data Sheets

Data Sheets

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Data Sheet B2.1 *Number System: Definition*

The set of REAL numbers can be divided into TWO non-overlapping sets:

RATIONAL numbers and IRRATIONAL numbers.

RATIONAL numbers, **Q**:

any number that can be written in the form $\frac{m}{n}$ when m and n are integers and $n \neq 0$.

For example, $\frac{4}{5}$, $1\frac{1}{3}\left(=\frac{4}{3}\right)$, $2\left(=\frac{2}{1}\right)$, $-\frac{3}{4}$, etc.

IRRATIONAL numbers:

any number that is <u>not</u> a rational number.

For example, π, $\sqrt{2}$, $\sqrt{3}$, 2π, $-\sqrt{2}$, etc.

Rational numbers can also be divided into

N: natural (or counting) numbers; for example, 1, 2, 3, ...

Z: integers; for example, ..., -5, -4, -3, -2, -1, 0, 1, 2, 3, ...

Q^+: positive rational numbers; for example, $\frac{1}{2}$, $\frac{2}{3}$, 1, $\frac{4}{3}$, etc.

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Data Sheet B2.2 *Classifying Numbers*

Classify the following numbers as

integers, rational, irrational,

recurring decimals, terminating decimals.

NUMBER	Integer	Rational	Irrational	Recurring Decimal	Terminating Decimal
$\frac{5}{7}$					
-7					
0.6					
$0.4\dot{1}21\dot{3}$					
$\frac{5}{8}$					
11					
$\sqrt{10}$					
$\frac{\pi}{4}$					
$\sqrt{49}$					

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Data Sheet B2.3 *Using Venn Diagrams to Illustrate Number System*

In the Venn diagram below, place each of the following numbers in the correct set.

$$0,\ \frac{1}{2},\ -7,\ -\frac{3}{2},\ \pi,\ 4,\ \frac{4}{3}\ -1,\ \sqrt{3},\ 10,\ \sqrt{2},\ -\frac{5}{3},\ \frac{3}{4},\ 2\pi,\ 1+\sqrt{2}$$

The sets are

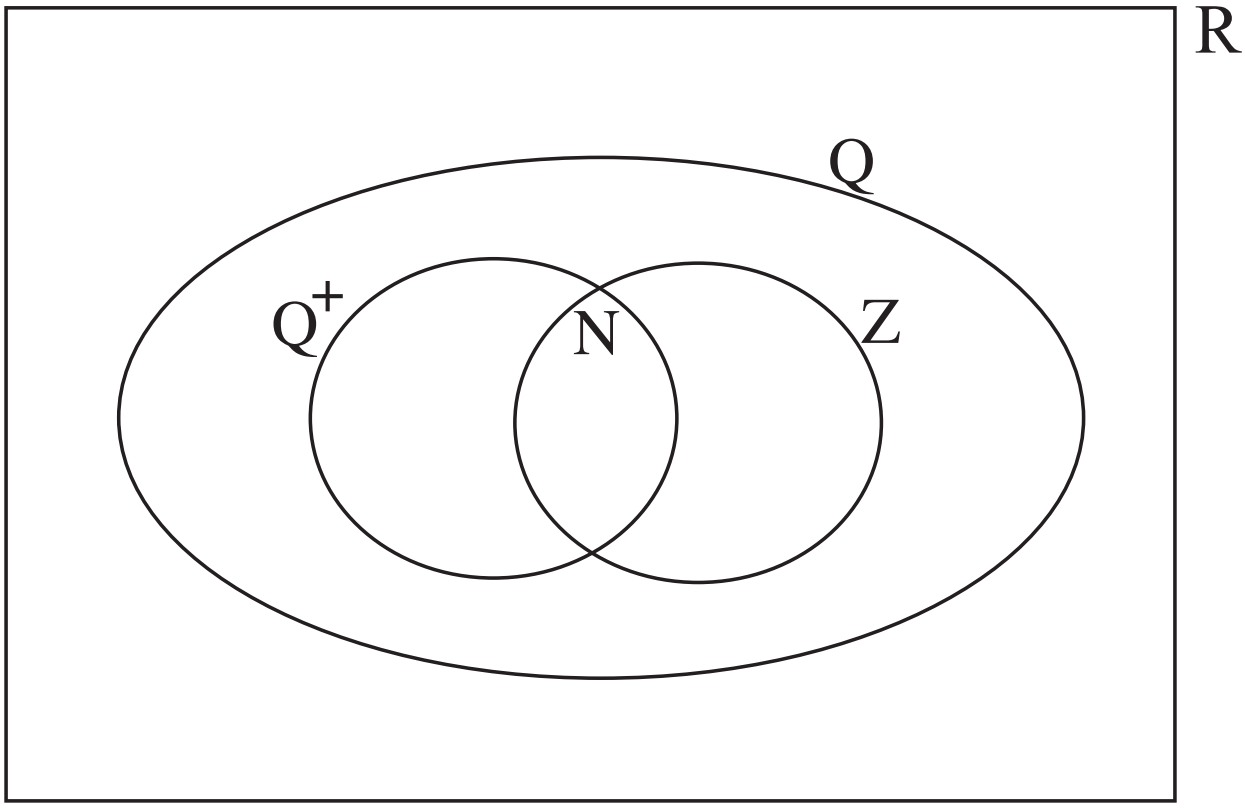
R : real numbers

Q : rational numbers

Q^+: positive rational numbers

N : natural numbers

Z : integers



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Data Sheet B2.4

Binary and Base 10

Convert the binary numbers 1011, 110011 and 100101 to base 10 numbers.

