

Form 4 Chapter 2
Number Bases
Fully-Worked Solutions

UPSKILL 2.1a

1 $13_{10} = 23_5$

2 (a)

<i>Place value</i>	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	0	1	1	0	0	1

The value of the underlined digit = $1 \times 2^3 = 8$

(b)

<i>Place value</i>	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	1	1	0	1	0	1

The value of the underlined digit = $1 \times 2^4 = 16$

(c)

<i>Place value</i>	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	0	0	1	0	0	1

The value of the underlined digit = $0 \times 2^5 = 0$

(d)

<i>Place value</i>	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	1	0	1	0	1	0	1

The value of the underlined digit = $1 \times 2^7 = 128$

3 (a)

<i>Place value</i>	8^2	8^1	8^0
<i>Digit</i>	5	6	3

The value of the underlined digit = $5 \times 8^2 = 320$

(b)

<i>Place value</i>	8^3	8^2	8^1	8^0
<i>Digit</i>	3	2	4	1

The value of the underlined digit = $3 \times 8^3 = 1\ 536$

(c)

<i>Place value</i>	8^3	8^2	8^1	8^0
<i>Digit</i>	6	3	4	1

The value of the underlined digit = $6 \times 8^3 = 3\ 072$

(d)

<i>Place value</i>	8^5	8^4	8^3	8^2	8^1	8^0
<i>Digit</i>	7	3	5	2	6	4

The value of the underlined digit = $7 \times 8^5 = 229\ 376$

4 (a)

<i>Place value</i>	<u>5^2</u>	5^1	5^0
<i>Digit</i>	4	3	2

The value of the underlined digit = $4 \times 5^2 = 100$

(b)

<i>Place value</i>	<u>5^3</u>	5^2	5^1	5^0
<i>Digit</i>	4	1	2	3

The value of the underlined digit = $4 \times 5^3 = 500$

(c)

<i>Place value</i>	<u>5^4</u>	5^3	5^2	5^1	5^0
<i>Digit</i>	3	2	1	0	4

The value of the underlined digit = $3 \times 5^4 = 1\ 875$

(d)

<i>Place value</i>	<u>5^4</u>	5^3	5^2	5^1	5^0
<i>Digit</i>	2	4	0	1	3

The value of the underlined digit = $2 \times 5^4 = 1\ 250$

5 (a)

<i>Place value</i>	<u>3^2</u>	3^1	2^0
<i>Digit</i>	2	0	1

The value of the underlined digit = $2 \times 3^2 = 18$

(b)

<i>Place value</i>	<u>4^3</u>	4^2	4^1	4^0
<i>Digit</i>	3	2	1	0

The value of the underlined digit = $3 \times 4^3 = 192$

(c)

<i>Place value</i>	<u>6^3</u>	6^2	6^1	6^0
<i>Digit</i>	2	3	5	4

The value of the underlined digit = $2 \times 6^3 = 432$

(d)

<i>Place value</i>	<u>7^4</u>	7^3	7^2	7^1	7^0
<i>Digit</i>	6	2	3	5	0

The value of the underlined digit = $6 \times 7^4 = 14\ 406$

(e)

<i>Place value</i>	<u>9^4</u>	9^3	9^2	9^1	9^0
<i>Digit</i>	2	4	1	3	5

The value of the underlined digit = $2 \times 9^4 = 13\ 122$

6 (a)

<i>Place value</i>	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	0	1	1	0

$$10110_2 = (1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (0 \times 2^0)$$

(b)

<i>Place value</i>	8^3	8^2	8^1	8^0
<i>Digit</i>	2	7	4	3

$$2743_8 = (2 \times 8^3) + (7 \times 8^2) + (4 \times 8^1) + (3 \times 8^0)$$

(c)

<i>Place value</i>	5^3	5^2	5^1	5^0
<i>Digit</i>	4	2	3	1

$$4231_5 = (4 \times 5^3) + (2 \times 5^2) + (3 \times 5^1) + (1 \times 5^0)$$

(d)

<i>Place value</i>	3^2	3^1	3^0
<i>Digit</i>	1	2	0

$$120_3 = (1 \times 3^2) + (2 \times 3^1) + (0 \times 3^0)$$

(e)

