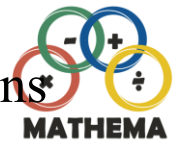


NUMBER BASES

Study Materials: Key Concepts, Practice Questions, Answers

Mathema
Contest

Number Bases -Study guide and Practice Questions



Name: _____

Overview

Number bases, also known as numeral systems, represent numbers using different bases. The most common base is base 10 (decimal), but others include base 2 (binary), base 8 (octal), and base 16 (hexadecimal).

Common Number Bases:

- **Base 2 (Binary):** Uses digits 0 and 1.
- **Base 8 (Octal):** Uses digits 0-7.
- **Base 10 (Decimal):** Uses digits 0-9.
- **Base 16 (Hexadecimal):** Uses digits 0-9 and letters A-F (where A=10, B=11, ..., F=15).

Conversion Methods:

1. **Decimal to Other Bases:** Repeatedly divide the number by the new base and record the remainders.
2. **Other Bases to Decimal:** Multiply each digit by its base raised to the power of its position (right to left, starting at 0).

Examples:

1. Binary to Decimal:

1101211012

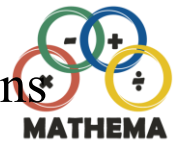
$$1 \times 2^3 + 1 \times 2^2 + 1 \times 2^3 + 1 \times 2^2$$

+

$$0 \times 2^1 + 0 \times 2^1$$

+

Number Bases -Study guide and Practice Questions



1 X 201 X 20

- $8+4+0+1=13$
 $108+4+0+1=1310$

2. Decimal to Binary:

13101310

- $13 \div 2 = 6$ remainder 1
- $6 \div 2 = 3$ remainder 0
- $3 \div 2 = 1$ remainder 1
- $1 \div 2 = 0$ remainder 1
- Reading remainders from bottom to top:

1101211012

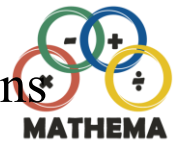
3. Decimal to Hexadecimal:

2551025510

- $255 \div 16 = 15$ remainder 15 (F in hex)
- $15 \div 16 = 0$ remainder 15 (F in hex)
- Result:

FF16FF16

Number Bases -Study guide and Practice Questions



Practice Questions:

1. Convert

1011210112

to decimal.

2. Convert

45104510

to binary.

3. Convert

1A161A16

to decimal.

4. Convert

27102710

to octal.

5. Convert

11121112

to hexadecimal.

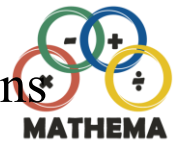
6. Convert

17281728

to decimal.

7. Convert

Number Bases -Study guide and Practice Questions



1001210012

to octal.

8. Convert

29102910

to hexadecimal.

9. Convert

53105310

to binary.

10.Convert

3B163B16

to decimal.

Answers:

1. $10112=10112=$

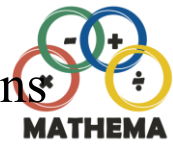
$$\begin{array}{rclcl} 1 \times 2^3 & + 0 \times 2^2 & + 1 \times 2^1 & + 1 \times 2^0 & = 8+0+2+1= 1110 \\ + 0 \times 2^2 & + 1 \times 2^1 & + 1 \times 2^0 & = 8+0+2+1= & 1110 \end{array}$$

2. 45104510

:

- **$45 \div 2 = 22$ remainder 1**
- **$22 \div 2 = 11$ remainder 0**
- **$11 \div 2 = 5$ remainder 1**

Number Bases -Study guide and Practice Questions



- $5 \div 2 = 2$ remainder 1
- $2 \div 2 = 1$ remainder 0
- $1 \div 2 = 0$ remainder 1
- Result:

10110121011012

3. $1A_{16} = 1A_{16} =$

$$1 \times 16^1 + 10 \times 16^0 = 16 + 10 = 1 \times 16^1 + 10 \times 16^0 = 16 + 10 =$$

26102610

4. $27_{10} = 27_{10}$

:

- $27 \div 8 = 3$ remainder 3
- $3 \div 8 = 0$ remainder 3
- Result:

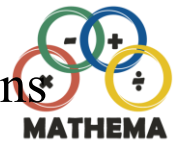
338338

5. $1112_{11} = 1112_{11}$

:

- $1112 = 1112 =$

Number Bases -Study guide and Practice Questions



$$1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 4 + 2 + 1 = 7_{10} \quad 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0 = 4 + 2 + 1 = 7_{10}$$

○ **Result:**

716716

6. $1728_{10} = 1728_{10}$

$$1 \times 8^2 + 7 \times 8^1 + 2 \times 8^0 = 64 + 56 + 2 = 122_{10} \quad 1 \times 8^2 + 7 \times 8^1 + 2 \times 8^0 = 64 + 56 + 2 = 122_{10}$$

7. 1001210012_{10}

:

○ **Group into sets of 3 from the right: 001 001**

○ **Convert each group:**

$$001_{10} = 1_{10}, 001_{10} = 1_{10} \quad 001_{10} = 1_{10}, 001_{10} = 1_{10}$$

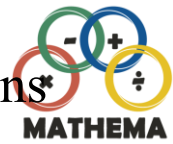
○ **Result:**

118118

8. 29102910_{10}

:

Number Bases -Study guide and Practice Questions



- $29 \div 16 = 1$ remainder 13 (D in hex)

- $1 \div 16 = 0$ remainder 1

- Result:

1D161D16

9. 53105310

:

- $53 \div 2 = 26$ remainder 1

- $26 \div 2 = 13$ remainder 0

- $13 \div 2 = 6$ remainder 1

- $6 \div 2 = 3$ remainder 0

- $3 \div 2 = 1$ remainder 1

- $1 \div 2 = 0$ remainder 1

- Result:

11010121101012