8	4	2	1
1	0	1	1

→ ☐ + ☐ + ☐ + ☐ = ☐

32	16	8	4	2	1
1	1	0	0	1	1

→ ☐ + ☐ + ☐ + ☐ + ☐ + ☐ = ☐

32	16	8	4	2	1
1	0	0	1	0	1

→ ☐ + ☐ + ☐ + ☐ + ☐ + ☐ = ☐

Convert these base 10 numbers into binary numbers:

5 = 4 + 1 → | 4 | 2 | 1 |
|---|---|---|
| ☐ | ☐ | ☐ |

12 = 8 + 4 → | 8 | 4 | 2 | 1 |
|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ |

23 = ☐ → | 16 | 8 | 4 | 2 | 1 |
|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ |

77 = ☐ →	64	32	16	8	4	2	1
☐	☐	☐	☐	☐	☐	☐

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Data Sheet B2.5 *Adding Binary Numbers*

Key results with binary numbers

$1 + 0 = \square$

$1 + 1 = \square$

$1 + 1 + 1 = \square$

Calculate, using these binary numbers

$$\begin{array}{r} 1\ 0\ 1 \\ +\quad 1\ 1 \\ \hline \square \end{array}$$

$$\begin{array}{r} 1\ 1\ 1 \\ +\ 1\ 0\ 1 \\ \hline \square \end{array}$$

$$\begin{array}{r} 1\ 0\ 1\ 1 \\ +\quad 1\ 0\ 1 \\ \hline \square \end{array}$$

$$\begin{array}{r} 1\ 1\ 1\ 1 \\ +\ 1\ 1\ 0\ 1 \\ \hline \square \end{array}$$

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Data Sheet B2.6 *Subtracting Binary Numbers*

Key results with binary numbers

$$1 - 0 = \square$$

$$10 - 1 = \square$$

$$11 - 1 = \square$$

Calculate, using these binary numbers

$$\begin{array}{r} 1\ 1\ 1 \\ -\ 1\ 0\ 1 \\ \hline \end{array} \qquad \square$$

$$\begin{array}{r} 1\ 1\ 0\ 1\ 1 \\ -\ \ 1\ 0\ 1\ 0 \\ \hline \end{array} \qquad \square$$

$$\begin{array}{r} 1\ 0\ 0\ 1 \\ -\ \ \ 1\ 0\ 1 \\ \hline \end{array} \qquad \square$$

$$\begin{array}{r} 1\ 1\ 1\ 0 \\ -\ \ \ 1\ 1\ 1 \\ \hline \end{array} \qquad \square$$

$$\begin{array}{r} 1\ 0\ 0\ 1 \\ -\ \ \ \ \ 1\ 1 \\ \hline \end{array} \qquad \square$$

$$\begin{array}{r} 1\ 0\ 0\ 1\ 1 \\ -\ \ \ 1\ 0\ 1\ 0 \\ \hline \end{array} \qquad \square$$

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Data Sheet B2.7

Binary Multiplication

Calculate, using these binary numbers:

$$\begin{array}{r} 1\ 1\ 0 \\ \times\quad 1\ 1 \\ \hline \\ \\ \hline \\ \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 1\ 1 \\ \times\quad 1\ 1 \\ \hline \\ \\ \hline \\ \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 1\ 0\ 1 \\ \times\quad 1\ 1\ 0 \\ \hline \\ \\ \hline \\ \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 0\ 1\ 1\ 0 \\ \times\quad 1\ 1\ 1 \\ \hline \\ \\ \hline \\ \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 1\ 1\ 1 \\ \times\quad 1\ 1\ 0 \\ \hline \\ \\ \hline \\ \\ \hline \end{array}$$

$$\begin{array}{r} 1\ 1\ 0\ 1 \\ \times\quad 1\ 0\ 1 \\ \hline \\ \\ \hline \\ \\ \hline \end{array}$$

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Data Sheet B2.8

Examples in Base 5

Convert the base 5 numbers 124 and 1223 into base 10.

25	5	1						
1	2	4	→		+		+		=	

125	25	5	1									
1	2	2	3	→		+		+		+		=	

Convert 152 from base 10 to base 5.

152 = 125 + 25 + 2 →

125	25	5	1

Carry out the following base 5 calculations:

	4	1
+	2	2

	1	0	4	3
+		1	2	3

	1	2
×	2	4

	1	4	4
×		2	3

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Data Sheet B2.9

Examples in Base 7

Convert 164 from base 7 to base 10.

49	7	1
1	6	4

$\rightarrow \square + \square + \square = \square$

Convert 142 from base 10 to base 7.

$142 = (2 \times 49) + (6 \times 7) + (2 \times 1) \rightarrow$ | 49 | 7 | 1 |

Carry out the following calculations in base 7:

$$\begin{array}{r} 1\ 4 \\ +\ 2\ 3 \\ \hline \square \end{array}$$

$$\begin{array}{r} 1\ 4\ 3 \\ +\ 2\ 2\ 5 \\ \hline \square \end{array}$$

$$\begin{array}{r} 3\ 4 \\ \times\ 1\ 2 \\ \hline \square \\ \hline \square \end{array}$$

$$\begin{array}{r} 4\ 6 \\ \times\ 3\ 4 \\ \hline \square \\ \hline \square \end{array}$$

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