<i>Place value</i>	2^3	2^2	2^1	2^0
<i>Digit</i>	5	4	3	2

$$5432_6 = (5 \times 2^3) + (4 \times 2^2) + (3 \times 2^1) + (2 \times 2^0)$$

(f)

<i>Place value</i>	9^3	9^2	9^1	9^0
<i>Digit</i>	8	7	6	4

$$8764_9 = (8 \times 9^3) + (7 \times 9^2) + (6 \times 9^1) + (4 \times 9^0)$$

UPSKILL 2.1b

1 (a)

<i>Place value</i>	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	1	0	0	1	1

$$110011_2 = (1 \times 2^5) + (1 \times 2^4) + (1 \times 2^1) + (1 \times 2^0) = 51_{10}$$

(b)

<i>Place value</i>	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	0	1	1	1	1	0

$$1011110_2 = (1 \times 2^6) + (1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) = 94_{10}$$

(c)

<i>Place value</i>	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	1	0	1	1	0	1	1

$$11011011_2 = (1 \times 2^7) + (1 \times 2^6) + (0 \times 2^5) + (1 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = 219_{10}$$

2 (a)

Place value	8^3	8^2	8^1	8^0
Digit	2	1	3	7

$$2137_8 = (2 \times 8^3) + (1 \times 8^2) + (3 \times 8^1) + (7 \times 8^0) = 1\,119_{10}$$

(b)

Place value	8^4	8^3	8^2	8^1	8^0
Digit	1	1	1	1	0

$$11110_8 = (1 \times 8^4) + (1 \times 8^3) + (1 \times 8^2) + (1 \times 8^1) + (0 \times 8^0) = 4\,680_{10}$$

(c)

Place value	8^4	8^3	8^2	8^1	8^0
Digit	7	6	5	3	4

$$76534_8 = (7 \times 8^4) + (6 \times 8^3) + (5 \times 8^2) + (3 \times 8^1) + (4 \times 8^0) = 32\,092_{10}$$

3 (a)

Place value	5^2	5^1	5^0
Digit	3	0	4

$$304_8 = (3 \times 5^2) + (0 \times 5^1) + (4 \times 5^0) = 79_{10}$$

(b)

Place value	5^3	5^2	5^1	5^0
Digit	1	0	2	4

$$1024_8 = (1 \times 5^3) + (0 \times 5^2) + (2 \times 5^1) + (4 \times 5^0) = 139_{10}$$

(c)

Place value	5^4	5^3	5^2	5^1	5^0
Digit	1	2	3	0	4

$$12304_8 = (1 \times 5^4) + (2 \times 5^3) + (3 \times 5^2) + (0 \times 5^1) + (4 \times 5^0) = 954_{10}$$

4 (a)

Place value	3^2	3^1	3^0
Digit	2	1	2

$$212_3 = (2 \times 3^2) + (1 \times 3^1) + (2 \times 3^0) = 23_{10}$$

(b)

Place value	4^3	4^2	4^1	4^0
Digit	1	2	3	0

$$1230_4 = (1 \times 4^3) + (2 \times 4^2) + (3 \times 4^1) + (0 \times 4^0) = 108_{10}$$

(c)

Place value	6^3	6^2	6^1	6^0
Digit	5	3	2	0

$$5320_6 = (5 \times 6^3) + (3 \times 6^2) + (2 \times 6^1) + (0 \times 6^0) = 1\,200_{10}$$

(d)

Place value	7^3	7^2	7^1	7^0
Digit	2	6	1	4

$$2614_6 = (2 \times 7^3) + (6 \times 7^2) + (1 \times 7^1) + (4 \times 7^0) = 991_{10}$$

(c)

Place value	9^3	9^2	9^1	9^0
Digit	2	4	6	8

$$2468_9 = (2 \times 9^3) + (4 \times 9^2) + (6 \times 9^1) + (8 \times 9^0) = 1\,844_{10}$$

