Fully-Worked Solutions

FORM 4

CHAPTER 2

Self Test 1

1 (Accept any correct answers)

Base	Examples
Three	12_3, 202_3
Five	1234_5, 302_5
Seven	65_7, 431_7

2

(a) $101\underline{1}101_2$

Number in base 2	1	0	**1**	1	1	0	1
Place value	2^6	2^5	2^4	2^3	2^2	2^1	2^0

Place value $= 2^4$
$= 16$

(b) $2\underline{2}112_3$

Number in base 3	2	**2**	1	1	2
Place value	3^4	3^3	3^2	3^1	3^0

Place value $= 3^3$
$= 27$

(c) $\underline{3}123021_4$

Number in base 4	**3**	1	2	3	0	2	1
Place value	4^6	4^5	4^4	4^3	4^2	4^1	4^0

Place value $= 4^6$
$= 4\ 096$

(d) $42\underline{3}31_5$

Number in base 5	4	2	**3**	3	1
Place value	5^4	5^3	5^2	5^1	5^0

Place value $= 5^2$
$= 25$

(e) $5\underline{4}321_6$

Number in base 6	5	**4**	3	2	1
Place value	6^4	6^3	6^2	6^1	6^0

Place value $= 6^3$
$= 216$

(f) $4\underline{3}025_7$

Number in base 7	4	**3**	0	2	5
Place value	7^4	7^3	7^2	7^1	7^0

Place value $= 7^3$
$= 343$

(g) $145\underline{6}3_8$

Number in base 8	1	4	5	**6**	3
Place value	8^4	8^3	8^2	8^1	8^0

Place value $= 8^1$
$= 8$

(h) $\underline{5}763_9$

Number in base 9	**5**	7	6	3
Place value	9^3	9^2	9^1	9^0

Place value $= 9^3$
$= 729$

3

(a) $\underline{1}0101_2$

Number in base 2	**1**	0	1	0	1
Place value	2^4	2^3	2^2	2^1	2^0

Digit value $= 1 \times 2^4$
$= 16$

(b) $21\underline{2}11_3$

Number in base 3	2	1	**2**	1	1
Place value	3^4	3^3	3^2	3^1	3^0

Digit value $= 2 \times 3^2$
$= 18$

(c) $3\underline{3}021_4$

Number in base 4	3	**3**	0	2	1
Place value	4^4	4^3	4^2	4^1	4^0

Digit value $= 3 \times 4^3$
$= 192$

(d) $42\underline{4}31_5$

Number in base 5	4	2	**4**	3	1
Place value	5^4	5^3	5^2	5^1	5^0

Digit value $= 4 \times 5^2$
$= 100$

(e) $53\underline{4}21_6$

Number in base 6	5	3	**4**	2	1
Place value	6^4	6^3	6^2	6^1	6^0

Digit value $= 4 \times 6^2$
$= 144$

(f) $5\underline{6}23_7$

Number in base 7	5	**6**	2	3
Place value	7^3	7^2	7^1	7^0

Digit value $= 6 \times 7^2$
$= 294$

| (g) | $40\underline{7}53_8$ | **Number in base 8** | 4 | **0** | 7 | 5 | 3 | Digit value $= 0 \times 8^3$ |
| | | **Place value** | 8^4 | 8^3 | 8^2 | 8^1 | 8^0 | $= 0$ |

| (h) | $\underline{2}473_9$ | **Number in base 9** | **2** | 4 | 7 | 3 | Digit value $= 2 \times 9^3$ |
| | | **Place value** | 9^3 | 9^2 | 9^1 | 9^0 | $= 1\,458$ |

4

(a)	1101_2	**Number in base 2**	1	1	0	1	Number value $= 1(2^3) + 1(2^2) + 1(2^0)$
		Place value	2^3	2^2	2^1	2^0	$= 8 + 4 + 1$
							$= 13$

(b)	2012_3	**Number in base 3**	2	0	1	2	Number value $= 2(3^3) + 1(3^1) + 2(3^0)$
		Place value	3^3	3^2	3^1	3^0	$= 54 + 3 + 2$
							$= 59$

