★ Convert following decimal number in its equivalent number.

1) $(1248.56)_{10} = (?)_2$

Sol^n :) Integer part

2	1248	
2	624	0 ↑ LSB
2	312	0
2	156	0
2	78	0
2	39	0
2	19	1
2	9	1
2	4	1
2	2	0
2	1	0
	0	1 MSB

$\therefore (1248.56)_{10} = (10011100000)_2$

Fractional Part

	MSB
$0.56 \times 2 = 1.12$	1
$0.12 \times 2 = 0.24$	0
$0.24 \times 2 = 0.48$	0
$0.48 \times 2 = 0.96$	0
$0.96 \times 2 = 1.92$ ↓	1 LSB

$\therefore$ ~~(0.56)~~ $(0.56)_{10} = (10001)_2$

3) $(420.6)_{10} = (?)_2$

Soln:- Integer part

2 | 420		
2 | 210	0	↑ LSB
2 | 105	0	
2 | 52	1	
2 | 26	0	
2 | 13	0	
2 | 6	1	
2 | 3	0	
2 | 1	1	
0	1	MSB

$\therefore (420)_{10} = (110100100)_2$

Fractional Part

$0.6 \times 2 = 1.2$ — 1 — MSB
$0.2 \times 2 = 0.4$ — 0
$0.4 \times 2 = 0.8$ — 0
$0.8 \times 2 = 1.6$ — 1
$0.6 \times 2 = 1.2$ — 1
$0.2 \times 2 = 0.4$ — 0 ↓ LSB

$\therefore (0.6)_{10} = (100110)_2$

$\therefore (420.6)_{10} = (110100100.100110)_2$

4) $(8476.47)_{10} = (?)_2$

Sol^n:- Integer part

2 | 8476		
2 | 4238	0	↑ LSB
2 | 2119	0	
2 | 1059	1	
2 | 529	1	
2 | 264	1	
2 | 132	0	
2 | 66	0	
2 | 33	0	
2 | 16	1	
2 | 8	0	
2 | 4	0	
2 | 2	0	
2 | 1	0	
0 | 0	1	MSB

$\therefore (8476)_{10} = (10000100011100)_2$

Fractional Part

$0.47 \times 2 = 0.94$	MSB	0
$1.88 \times 2 = 1.88$		1
$1.76 \times 2 = 1.76$		1
$1.52 \times 2 = 1.52$		1
$1.04 \times 2 = 1.04$		1
$0.08 \times 2 = 0.08$	↓ LSB	0

$\therefore (0.47)_{10} = (01111)_2$

$\therefore (8476.47)_{10} = (10000100011100.01111)_2$

★ Convert following Decimal numb into its equivalent octal number.

1) $(1248.56)_{10} = (?)_8$

Integer part:

8	1248		
8	156	0	↑ LSB
8	19	4	
8	2	3	
	0	2	MSB

$\therefore (1248)_{10} = (2340)_8$

Fractional Part

$0.56 \times 8 = 4.48$	4	MSB
$0.48 \times 8 = 3.84$	3	
$0.84 \times 8 = 6.72$	6	
$0.72 \times 8 = 5.76$	5	
$0.76 \times 8 = 6.08$	6	
$0.08 \times 8 = 0.64$	0	↓ LSB

$\therefore (0.56)_{10} = (436560)_8$

$\therefore \underline{(1248.56)_{10} = (2340.436560)_8}$

2) $(8957.75)_{10} = (?)_8$

Sol:- Integer part

8 | 8957		
8 | 1119	5	↑ LSB
8 | 139	7	
8 | 17	3	
8 | 2	1	
0	2	MSB

$\therefore (8957)_{10} = (21375)_8$

Fractional Part

$0.75 \times 8 = 6.00$ → 6 MSB

$0.00 \times 8 = 0.00$ → 0 LSB

$\therefore (0.75)_{10} = (60)_8$

$\therefore \underline{(8957.75)_{10} = (21375.60)_8}$

3) $(420.6)_{10} = (?)_8$

Sol:- Integer Part

8 | 420		
8 | 52	4	↑ LSB
8 | 6	4	
0	6	MSB

$\therefore (420)_{10} = (644)_8$

P.T.O.