5 (a) $47_{10} = 101111_2$

2	47	Remainder	
2	23	-1	↑
2	11	-1	
2	5	-1	
2	2	-1	
2	1	-1	
	0	-1	

(b) $98_{10} = 1100010_2$

2	98	Remainder	
2	49	-1	↑
2	24	-1	
2	12	-1	
2	6	-1	
2	3	-1	
2	1	-1	
2	0	-1	

(c) $156_{10} = 10011100_2$

2	156	Remainder	
2	78	-0	↑
2	39	-0	
2	19	-1	
2	9	-1	
2	4	-1	
2	2	-0	
2	1	-0	
	0	-1	

6 (a) $128_{10} = 200_8$

8	128	Remainder	
8	16	-0	↑
8	2	-0	
	0	-2	

(b) $2051_{10} = 4003_8$

8	2051	Remainder	
8	256	-3	↑
8	32	-0	
8	4	-0	
	0	-4	

(c) $10101_{10} = 23565_8$

8	10101	Remainder	
8	1262	-5	↑
8	157	-6	
8	19	-5	
8	2	-3	
	0	-2	

7 (a) $43_{10} = 133_5$

5	43	Remainder	
5	8	-3	↑
5	1	-3	
	0	-1	

(b) $410_{10} = 3120_5$

5	410	Remainder	
5	82	-0	↑
5	16	-2	
5	3	-1	
	0	-3	

(c) $733_{10} = 10413_5$

5	733	Remainder	
5	146	-3	↑
5	29	-1	
5	5	-4	
5	1	-0	
	0	-1	

8 (a) $26_{10} = 222_3$

$h = 222$

3	26	Remainder	
3	8	-2	↑
3	2	-2	
	0	-2	

(b) $56_{10} = 320_4$

$f = 320$

4	56	Remainder	
4	14	-0	↑
4	3	-2	
	0	-3	

(c) $420_{10} = 1540_6$

$g = 1540$

6	420	Remainder	
6	70	-0	↑
6	11	-4	
6	1	-5	
	0	-1	

(d) $2095_{10} = 6052_7$

$m = 6052$

7	2095	Remainder	
7	299	-2	↑
5	42	-5	
5	6	-0	
	0	-6	

(c) $6322_{10} = 8604_9$

$k = 8604$

9	6322	Remainder
9	102	- 4
9	78	- 0
9	8	- 6
9	0	- 8

9 $8[7(8^4) + 6(8^2) + 5]$
 $= 7(8^5) + 6(8^3) + 8(5)$
 $= 706050_8$

<i>Place value</i>	8^5	8^4	8^3	8^2	8^1	8^0
<i>Digit</i>	7	0	6	0	5	0

10 (a)

3	213	Remainder
3	71	- 0
3	23	- 2
3	7	- 2
3	2	- 1
3	0	- 2

$213_{10} = 21220_3$

(b)

<i>Place value</i>	9^4	9^3	9^2	9^1	9^0
<i>Digit</i>	3	5	0	0	7

35007_9

11

<i>Place value</i>	7^4	7^3	7^2	7^1	7^0
<i>Digit</i>	5	3	0	6	0

53060_7

12 (a) $199_{10} = 3013_4$

$\therefore h = 3013$

4	199	Remainder
4	49	- 3
4	12	- 1
4	3	- 0
4	0	- 3

(b) $6[3(6^4) + 2(6^3) + 5]$
 $= 3(6^5) + 2(6^4) + 5(6)$

<i>Place value</i>	6^5	6^4	6^3	6^2	6^1	6^0
<i>Digit</i>	3	2	0	0	5	0

$= 320050_6$

13 (a)

10	100	110
2	4	6

Hence, $10100110_2 = 246_8$

(b)

100	001	000
4	1	0

Hence, $100001000_2 = 410_8$

(c)

11	101	111
3	5	7

Hence, $11101111_2 = 357_8$

14 (a)

1	3	0
1	011	000

Hence, $130_8 = 1011000_2$

(b)

4	0	7
100	000	111

Hence, $407_8 = 100000111_2$

(c)

2	5	6
10	101	110

Hence, $256_8 = 10101110_2$

15 (a)