(c)	321_4	**Number in base 4**	3	2	1	Number value $= 3(4^2) + 2(4^1) + 1(4^0)$
		Place value	4^2	4^1	4^0	$= 48 + 8 + 1$
						$= 57$

(d)	4221_5	**Number in base 5**	4	2	2	1	Number value $= 4(5^3) + 2(5^2) + 2(5^1) + 1(5^0)$
		Place value	5^3	5^2	5^1	5^0	$= 500 + 50 + 10 + 1$
							$= 561$

(e)	4352_6	**Number in base 6**	4	3	5	2	Number value $= 4(6^3) + 3(6^2) + 5(6^1) + 2(6^0)$
		Place value	6^3	6^2	6^1	6^0	$= 864 + 108 + 30 + 2$
							$= 1\,004$

(f)	2563_7	**Number in base 7**	2	5	6	3	Number value $= 2(7^3) + 5(7^2) + 6(7^1) + 3(7^0)$
		Place value	7^3	7^2	7^1	7^0	$= 686 + 245 + 42 + 3$
							$= 976$

(g)	745_8	**Number in base 8**	7	4	5	Number value $= 7(8^2) + 4(8^1) + 5(8^0)$
		Place value	8^2	8^1	8^0	$= 448 + 32 + 5$
						$= 485$

(h)	3845_9	**Number in base 9**	3	8	4	5	Number value $= 3(9^3) + 8(9^2) + 4(9^1) + 5(9^0)$
		Place value	9^3	9^2	9^1	9^0	$= 2\,187 + 648 + 36 + 5$
							$= 2\,876$

5 (a) $\qquad 2101_3 = (2 \times 3^p) + (1 \times 3^2) + (1 \times 3^q)$

Number in base 3	2	1	0	1
Place value	3^3	3^2	3^1	3^0

therefore, $p = 3$, $q = 0$

(b) $3241_5 = (3 \times 5^3) + (2 \times 5^p) + (q \times 5) + 1$

Number in base 5	3	2	4	1
Place value	5^3	5^2	5^1	5^0

therefore, $p = 2$, $q = 4$

(c) $5324_7 = (5 \times 7^p) + (3 \times q) + (2 \times 7) + (4 \times 7^0)$

Number in base 7	5	3	2	4
Place value	7^3	7^2	7^1	7^0

therefore, $p = 3$, $q = 49$

6 $6(6^4 + 36 + 3) = 6^5 + 6(6^2) + 3(6^1)$
$\qquad\qquad\quad = 1(6^5) + 0(6^4) + 1(6^3) + 0(6^2) + 3(6^1) + 0(6^0)$
$\qquad\qquad\quad = 101030_6$

7 $6(9^1) + 6(7^3) = 54 + 2\,058$
$\qquad\qquad\quad\; = 2\,112$

8 (a)
```
3 | 156
3 |  52 ...0 ↑
3 |  17 ...1
3 |   5 ...2
3 |   1 ...2
      0 ...1
```
$156_{10} = 12210_3$

(b)
```
4 | 156
4 |  39 ...0 ↑
4 |   9 ...3
4 |   2 ...1
      0 ...2
```
$156_{10} = 2130_4$

(c)
```
6 | 156
6 |  26 ...0 ↑
6 |   4 ...2
      0 ...4
```
$156_{10} = 420_6$

(d)
```
7 | 156
7 |  22 ...2 ↑
7 |   3 ...1
      0 ...3
```
$156_{10} = 312_7$

(e)
```
8 | 156
8 |  19 ...4 ↑
8 |   2 ...3
      0 ...2
```
$156_{10} = 234_8$

(f)
```
9 | 156
9 |  17 ...3 ↑
9 |   1 ...8
      0 ...1
```
$156_{10} = 183_9$

9 (a) 113_5 (base three)
$= 1(5^2) + 1(5^1) + 3(5^0)$
$= 33_{10}$
$= 1020_3$

```
3 | 33
3 | 11 ...0 ↑
3 |  3 ...2
3 |  1 ...0
     0 ...1
```

(b) 3521_6 (base four)
$= 3(6^3) + 5(6^2) + 2(6^1) + 1(6^0)$
$= 841_{10}$
$= 31021_4$

```
4 | 841
4 | 210 ...1 ▲
4 |  52 ...2 |
4 |  13 ...0 |
4 |   3 ...1 |
    0 ...3
```