Fractional Part

$0.6 \times 8 = 4.8$ → 4 (MSB)
$0.8 \times 8 = 6.4$ → 6
$0.4 \times 8 = 3.2$ → 3
$0.2 \times 8 = 1.6$ → 1
$0.6 \times 8 = 4.8$ → 4 (LSB)

$\therefore (0.6)_{10} = (46314)_8$

$\therefore (420.6)_8 = (644.46314)_8$

4) $(8476.47)_{10} = (?)_8$

Sol^n :- Integer Part

8	8476
8	1059
8	132
8	16
8	2
	0

Remainders (bottom to top): 4 (LSB), 3, 4, 0, 2 (MSB)

$\therefore (8476)_{10} = (20434)_8$

Fractional Part

$0.47 \times 8 = 3.76$ → 3 (MSB)
$0.76 \times 8 = 6.08$ → 6
$0.08 \times 8 = 0.64$ → 0
$0.64 \times 8 = 5.12$ → 5
$0.12 \times 8 = 0.96$ → 0 (LSB)

$\therefore (0.47)_{10} = (36050)_8$

$\therefore (8476.47)_{10} = (20434.36050)_8$

* Convert the following decimal number into its equivalent hex. number.

1) $(1248.56)_{10} = (?)_{16}$

Sol^n:- Integer Part

16	1248		
16	78	0	↑ LSB
16	4	14 = E	
	0	4	↓ MSB

$\therefore (1248)_{10} = (4E0)_{16}$

Fractional Part

$0.56 \times 16 = 8.96$	8	↓ MSB
$0.96 \times 16 = 15.36$	15 = F	
$0.36 \times 16 = 5.76$	5	
$0.76 \times 16 = 12.16$	12 = C	
$0.16 \times 16 = 2.56$	2	↓ LSB

$\therefore (0.56)_{10} = (8F5C2)_{16}$

$\therefore (1248.56)_{10} = (4E0.8F5C2)_{16}$

2) $(8957.75)_{10} = (?)_{16}$

Sol^n:- Integer part

16	8957		
16	559	13 = D	↑ LSB
16	34	15 = F	
16	2	2	
	0	2	↓ MSB

PTO

$\therefore (8957)_{10} = (22FD)_{16}$

Fractional Part

$0.75 \times 16 = 12.00$ → 12 = C (MSB)

$0.00 \times 16 = 0.00$ → 0 (LSB)

$\therefore (0.75)_{10} = (C0)_{16}$

$\therefore \underline{(8957.75)_{10} = (22FD.C0)_{16}}$

3) $(420.6)_{10} = (?)_{16}$

Sol^n :

Integer Part

16	420		
16	26	4	LSB
16	1	10 = A	
	0	1	MSB

$\therefore (420)_{10} = (4A1)_{16}$

Fractional Part

$0.6 \times 16 = 9.6$ → 9 (MSB)

$0.6 \times 16 = 9.6$ → 9

$0.6 \times 16 = 9.6$ → 9 (LSB)

$\therefore (0.6)_{10} = (999)_{16}$

$\therefore \underline{(120.6)_{10} = (1A4.999)_{16}}$

4) $(8476.47)_{10} = (?)_{16}$

Soln:- Integer part

16 | 8476		
16 | 529	12 = C	↑ LSB
16 | 33	1	
16 | 2	1	
0	2	↓ MSB

$\therefore (8476)_{10} = (211C)_{16}$

Fractional Part

$0.47 \times 16 = 7.52$	7	MSB
$0.52 \times 16 = 8.32$	8	
$0.32 \times 16 = 5.12$	5	
$0.12 \times 16 = 1.92$	1	
$0.92 \times 16 = 14.72$	E	LSB

$\therefore (0.47)_{10} = (7851E)_{16}$

$\therefore (8476.47)_{10} = (211C.7851E)_{16}$

* Convered following binary number into it's equivalent decimal number.

1) $(1101110.011)_2 = (?)_{10}$

Soln :-

Given binary number is
1101110.011

Positional weight
$2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0\ 2^{-1}\ 2^{-2}\ 2^{-3}$

$= (1\times 2^6) + (1\times 2^5) + (0\times 2^4) + (1\times 2^3) + (1\times 2^2) + (1\times 2^1) + (0\times 2^0) + (0\times 2^{-1}) + (0\times 2^{-2}) + (1\times 2^{-3})$

$= 64 + 32 + 0 + 8 + 4 + 2 + 0 + 0 + 0.25 + 0.125$

$= 110 + 0.375$

$= 110.375$

$\therefore (1101110.011)_2 = (110.375)_{10}$

2) $(1101.11)_2 = (?)_{10}$

Soln :-

Binay Part 1101.11

Positional weight
$2^3\ 2^2\ 2^1\ 2^0 . 2^{-1}\ 2^{-2}$

$= (1\times 2^3) + (1\times 2^2) + (0\times 2^1) + (1\times 2^0) . (1\times 2^{-1}) + (1\times 2^{-2})$

$= 8 + 4 + 0 + 1 + 0.5 + 0.25$

$= 13 + 0.75$

$= 13.75$

$\therefore (1101.11)_2 = (13.75)_{10}$

3) $(10001.01)_2 = (?)_{10}$

Soln:- Binary no. 10001.01

Positional weight

$2^4 \; 2^3 \; 2^2 \; 2^1 \; 2^0 . \; 2^{-1} \; 2^{-2}$

$= (1 \times 2^4) + (0 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0) . (0 \times 2^{-1}) + (1 \times 2^{-2})$

$= 16 + 0 + 0 + 0 + 1 + 0.5 + 0.25$

$= 17 + 0.75$

$= 17.75$

$\therefore (10001.01)_2 = (17.75)_{10}$

* Convert the following octal number into its equivalent decimal number.