Place value	2^3	2^2	2^1	2^0
Digit	1	1	1	1

$$1111_2 = (1 \times 2^3) + (1 \times 2^2) + (1 \times 2^1) + (1 \times 2^0) = 15_{10}$$

$$\begin{array}{r} 5 \overline{) 15} \text{ Remainder} \\ 5 \overline{) 3} - 0 \quad \uparrow \\ \quad 0 - 3 \end{array}$$

$15_{10} = 30_5$

(b)

Place value	5^1	5^0
Digit	4	2

$$42_5 = (4 \times 5^1) + (2 \times 5^0) = 22_{10}$$

$$\begin{array}{r} 2 \overline{) 22} \text{ Remainder} \\ 2 \overline{) 11} - 0 \quad \uparrow \\ 2 \overline{) 5} - 1 \\ 2 \overline{) 2} - 1 \\ 2 \overline{) 1} - 0 \\ \quad 0 - 1 \end{array}$$

$22_{10} = 10110_2$

(c)

<i>Place value</i>	8^1	8^0
<i>Digit</i>	7	4

$$74_8 = (7 \times 8^1) + (4 \times 8^0) = 60_{10}$$

$$\begin{array}{r|l} 5 & 60 \text{ Remainder} \\ 5 & \underline{12} \quad -0 \quad \uparrow \\ 5 & \underline{2} \quad -2 \\ & 0 \quad -2 \end{array}$$

$$60_{10} = 220_5$$

(d)

<i>Place value</i>	5^1	5^0
<i>Digit</i>	4	3

$$43_8 = (4 \times 5^1) + (3 \times 5^0) = 23_{10}$$

$$\begin{array}{r|l} 8 & 23 \text{ Remainder} \\ 8 & \underline{2} \quad -7 \quad \uparrow \\ & 0 \quad -2 \end{array}$$

$$23_{10} = 27_8$$

16 (a)

<i>Place value</i>	4^2	4^1	4^0
<i>Digit</i>	2	3	1

$$231_4 = (2 \times 4^2) + (3 \times 4^1) + (1 \times 4^0) = 45_{10}$$

$$\begin{array}{r|l} 6 & 45 \text{ Remainder} \\ 6 & \underline{7} \quad -3 \quad \uparrow \\ 6 & \underline{1} \quad -1 \\ & 0 \quad -1 \end{array}$$

$$45_{10} = 113_6$$

(b)

<i>Place value</i>	5^3	5^2	5^1	5^0
<i>Digit</i>	3	2	1	3

$$3213_5 = (3 \times 5^3) + (2 \times 5^2) + (1 \times 5^1) + (3 \times 5^0) = 433_{10}$$

$$433_{10} = 121001_3$$

$$\begin{array}{r|l} 3 & 433 \text{ Remainder} \\ 3 & \underline{144} \quad -1 \quad \uparrow \\ 3 & \underline{48} \quad -0 \\ 3 & \underline{16} \quad -0 \\ 3 & \underline{5} \quad -1 \\ 3 & \underline{1} \quad -2 \\ & 0 \quad -1 \end{array}$$

(c)

Place value	9^3	9^2	9^1	9^0
Digit	3	4	5	7

$$3457_9 = (3 \times 9^3) + (4 \times 9^2) + (5 \times 9^1) + (7 \times 9^0) = 2\,563_{10}$$

$$2\,563_{10} = 10321_7$$

7	2563	Remainder	
7	366	-1	↑
7	52	-2	
7	7	-3	
7	1	-0	
	0	-1	

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1 (a)

$$\begin{array}{r} 111 \\ 1101_2 \\ (+) 1011_2 \\ \hline 11000_2 \end{array}$$

← $\begin{array}{l} 2_{10} = 10_2 \\ 3_{10} = 11_2 \end{array}$

(b)

$$\begin{array}{r} 11 \\ 102_3 \\ (+) 221_3 \\ \hline 1100_3 \end{array}$$

← $\begin{array}{r} 3 \overline{) 4} \text{ Remainder} \\ 3 \overline{) 1} - 1 \uparrow \\ 0 - 1 \end{array}$