(c) 67_8 (base five)
$= 6(8^1) + 7(8^0)$
$= 55_{10}$
$= 210_5$

(d) 1110111_2 (base seven)
$= 1(2^6) + 1(2^5) + 1(2^4) + 0(2^3) + 1(2^2) + 1(2^1) + 1(2^0)$
$= 119_{10}$
$= 230_7$

(e) 21112_3 (base eight)
$= 2(3^4) + 1(3^3) + 1(3^2) + 1(3^1) + 2(3^0)$
$= 203_{10}$
$= 313_8$

```
8 | 203
8 |  25 ...3 ▲
8 |   3 ...1 |
    0 ...3
```

(f) 3212302_4 (base nine)
$= 3(4^6) + 2(4^5) + 1(4^4) + 2(4^3) + 3(4^2) + 0(4^1) + 2(4^0)$
$= 14\,770_{10}$
$= 22231_9$

10 (a) 1101101_2

Number in base 2	1	1	0	1	1	0	1
Place value	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	1	$4+1=5$			$4+1=5$		
Number in base 8	155_8						

(b) 1011101_2

Number in base 2	1	0	1	1	1	0	1
Place value	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	1	$2+1=3$			$4+1=5$		
Number in base 8	135_8						

(c) 10011101_2

Number in base 2	1	0	0	1	1	1	0	1
Place value	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	$2+0$ $=2$		$2+1$ $=3$			$4+1$ $=5$		
Number in base 8	235_8							

(d) 1111111_2

Number in base 2	1	1	1	1	1	1	1
Place value	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	1	$4+2+1=7$			$4+2+1=7$		
Number in base 8	177_8						

(e) 11111001_2

Number in base 2	1	1	1	1	1	0	0	1
Place value	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	$2+1$ $=3$		$4+2+1$ $=7$			1		
Number in base 8	371_8							

(f) 101011_2

Number in base 2	1	0	1	0	1	1
Place value	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	$4+1=5$			$2+1=3$		
Number in base 8	53_8					

11 (a) 175_8

Base 8	1			7			5		
	$0+0+1$			$4+2+1$			$4+0+1$		
Place value	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Base 2	0	0	1	1	1	1	1	0	1
	1111101_2								

(b) 31_8

Base 8	3			1		
	$0+2+1$			$0+0+1$		
Place value	2^2	2^1	2^0	2^2	2^1	2^0
Base 2	0	1	1	0	0	1
	11001_2					

(c) 462_8

Base 8	4			6			2		
	$4+0+0$			$4+2+0$			$0+2+0$		
Place value	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Base 2	1	0	0	1	1	0	0	1	0
	100110010_2								

(d) 564_8

Base 8	5			6			4		
	$4+0+1$			$4+2+0$			$4+0+0$		
Place value	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Base 2	1	0	1	1	1	0	1	0	0
	101110100_2								

(e) 2734_8

Base 8	2			7			3			4		
	$0+2+0$			$4+2+1$			$0+2+1$			$4+0+0$		
Place value	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Base 2	0	1	0	1	1	1	0	1	1	1	0	0
	10111011100_2											

(f) 125_8

Base 8	1			2			5		
	$0+0+1$			$0+2+0$			$4+0+1$		
Place value	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Base 2	0	0	1	0	1	0	1	0	1
	1010101_2								

12 (a) $10101_2 + 11101_2 = 110010_2$

```
    ¹ ¹   ¹
    1 0 1 0 1₂
+   1 1 1 0 1₂
─────────────
  1 1 0 0 1 0₂
```

(b) $211_3 + 102_3 = 1020_3$

```
          ¹
    2 1 1₃
+   1 0 2₃
─────────
  1 0 2 0₃
```

(c) $1302_4 + 2113_4 = 10021_4$

```
    ¹ ¹
    1 3 0 2₄
+   2 1 1 3₄
───────────
  1 0 0 2 1₄
```

(d) $2341_5 + 304_5 = 3200_5$

```
    ¹ ¹ ¹
    2 3 4 1₅
+     3 0 4₅
───────────
  3 2 0 0₅
```