1) $(3006.05)_8 = (?)_{10}$

Soln:-

Octal no. 3 0 0 6 . 0 5

Positional weight

$8^3 \; 8^2 \; 8^1 \; 8^0 . \; 8^{-1} \; 8^{-2}$

$= (3 \times 8^3) + (0 \times 8^2) + (0 \times 8^1) + (6 \times 8^0) + (0 \times 8^{-1}) + (5 \times 8^{-2})$

$= (3 \times 512) + 0 + 0 + (6 \times 1) + 0 + (5 \times 0.015)$

$= 1536 + 6 + 0.075$

$= 1542.075$

$\therefore (3006.05)_8 = (1542.075)_{10}$

2) $(273.56)_8 = (?)_{10}$

Soln :-

Octal number 2 7 3 5 6

Positional weight 8^2 8^1 8^0 8^{-1} 8^{-2}

$= (2 \times 8^2) + (7 \times 8^1) + (3 \times 8^0) + (5 \times 8^{-1}) + (6 \times 8^{-2})$

$= 128 + 56 + 3 + 0.62 + 0.09$

$= 187.71$

$\therefore (273.56)_8 = (187.71)_{10}$

3) $(6534.04)_8 = (?)_{10}$

Soln :-

Octal number 6 5 3 4 . 0 4

Positional weight 8^3 8^2 8^1 8^0 . 8^{-1} 8^{-2}

$= (6 \times 8^3) + (5 \times 8^2) + (3 \times 8^1) + (4 \times 8^0) + (0 \times 8^{-1}) + (4 \times 8^{-2})$

$= 3035 + 320 + 24 + 32 + 0.06$

$= 3411.06$

$\therefore (6534.04)_8 = (3411.06)_{10}$

* Convert following hexadecimal numbers into it's equivalent decimal numbers.

1) $(4056)_{16} = (?)_{10}$

Sol^n:-

Hexadecimal number 4 0 5 6

Positional weight 16^3 16^2 16^1 16^0

$= (4 \times 16^3) + (0 \times 16^2) + (5 \times 16^1) + (6 \times 16^0)$

$= 16384 + 240 + 6$

$= 16630$

$\therefore (4056)_{16} = (16630)_{10}$

2) $(6B7)_{16} = (?)_{10}$

Sol^n:-

Hex. No. 6 B 7

6 11 7

Positional weight

16^2 16^1 16^0

$= (6 \times 16^2) + (11 \times 16^1) + (7 \times 16^0)$

$= 1536 + 176 + 7$

$= 1719$

$\therefore (6B7)_{16} = (1719)_{10}$

3) $(8E47.AB)_{16} = (?)_{10}$

Sol^n :-

Hex. No. 8 E 4 7 . A B

8 14 4 7 10 11

Positional weight

16^3 16^2 16^1 16^0 16^{-1} 16^{-2}

$= (8 \times 16^3) + (14 \times 16^2) + (4 \times 16^1) + (7 \times 16^0) + (10 \times 16^{-1}) + (11 \times 16^{-2})$

$= 32768 + 3584 + 64 + 7 + 0.625 + 0.0429$

$= 36423.6679$

$\therefore (8E47.AB)_{16} = (36423.6679)_{10}$

★ Convert following binary number into its equivalent octal number.

1) Sol^n :- $(1101110.011)_2 = (?)_8$

Bit

1 101.110 . 011

1 ← 5 ← 6 → 3 Decimal

$\therefore (1101110.011)_2 = (156.3)_8$

2) $(1101.11)_2 = (?)_8$

Soln:

0 0 1 1 0 1 . 1 1 0

← ← →

1 5 6

3 bit binary Decimal

$\therefore (1101.11_0)_2 = (15.6)_8$

3) $(10001.01)_2 = (?)_8$

Soln: 10001.01

0 1 0 0 0 1 . 0 1 0

← ← →

2 1 . 2

3 bit binary Decimal

$\therefore (10001.01)_2 = (21.2)_8$

★ Convert following binary number into its equivalent hexadecimal number.