(c)

$$\begin{array}{r} 523_6 \\ (+) 402_6 \\ \hline 1325_6 \end{array}$$

← $\begin{array}{r} 6 \overline{) 9} \text{ Remainder} \\ 6 \overline{) 1} - 3 \uparrow \\ 0 - 1 \end{array}$

(d)

Place value	8^2	8^1	8^0
Digit	3	5	1

$$351_8 = (3 \times 8^2) + (5 \times 8^1) + (1 \times 8^0) = 233_{10}$$

Place value	8^2	8^1	8^0
Digit	4	6	7

$$467_8 = (4 \times 8^2) + (6 \times 8^1) + (7 \times 8^0) = 311_{10}$$

$$233_{10} + 311_{10} = 544_{10} = 1040_8$$

8	544	Remainder	
8	68	- 0	↑
8	8	- 4	
8	1	- 0	
0		- 1	

2 (a)

$$\begin{array}{r} 333_4 \\ (-) 202_4 \\ \hline 131_4 \end{array}$$

(b)

<i>Place value</i>	7^2	7^1	7^0
<i>Digit</i>	6	3	2

$$632_7 = (6 \times 7^2) + (3 \times 7^1) + (2 \times 7^0) = 317_{10}$$

<i>Place value</i>	7^2	7^1	7^0
<i>Digit</i>	1	4	6

$$146_7 = (1 \times 7^2) + (4 \times 7^1) + (6 \times 7^0) = 83_{10}$$

$$317_{10} - 83_{10} = 234_{10} = 453_7$$

7	234	Remainder	
7	33	- 3	↑
7	4	- 5	
0		- 4	

(c)

<i>Place value</i>	9^2	9^1	9^0
<i>Digit</i>	8	5	3

$$853_9 = (8 \times 9^2) + (5 \times 9^1) + (3 \times 9^0) = 696_{10}$$

<i>Place value</i>	9^2	9^1	9^0
<i>Digit</i>	4	1	7

$$417_9 = (4 \times 9^2) + (1 \times 9^1) + (7 \times 9^0) = 340_{10}$$

$$696_{10} - 340_{10} = 356_{10} = 435_9$$

9	356	Remainder	
9	39	- 5	↑
9	4	- 3	
0		- 4	

3

<i>Place value</i>	6^2	6^1	6^0
<i>Digit</i>	4	2	1

$$421_6 = (4 \times 6^2) + (2 \times 6^1) + (1 \times 6^0) = 157_{10}$$

<i>Place value</i>	8^2	8^1	8^0
<i>Digit</i>	7	6	4

$$764_8 = (7 \times 8^2) + (6 \times 8^1) + (4 \times 8^0) = 500_{10}$$

$$157_{10} + 500_{10} = 657_{10} = 10112_5$$

5	657	Remainder	
5	131	- 2	↑
5	26	- 1	
5	5	- 1	
5	1	- 0	
	0	- 1	

4

<i>Place value</i>	6^2	6^1	6^0
<i>Digit</i>	5	1	2

$$512_6 = (5 \times 6^2) + (1 \times 6^1) + (2 \times 6^0) = 188_{10}$$

<i>Place value</i>	4^2	4^1	4^0
<i>Digit</i>	3	3	2

$$332_8 = (3 \times 4^2) + (3 \times 4^1) + (2 \times 4^0) = 62_{10}$$

$$188_{10} - 62_{10} = 126_{10} = 11200_5$$

3	126	Remainder	
3	42	- 0	↑
3	14	- 0	
3	4	- 2	
3	1	- 1	
	0	- 1	

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$$1 \ 10_2 = 2_{10}$$

<i>Place value</i>	3^2	3^1	3^0
<i>Digit</i>	2	2	2

$$222_3 = (2 \times 3^2) + (2 \times 3^1) + (2 \times 3^0) = 26_{10}$$

$$101_2 = 5_{10}$$

<i>Place value</i>	4^2	4^1	4^0
<i>Digit</i>	1	2	1

$$121_4 = (1 \times 4^2) + (2 \times 4^1) + (1 \times 4^0) = 25_{10}$$

$$2x + 2y = 26$$

$$x + y = 13 \quad \dots (1)$$

$$5x + y = 25 \quad \dots (2)$$

$$(2) - (1) : 4x = 12$$

$$x = 3$$

$$\text{From (1) : } 3 + y = 13$$

$$y = 10$$

Hence, the prices of a greeting card and 1 rim of A4 papers are RM3 and RM10 respectively.