(e) $5134_6 + 245_6 = 5423_6$

$$
\begin{array}{r}
\overset{1}{5}\,\overset{1}{1}\,3\,4_6 \\
+\quad 2\,4\,5_6 \\
\hline
5\,4\,2\,3_6
\end{array}
$$

(f) $454_7 + 365_7 = 1152_7$

$$
\begin{array}{r}
\overset{1}{4}\,\overset{1}{5}\,4_7 \\
+\quad 3\,6\,5_7 \\
\hline
1\,1\,5\,2_7
\end{array}
$$

(g) $6125_8 + 357_8 = 6504_8$

$$
\begin{array}{r}
6\,\overset{1}{1}\,\overset{1}{2}\,5_8 \\
+\quad 3\,5\,7_8 \\
\hline
6\,5\,0\,4_8
\end{array}
$$

(h) $286_9 + 254_9 = 551_9$

$$
\begin{array}{r}
\overset{1}{2}\,\overset{1}{8}\,6_9 \\
+\,2\,5\,4_9 \\
\hline
5\,5\,1_9
\end{array}
$$

13 (a) $110101_2 - 11101_2 = 11000_2$

$$
\begin{array}{r}
1\,1\,0\,1\,0\,1_2 \\
-\quad 1\,1\,1\,0\,1_2 \\
\hline
1\,1\,0\,0\,0_2
\end{array}
$$

(b) $1221_3 - 112_3 = 1102_3$

$$
\begin{array}{r}
1\,2\,2\,1_3 \\
-\quad 1\,1\,2_3 \\
\hline
1\,1\,0\,2_3
\end{array}
$$

(c) $2312_4 - 213_4 = 2033_4$

$$
\begin{array}{r}
2\,3\,1\,2_4 \\
-\quad 2\,1\,3_4 \\
\hline
2\,0\,3\,3_4
\end{array}
$$

(d) $4321_5 - 1324_5 = 2442_5$

$$
\begin{array}{r}
4\,3\,2\,1_5 \\
-\,1\,3\,2\,4_5 \\
\hline
2\,4\,4\,2_5
\end{array}
$$

(e) $5341_6 - 3254_6 = 2043_6$

$$
\begin{array}{r}
5\,3\,4\,1_6 \\
-\,3\,2\,5\,4_6 \\
\hline
2\,0\,4\,3_6
\end{array}
$$

(f) $654_7 - 266_7 = 355_7$

$$
\begin{array}{r}
6\,5\,4_7 \\
-\,2\,6\,6_7 \\
\hline
3\,5\,5_7
\end{array}
$$

(g) $654_8 - 367_8 = 265_8$

$$
\begin{array}{r}
6\,5\,4_8 \\
-\,3\,6\,7_8 \\
\hline
2\,6\,5_8
\end{array}
$$

(h) $758_9 - 364_9 = 384_9$

$$
\begin{array}{r}
7\,5\,8_9 \\
-\,3\,6\,4_9 \\
\hline
3\,8\,4_9
\end{array}
$$

14 Let z = Zakiah's age this year

Kim's age this year $= 2(5^1) + 1(5^0)$
$$= 11_{10}$$

$\left.\begin{array}{l} 11_2 = 1(2^1) + 1(2^0) \\ \qquad = 3_{10} \\ 22_3 = 2(3^1) + 2(3^0) \\ \qquad = 8_{10} \end{array}\right\}$ Zakiah's age is 3 times Kim's age 8 years ago

Therefore, $z - 8 = 3(11 - 8)$
$$z = 3(3) + 8$$
$$= 17$$

Zakiah's age 50_6 years later
$$= 17 + [5(6^1) + 0(6^0)]$$
$$= 17 + 30$$
$$= 47$$

15 $483_9 = 4(9^2) + 8(9^1) + 3(9^0)$
$$= 399_{10}$$
$543_7 = 5(7^2) + 4(7^1) + 3(7^0)$
$$= 276_{10}$$
$1211_3 = 1(3^3) + 2(3^2) + 1(3^1) + 1(3^0)$
$$= 49_{10}$$

Remaining stamps $= 483_9 - 543_7 - 1211_3$
$$= 399 - 276 - 49$$
$$= 74_{10}$$
$$= 244_5$$

$$
\begin{array}{r|l}
5 & 74 \\
\hline
5 & 14 \ \dots 4 \\
\hline
5 & 2 \ \dots 4 \\
\hline
& 0 \ \dots 2
\end{array}
$$