1) $(1101110.011)_2 = (?)_{16}$

Soln:

4 bit binary

0 1 1 0 1 1 1 0 . 0 1 1 0

← ← →

6 14 6

6 E 6 Decimal

$\therefore (1101110.011)_2 = (6E6)_{16}$

2) $(1101.11)_2 = (?)_{16}$

Soln:- 4 bit binary

1 1 0 1 . 1 1 0 0

← →

13 12 Decimal

D . C

$\therefore (1101.11)_2 = (DC)_{16}$

3) $(10001.01)_2 = (?)_{16}$

Soln:- 4 bit binary.

0 0 0 1 0001 . 0100

← ← →

1 1 4 Decimal

$\therefore (10001.01)_2 = (114)_{16}$

★ Convert following octal number into its equivalent binary number.

1) $(3006.05)_8 = (?)_2$

Soln:- 3 bit binary

011 000 000 110 . 000 101

3 0 0 6 0 5 Octal

$\therefore (3006.05)_8 = (11000000110.000101)_2$

2) $(273.56)_8 = (?)_2$

Soln: 3 bit binary

010 111 011 . 101 110

2 7 3 . 5 6 Octal

$\therefore (273.56)_8 = (10111011.101110)_2$

3) $(6534.04)_8 = (?)_2$

Soln: 3 bit binary

110 101 011 100 . 000 100

6 5 3 4 0 4 Octal

$\therefore (6534.04)_8 = (110101011100.000100)_2$

★ Convert following hexadecimal number into equivalent binary number.

1) $(4056)_{16} = (?)_2$

Soln: 4 bit binary

0100 0000 0101 0110 Hexadecimal

4 0 5 6

$\therefore (4056)_{16} = (100000001010110)_2$

2) $(6B7)_{16} = (?)_2$

Soln :- 4 bit binary

0110 1011 0111 Hexadecimal

$\therefore (6B7)_{16} = (11010110111)_2$

3) $(BE47.AB)_{16} = (?)_2$

Soln :- 4 bit binary

1000 1110 0100 0111 . 1010 1011

Hexadecimal

$\therefore (8E47.AB)_{16} = (1000111001000111.10101011)_2$

★ Convert the following octal numbers into its equivalent hexadecimal numbers.

1) $(3006.05)_8 = (?)_{16}$

Soln :- 3 bit binary.

011 000 000 110 . 000 101

3 0 0 6 0 5 Octal

011000000110.000101

4 bit binary

0110 0000 0110 . 00010100

← ← ← → →

6 0 6 . 1 4 Hex.

$\therefore (3006.05)_8 = (606.14)_{16}$

2) $(273.56)_8 = (?)_{16}$

Soln:- 3 bit binary

010 111 011 . 101 110

2 7 3 . 5 6 Octal

010111011.101110

4 bit binary

0000 1011 1011 . 1011 1000

← ← ← → →

0 B B . B 8 Hexadecimal

$\therefore (273.56)_8 = (BB.B8)_{16}$

3) $(6534.04)_8 = (?)_{16}$

Soln:- 3 bit binary

110 101 011 100 . 000 100

110101011100.000100

4 bit binary

1101 0101 1100 . 0001

← ← ← →

D 5 C 1 Hexadecimal

$\therefore (6534.04)_8 = (D5C.1)_{16}$

Date.

★ Convert following hexadecimal number into it's equivalent octal number.

1) $(4056)_{16} = (?)_8$

Soln :-

4 bit binary

0100 0000 0101 0110

4 0 5 6 Hexadecimal

0100 0000 0101 0110

3 bit binary

0 100 000 001 010 110

← ← ← ← ←

4 0 1 2 6 Octal

$\therefore (4056)_{16} = (40126)_8$

2) $(6B7)_{16} = (?)_8$

Soln :-

4 bit binary

0110 1011 0111

6 B 7 Hexadecimal

011010110111

3 bit binary

0 110 101 101 0111

← ← ← ←

3 2 6 7

$\therefore (6B7)_{16} = (3267)_8$

3) $(8E47.AB)_{16} = (?)_8$

Sol^n:-

4 bit binary

1000 1110 0100 0111 . 1010 1011

8 E 4 7 . A B Hexadecimal

$1000111001000111.10101011$

3 bit binary

001 000 111 001 000 111 . 101 010 110

1 0 7 1 0 7 . 5 2 6 octal

$\therefore (8E47.AB)_{16} = (107107.526)_8$

★ Perform binary addition of following.