2 $110_2 = 6_{10}$
 $11_2 = 3$

<i>Place value</i>	6^3	6^2	6^1	6^0
<i>Digit</i>	2	1	2	0

$$2120_6 = (2 \times 6^3) + (1 \times 6^2) + (2 \times 6^1) + (0 \times 6^0) = 480_{10}$$

$1000_2 = 8_{10}$

<i>Place value</i>	7^3	7^2	7^1	7^0
<i>Digit</i>	1	1	1	1

$$1111_7 = (1 \times 7^3) + (1 \times 7^2) + (1 \times 7^1) + (1 \times 7^0) = 400_{10}$$

$$6x + 3y = 480$$

$$2x + y = 160 \dots (1)$$

$$8x + y = 400 \dots (2)$$

$$(2) - (1) : 6x = 240$$

$$x = 40$$

From (1) : $2(40) + y = 160$
 $y = 80$

Hence, the prices of a local reference book and an imported reference book are RM40 and RM80 respectively.

3

<i>Place value</i>	3^2	3^1	3^0
<i>Digit</i>	2	0	2

$$202_3 = (2 \times 3^2) + (0 \times 3^1) + (2 \times 3^0) = 20_{10}$$

<i>Place value</i>	9^1	9^0
<i>Digit</i>	5	1

$$51_9 = (5 \times 9^1) + (1 \times 9^0) = 46_{10}$$

$$x + y = 20 \dots (1)$$

$$2x + 2y = 40 \dots (1) \times 2$$

$$2x + 3y = 46 \dots (2)$$

$$(2) - (1) \times 2 : -y = -6$$

$$y = 6$$

From (1) : $x + 6 = 20$
 $x = 14$

Hence, the numbers of kg of a local watermelon and an imported watermelon bought are 14 and 6