16 Price of television $= \text{RM}20140_8$
$$= \text{RM}2(8^4) + 1(8^2) + 4(8^1)$$
$$= \text{RM}8288$$
Total discount $= \text{RM}(8288 - 5801.60)$
$$= \text{RM}2486.40$$

Percentage of discount $= \dfrac{\text{RM}2486.40}{\text{RM}8288} \times 100\%$
$$= 30\%$$
$$= 11110_2\%$$

$$
\begin{array}{r|l}
2 & 30 \\
\hline
2 & 15 \ \dots 0 \\
\hline
2 & 7 \ \dots 1 \\
\hline
2 & 3 \ \dots 1 \\
\hline
2 & 1 \ \dots 1 \\
\hline
& 0 \ \dots 1
\end{array}
$$

SPM PRACTICE

Paper 1

1 D

Place value	7^4	7^3	7^2	7^1	7^0
Number in base 7	1	0	0	3	0

2 B $10110_2 + 111_2 = 11101_2$

$$
\begin{array}{r}
1\,\overset{1}{0}\,\overset{1}{1}\,1\,0_2 \\
+\quad 1\,1\,1_2 \\
\hline
1\,1\,1\,0\,1_2
\end{array}
$$

3 C $10011110011_2 = 2363_8$

Number in base 2	1	0	0	1	1	1	1	0	0	1	1
Place value	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0	2^2	2^1	2^0
Digit value	$2 + 0$ $= 2$		$2 + 1$ $= 3$			$4 + 2 + 0$ $= 6$			$2 + 1$ $= 3$		
Number in base 8	2363_8										

4 C $p = x^2 \qquad q = x^1 \qquad r = x^0$
$$2x^2 + x + 2(x^0) = 23$$
$$2x^2 + x + 2 - 23 = 0$$
$$2x^2 + x - 21 = 0$$
$$(2x + 7)(x - 3) = 0$$
$$x = 3 \text{ (negative value is rejected)}$$
Therefore. $p + q - r = 3^2 + 3^1 - 3^0$
$$= 11$$

5 C Digit value of 2 $= 2 \times 6^2$
$$= 72$$

6 B $(3 \times 4^3) + (2 \times 4^2) + 4x = 3220_4$

Place value	4^3	4^2	4^1	4^0
Number in base 7	3	2	x	0

$x = 2$

7 B Digits in the number base 5 are 0, 1, 2, 3 and 4.

8 C $4(6^2) - 4(8) = 112$

9 D $463_8 + 57_8 = 542_8$

$$
\begin{array}{r}
4\,\overset{1}{6}\,\overset{1}{3}_8 \\
+\quad 5\,7_8 \\
\hline
5\,4\,2_8
\end{array}
$$

10 A Encik Alif's savings in Bank $A = \text{RM}43562_9$
$$= \text{RM}[4(9^4) + 3(9^3) + 5(9^2) + 6(9^1) + 2(9^0)]$$
$$= \text{RM}(26\,244 + 2\,187 + 405 + 54 + 2)$$
$$= \text{RM}28\,892$$
Encik Alif's savings in Bank $B = \text{RM}25413_6$
$$= \text{RM}[2(6^4) + 5(6^3) + 4(6^2) + 1(6^1) + 3(6^0)]$$
$$= \text{RM}(2\,592 + 1\,080 + 144 + 6 + 3)$$
$$= \text{RM}3\,825$$
Total savings
$$= \text{RM}(28\,892 + 3\,825)$$
$$= \text{RM}32\,717$$
Total down payment
$$= 10\% \times \text{RM}485\,600$$
$$= \text{RM}48\,560$$

Amount of money still needed
= RM(48 560 − 32 717)
= RM15 843

11 A $3412_5 - 34_5 = 3323_5$

$$\begin{array}{r} 3\ 4\ \overset{3}{\cancel{1}}\ \overset{5}{\cancel{\overset{5}{}}}\overset{7}{2}_5 \\ -\ \ \ \ \ 3\ 4_5 \\ \hline 3\ 3\ 2\ 3_5 \end{array}$$