1) $(11011)_2 + (1101)_2$

Sol^n:-

$$\begin{array}{r} 11011 \\ +\ 1101 \\ \hline 101000 \end{array}$$

$\therefore (11011)_2 + (1101)_2 = (101000)_2$

2) $(1011)_2 + (1101)_2 + (1001)_2 + (1111)_2$

Sol^n:-

$$\begin{array}{r} 1011 \\ +\ 1101 \\ +\ 1001 \\ +\ 1111 \\ \hline 110000 \end{array}$$

$\therefore (1011)_2 + (1101)_2 + (1001)_2 + (1111)_2 = 110000$

3) $(1010.11)_2 + (1101.10)_2 + (1001.11)_2 + (1111.11)_2$

Soln :-

```
  10 10 10 10  1
   1010.11
+  1101.10
+  1001.11
+  1111.11
-----------
  110001.11
```

$\therefore (1010.11)_2 + (1101.10)_2 + (1001.11)_2 + (1111.11)_2 = (110001.11)_2$

4) $(10111.101)_2 + (110111.01)_2$

Soln :-

```
    1 1 1
  10111.101
+ 110111.01
-----------
 1001110.111
```

$\therefore (10111.101)_2 + (110111.01)_2 = (1001110.111)_2$

* Perform binary subtraction of following.

1) $(1011)_2 - (101)_2$

Soln :-

```
  1011
- 101
------
  0110
```

$\therefore (1011)_2 - (101)_2 = (110)_2$

2) $(1100.10)_2 - (111.01)_2$

Soln:-

$$\begin{array}{r} {}^{1}{}^{0}{}^{1}{}^{1}{}^{1}{}^{0}{}^{1}{}^{0} \\ 1100.10 \\ -\ \ 111.01 \\ \hline 0101.01 \end{array}$$

$\therefore (1100.10)_2 - (111.01)_2 = (101.01)_2$

3) $(10110)_2 - (1011)_2$

Soln:-

$$\begin{array}{r} {}^{1}{}^{0}{}^{0}{}^{1}{}^{0}{}^{1}{}^{0}{}^{1}{}^{0} \\ 10110 \\ -\ \ 1011 \\ \hline 01011 \end{array}$$

$\therefore (10110)_2 - (1011)_2 = (01011)_2$

4) $(10001.01)_2 - (1111.11)_2$

Soln:-

$$\begin{array}{r} {}^{1}{}^{0}{}^{1}{}^{0}{}^{1}{}^{0}{}^{0}{}^{1}{}^{0} \\ 10001.01 \\ -\ \ 1111.11 \\ \hline 00001.10 \end{array}$$

$\therefore (10001.01)_2 - (1111.11)_2 = (1.10)_2$

★ Perform binary multiplication of following.

1) $(1101)_2 \times (101)_2$

Soln :-

```
    1101
  x  101
  ------
    1101
+  0000x
+ 1101xx
  -------
  1000001
```

$\therefore (1101)_2 \times (101)_2 = (1000001)_2$

2) $(1101.11)_2 \times (101.1)$

Soln :-

```
   1101.11
  x  101.1
  --------
   110111
  1101110x
 0000000xx
+1101110xxx
-----------
 1001011.101
```

$\therefore (1101.11)_2 \times (101.1)_2 = (1001011.101)_2$

3) $(11001)_2 \times (10)_2$

Soln:-

$$\begin{array}{r} 11001 \\ \times \quad 10 \\ \hline 00000 \\ 11001\times \\ \hline 110010 \end{array}$$

$\therefore (11001)_2 \times (10)_2 = (110010)_2$

4) $(10110)_2 \times (10.1)_2$

Soln:-

$$\begin{array}{r} 10110 \\ \times \quad 10.1 \\ \hline 10110 \\ 00000\times \\ +10110\times\times \\ \hline 110111.0 \end{array}$$

$\therefore (10110)_2 \times (10.1) = (110111.0)_2$

★ Perform binary division of following.

1) $(1010)_2$ by $(11)_2$

Soln :-

```
        011
    11 | 1010
         0
        ---
         10
          11
        ----
          100
           11
         ----
           01
```

```
    11
   x11
   ---
    11
   11x
  ----
  1001
     1
  ----
  1010
```

2) $(11110)_2$ by $(101)_2$

Soln :-

```
        110
   101 | 11110
       - 101
       -----
        0101
       - 101
       -----
         000
       - 000
       -----
         000
```

```
   101
   110
  ----
   000
  101x
 -----
 101xx
 -----
 11110
```

3) $(11011)_2$ by $(101)_2$

Soln:-

$$101 \overline{)\ 11011}$$

4) $(110111.1)_2$ by $(101)_2$

Soln:-

$$\begin{array}{r} 101 \overline{)\ 110111.1} \\ 101 \\ \hline 11 \\ 0 \\ \hline 111 \\ 101 \\ \hline 101 \\ 101 \\ \hline 01 \\ 0 \\ \hline 010 \\ 0 \\ \hline 100 \\ 0 \\ \hline 1000 \\ 101 \\ \hline 011 \end{array}$$

* Perform binary subtraction using 1's complement method.