Summative Practice 2

Multiple-Choice Questions

1

Place value	8^2	8^1	8^0
Digit	7	5	2

$$7 \times 8^2 = 448$$

Answer: C

2

Place value	5^4	5^3	5^2	5^1	5^0
Digit	1	0	3	0	4

$$10304_5$$

Answer: B

3

2	7	3
10	111	011

$$273_8 = 10111011_2$$

Answer: A

4

$$\begin{array}{r} 567_8 \\ (-) 432_8 \\ \hline \end{array}$$

$$135_8$$

Answer: A

5

Place value	8^2	8^1	8^0
Digit	5	6	7

$$567_8 = (5 \times 8^2) + (6 \times 8^1) + (7 \times 8^0) = 375_{10}$$

Place value	6^2	6^1	6^0
Digit	5	4	3

$$543_8 = (5 \times 6^2) + (4 \times 6^1) + (3 \times 6^0) = 207_{10}$$

$$375_{10} - 207_{10} = 168_{10} = 20020_3$$

3	168	Remainder
3	56	- 0
3	18	- 2
3	6	- 0
3	2	- 0
	0	- 2

\uparrow

Answer: A

Structured Questions

1

<i>Place value</i>	6^4	6^3	6^2	6^1	6^0
<i>Digit</i>	2	0	3	0	1

$$2 \times 6^4 = 2\ 592$$

2

<i>Place value</i>	9^4	9^3	9^2	9^1	9^0
<i>Digit</i>	8	1	6	3	5

$$6 \times 9^2 = 486$$

3

<i>Place value</i>	5^3	5^2	5^1	5^0
<i>Digit</i>	1	2	0	4

$$1204_5$$

4

<i>Place value</i>	7^3	7^2	7^1	7^0
<i>Digit</i>	2	4	3	0

$$7d = 21$$

$$d = 3$$

5

<i>Place value</i>	2^6	2^5	2^4	2^3	2^2	2^1	2^0
<i>Digit</i>	1	1	0	0	1	0	1

$$1100101_2$$

6 $194_{10} = 1234_5$

$$q = 2$$

7

111	101	010
7	5	2

$$111101010_2 = 752_8$$

8

5	0	3
101	000	011

$$503_8 = 101000011_2$$

9

<i>Place value</i>	8^2	8^1	8^0
<i>Digit</i>	2	1	4

$$214_8 = (2 \times 8^2) + (1 \times 8^1) + (4 \times 8^0) = 140_{10} = 1030_5$$

5	140	Remainder
5	28	- 0
5	5	- 3
5	1	- 0
5	0	- 1

↑

10

Place value	2^5	2^4	2^3	2^2	2^1	2^0
Digit	1	0	0	1	1	1

$$\begin{aligned}
 100111_2 &= (1 \times 2^5) + (1 \times 2^2) + (1 \times 2^1) + 1 \\
 &= 39_{10} \\
 &= 103_6 \\
 \therefore g &= 103
 \end{aligned}$$

$$\begin{array}{r|l}
 6 & 39 \text{ Remainder} \\
 6 & \underline{6} \quad -3 \quad \uparrow \\
 6 & \underline{1} \quad -0 \\
 & 0 \quad -1
 \end{array}$$

11

Place value	8^3	8^2	8^1	8^0
Digit	1	0	4	6

$$\begin{aligned}
 1046_8 &= (1 \times 8^3) + (4 \times 8^1) + 6 \\
 &= 550_{10} \\
 &= 1\ 414_7 \\
 &= 103_6
 \end{aligned}$$

$$t = 1414$$

$$\begin{array}{r|l}
 7 & 550 \text{ Remainder} \\
 7 & \underline{78} \quad -4 \quad \uparrow \\
 7 & \underline{11} \quad -1 \\
 7 & \underline{1} \quad -4 \\
 & 0 \quad -1
 \end{array}$$

12 (a)

Place value	5^3	5^2	5^1	5^0
Digit	1	2	3	4

$$\begin{aligned}
 1234_5 &= (1 \times 5^3) + (2 \times 5^2) + (3 \times 5^1) + (4 \times 5^0) = 194_{10} \\
 \therefore p &= 194
 \end{aligned}$$

(b) $194_{10} = 21012_3$

$$\therefore q = 21012$$

$$\begin{array}{r|l}
 3 & 194 \text{ Remainder} \\
 3 & \underline{64} \quad -2 \quad \uparrow \\
 3 & \underline{21} \quad -1 \\
 3 & \underline{7} \quad -0 \\
 3 & \underline{2} \quad -1 \\
 & 0 \quad -2
 \end{array}$$

(c) $194_{10} = 235_9$

$$\therefore r = 235$$

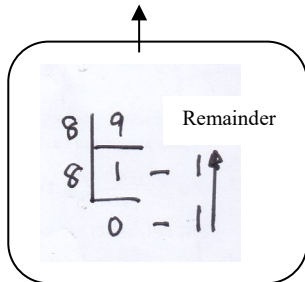
$$\begin{array}{r|l}
 9 & 194 \text{ Remainder} \\
 9 & \underline{21} \quad -5 \quad \uparrow \\
 9 & \underline{2} \quad -3 \\
 & 0 \quad -2
 \end{array}$$

13

$$\begin{array}{r} 1110_2 \\ (+) 11011_2 \\ \hline 111001_2 \end{array}$$

14

$$\begin{array}{r} 7650_8 \\ (+) 1234_8 \\ \hline 11104_8 \end{array}$$



15

<i>Place value</i>	5^3	5^2	5^1	5^0
<i>Digit</i>	4	4	1	0

$$4410_5 = (4 \times 5^3) + (4 \times 5^2) + (1 \times 5^1) = 605_{10}$$

<i>Place value</i>	5^3	5^2	5^1	5^0
<i>Digit</i>	1	4	3	2

$$1432_5 = (1 \times 5^3) + (4 \times 5^2) + (3 \times 5^1) + (2 \times 5^0) = 242_{10}$$

$$625_{10} - 242_{10} = 383_{10} = 2423_5$$

$$\begin{array}{r} 5 \overline{) 363} \text{ Remainder} \\ 5 \overline{) 72} \text{ -3} \uparrow \\ 5 \overline{) 14} \text{ -2} \\ 5 \overline{) 2} \text{ -4} \\ 0 \text{ -2} \end{array}$$