12 C $4k5_6 = 326_7$
$4(6^2) + k(6^1) + 5(6^0) = 3(7^2) + 2(7^1) + 6(7^0)$
$144 + 6k + 5 = 147 + 14 + 6$
$6k = 18$
$k = 3$

13 D $70_9 = 7(9^1) + 0(9^0)$
$= 63$
$230_5 = 2(5^2) + 3(5^1) + 0(5^0)$
$= 65$

$$\begin{array}{r|l} 7 & 63 \\ \hline 7 & 9\ ...0 \\ \hline 7 & 1\ ...2 \\ \hline & 0\ ...1 \end{array} \qquad \begin{array}{r|l} 7 & 65 \\ \hline 7 & 9\ ...2 \\ \hline 7 & 1\ ...2 \\ \hline & 0\ ...1 \end{array}$$

14 C $52024_8 = 5(8^4) + 2(8^3) + 0(8^2) + 2(8^1) + 4(8^0)$
$= 20\ 480 + 1\ 024 + 16 + 4$
$= 21\ 524$
$2240453_6 = 2(6^6) + 2(6^5) + 4(6^4) + 0(6^3) + 4(6^2) + 5(6^1) + 3(6^0)$
$= 93\ 312 + 15\ 552 + 5\ 184 + 144 + 30 + 3$
$= 114\ 225$
$52024_8 + 2240453_6 = 21\ 524 + 114\ 225$
$= 135\ 749$

15 B $1513_6 = 1(6^3) + 5(6^2) + 1(6^1) + 3(6^0)$
$= 405$

$p\% = \dfrac{450 - 405}{450} \times 100\%$

$$\begin{array}{r|l} 4 & 10 \\ \hline 4 & 2\ ...2 \\ \hline & 0\ ...2 \end{array}$$

$= 10_{10}$
$= 22_4$

Paper 2

Section A

1 $4400_5 - 3041_5 = 1304_5$
$= 1(5^3) + 3(5^2) + 0(5^1) + 4(5^0)$
$= 125 + 75 + 4$
$= 204$
$= 411_7$
$M = 411$

$$\begin{array}{r} 4\ \overset{3}{\cancel{4}}\ \overset{5}{\cancel{0}}\ \overset{5}{0}_5 \\ -\ 3\ 0\ 4\ 1_5 \\ \hline 1\ 3\ 0\ 4_5 \end{array}$$

$$\begin{array}{r|l} 7 & 204 \\ \hline 7 & 29\ ...1 \\ \hline 7 & 4\ ...1 \\ \hline & 0\ ...4 \end{array}$$

2 $123_4 = 1(4^2) + 2(4^1) + 3(4^0)$
$= 16 + 8 + 3$
$= 27$
$26_7 = 2(7^1) + 6(7^0)$
$= 14 + 6$
$= 20$
$34_5 = 3(5^1) + 4(5^0)$
$= 15 + 4$
$= 19$
$47_8 = 4(8^1) + 7(8^0)$
$= 32 + 7$
$= 39$
Arrangement in descending: 47_8, 123_4, 26_7, 34_5

3 Total digit value of '2' $= 2(3^2) + 2(8^2) + 2(6^3)$
$= 18 + 128 + 432$
$= 578$

4 Given that $431_p = 102010_3 - 312_5$
$4p^2 + 3p + 1p^0 = 1(3^5) + 2(3^3) + 1(3^1) - [3(5^2) + 1(5^1) + 2(5^0)]$
$4p^2 + 3p + 1 = 243 + 54 + 3 - [75 + 5 + 2]$
$4p^2 + 3p - 217 = 0$
$(4p + 31)(p - 7) = 0$
$p = 7$ (negative value of p is rejected)

5 (a) $\dfrac{228°}{360°} \times 90 = 57$
$= 212_5$

$$\begin{array}{r|l} 5 & 57 \\ \hline 5 & 11\ ...2 \\ \hline 5 & 2\ ...1 \\ \hline & 0\ ...2 \end{array}$$

(b) Number of students who prefer rambutans $= \dfrac{56°}{360°} \times 90$
$= 14$