1) $(52)_{10} - (17)_{10}$

Soln :-

$(52)_{10} = (?)_2$

2	52	
2	26	0 ↑ LSB
2	13	0
2	6	1
2	3	0
2	1	1
	0	1 MSB

$\therefore (52)_{10} = (110100)_2$

$(17)_{10} = (?)_2$

2	17	
2	8	1 ↑ LSB
2	4	0
2	2	0
2	1	0
2	0	1 MSB

$\therefore (17)_{10} = (10001)_2$

$\therefore$ 1's complement of $(52)_{10} - (17)_{10}$

$= (110100)_2 - (10001)_2$

Now,

```
  1 1 1
  0 1 1 1 0
+ 1 0 1 0 0
-------------
(1) 1 0 0 1 0
+       1
-------------
  1 0 0 0 1 1      Carry
```

$\therefore (52)_{10} - (17)_{10} = (100011)_2$

2) $(46)_{10} - (84)_{10}$

Soln:- $(46)_{10} = (?)_2$

2 | 46		
2 | 23	0	↑ LSB
2 | 11	1	
2 | 5	1	
2 | 2	1	
2 | 1	0	
0	1	MSB

$\therefore (46)_{10} = (101110)_2$

Now, $(84)_{10} = (?)_2$

2 | 84		LSB
2 | 42	0	↑
2 | 21	0	
2 | 10	1	
2 | 5	0	
2 | 2	1	
2 | 1	0	
2 | 0	1	MSB

$\therefore (84)_{10} = (1010100)_2$

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

There is no carry generated

So, answer is negative

$\therefore (46)_{10} - (84)_{10} = -(0\,1001\,10)_2$

3) $(63.75)_{10} = (17.5)_{10}$

Soln :- $(63.75)_{10} = (?)_2$

Integer part

2	63		
2	31	1	↑ LSB
2	15	1	
2	7	1	
2	3	1	
2	1	1	
	0	1	MSB

$\therefore (63)_{10} = (111111)_2$

Fractional Part

$0.75 \times 2 = 1.50$ — 1 — MSB
$0.50 \times 2 = 1.00$ — 1
$0.00 \times 2 = 0.00$ — 0 — LSB

$\therefore (0.75)_{10} = (110)_2$

$\therefore (63.75)_{10} = (111111.110)_2$

Now, $(17.5)_{10} = (?)_2$

Integer part

2 | 17		
2 | 8	1	↑ LSB
2 | 4	0	
2 | 2	0	
2 | 1	0	
0	1	MSB

$(17)_{10} = (10001)_2$

Fractional Part

$0.5 \times 2 = 1.0$ 1 ↓ MSB

$0.0 \times 2 = 0.0$ 0 ↓ LSB

$\therefore (0.5)_{10} = (0.10)$

$\therefore (17.5)_{10} = (10001.10)_2$

Then Now

$$\begin{array}{r} 10111\,0.011 \\ 11111.110 \\ \hline (1)\,101110.001 \\ \hline 101110.010 \end{array}$$

(1) → 1 Carry

$\therefore \underline{(63.75)_{10} - (17.5)_{10} = (101110.010)_2}$

4) $(73.5)_{10} - (112.75)_{10}$

Soln :- $(73.5)_{10} = (?)_2$

Integer part

2 | 73		
2 | 36	1	↑ LSB
2 | 18	0	
2 | 9	0	
2 | 4	1	
2 | 2	0	
2 | 1	0	
0	1	MSB

$\therefore (73)_{10} = (1001001)_2$

Fractional part

$0.5 \times 2 = 1.0$ → 1 (MSB)

$0.0 \times 1 = 0.0$ → 0 (LSB)

$\therefore (0.5)_{10} = (10)_2$

Now, $(112.75)_{10} = (?)_2$

2 | 112		
2 | 56	0	↑ LSB
2 | 28	0	
2 | 14	0	
2 | 7	0	
2 | 3	1	
2 | 1	1	
0	1	MSB

* Perform binary subtraction using 2's complement method.