16

$$\begin{array}{r} 75\cancel{3}1_8 \\ (-) 2460_8 \\ \hline 5051_8 \end{array}$$

17

<i>Place value</i>	9^3	9^2	9^1	9^0
<i>Digit</i>	3	2	1	8

$$3218_9 = (3 \times 9^3) + (2 \times 9^2) + (1 \times 9^1) + (8 \times 9^0) = 2\,366_{10}$$

<i>Place value</i>	6^3	6^2	6^1	6^0
<i>Digit</i>	5	4	3	1

$$5431_6 = (5 \times 6^3) + (4 \times 6^2) + (3 \times 6^1) + (1 \times 6^0) = 1\,243_{10}$$

$$2\,366_{10} + 1\,243_{10} = 3\,609_{10} = 7031_8$$

8		3609	Remainder
8		451	- 1
8		56	- 3
8		7	- 0
		0	- 7

18

<i>Place value</i>	7^3	7^2	7^1	7^0
<i>Digit</i>	6	3	2	1

$$6321_7 = (6 \times 7^3) + (3 \times 7^2) + (2 \times 7^1) + (1 \times 7^0) = 2\,220_{10}$$

<i>Place value</i>	5^3	5^2	5^1	5^0
<i>Digit</i>	4	2	3	1

$$4231_5 = (4 \times 5^3) + (2 \times 5^2) + (3 \times 5^1) + (1 \times 5^0) = 566_{10}$$

$$2\,220_{10} - 566_{10} = 1\,654_{10} = 11354_6$$

6		1654	Remainder
6		275	- 4
6		45	- 5
6		7	- 3
6		1	- 1
		0	- 1

19 $110_2 = 6_{10}$

$$12_5 = (1 \times 5^1) + (2 \times 5^0) = 7_{10}$$

$$350_6 = (3 \times 6^2) + (5 \times 6^1) = 138_{10}$$

$$22_3 = (2 \times 3^1) + (2 \times 3^0) = 8_{10}$$

$$21_4 = (2 \times 4^1) + (1 \times 4^0) = 9_{10}$$

$$350_7 = (3 \times 7^2) + (5 \times 7^1) = 182_{10}$$

$$6x + 7y = 138 \dots (1)$$

$$8x + 9y = 182 \dots (2)$$

$$\begin{array}{r}
 48x + 56y = 1\ 104 \dots (1) \times 8 \\
 (-) \quad 48x + 54y = 1\ 092 \dots (2) \times 6 \\
 \hline
 2y = 12 \\
 y = 6
 \end{array}$$

From (1) : $6x + 7(6) = 138$
 $x = 16$

Hence, the price of a kilogram of garlies and a kilogram of onions are RM16 and RM6 respectively.

20 $210_3 = (2 \times 3^2) + (1 \times 3^1) = 21_{10}$
 $322_4 = (3 \times 4^2) + (2 \times 4^1) + (2 \times 4^0) = 58_{10}$
 $134_5 = (1 \times 5^2) + (3 \times 5^1) + (4 \times 5^0) = 44_{10}$

$$\begin{array}{r}
 6 \overline{) 21} \text{ Remainder} \\
 \underline{6 \quad 3} \quad -3 \quad \uparrow \\
 0 \quad -3 \quad |
 \end{array}$$

$210_3 = 33_6$

$$\begin{array}{r}
 6 \overline{) 58} \text{ Remainder} \\
 \underline{6 \quad 9} \quad -4 \quad \uparrow \\
 6 \overline{) 1} \quad -3 \quad \uparrow \\
 \underline{0} \quad -1 \quad |
 \end{array}$$

$322_4 = 134_6$

$$\begin{array}{r}
 6 \overline{) 44} \text{ Remainder} \\
 \underline{6 \quad 7} \quad -2 \quad \uparrow \\
 6 \overline{) 1} \quad -1 \quad \uparrow \\
 \underline{0} \quad -1 \quad |
 \end{array}$$

$134_5 = 112_6$

Hence, the secret code is 33 134 112.