Problems

Q $(43)_x = (y3)_8$

How many possible combinations for x & y (solutions)

$(43)_x \rightarrow$ Here $x > 4$ (minimum requirement)

$(y3)_8 \rightarrow (0, 1, 2, 3, 4, 5, 6, 7)$

$y < 8$

Step 1:- Convert into decimal

$(43)_x = (y3)_8$

$4 \times x^1 + 3 \times x^0 = y \times 8^1 + 3 \times 8^0$

$4x + 3 = 8y + 3$

$\boxed{x = 2y}$

x	y
14	7
12	6
10	5
8	4
6	3
4	2

$x > 4$

not possible

$y < 8$

Q $(123)_5 = (x8)_y$

$x < y$ $\quad (0, \ldots \ldots \underline{x-1})_{(x)}$

$y > 8$

Step 1:- Decimal used for Comparision

$(123)_5 = (x8)_y$

$1 \times 5^2 + 2 \times 5^1 + 3 \times 5^0 = x \times y^1 + 8 \times y^0$

$25 + 10 + 3 = xy + 8$

$38 = xy + 8$.

$xy = 30$

$x < y$

x	y	$y > 8$
1	30	
2	15	3 possible combⁿ.
3	10	
5	6	$y < 8$

$x < y$

9 $\frac{312}{20} = 13.1$

Find the base.

$$\frac{(312)_x}{(20)_x} = (13.1)_x$$

$$\frac{3x^2 + 1x^1 + 2x^0}{2x^1 + 0x^0} = 1x^1 + 3x^0 + 1x^{-1}$$

$$\frac{3x^2 + x + 2}{2x} = x + 3 + \frac{1}{x}$$

$$\frac{3x^2 + x + 2}{2x} = \frac{x^2 + 3x + 1}{x}$$

$$3x^2 + x + x = 2x^2 + 6x + 2$$

$$x^2 - 5x = 0$$

$$x(x-5) = 0$$

$x \neq 0$ $\boxed{x = 5}$

Addition and Subtraction of any base

i) Addition

Decimal

$$\begin{array}{r} {\scriptstyle 1\ 1\ \ \ } \\ (786)_{10} \\ +(687)_{10} \\ \hline 1473 \end{array}$$

13 → decimal (0, ... 9)

$$\begin{array}{r} 13 \\ -10 \leftarrow \text{Subtract from base} \\ \hline (3) \leftarrow \text{How many times subtracted} \end{array}$$

Ans

(1) ← Carry

$$\begin{array}{r} {\scriptstyle 1\ \ \ } \\ +\ 8 \\ +\ 8 \\ \hline 17 \end{array} \qquad \begin{array}{r} 17 \\ -10 \\ \hline (7) \end{array}$$

→ Ans 1 ← Carry

2) Binary

i) Convert to decimal & then binary

2) Direct

$$\begin{array}{r} {\scriptstyle 1\ 1\ 1\ 1\ \ } \\ 1\ 1\ 0\ 0\ 1_2 \\ +\ 1\ 0\ 1\ 1\ 1_2 \\ \hline 1\ 1\ 0\ 0\ 0\ 0 \end{array}$$

$$\begin{array}{r} 2 \\ -2 \\ \hline 0 \end{array}$$ (How many times)

$$\begin{array}{r} 3 \\ -2 \\ \hline 1 \end{array}$$

3) Base 6

$$(524)_6 + (321)_6 = (1245)_6$$

8 − 6 = 2

(1) once subtracted

12 − 8 = 4

4)

$$(741)_8 + (456)_8 = (1417)_8$$

9 − 8 = 1

5)

$$(5A7D)_{16} + (F43B)_{10} = (14EB8)_{16}$$

D → 13

13 + B = 11 + 24

24 − 16 = (1)8

15 + 5 = 20

20 − 16 = 4

Q i) $(566)_7 + (345)_7 =$ _____

2) $(312)_4 + (123)_4 =$ _____

Subtraction

i) Decimal

$$(786)_{10} - (687)_{10}$$

$$099$$

10 + 6 − 7 = 9

10 + 7 − 8 = 1

2)

$$(1000\,0\,(0))_2 - (01011\,(1))_2$$

$$001011$$

Borrow

2 + 0 − 1 = 1

3)

$$(524)_6 - (355)_6$$

$$125$$

6 + 1 − 5 = 2

6 + 4 − 5 = 5

$$(560)_8 - (245)_8$$

$$346$$

8 − 4 = 4

4 + 3 − 5 = 6

$$(FA3B)_{16} - (5A7D)_{16}$$

$$99BE$$

16 + 3 − 10 = 9

16 + 2 − 7 = 11 → B

16 + 11 − 13 = 14 → E