1) $(46)_{10} - (19)_{10}$

Sol^n:- $(46)_{10} = (?)_2$

2 | 46		
2 | 23	0	↑ LSB
2 | 11	1	
2 | 5	1	
2 | 2	1	
2 | 1	0	
0	1	MSB

$\therefore (46)_{10} = (101110)_2$

$\because (19)_{10} = (?)_2$

2 | 19		
2 | 9	1	↑ LSB
2 | 4	1	
2 | 2	0	
2 | 1	0	
0	1	MSB

$\therefore (19)_{10} = (010011)_2$

Now

2's complement of $(19)_{10} = 101100$ 1st complement (19)

$$\begin{array}{r} 101100 \\ + \quad\quad 1 \\ \hline 101101 \end{array} \rightarrow 2^s \text{ complement of (19)}$$

2) $(27)_{10} - (75)_{10}$

Soln :-

$(27)_{10} = (?)_2$

2 | 27		
2 | 13	1	↑ LSB
2 | 6	1	
2 | 3	0	
2 | 1	1	
0	1	MSB

$\therefore (27)_{10} = (11011)_2$

Now, $(75)_{10} = (?)_2$

2 | 75		
2 | 37	1	↑ LSB
2 | 18	1	
2 | 9	0	
2 | 4	1	
2 | 2	0	
2 | 1	0	
0	1	MSB

$\therefore (75)_{10} = (1001011)_2$

2's complement of $(75)_{10} = 1001011 + 1$

$= 1001100$

Now,

$$\begin{array}{r} 1001100 \\ +\ 11011 \\ \hline 1100111 \end{array}$$

∴ There is no carry generated

Answer is negative

∴ 2's complement of (1100111)

$= 0011000$

$+\ 1$

0011001

$\therefore (27)_{10} - (75)_{10} = -(01001001)_2$

3) $(125.3)_{10} - (46.7)_{10}$

Soln:- $(125.3)_{10} = (?.)_2$

Integer part

2 | 125		
2 | 62	1	↑ LSB
2 | 31	0	
2 | 15	1	
2 | 7	1	
2 | 3	1	
2 | 1	1	
0	1	MSB

$\therefore (125)_{10} = (1111101)_2$

Fractional part

$0.3 \times 2 = 0.6$	0	MSB
$0.6 \times 2 = 1.2$	1	
$0.2 \times 2 = 0.4$	0	
$0.4 \times 2 = 0.8$	0	
$0.8 \times 2 = 1.6$	1	↓ LSB

$\therefore (0.3)_{10} = (0.01001)_2$

Now, $(46.7)_{10} = (?.)_2$

Integer part

2 | 46		
2 | 23	0	↑ LSB
2 | 11	1	
2 | 5	1	
2 | 2	1	
2 | 1	0	
		MSB

Fractional Part

$0.7 \times 2 = 1.4$ — 1 (MSB)
$0.4 \times 2 = 0.8$ — 0
$0.8 \times 2 = 1.6$ — 1
$0.6 \times 2 = 1.2$ — 1
$0.2 \times 2 = 0.4$ — 0 (LSB)

$\therefore (0.7)_{10} = (10110)_2$

2's complement of (46.7)

= 1 0 10001 . 01001
+ 1
10 1 0 0 0 1 . 01010

Now,

1 0 10001 . 01010 — 2's complement
+ 1 1 11101 . 01001 — binary of (125.3)
1 1 0 0 1 1 1 0 . 1 0 0 1 1

$\therefore (125.3)_{10} - (46.7)_{10} = (11001110.1001)_2$

4) $(36.75)_{10} - (89.5)_{10}$

Sol^n: $(36.75)_{10} = (?)_2$

Integer part

2	36		
2	18	0	LSB
2	9	0	
2	4	1	
2	2	0	
2	1	0	
	0	1	MSB

$\therefore (36)_{10} = (100100)_2$

Fractional Part

$0.75 \times 2 = 1.50$ 1 MSB

$0.50 \times 2 = 1.00$ 1

$0.00 \times 2 = 0.00$ 0 LSB

$\therefore (0.75)_{10} = (110)_2$

Now, $(89.5)_{10} = (?)_2$

Integer part

2 | 89		
2 | 44	1	↑ LSB
2 | 22	0	
2 | 11	0	
2 | 5	1	
2 | 2	1	
2 | 1	0	
0	1	MSB

$\therefore (89)_{10} = (1011001)_2$

Fractional part

$0.5 \times 2 = 1.0$ 1 MSB

$0.0 \times 2 = 0.0$ 0 LSB

$\therefore (0.5) = (0.10)_2$

2's complement of $(89.5)_{10}$ = 01001 10.011

$+ \quad 1$

0100110.100

Now,

$0\ 1\ 0\ 0\ 1\ 1\ 0.\ 1\ 0\ 0$ 2's comp. $(89.5)_{10}$

$+\ 1\ 0\ 0\ 1\ 0\ 0.\ 1\ 1\ 0$ Binary of $(36.75)_{10}$

$1\ 0\ 0\ 1.0\ 1\ 1\ .\ 0\ 1\ 0$

∴ There is no carry so it is answer is negative.

∴ 2's complement of (1001011.010) =

0 1101100.101
+ 1
0 1101100.110

∴ $(36.75)_{10} - (89.5)_{10} = -(0110100.110)$

* Convert following binary number into Gray code.

