

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

The value of the underlined digit = $6 \times 8^4 = 24\ 576$

(d)

<i>Place value</i>	<u>8^5</u>	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 = $3 \times 6^2 = 108$

(d)

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

The value of the underlined digit = $4 \times 9^3 = 2\ 916$

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)

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

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

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

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

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

(b)

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

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

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

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

(b)

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

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

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

$$2614_7 = (2 \times 7^3) + (6 \times 7^2) + (1 \times 7^1) + (4 \times 7^0) = 991_{10}$$

(e)

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

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

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

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

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

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) $156_{10} = 10011100_2$

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	

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

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

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

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

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

$h = 222$

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

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

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

(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	↑
7	42	- 5	
7	6	- 0	
	0	- 6	

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

$k = 8604$

9	6322	Remainder	
9	102	- 4	↑
9	78	- 0	
9	8	- 6	
	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	
	0	- 2	

$213_{10} = 21220_3$
 $\therefore k = 21220$

(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

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

$$53600_7$$

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

$$\therefore h = 3013$$

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

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

$$= 3(6^5) + 2(6^4) + 5(6)$$

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

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

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

$$\begin{array}{r|l} 5 & 15 \text{ Remainder} \\ 5 & \underline{3} \quad -0 \\ & 0 \quad -3 \end{array} \uparrow$$

$$15_{10} = 30_5$$

(b)

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

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

$$\begin{array}{r|l} 2 & 22 \text{ Remainder} \\ 2 & \underline{11} \quad -0 \\ 2 & \underline{5} \quad -1 \\ 2 & \underline{2} \quad -1 \\ 2 & \underline{1} \quad -0 \\ & 0 \quad -1 \end{array} \uparrow$$

$$22_{10} = 10110_2$$

(c)

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

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

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

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

(d)

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

$$43_5 = (4 \times 5^1) + (3 \times 5^0) = 23_{10}$$

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

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

16 (a)

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

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

6	45	Remainder	
6	7	-3	↑
6	1	-1	
6			
	0	-1	

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

(b)

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

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

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

3	433	Remainder	
3	144	-1	↑
3	48	-0	
3	16	-0	
3	5	-1	
3	1	-2	
	0	-1	

(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	

UPSKILL 2.1c

1 (a)

$$\begin{array}{r} 11 \\ 1101_2 \\ (+) 1011_2 \\ \hline 11000_2 \end{array}$$

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

(b)

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

3	4	Remainder
3	1	-1
0	-1	↑

(c)

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

6	9	Remainder
6	1	-3
0	-1	↑

(d)

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

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

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

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

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

$$188_{10} - 62_{10} = 126_{10} = 11200_3$$

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

↑

UPSKILL 2.1d

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

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

$$2x + 2y = 26$$

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

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

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

$$x = 3$$

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

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

$$6x + 3y = 480$$

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

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

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

$$x = 40$$

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

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

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

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

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

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

$$y = 6$$

$$\text{From (1) : } x + 6 = 20$$

$$x = 14$$

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

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

$$\begin{array}{r} 567_8 \\ (-) 432_8 \\ \hline 135_8 \end{array}$$

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

Answer: A

Structured Questions

1

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

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

2

Place value	9^4	9^3	9^2	9^1	9^0
Digit	8	1	6	3	5

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

3

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

$$1204_5$$

4

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

$$7d = 21$$

$$d = 3$$

5

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

$$1100101_2$$

6 $194_{10} = 1234_5$

$$q = 2$$

5	194	–	Remainder
5	38	–	4
5	7	–	3
5	1	–	2
	0		1

\uparrow

7

111	101	010
7	5	2

$$111101010_2 = 752_8$$

8

5	0	3
101	000	011

$$503_8 = 101000011_2$$

9

Place value	8^2	8^1	8^0
Digit	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
	0	– 1

\uparrow

10

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

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

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

11

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

$$\begin{aligned}
 1046_8 &= (1 \times 8^3) + (4 \times 8^1) + 6 \\
 &= 550_{10} \\
 &= 1\ 414_7 \\
 &= 103_6 \\
 t &= 1414
 \end{aligned}$$

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

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) $194_{10} = 21012_3$
 $\therefore q = 21012$

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

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

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

13 $\begin{array}{r} 1\ 1\ 1 \\ 1110_2 \end{array}$

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

$\begin{array}{r} 111001_2 \\ \hline \end{array}$

<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	
8	0	-7	
	0		

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 $110_2 = 6_{10}$

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

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

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

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

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

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

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

$$48x + 56y = 1\,104 \dots (1) \times 8$$

$$(-) \quad 48x + 54y = 1\,092 \dots (2) \times 6$$

$$2y = 12$$

$$y = 6$$

$$\begin{aligned} \text{From (1) : } 6x + 7(6) &= 138 \\ x &= 16 \end{aligned}$$

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

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

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

$$210_3 = 33_6$$

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

$$322_4 = 134_6$$

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

$$134_5 = 112_6$$

Hence, the secret code is 33 134 112.

