# Numeral System

**by Gonit Sora - Monday, January 28, 2013**

https://gonitsora.com/numeral-system/

1) The symbol $latex 25_b$ represents a two-digit number in base b. If the number $latex 52_b$ is double the number $latex 25_b,$ then b is: *[Asked in "FMS".]*

A) 7 B) 8 C) 9 D) 11

2) Convert the decimal number 22 to binary number.

3) Convert the decimal number 110 to octal number.

4) Convert the decimal number 733 to hexadecimal number.

5) Convert the decimal number 0.153 to binary number.$

6) Convert the decimal number $latex \frac{5}{11}$ to binary number.

7) Convert the decimal number 0.153 to octal number.

8) Convert the decimal number 0.153 to hexadecimal number.

9) Convert the binary number 1111101000.10101 to octal number.

10) Convert the binary number 1111101000.10101 to hexadecimal number.

11) Convert the hexadecimal number 3E8.A8 to binary number.

12) Convert the octal number 1750.52 to binary number.

13) Convert the octal number 1750.52 to hexadecimal number.

14) Convert the hexadecimal number 3E8.A8 to octal number.

15) $latex 111010_2+1110111_2=$ ?

16) $latex 1010110001_2-11110111_2=$ ?

17) $latex 110.11_2\times 11.01_2=$ ?

18) $latex 156_8+34_8=$ ?

19) $latex 106_8-37_8=$ ?

20) $latex 1011011_2\div 111_2=$ ?

_____?_____

## Detailed solutions and some general tricks:

**1)** 25 and 52 are two-digit numbers in base b. Therefore 2 and 5 are digits in the base b numeral system.

Also given that $latex 25_b\times 2_b=52_b.$

We have $latex 2_b\times 2_b=4_n.$

$latex \therefore 5_b\times 2_b=12_b$

$latex \Rightarrow 5_b\times 2_b=10_b+2_b.$

Now $latex 10_b=b_{10},$ $latex 5_b=5_{10}$ and $latex 2_b=2_{10}.$

$latex \therefore 5_{10}\times 2_{10}=b_{10}+2_{10}$

$latex \Rightarrow 10_{10}=(b+2)_{10}$

$latex \Rightarrow b=8_{10}.$

**2)**

Hence $latex 22_{10}=1\times 2^4+0\times 2^3+1\times 2^2+1\times 2^1+0\times 2^0=10110_2.$

**3)**

Hence $latex 110_{10}=1\times 8^2+5\times 8^1+6\times 8^0=156_8.$

**4)**

Hence $latex 733_{10}=2\times 16^2+D\times 16^1+D\times 16^0=2DD_{16}.$

**5)**

Hence $latex 0.153_{10}=0\times 2^{-1}+0\times 2^{-2}+1\times 2^{-3}+0\times 2^{-4}+0\times 2^{-5}+1\times 2^{-6}+1\times 2^{-7}+1\times 2^{-8}+\dots =0.00100111_2.$ (After we round and cut the number.)

**6)**

Hence $latex \frac{5}{11}=0.0111\dots _2.$

**7)**

Hence $latex 0.153_{10}=1\times 8^{-1}+1\times 8^{-2}+6\times 8^{-3}+2\times 8^{-4}+5\times 8^{-5}+4\times 8^{-6}+\dots =0.116254_8.$ (After we round and cut the number.)

**8)**

Hence $latex 0.153_{10}=2\times 16^{-1}+7\times 16^{-2}+2\times 16^{-3}+11\times 16^{-4}+0\times 16^{-5}+2\times 16^{-6}+\dots =0.272B02_{16}.$ (After we round and cut the number.)

**9)**

1111101000.10101

1 111 101 000 . 101 010

1 7 5 0 . 5 2

Hence $latex 1111101000.10101_2=1750.52_8.$

**10)**

1111101000.10101

11 1110 1000 . 1010 1000

3 14 8 . 10 8

3 E 8 . A 8

Hence $latex 1111101000.10101_2=3E8.A8_{16}.$

**11)**

3E8.A8

3 E 8 . A 8

11 1110 1000 . 1010 1000

Hence $latex 3E8.A8_{16}=1111101000.10101_2.$

**12)**

1750.52

1 7 5 0 . 5 2

1 111 101 000 . 101 010

Hence $latex 1750.52_8=1111101000.10101_2.$

**13)**

1750.52

1 7 5 0 . 5 2

1 111 101 000 . 101 010

1111101000.10101

11 1110 1000 . 1010 1000

3 14 8 . 10 8

3 E 8 . A 8

Hence $latex 1750.52_8=3E8.A8_{16}.$

**14)**

3E8.A8

3 E 8 . A 8

11 1110 1000 . 1010 1000

1111101000.10101

1 111 101 000 . 101 010

1 7 5 0 . 5 2

Hence $latex 3E8.A8_{16}=1750.52_8.$

**15)**

**16)**

**17)**

Hence required value = 10101.1111

**18)**

**19)**

**20)**

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