1) $(1011)_2$

Soln :- Binary no.

1 0 1 1

Gray code 1 1 1 0

∴ $(1011)_2 = (1110)_{Gray}$

2) $(11011001 0)_2$

Soln :- Binary no.

1 1 0 1 1 0 0 1 0

1 0 1 1 0 1 0 1 1

∴ $(110110010)_2 = (101101011)_{Gray}$

3) $(1010101101)_2$

Soln:- Binary no. 1 0 1 0 1 0 1 1 0 1

↓

Gray code 1 1 1 1 1 1 1 0 1 1

$\therefore (1010101101)_2 = (1111111011)_{Gray}$

4) $(100001)_2$

Soln:- Binary no. 1 0 0 0 0 1

↓

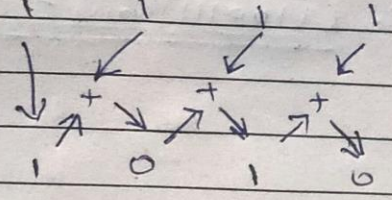
Gray code 1 1 0 0 0 1

$\therefore (100001)_2 = (110001)_{Gray}$

★ Convert following gray number into binary number.

1) $(1111)_{Gray}$

Soln:- Gray no. 1 1 1 1



Binary no. 1 0 1 0

$\therefore (1111)_{Gray} = (1010)_2$

2) $(101110)_{Gray}$

Soln :- Gray code 1 0 1 1 1 0

↓

1 1 0 1 0 0

$\therefore (101110)_{Gray} = (110100)_2$

3) $(100010110)_{Gray}$

Soln :- Gray no. 1 0 0 0 1 0 1 1 0

↓

Binary no. 1 1 1 1 0 0 1 0 0

$\therefore (100010110)_{Gray} = (111100100)_2$

4) $(11100111)_{Gray}$

Soln :- Gray no. 1 1 1 0 0 1 1 1

↓

Binary no. 1 0 1 1 1 0 1 0

$\therefore (11100111)_{Gray} = (10111010)_2$

* Convert following Decimal number in excess-3 code.

1) $(40)_{10}$

Soln :-

Decimal no.	4	0
4 bit binary	1000	0000
+	0011	0011
	1011	0011

$\therefore (40)_{10} = (10110011)_{Ex-3}$

2) $(88)_{10}$

Soln :-

Decimal no.	8	8
4 bit binary	1000	1000
+	0011	0011
	1011	1011

$\therefore (88)_{10} = (10111011)_{Ex.3}$

3) $(64)_{10}$

Soln :-

Decimal no.	6	4
4 bit binary	0110	0100
+	0011	0011
	1001	0111

$\therefore (64)_{10} = (10010111)_{Ex.3}$

4) $(23)_{10}$

Soln :-

Decimal no. 2 3

4 bit binary 0010 0011

+ 0011 0011

0101 0110

$\therefore (23)_{10} = (01010110)_{Ex\cdot 3}$

* Perform BCD addition :-

1) $(275)_{10} + (493)_{10}$

Soln :-

Decimal no. 275

+493

768

BCD 0010 0111 0101

+0100 1001 0011

0111 0000 1000

0000 0110 0000

0111 0110 1000

↓ ↓ ↓

7 6 8

$\therefore (275)_{10} + (493)_{10} = (768)_{10}$

2) $(109)_{10} + (778)_{10}$

Soln:-

Decimal no. 109
778
887

BCD 0001 0000 1001
+ 0111 0111 1000
1000 1000 0001
0000 0000 0110
1000 1000 0111

∴ ~~$(109)_{10} = (100001000111)_{10}$ or $(778$~~

∴ $(109)_{10} + (778)_{10} = (887)_{10}$

3) $(88.7)_{10} + (265.8)_{10}$

Soln:-

Decimal no. 88.7 or 0887
+ 265.8 2658
354.5

BCD 0000 1000 1000 . 0111
+ 0010 0110 0101 . 1000
0010 1110 1101 . 1111
+ 0000 0110 0110 . 0110
0011 0101 0100 . 0101
↓ ↓ ↓ ↓
3 5 4 5

∴ $(88.7)_{10} + (265.8)_{10} = (354.5)_{10}$

4) $(204.6)_{10} + (185.56)_{10}$

Soln:

Decimal 204.6
+ 185.56
390.16

BCD 0010 0000 0100 . 0110
+ 0001 1000 0101 . 0101 0110
0011 1000 1001 . 1011 0110
+ 0110 . 0110
0011 1001 0000 . 0001 0110
↓ ↓ ↓ ↓ ↓
3 9 0 1 6

$\therefore (204.6)_{10} + (185.56)_{10} = (390.16)_{10}$