HOMWORK 0
HISTORY OF MATH
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① (a) Base 2:

$2^0 = 1$
$2^1 = 2$
$2^2 = 4$
$2^3 = 8$
$2^4 = 16$
$2^5 = 32$
$2^6 = 64$

$100 = 2^6 + 2^5 + 2^2 \Rightarrow \boxed{1100100}$

$100 - 64 = 36$ $\quad 36 - 32 = 4$ $\quad 4 - 4 = 0$

(b) Base 3:

$3^0 = 1$
$3^1 = 3$
$3^2 = 9$
$3^3 = 27$
$3^4 = 81$

$100 = 3^4 + 3^2 + 3^2 + 3^0 \Rightarrow \boxed{10201}$

$100 - 81 = 19$ $\quad 19 - 9 = 10$ $\quad 10 - 9 = 1$ $\quad 1 - 1 = 0$

(c) Base 4:

$4^0 = 1$
$4^1 = 4$
$4^2 = 16$
$4^3 = 64$
$4^4 = 256$

$100 = 4^3 + 4^2 + 4^2 + 4^1 \Rightarrow \boxed{1210}$

$100 - 64 = 36$ $\quad 36 - 16 = 20$ $\quad 20 - 16 = 4$ $\quad 4 - 4 = 0$

(d) Base 5:

$5^0 = 1$
$5^1 = 5$
$5^2 = 25$
$5^3 = 125$

$100 = 5^2 + 5^2 + 5^2 + 5^2 \Rightarrow \boxed{400}$

$100 - 25 = 75$ $\quad 75 - 25 = 50$ $\quad 50 - 25 = 25$ $\quad 25 - 25 = 0$

(e) Base 6:

$6^0 = 1$
$6^1 = 6$
$6^2 = 36$

$100 = 6^2 + 6^2 + 6^1 + 6^1 + 6^1 + 6^1 + 6^0 + 6^0 + 6^0 + 6^0 = \boxed{244}$

$100 - 36 = 64$ $\quad 64 - 36 = 28$ $\quad 28 - 6 = 22$ $\quad 22 - 6 = 16$ $\quad 16 - 6 = 10$ $\quad 10 - 6 = 4$ $\quad 4 - 1 = 3$ $\quad 3 - 1 = 2$ $\quad 2 - 1 = 1$ $\quad 1 - 1 = 0$

(f) Base 7: $100 = 7^2 + 7^2 + 7^0 + 7^0 \Rightarrow \boxed{202}$

$7^0 = 1$, $7^1 = 7$, $7^2 = 49$

100	51	2	1
-49	-49	-1	-1
51	2	1	0

(g) Base 8: $100 = 8^2 + 8^1 + 8^1 + 8^1 + 8^0 + 8^0 + 8^0 + 8^0 \Rightarrow \boxed{144}$

$8^0 = 1$, $8^1 = 8$, $8^2 = 64$

100	36	28	20	12	4	3	2	1
-64	-8	-8	-8	-8	-1	-1	-1	-1
36	28	20	12	4	3	2	1	0

(h) Base 9: $100 = 9^2 + 9^1 + 9^1 + 9^0 \Rightarrow \boxed{121}$

$9^0 = 1$, $9^1 = 9$, $9^2 = 81$

100	19	10	1
-81	-9	-9	-1
19	10	1	0

(i) Base 10: $\boxed{100}$

(j) Base 11:

" 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A

" 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 1A

" 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 2A

" 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 3A

⋮ ⋮ ⋮ ⋮ ⋮ ⋮

" 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 9A

$100 - 9 \Rightarrow \boxed{91}$

(k) Base 12: $100 - 16 \Rightarrow \boxed{84}$

(#2) 101×97

$101 = 100 + 1 = 1 \cdot 10^2 + 0 \cdot 10^1 + 1 \cdot 10^0 = (1, 0, 1)$

$97 = 100 - 3 = 1 \cdot 10^2 + 0 \cdot 10^1 - 3 \cdot 10^0 = (1, 0, -3)$

$$\begin{array}{r} 1\ 0\ 1 \\ 1\ 0\ -3 \\ \hline 3\ 0\ 3 \\ +\ 0\ 0\ 0 \\ 1\ 0\ 1 \\ \hline 1\ 0\ 4\ 0\ -3 \end{array}$$

$(1, 0, 4, 0, -3) \Rightarrow \boxed{9,797}$

#3 $26_{10} \times 80_{10}$

$26 = 3^2 + 3^2 + 3^1 + 3^1 + 3^0 + 3^0 = \boxed{222}$

26	17	8	5	2	1
-9	-9	-3	-3	-1	-1
17	8	6	2	1	0

$80 = 3^3 + 3^3 + 3^2 + 3^2 + 3^1 + 3^1 + 3^0 + 3^0 = \boxed{2222}$

80	53	26	17	8	5	2	1
-27	-27	-9	-9	-3	-3	-1	-1
53	26	17	8	5	2	1	0

$$
\begin{array}{r}
2\,2\,2\,2 \\
\times\quad 2\,2\,2 \\
\hline
4\,4\,4\,4 \\
4\,4\,4\,4\, \\
+\quad 4\,4\,4\,4\, \\
\hline
4\,9\,3\,2\,8\,4
\end{array}
$$

$(4, 9, 3, 2, 8, 4) \Rightarrow \boxed{2,080}$

#4

$1_{10} = 1$
$2_{10} = 2$
$3_{10} = 10$
$4_{10} = 11$
$5_{10} = 12$
$6_{10} = 20$
$7_{10} = 21$
$8_{10} = 22$
$9_{10} = 100$
$10_{10} = 101$
$11_{10} = 102$
$12_{10} = 110$
$13_{10} = 111$
$14_{10} = 112$
$15_{10} = 120$
$16_{10} = 121$
$17_{10} = 122$
$18_{10} = 200$
$19_{10} = 201$
$20_{10} = 202$
$21_{10} = 210$
$22_{10} = 211$
$23_{10} = 212$
$24_{10} = 220$
$25_{10} = 221$
$26_{10} = 222$

BOX 1:
(1 in unit)

1, 4, 7, 10, 13, 16, 19, 22, 25

BOX 2:
(2 in unit)

2, 5, 8, 11, 14, 17, 20, 23, 26

BOX 3:
(1 in 10)

3, 4, 5, 12, 13, 14, 21, 22, 23

BOX 4:
(2 in 10)

6, 7, 8, 15, 16, 17, 24, 25, 26

BOX 5:
(1 in 100)

9, 10, 11, 12, 13, 14, 15, 16, 17

BOX 6:
(2 in 100)

18, 19, 20, 21, 22, 23, 24, 25, 26

1	4	7
10	13	16
19	22	25

2	5	8
11	14	17
22	23	26

3	4	5
12	13	14
21	22	23

6	7	8
15	16	17
24	25	26

9	10	11
12	13	14
15	16	17

18	19	20
21	22	23
24	25	26