Number of students who prefer bananas $= \dfrac{40°}{360°} \times 90$
$= 10$

Number of students who prefer mangoes $= 90 - 57 - 14 - 10$
$= 9$

Difference in the number of students who prefer rambutans and mangoes $= 14 - 9$
$= 5_{10}$
$= 12_3$

Section B

6 (a) Banana flavour: $100000_2 = 2^5$
$= 32$
Orange flavour: $110_4 = 1(4^2) + 1(4^1)$
$= 20$
Chocolate flavour: $143_5 = 1(5^2) + 4(5^1) + 3(5^0)$
$= 48$
Banana : Orange : Chocolate
$= 32 : 20 : 48$
$= 8 : 5 : 12$

(b) New total of banana cupcakes
$= 32 + 8$
$= 40$
Banana : Orange : Chocolate
$= 8 : 5 : 12$
$\quad \times 5 \ \times 5 \quad \times 5$
$= 40 : 25 : 60$
Additional number of orange cupcakes needed
$= 25 - 20$
$= 5$
$= 12_3$

$$\begin{array}{r|l} 3 & 5 \\ \hline 3 & 1\ ...2 \\ \hline & 0\ ...1 \end{array}$$

Additional number of chocolate cupcakes needed
$= 60 - 48$
$= 12$
$= 110_3$

$$\begin{array}{r|l} 3 & 12 \\ \hline 3 & 4\ ...0 \\ \hline 3 & 1\ ...1 \\ \hline & 0\ ...1 \end{array}$$
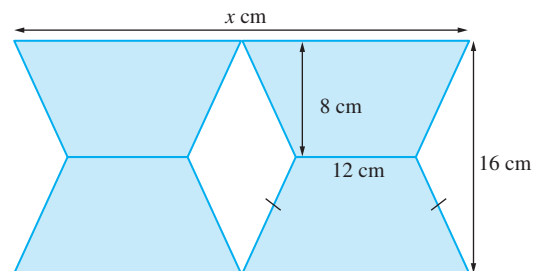
7 (a) Area of trapezium $= 4301_5$

$4 \times \dfrac{1}{2} \times \left(12 + \dfrac{x}{2}\right)(8) = 4(5^3) + 3(5^2) + 0(5^1) + 1(5^0)$

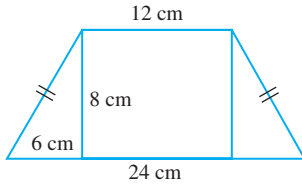$16\left(12 + \dfrac{x}{2}\right) = 500 + 75 + 1$

$192 + 8x = 576$
$8x = 384$
$x = 48$

(b) Length of hypotenuse of triangle formed in the trapezium

$= \sqrt{8^2 + 6^2}$

$= 10$ cm

Perimeter of the shaded region

$= 2(48) + 8(10)$

$= 176$ cm

$= 260_8$ cm

```
8 | 176
8 |  22 ...0 ↑
8 |   2 ...6 |
  |   0 ...2 |
```

Section C

8 Radius $= 1(2^2) + 1(2^1) + 1(2^0)$

$= 4 + 2 + 1$

$= 7$ cm

(a) Slanting height $= \sqrt{7^2 + 10^2}$

$= 12.21$ cm

(b) Volume $=$ Volume of cone + volume of hemisphere

$= \dfrac{1}{3}\left(\dfrac{22}{7}\right)(7^2)(10) + \left(\dfrac{2}{3}\right)\left(\dfrac{22}{7}\right)(7^3)$

$= 513\dfrac{1}{3} + 718\dfrac{2}{3}$

$= 1\,232$ cm^3

$= 1618_9$ cm^3

```
9 | 1232
9 |  136 ...8 ↑
9 |   15 ...1 |
9 |    1 ...6 |
  |    0 ...1 |
```

(c) Total surface area of hemisphere $= 2\left(\dfrac{22}{7}\right)(7^2)$

$= 308$ cm^2

$= 464_8$ cm^2

```
8 | 308
8 |  38 ...4 ↑
8 |   4 ...6 |
  |   0 ...4 |
```

(d) Price of a can of paint $=$ RM$1(2^2)$

$=$ RM4

$308 \div 100 = 3.08$

Number of cans $= 4$

Amount of money needed $= 4 \times$ RM4

$=$ RM16